Transport Research Laboratory
Creating the future of transport



PUBLISHED PROJECT REPORT PPR679

International L-category approval in the area of Environmental and Propulsion unit Performance Requirements

Establishing and Revision of UN Regulations and Global Technical Regulations

A Nathanson, M Seidl, T Barlow, R Cuerden, R Beekman, K Vervoort and R J Molemaker

Prepared for: EC, DG Enterprise and Industry

Project Ref: 1111859

Quality approved:

M Ainge (Project Manager)

R Cuerden (Technical Referee)

Disclaimer

This report has been produced by the Transport Research Laboratory under a contract with European Commission (EC). Any views expressed in this report are not necessarily those of EC.

The information contained herein is the property of TRL Limited and does not necessarily reflect the views or policies of the customer for whom this report was prepared. Whilst every effort has been made to ensure that the matter presented in this report is relevant, accurate and up-to-date, TRL Limited cannot accept any liability for any error or omission, or reliance on part or all of the content in another context.

When purchased in hard copy, this publication is printed on paper that is FSC (Forest Stewardship Council) and TCF (Totally Chlorine Free) registered.

Contents amendment record

This report has been amended and issued as follows:

Version	**Date**	**Description**	**Editor**	**Technical Referee**
Draft final report	Nov/2013	Draft of completed final report		
Final report for review	Jan/2014	New version with Ecorys and TRL Sections	RWC	RWC
Final report	Feb/2014	Final report for comments	AAN	AAN
Final report	Mar/2014	Final report	AAN	MA

Table of contents

1 Introduction

1.1 Purpose and scope of the project

On 15th January 2013, the European Parliament and the Council adopted Regulation (EU) No 168/2013 on approval and market surveillance of two or three-wheel vehicles and quadricycles, also referred to as 'the codecision act'. A wide range of different light vehicles are within the scope of this codecision act, among others powered cycles, two- and three-wheel mopeds, - and three-wheel motorcycles, motorcycles with side cars, tricycles, light and heavy on-road quads and light and heavy quadrimobiles, covering both vehicles used for private and commercial purposes. The two- or three-wheel vehicles and quadricycles are grouped under the family name "L-category vehicles", where the "L" stands for "Light". Table 1-1 provides an overview of the EC's L-category vehicles and their sub-categories.

Table 1-1: L-category vehicle categorisation (EU)

Category	Sub category
L1e - Light two-wheel powered vehicle	L1Ae powered cycle
	L1Be two-wheel moped
L2e - Three-wheeled moped	-
L3e - Two-wheel motorcycle	L3e-A1 – two-wheel motorcycle low performance
	L3e-A2 - two-wheel motorcycle medium performance
	L3e-A3 - two-wheel motorcycle high performance
L4e - Motorcycle with side car	L4e-A1, -A2, -A3 (follows same subcategory as L3e)
L5e - Tricycles	L5e-A Tricycles
	L5e-B Commercial tricycles
L6e - Light quadricycle	L6e-A Light on-road quad
	L6e-B Light quadri-mobiles
L7e - Heavy quadricycle	L7e-A Heavy on-road quad
	L7e-B Heavy all terrain quads
	L7e-C Heavy quadri-mobiles

The **aim** of this project was to derive cost effective measures and proposals to revise GTR No 2 and to develop new UN Regulations and Global Technical Regulations in order to harmonise L-category approval legislation at a world-wide level. This will also support the objective of the EU to replace legislative text in the Regulation (EU) No 168/2013 and its delegated act on the Environment and Propulsion unit Performance Requirements (REPPR) to the maximum extent possible with references to applicable UN Regulations.

Currently, the share of hydrocarbon emissions by L-category vehicles is disproportionately high compared to their share in road transport. This is mainly due to

the decreasing share of emissions of other road transport vehicles, related to the introduction of more strict emission norms for other categories of vehicles.

L-category regulation on emissions in the EU dates from 1998 and has since barely been changed, or is non-existent for certain sub-categories. Since 2006 manufacturers may test a motorcycle to be approved according to the world-harmonised motorcycle test cycle test procedure set-out in GTR No 2 as alternative to the traditional European driving cycle test (EDC).

Specifically the **test types** related to Environmental and Propulsion unit Performance Requirements (EPPR) that have been reviewed and are proposed to be re-drafted, namely:

- The type I test: cold start tailpipe emissions;
- The type II test: tailpipe emissions at idle and fast idle;
- The type III test: crankcase emissions;
- The type IV test: evaporative emissions;
- The type V test: durability;
- The type VII test: CO2 and fuel consumption;
- The type VIII test: on-board diagnostics environmental tests (OBD);
- Propulsion unit Performance Requirements (PPR);
- The classification of L-category vehicles at the international level.

The test types were grouped and the details with respect to the methodology used, along with more background information and a description of the work undertaken by the project team, comprised of independent experts from Ecorys and TRL, is given in Section 2. The project team undertook the work programme on behalf of the European Commission (DG Enterprise and Industry), and primarily worked to help meet their objectives with regards to improving international harmonisation for L-category vehicle type approval legislation, specifically with respect to EPPR.

1.2 International Environmental and Propulsion unit Performance Requirements (L-EPPR)

There are different international standards and specifications for Environmental and Propulsion unit Performance Requirements for light vehicles (L-EPPR). Worldwide the United Nations develop specific regulations within the United Nations Economic Commission for Europe (UNECE) in the World Forum for world-harmonised vehicle legislation (WP29 and its subsidiary working groups). Once these international regulations are adopted by WP29 the countries / regions have to incorporate these requirements into their national / regional constitutions.. For Europe, the European Commission develops and proposes these regulations for L-category vehicles to the Council and the European Parliament that decide if these proposals become European legislation. The United States of America has its federal regulation authority; the EPA that is responsible for the domestic vehicle certification legislation, and a self-certification system of regulation is used. Other regions with regulatory authorities include China, India and Japan and many other contracting parties of the UNECE 1958 and 1998 Agreements.

As a consequence geographically different regulations and specifications are in force at the global level. This means that if a manufacturer of L-category vehicles wants to market a product worldwide, often technical adjustments have be made to fulfil the regulations as applied in that specific country. In the current situation, this requires multiple type approvals in different regions around the globe or the need to perform different and/or supplementary tests for countries applying self-certification to be performed for the same product.

The aim is to derive cost effective measures and various proposals for UN Regulations and Global Technical Regulations (GTRs) in order to strengthen the world-harmonisation of L-category type approval legislation. This will also support the objective of the EU to replace legislative text in the Regulation for Environment and Propulsion unit Performance Requirements (REPPR) to the maximum extent possible with references to applicable UN Regulations.

1.3 L-category vehicle type approval

1.3.1 Environmental and Propulsion unit Performance Requirements

The Environmental and Propulsion unit Performance Requirements (EPPR) specifications are tested as part of the type-approval of L-category vehicles. However, EPPR isn't the only regulation to be tested in type approval procedures. Also specifications on safety and the conformity of production of the approved vehicle are part of the type approval procedure. As stated by the Dutch type approval authority (the RDW): "The type-approval for a vehicle is the binding element between the certification, registration and sale of automotive products."

In short, the type approval procedures apply as follows. Whenever an economic operator wants to market a type of vehicle or a system, component and separate technical unit for such type-approved vehicles in the EU, the particular type has to acquire type approval, which is issued by a Type Approval Authority (TAA). Manufacturers can obtain Whole Vehicle Type-Approval (WVTA) for L-category vehicle types, and approval for systems, components and separate technical units intended for such vehicles in one Member State. If their products meet the Union's type-approval requirements they can market them EU-wide with no need for further tests or checks. Registration of a vehicle must be granted in all Member States on a simple presentation of a valid certificate of conformity (CoC), which is a type-approval requirement for a vehicle manufacturer to deliver such a certificate with each new vehicle placed on the EU market.

Each Member State (MS) may appoint a TAA to issue the approvals. Furthermore, each MS may appoint one or more Technical Services (TS), which function as a conformity assessment body to carry out tests on behalf of the approval authority. A TAA can also be appointed as a TS, in which case the TAA can also perform tests. Furthermore, an economic operator can perform some of the type approval tests himself provided the vehicle manufacturer is certified as an in-house technical service, and have representative(s) from a TAA present to witness the test: a so-called witness-test.

Within the European Union, the type approval of L-category vehicles is currently framed under the Directive 2002/24/EC7 ('Framework Directive').

1.3.2 Type approval procedures in relation with Conformity of Production

Conformity of Production is closely related to type approval. Prior to issuing the type approval, the production processes of the manufacturer have to be assessed to evaluate the Conformity of Production, called the initial assessment: the ability to produce series products in conformity with the specification, performance and marking requirements in the type approval process. In order to verify that the manufacturer has satisfactory arrangements in place for effective control of conformity of production, the manufacturer might handover formal certification for its Quality Management System (such as the ISO 9001 series) and/or have regular audits performed by the TAA.

Once a type approval is granted, a manufacturer is obliged to ensure that the production of vehicles, systems, components and separate technical units remains in conformity with the approved type, by performing evaluation tests. Of these tests, the manufacturer has to maintain an administrative record. The TAA that approved the vehicle, system, component and separate technical unit or a designated technical service in case the TAA opts to delegate this task, has to check these records, at least every two years.

In case vehicles, systems, components and separate technical units are found not to be in conformity with the approved type, the TAA that approved the type must take steps necessary to ensure that conformity of production is restored by the manufacturer and inform other Member States of its findings and actions. Restoring conformity will typically involve discussion with the manufacturer over which corrective steps are to be taken. In case the manufacturer proves to be unable (or unwilling) to comply to the requirements for Conformity of Production, the type approval could possibly be withdrawn by the Type Approval Authority that granted the type-approval, and in such case this must also be communicated to all other Member States.

1.4 Regulation (EU) No 168/2013

1.4.1 Issues with type-approval regulation

Generally within the European Union, prior to the codecision act, the situation with regards to type-approval regulation for L-category vehicles had some key issues, namely:

- The previous legislation (Directive 2002/24/EC) was outdated, in particular towards vehicles that are fitted with new technologies; much of these regulations dated from the nineties or before. As a consequence regulations for new technologies were lacking, for example for hybrid electric and pure electric vehicles.
- The legal framework was complex; requirements were not in coherence with other vehicle-type legislation. Manufacturers have to get their products approved for each different market outside the EU they want to enter. This requires multiple type approvals in different regions around the globe or the need to perform different and/or supplemental tests for countries applying self-certification to be performed for the same product. Having different test procedures for different markets makes it more costly for manufacturers to enter markets outside the EU and the need to overcome so-called non-tariff barriers before getting market access.
- Emissions of traffic play an important role in the overall emission levels in the EU. The levels of emissions of L-category vehicles, and its increasing share in total

road transport emissions, are increasing overall; in general the level of emissions of L-category vehicles are quite high, compared to other road vehicles. The pre-codecision act type approval Directive 2002/24/EC however does not create the conditions to improve this. Contracting parties to the UNECE Agreements experience similar environmental concerns with these light vehicles, in particular in urban areas.

- Another goal related to traffic is that of road safety. Functional safety of L-categories, i.e. the part of safety related to the technical performance of such vehicles, is an issue and is the part of safety that can be addressed at type-approval. The relative high rate of fatalities and seriously injured riders requires improvement of vehicle functional safety aspects.
- Products which do not comply with the pre-codecision act type-approval requirements regarding functional vehicle safety and/or environmental protection could enter into the EU market. The 1990s requirements are believed to be not sufficiently efficient and effective, specifically in dealing with globalisation with imports of vehicles, components and Separate Technical Units (STUs) from third countries and new market players.

1.4.2 Overcoming the stated issues: Regulation (EU) No 168/2013 (The codecision act)

To overcome these and other stated issues, as of 15 January 2013, Regulation (EU) No 168/2013 ("the codecision act") has been adopted by the European Parliament and of the Council. The codecision act entered into force in the beginning of 2013, and will be applied as of January 2016.

The codecision act aims to take into account each of the issues mentioned in the previous section:

- Simplifying the legislation, possibly reducing the administrative burden on the L-category vehicle sector and referring as much as possible to globally applied UN-ECE requirements.
- L-category vehicles contributing to a lower, more proportionate share of overall road transport emissions by complying with appropriate environmental performance requirements.
- Helping to achieve the same high reductions in road accident fatalities and casualties as for other means of road transport, to maximise accident mitigation to prevent serious and minor injuries as much as possible, and to help close the gap between actual road accident fatalities and casualties and the medium- to long-term EU road safety targets, by strengthening vehicle functional safety requirements.
- Providing a legislative framework for current and near future innovative technologies.
- Improving market surveillance and strengthening important procedures such as Conformity of Production.

1.4.3 Supplemented with new EPPR-regulation in the EU

This main Regulation will be supplemented with three delegated acts setting out detailed test procedures and technical requirements and one implementing act laying down the applicable administrative provisions. The subject of one of the three delegated acts is the Regulation on the Environmental and Propulsion unit Performance Requirements (REPPR). This regulation deals with various test types on the environmental and propulsion unit performance of vehicles and its systems, components and Separate Technical Units (STUs) that are part of the type approval process of L-category vehicles.

The overall aim is to introduce or to improve regulation for current test procedures. This is to be reached by:

- To carry over test procedures and requirements with a proven track record;
- the improvement of present test procedures if deemed cost effective;
- the introduction of new or additional test procedures to deal with i.e. technical progress;

The aim is to align the European legislation on test procedures with UN-test procedures, so EU regulation becomes more harmonised with international legislation. Simplification is one of the major objectives of the European Union. The Commission representing the Union has the objective "to replace the legislative text in the draft EPPR to the maximum extent possible with references to applicable UN Regulations, under the condition that these guarantee a similar or higher level of environmental protection. This includes decreasing the complexity of the legislation by means of formulating the new legislative package which is to repeal the existing legislation on environmental and propulsion unit performance of L-category vehicles. In a future step the requirements set-out in the EPPR can then be replaced by simple references to UN Regulations providing the objective referred to above can be achieved."

It is important to note that in the current framework, the emission limit norms are included in Regulation (EU) No 168/2013, and with the possible removal of the REPPR with references to the new and updated UN legislation, this is unlikely to not change during these initial stages. Some of the UN legislation under development contain emission norms and other key variables, the effort to develop and harmonise these will continue in the future.

2 Project methodology

2.1 Overview of work programme and approach

The work programme was undertaken by a team made up of Ecorys and TRL staff.

The methodology used in this study to develop the test procedures contained within the options documents and regulations involved an iterative process of review. The process was initially based on an assessment of existing literature and new evidence, which was gathered from a wide range of pertinent stakeholders, to provide more insight with regards to the future requirements of the regulations.

The first phase comprised a stocktake of appropriate literature, international legislation and proposals. The aim was to ensure that all current and proposed test types and the specific requirements of different regions were captured.

The second phase of the evidence gathering consisted of a stakeholder consultation. An important part of this was a questionnaire, which asked stakeholders to provide information and at times their views on current practices in different regions and the way forward.

The third and final phase of the study, the derivation of the test procedures contained within the regulations, consisted of a technical evaluation of the information collected in phases one and two. Specifically, each test type was assessed and the following aspects considered:

- Common international practices (existing harmonised practices)
- Significant differences with respect to testing methods and procedures
- The global technical feasibility
- The likely cost and economic impact
- The likely acceptability for all Contracting Parties
- The effectiveness of each proposal at improving vehicle environmental performance
- The suitability of the EPPR testing procedures with regard to current and future powertrains and technologies

The order of the aspects presented above does not represent any ranking, the priority was dependent on, each of the specific areas analysed during the development of the Regulations. This is shown where applicable in the accompanying options documents (see Section 4). Where multiple options were left after the assessment of the factors listed above, further iterative evaluation were undertaken by the EPPR Informal Working Group on light vehicles, and the role of this organisation is described below (Section 2.2).

2.2 Supporting the EC (L-EPPR Informal Working Group)

A significant part of the work programme involved helping the EC to develop and present proposals to the international stakeholders. The EC are formal representatives of the EU.

International harmonisation is performed through the United Nations Economic Commission for Europe (UNECE). The UNECE was set up in 1947 and it is one of five

regional commissions of the United Nations[1]. Although called "European" many other regions have joined both the 1958 and 1998 Agreements in order to harmonise vehicle legislation at an international level. Under the UNECE different Committees are operational e.g. the Inland Transport Committee that delegates work to different working parties. Working Party 29 (WP29) is the World Forum of world-harmonised vehicle legislation[2].

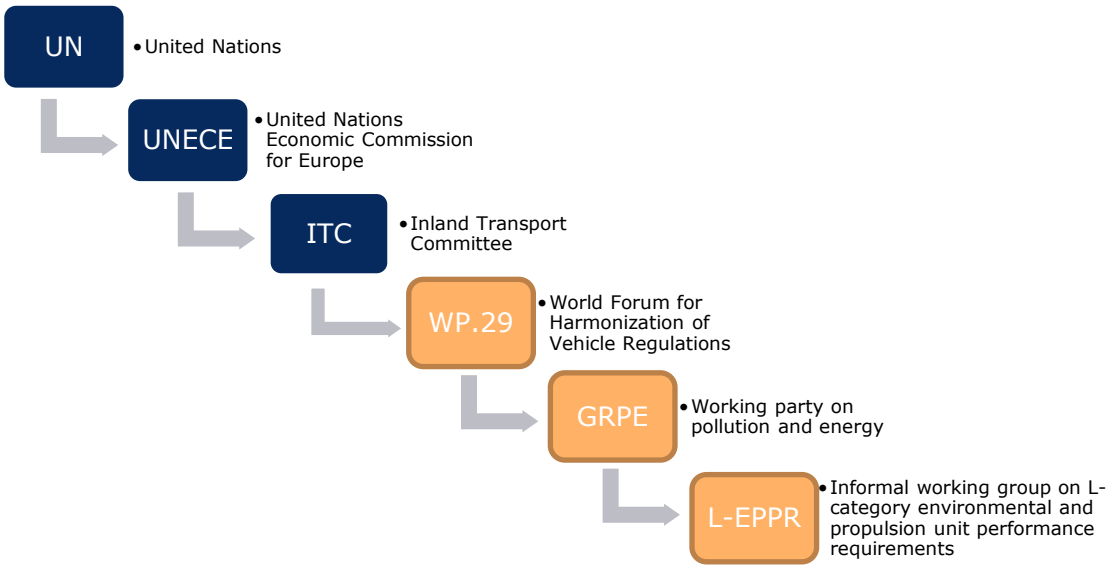


Figure 2-1: Informal working group hierarchy (other braches at each level are omitted)

A mandate (informal document: WP.29-158-15) was accepted at the 158th session of the WP.29 (13-16th November 2012) to establish an informal working group under the working party on pollution and energy[3]. The hierarchy of the UN system is shown below in Figure 2-1, the informal group is under the jurisdiction of WP.29 and is called the 'Informal working group on L-category environmental and propulsion unit performance requirements'.

The aims of the informal group are summed up in item 2 of the proposal for the creation of the group:

"2. Through this initiative, the sponsor and the international partners that have shown an interest to collaborate on these topics aim to:

- *"exchange information on current and future regulatory requirements in the area of environmental and propulsion unit performance requirements for L-category vehicles,*
- *"minimize the differences between these regulatory requirements, with a view toward facilitating the development of L-category vehicles to comply with such international requirements;*

[1] http://www.unece.org/about-unece.html

[2] *Refer to the UNECE bluebook that explains WP29 and its subsidiary groups, available on the UNECE website*

[3] https://www2.unece.org/wiki/pages/viewpage.action?pageId=5800520

- *"where possible, develop common requirements in the form of one or more UN Regulations and one or more UN Global Technical Regulations (UN GTR)."*

The aims of the L-EPPR informal group are to have members from key international regions in terms of developing legislation together (including China, India, Japan, Russia, Korea and the USA) but also all other countries that are Contracting Parties to the 1958 and 1998 Agreements, as well as Non-Governmental Organisations (NGOs) such as industry and environmental groups.

2.3 Method and Tasks

The main aim of the project for the EU is to develop proposals for legislation, which will be acceptable for adoption by WP.29. All other tasks are designed to assist with this primary aim. The tasks undertaken included:

- Participation in the UNECE Informal Working Group on L-category environmental and propulsion unit performance requirements and the EU MotorCycle Working Group
- The EC as representative of the EU and as technical sponsor undertook the required legal and administrative tasks within the UN to create the informal group
- Promoting and publicising the endeavour
    - The consortium performed steps to publicise the study and its importance, including hosting a workshop and mailing
- Undertaking a literature review of appropriate international legislation and proposals.
- A questionnaire study to gather stakeholder views.
- Developed future options.
    - The literature review and questionnaire responses formed the basis of the stocktaking exercise which was used to help inform the choices made in developing the options. This stage involved pooling together all the current international test methodologies for each test type and grouping these by task. The options were shared with the L-EPPR group for further discussion.
- An assessment of the 'Impacts of harmonisation L-EPPR regulation'
- Identified the best option for each regulatory requirement.
    - This was an iterative process based on the best evidence available. Each test was comprised of many different tasks with different options for each and a decision was made as to the preferred options.
    - The final stage was a review and final iterative loop by the EC. This final stage involved some re-drafting by the EC.
- Developed proposals:
    - With the preferred options chosen and agreed by the EC, the proposals for each regulatory requirement (test area) and UN Agreement (1958 and 1998) were written.
- Finally the developed proposals were submitted to the L-EPPR group by the technical sponsor (EC).

The data collected from the questionnaire along with the findings from the literature and feedback at the EU MCWG and UNECE L-EPPR Informal Working Group meetings provided the information used to develop the options. Once the options were developed, other information requested from the stakeholders in the questionnaire assisted in performing an assessment of the impact of the regulations. Figure 2-2 highlights the process.

The key aim of developing the draft regulations was to ensure these were based on an assessment which "identified the best options". Data was sought through desk research, the questionnaire and targeted in-depth interviews of the following groups:

- Rider organisations
- Policy maker on environmental and propulsion requirements
- Industry (e.g. manufacturer) or industry representative
- Type approval authority (TAA)*
- Technical Services provider (TSP)*
- Other governmental organisation, not one of the types mentioned above
- Rider or user association
- Other (e.g. consultancy firms)

Draft regulations will affect different stakeholders in different ways resulting from:

- Amendment of existing test types
- Introduction of new test types
- Global harmonisation of test procedure
- Global harmonisation of test equipment, tolerances, and definitions

All of the above may have effects in the areas of:

- Environmental
- Social (safety; employment)
- Economic (costs changes both positive and negative; competitiveness)

Therefore the pros and cons of any policy intervention need to be balanced with respect to all consequences and effects. This is considered in Section 5.

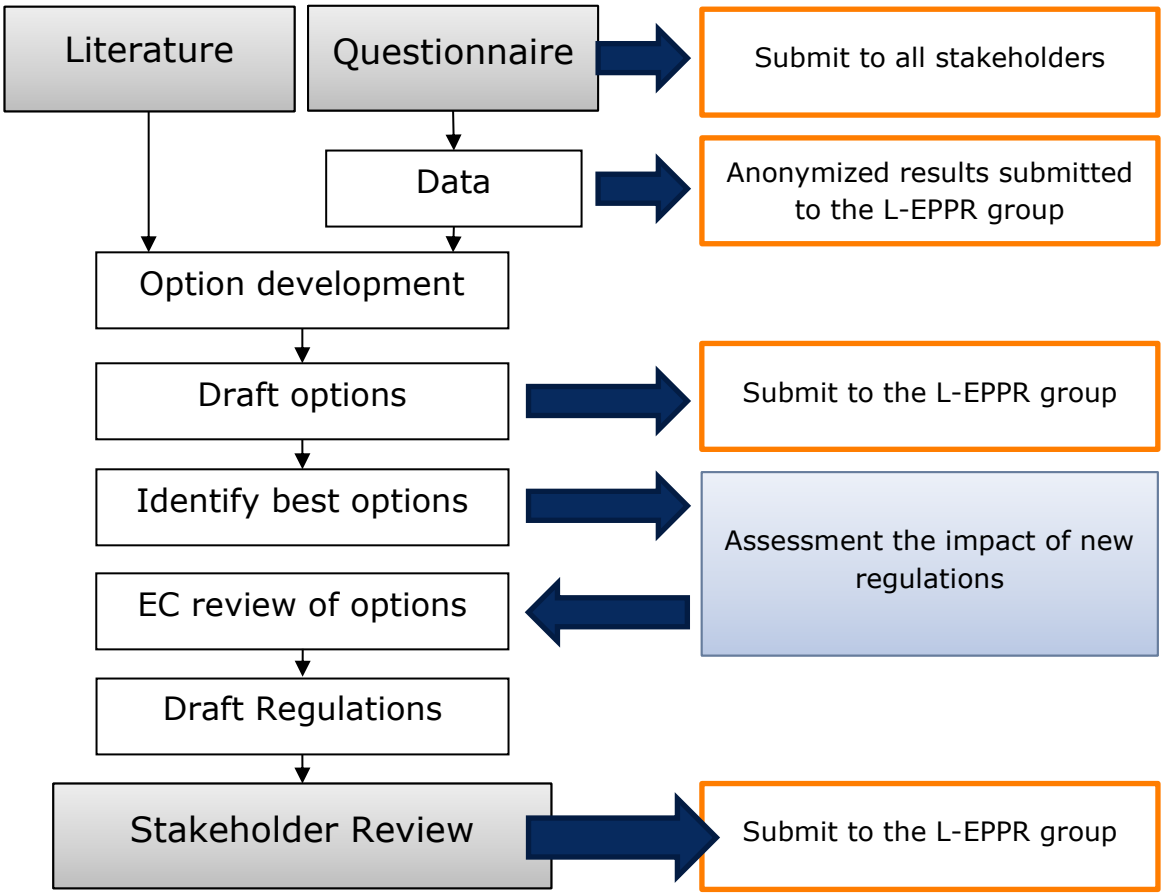


Figure 2-2: Overview of method and iterative steps

2.3.1 Communication and interaction with stakeholders

Figure 2-3 shows an overview of the process, with the consortium's assistance for specific tasks shown on the right. The activities undertaken by the consortium were:

- Publicising the project;
- Collecting and stocktaking legislation, standards and proposals;
- Developing options for the group, and to perform an impact assessment on; and
- Developing the EC's proposals to submit to the group.

In addition the project consortium assisted the EC by presenting proposals at the WP.29.

Three areas of stakeholder consultation were performed:

- Direct communications (including email, phone and face-to-face meetings)
- Publicising requests for information to be submitted (at UN and EC working group meetings as well as a wide scale email mailing); and
- Through a questionnaire.

Using these communication methods, the project aimed to develop a good understanding of the current state and future needs of the various contracting parties and other stakeholders, and to use the information collected to perform an assessment of the impacts of harmonisation for LEPPR regulation.

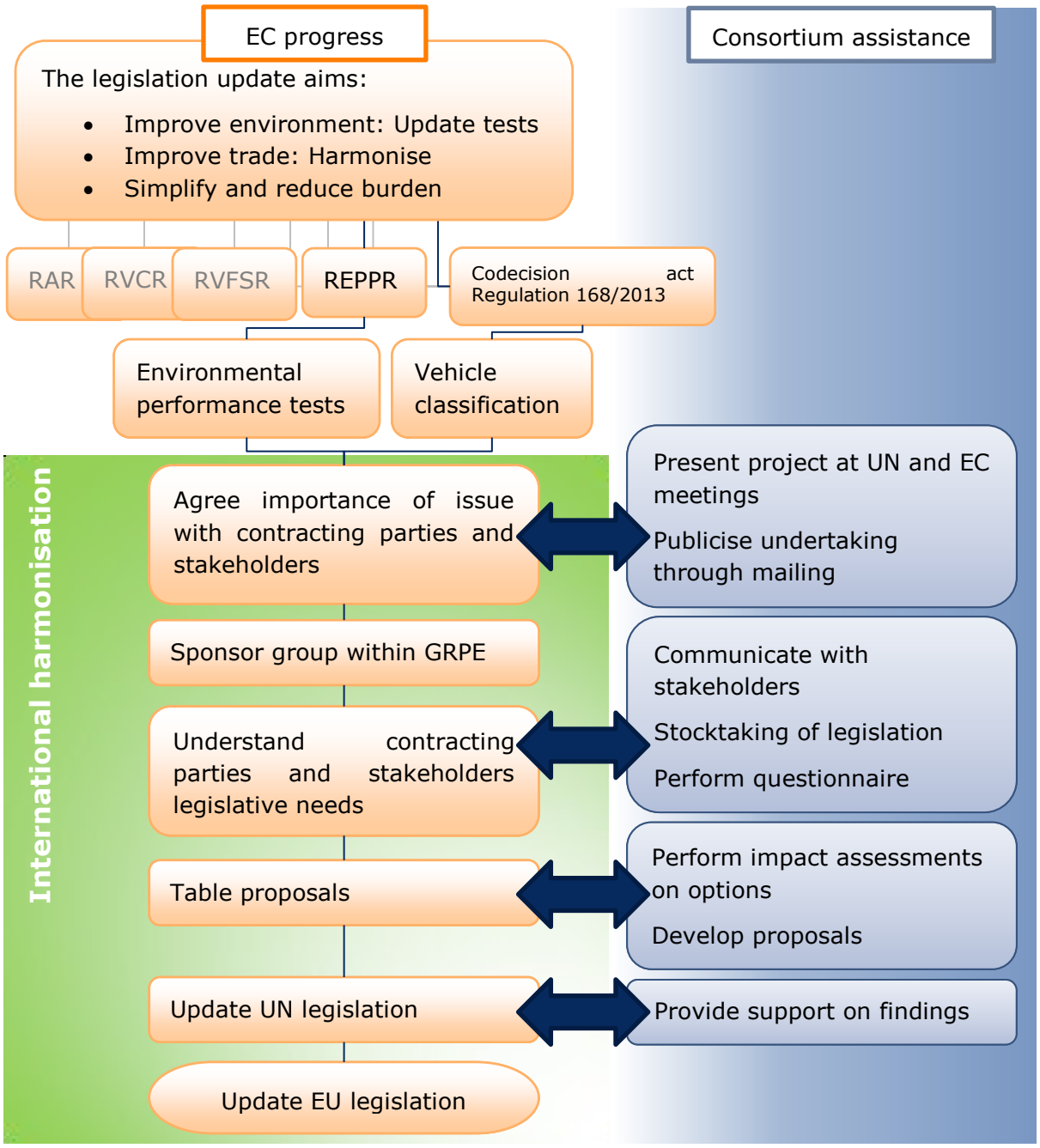


Figure 2-3: Overview of communication and interaction with stakeholders and the EC

3 Stakeholder consultation – questionnaire

An important element of this study in support of international harmonisation of environmental and propulsion unit performance requirements of L-category vehicles[4], is the consultation of stakeholders. Many different types of stakeholders are involved in the environmental and propulsion unit performance elements of L-category vehicles: manufacturers, their suppliers as well as aftermarket suppliers, approval authorities and testing agencies, and of course consumers. Implementing internationally harmonised standards means that all these stakeholders will be affected. A consultation was performed to allow stakeholders to provide input to the process of establishing internationally harmonised standards, by means of a questionnaire, which is discussed in this section of the report. The outcomes of the questionnaire were also used to assist in directing the formulation of the draft proposals. Firstly, stakeholder's submissions were used to highlight specific areas that may need to be asses. And secondly, the responses together with technical expertise were used to devise and select possible options for change.

3.1 Set up of the questionnaire

As part of the international stakeholder consultation, a questionnaire was distributed in January 2013. The main goal of this questionnaire was to allow all stakeholders involved in Environmental and Propulsion unit Performance Requirements of L-category vehicles (L-EPPR) to express their thought on elements such as:

- General information on the stakeholders' position in the L-category sector
- Cost-effectiveness of current domestic and UN legislation
- Shortcomings and benefits of current domestic and UN legislation
- Possible synergies between other category vehicle legislation and L-category legislation
- The effect of possible new worldwide harmonised legislation on the level playing field of the L-category industry and other industry stakeholders
- The effect of such worldwide harmonised measures on citizens in countries around the world by improving the air quality.

The overall aim of the questionnaire is threefold:

1. Gather opinions of different stakeholders on current legislation and on possible international harmonisation of L-EPPR
2. Gain input for possible draft proposals for internationally harmonised L-EPPR
3. Acquiring input for the Impact Assessment of possible draft proposals

The questionnaire was mainly focussed on the impacts of worldwide harmonisation of EPPR for L-category vehicles, and not so much on the different test types involved in these requirements. The test types are predominantly used in the questionnaire to

[4] Family name of light vehicles such as powered cycles, mopeds, motorcycles, tricycles and quadricycles.

determine the cost-effectiveness of possible new worldwide harmonised legislation, rather than acquiring detailed views of stakeholders with in-depth knowledge on the actual testing process of L-category approvals. For this detailed information, the more in-depth interviews have been used; see Section 5.

In order to gain as much (quantitative) information as possible on specific topics from different stakeholders, four versions of the questionnaire were constructed. Each of the four versions contained general questions on EPPR legislation and testing; the differences are mainly in the (type of) quantitative questions asked:

- **Manufacturers/industry representative version:** containing several detailed questions on the costs and cost-effectiveness of (EPPR) testing L-category vehicles for manufacturers, and possible changes in costs and benefits due to harmonisation;
- **Type Approval Authority version:** containing several detailed questions on the costs and cost-effectiveness of (EPPR) approval of L-category vehicles, and possible changes in costs and benefits due to harmonisation;
- **Technical Services version:** containing several detailed questions on the costs and cost-effectiveness of (EPPR) testing of L-category vehicles, and possible changes in costs and benefits due to harmonisation;
- **All other stakeholders version:** containing mainly general opinion questions on the matter of (cost-)effectiveness of (EPPR) approval of L-category vehicles, and possible negative of positive effects of harmonisation.

Through several preliminary questions, each respondent is directed to the correct version. Further specification can be made by means of these preliminary questions; e.g. policy makers and rider organisations can also be identified as such in the output of the questionnaire. This means that the results can be presented in a more elaborate categorisation than the subdivision of the questionnaire types.

3.2 Distribution of the questionnaire

The questionnaire was launched on the 21/1/2013 and originally sent out to 1,100 contacts, with further requests for links to the survey from the Department of the environment, transport, energy and communication in Switzerland, the Society of Indian Automobile Manufacturers, an agricultural vehicle manufacturer and the International Council on Clean Transportation. A reminder was sent out to all stakeholders that had not filled in any answers by then, on the 19th of February 2013. A similar second reminder was sent out on March the 5th 2013. Additionally, stakeholders from some countries and from Approval Authorities were contacted by telephone in the final week of March, in case they had not filled in the questionnaire yet.

3.3 Output: limited but diverse

By the time the questionnaire was closed in April 2013, a total of 90 people had opened the questionnaire. Of these 90 people, 46 people had answered questions. Out of these 46 people, 26 people had reached the end of the questionnaire: the remaining 20 partially answered the questionnaire. Amongst all the people that answered, there are also those that filled in random symbols; presumably to go through the questionnaire just to see which questions are asked. This means that of the 46 people that answered

the questionnaire, not all provided useful information for further analysis. This means that the results coming from the questionnaire should be treated accordingly: the findings presented here are an indication of how different stakeholders view the topic of Environmental and Propulsion unit Performance Requirements of L-category vehicles.

The following table provides an overview of the spread of the types of stakeholders amongst both people that clicked through to the questionnaire (i.e. that used the link in the invitation), as well as the number of respondents per stakeholder type that filled in at least one question, thereby (possibly) making the reply useful:

Table 3-1: Number of respondents and number of useful replies

Stakeholder type	Number that clicked through	Percentage of total	Number of useful replies	Percentage of total
Policy maker on environmental and propulsion requirements	11	24%	7	21%
Industry (e.g. manufacturer) or industry representative	8	17%	5	15%
Type approval authority (TAA)*	9	20%	8	24%
Technical Services provider (TSP)*	6	13%	4	12%
Other governmental organisation, not one of the types mentioned above	3	7%	3	9%
Rider or user association	1	2%	1	3%
Other (e.g. consultancy firms)	8	17%	6	18%
Total	**46**	**100%**	**34**	**100%**

*Amongst the TAA's and TSP there were respectively three and one stakeholder(s) that choose the "Other" option, instead of the correct version. This was due to the fact that they either are both a TAA and a TSP, or perform another role as well (e.g. consultant). In cases where this distinction is of importance, this is mentioned in the text.

These results show that, although only a small number of the invitees clicked through and provided useful replies to the questionnaire, the ones that have done so are well spread across the major stakeholders: regulators, industry, type approval authorities and technical service providers.

3.4 General results

Several questions were asked to all stakeholders, regardless which questionnaire they filled in (next to the personal details questions). These were questions with regards to:

- The respondents general opinion on the current L-EPPR regulations in place;
- Their general idea about the cost-effectiveness of current regulations;
- Whether or not stakeholders deem UN regulation a feasible alternative to current regulations.

The following tables show the answers of each stakeholder type on the (closed) questions with regard to the three mentioned topics.

Table 3-2: Stakeholder's their overall opinion on current requirements in the area of L-EPPR

	Policy makers	Industry	TAAs	TSPs	Others*	Total	Total in %
Excellent	2	1	0	0	0	3	9%
Good	4	2	5	0	2	13	39%
Fair	1	1	1	2	2	7	21%
Poor	0	1	1	1	3	6	18%
Do not know	0	0	1	1	2	4	12%

*Any other stakeholder than the four other groups mentioned here. See the results per stakeholder for further clarification.

With regards to the **current L-EPPR** in place, the stakeholders show a **mixed opinion**. The answers seem **slightly more positive than negative**, although **the more positive replies clearly came from policy makers, the industry and TAAs**. A non-EU policy maker indicated that they consider the current EPPR regulations excellent, and that they "pay much attention to UNECE regulations and EU directives on motorcycle emission".

A similar conclusion can be drawn with regards to the stakeholder's their opinion on the **cost-effectiveness of the current regulations**, as can be seen in the following table.

Table 3-3: Stakeholder's their overall opinion on the cost-effectiveness of current L-EPPR

	Policy makers	Industry	TAAs	TSPs	Others*	Total	Total in %
Very cost effective	3	0	0	0	0	3	9%
Cost effective	2	3	2	1	3	11	33%
Hardly cost effective	1	1	1	3	1	7	21%
Not cost effective	0	0	0	0	2	2	6%
Do not know	1	1	4	0	4	10	30%

*Any other stakeholder than the four other groups mentioned here. See the results per stakeholder for further clarification.

Again, **a mixed result, with the policy makers and the industry being the most positive**, together with the respondent belonging to the "others"-group (e.g. riders associations). One industry stakeholder did however remark that "for CO_2 and NO_x, more cost effective measures exist in non-mobile applications".

With regards to the **feasibility of UN regulation as an alternative** to current legislation, the respondents replied as shown in the following table.

Table 3-4: Stakeholder's their overall opinion on UN regulation as a feasible alternative

	Policy makers	Industry	TAAs	TSPs	Others*	Total	Total in %
Yes	3	4	6	1	4	18	69%
No	0	0	0	0	2	2	8%
Do not know	2	0	1	1	2	6	23%

*Any other stakeholder than the four other groups mentioned here. See the results per stakeholder for further clarification.

Here the general opinion seems more unanimous: 18 of the 26 respondents (69%) deem **UN regulation a feasible alternative to current domestic L-EPPR regulations**. Several remarks were however made about the feasibility of UN regulations. A rider organisation commented that "it is feasible, and for sure a great thing, but the main problem would be to satisfy requirements for every country in one international legislation". Also, a non-EU environmental organisation indicated that "equivalency or improvement of control and environmental protection must be guaranteed first". A non-European development sector NGO pointed out that "there has to be benchmarking system: following any new system is not easy".

Another element which was part of each of the versions of the questionnaire, was the stakeholder their views on **possible impacts of worldwide harmonised legislation**. The level of detail of these questions differed amongst the questionnaires, depending on the stakeholder type. Some stakeholders (e.g. industry stakeholders) were asked to indicate their thoughts on the effects of each separate test types, whereas others (e.g. rider organisations) were asked to express their views on possible effects in a less extensive manner. In this section a brief comparison between the different stakeholders will be provided: the more extensive answer will be discussed separately per stakeholder in the next sections.

With regards to the **cost impact of harmonised L-EPPR, all stakeholders seem to agree to disagree.** Within each stakeholder group, there seems to be no consensus on whether or not the cost of products will increase, decrease or remain the same. The "other stakeholders" (i.e.: rider organisations, non-EPPR policy makers, etc.) seem most positive, largely assuming that the price of L-category vehicles will decrease. But as with other stakeholders, there are stakeholders within the "other" group that assume a decrease or indicate that they do not know. Amongst TAAs there seems to be consensus that they do not know: the majority of them indicated for all test types that they do not know what the cost effect will be if the test type were to be introduced.

With regards to the **environmental or propulsion** unit **performance of L-category vehicles as a consequence of harmonisation**, **the stakeholders for the majority indicate a positive effect for all test types: stakeholders expect the test types to increase the environmental or propulsion** unit **performance of L-category vehicles**. This is illustrated most prominently by the policy makers: apart from one respondent who indicated that he/she does not know what the effect will be, all policy makers indicated that they expect each test type to have a (strong) positive effect on

the environmental or propulsion unit performance of L-category vehicles. One industry stakeholder indicated that all but Test Type VIII (OBD) has a positive effect.

No consensus seems to exist on the cost-effectiveness of harmonised L-EPPR test types, although overall it seems to be a slight positive effect can be expected. Type Approval Authorities seem to agree that they do not know what the effect will be; all other stakeholders indicated that they do not know or that the test types will be (hardly) cost-effective. One Technical Service Provider indicated only Test Type VII (energy efficiency) will not be cost effective: all other test types are presumed to be (hardly) cost effective.

3.5 Results per stakeholder

The results are presented for five different stakeholders:

- **Policy makers** on environmental and propulsion requirements
- **Industry** (e.g. manufacturer) or industry representative
- **Type Approval Authorities** (TAAs)
- **Technical Services Providers** (TSPs)
- **Others** (e.g. other policy makers, rider organisations, consultants, etc.)

For each stakeholder type, the number of useful questionnaires available (i.e. which could be used for analysis) are mentioned. The results shown here are focused on the impacts of international harmonisation of the test types: these have been used as input for the impact assessment, see Section 5.

3.5.1 Policy makers – 7 questionnaires available for analysis

On harmonisation

Various **advantages and disadvantages to international harmonisation** are given by policy makers.

Advantages:

- Economic:
  - Lower costs
- Environmental:
  - Contribution to reduce air pollution
- Social:
  - More people have access to "quality" vehicles

Disadvantages:

- Economic/Social:
  - Does not provide protection against non-compliant manufacturers (for manufacturers in countries with strict regulation in place)

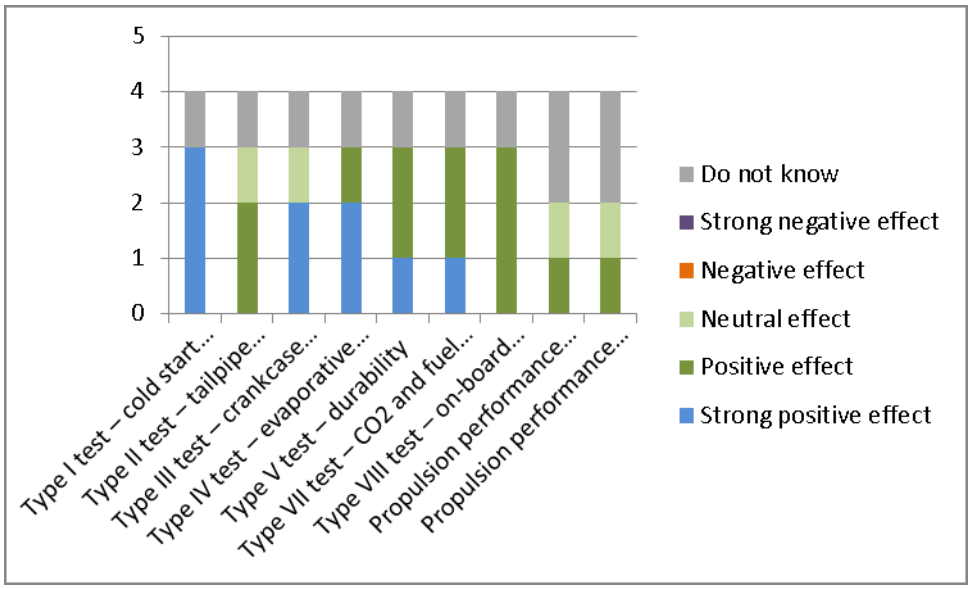
On the question whether or not international harmonisation would have an **effect on the costs of products** that manufacturers sell, policy makers responded diversified, as shown in Table 3-5:

Table 3-5: Opinion of policy makers on cost effect of harmonisation of EPPR legislation (# of respondents)

Answer	Number of times
A cost increase may be expected	1
A cost decrease may be expected	2
No cost impacts may be expected	0
Do not know	2

On the **effect of harmonised EPPR legislation on the environmental performance of products**, policy makers not once indicated a negative effect on the environmental performance of L-category vehicles: either neutral or (strong) positive effect, being a better environmental performance. With regards to the **effect of propulsion** unit **performance testing harmonisation**, policy makers either do not know what the effect will be, or assume a neutral to positive effect. See the following figure for the results:

Figure 3-1: Opinion of policy makers on environmental and propulsion unit performance of products due to harmonisation of EPPR legislation (# of respondents per test type)



With regards to the **cost-effectiveness of possible international harmonisation**, policy makers responded as shown Table 3-6: either they indicate they do not know what the effect will be, or that the test types will be (very) cost effective.

Table 3-6: Opinion of policy makers on cost-effectiveness of harmonisation of EPPR legislation (# of respondents)

Answer	Number of times
Very cost effective	1
Cost effective	1
Hardly cost effective	0
Not cost effective	0
Do not know	2

3.5.2 *Industry – 5 questionnaires available for analysis*

On harmonisation

Various **advantages and disadvantages to international harmonisation** are given by industry stakeholders.

Advantages:

- Economic:
  - Reduce development times and costs
  - Makes markets accessible for more manufacturers
  - Create cost-effectiveness for OEM's

Disadvantages:

- Economic:
  - Still need market surveillance
  - Increases prices for vehicles in particular in "poor(er)" countries

For the more detailed questions, two industry stakeholders replied in detail to the questions with regards to the specific effects of harmonisation. On the question whether or not international harmonisation would have an **effect on the costs of products** that manufacturers sell, the two industry stakeholders responded that these would increase for most of the test types, or otherwise would remain the same.

On the **effect of harmonised EPPR legislation on the environmental and propulsion unit performance of products**, the two industry stakeholders for the majority of the test types indicated that this would have a neutral or positive effect: one stakeholder expects the test type VIII (OBD) to have a negative effect.

With regards to the **cost-effectiveness of possible international harmonisation**, the two industry stakeholders expect that all test types will be cost-effective, apart from Test Type VIII (OBD): one stakeholder thinks that this test type will not be cost-effective.

3.5.3 *Type Approval Authorities (TAAs) – 8 questionnaire available for analysis*

On harmonisation

Various **advantages and disadvantages to international harmonisation** are given by TAAs.

Advantages:

- Economic:
  - Lower burden for moped manufacturers
- Economic/Social:
  - More effective measures to prohibit illegal tuning parts

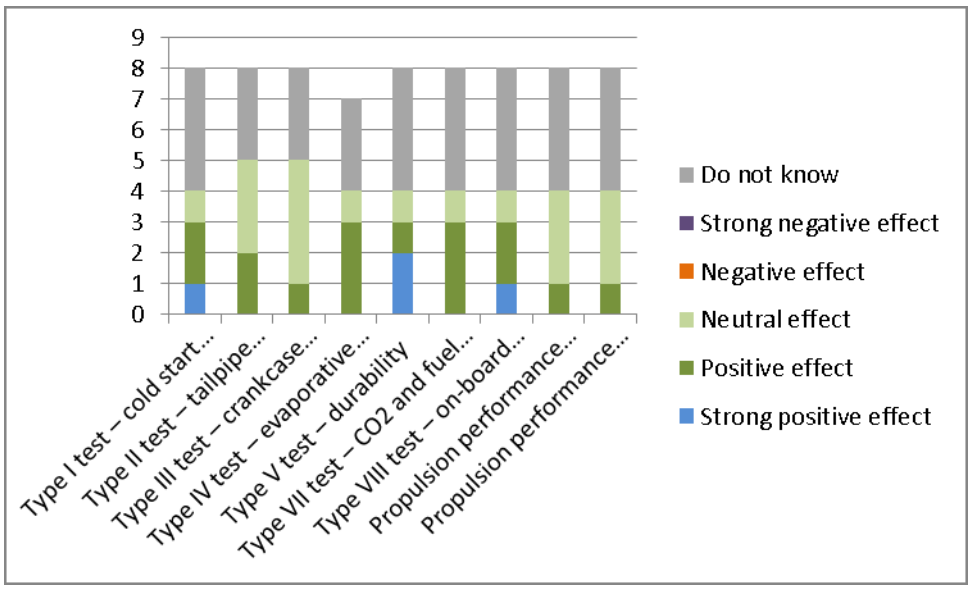
Disadvantages:

- Economic/Social:
  - Different approaches of regional authorities
- Environmental/Social:
  - Danger to end on a low level of harmonisation (targeting the lowest denominator between countries)

On the question if international harmonisation would have an **effect on the costs of testing**, four out of five TAAs indicated that they cannot answer the question: one TAA indicated that for all test types the costs will decrease

On the **effect of harmonised EPPR legislation on the environmental performance of products**, TAAs for the majority indicated that they do not know what the effect would be. TAAs that expects harmonised test types to have an effect on the environmental performance, not once indicated a negative effect: either neutral or (strong) positive effect, thereby indicating that they presume that the test types will enhance the environmental performance. The same counts for the **and propulsion unit performance harmonisation:** the majority of TAA's indicate that they do not know or are neutral about the effect of international harmonisation of propulsion unit performance testing. See the following figure for the results:

Figure 3-2: Opinion of TAAs on environmental and propulsion unit performance of products due to harmonisation of EPPR legislation (# of respondents per test type)



With regards to the **cost-effectiveness of possible international harmonisation**, all TAAs responded that they do not know whether or not the test types will be cost-effective.

3.5.4 Technical Services Providers (TSPs) – 4 questionnaires available for analysis

On harmonisation

Various **advantages and disadvantages to international harmonisation** are given by TSPs.

Advantages:

- Economic:
  - A simplification in the type approval procedures and as a consequence of this an important reduction in costs
- Environmental:
  - Important tool to measure and compare environmental performances of two different products
- Social/Environmental:
  - Easy information for customer to interpret

Disadvantages:

- No disadvantages

Only one TSP stakeholder answered the more detailed questions. This stakeholder expects the international harmonisation to have a neutral **effect on the costs of testing**: the costs will remain the same according to the stakeholder,

On the **effect of harmonised EPPR legislation on the environmental and propulsion unit performance of products**, the stakeholder indicated that they do not know what the effect would be for each of the test types.

With regards to the **cost-effectiveness of possible international harmonisation**, the TSPs responded that Test Type VII (energy efficiency) will not be cost effective: all the other test types will be (hardly) costs effective.

3.5.5 Other stakeholders – 10 questionnaires available for analysis

On harmonisation

Various **advantages and disadvantages to international harmonisation** are given by policy makers.

Advantages:

- Economic:
  - Simplification in the type approval procedures and as a consequence costs reductions
  - Type Approval process and tests of vehicle in use will become easier

Disadvantages:

- Social:
  - Tailoring to different motorcycle fleet characteristics may not be possible. The same accounts for tailoring to different driving conditions and speed limits
- Environmental:
  - Possibility that during the harmonization process the level of the standard is reduced
- Economic:
  - The costs required by the need to adapt to a new legislative framework

On the question whether or not international harmonisation would have an **effect on the costs of products** that manufacturers sell, other stakeholders responded diversified although expecting an increase in costs for the majority, as shown in Table 3-7:

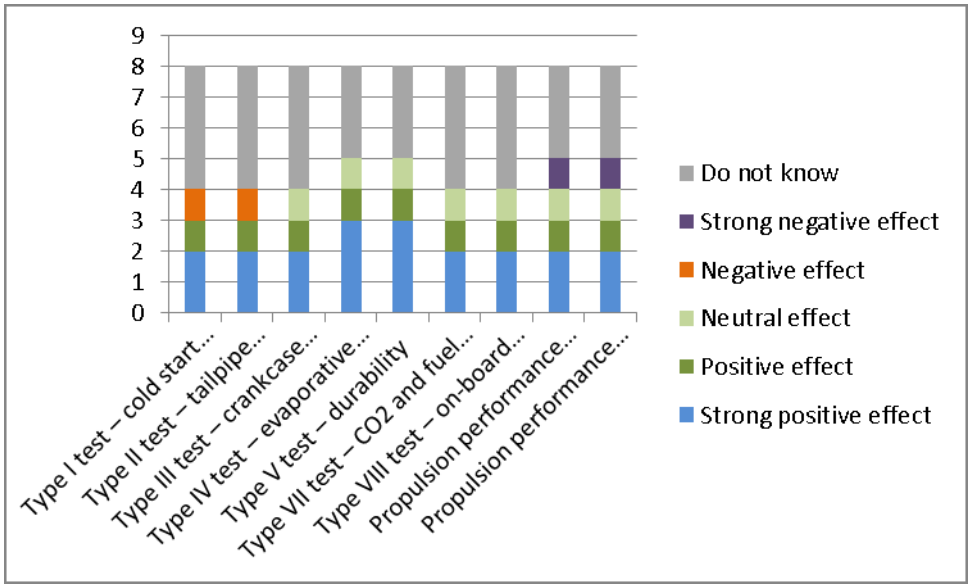
Table 3-7: Opinion of other stakeholders on cost effect of harmonisation of EPPR legislation (# of respondents)

Answer	Number of times
A cost increase may be expected	2
A cost decrease may be expected	4
No cost impacts may be expected	0
Do not know	2

On the **effect of harmonised EPPR legislation on the environmental performance of products**, other stakeholders are again diversified in their opinions. However for all of the environmental test types, the other stakeholders indicated that they assume that

the effect would be neutral to positive, or that they do not know what the effect will be. With regards to the **propulsion unit performance testing harmonisation**, the other stakeholders are even more diversified, ranging from strongly negative to positive as well as some indicating that they do not know what the effect will be; see Figure 3-3 below.

Figure 3-3: Opinion of other stakeholders on environmental and propulsion unit performance of products due to harmonisation of EPPR legislation (# of respondents per test type)



With regards to the **cost-effectiveness of possible international harmonisation**, other stakeholders responded as shown Table 3-8:

Table 3-8: Opinion of policy makers on cost-effectiveness of harmonisation of EPPR legislation (# of respondents)

Answer	Number of times
Very cost effective	1
Cost effective	3
Hardly cost effective	0
Not cost effective	1
Do not know	2

4 Development of L-EPPR Options and Regulations

4.1 Test areas to be assessed

The areas being covered in the project are environmental performance tests, together with the vehicle categorisation, which is used to assign the appropriate test version to be used.

The test types were grouped as follows:

- **Emissions 1 (tailpipe related)**
  - Type I test – Tailpipe emissions after cold start (over laboratory emission driving cycle)
  - Type II test – Idle emissions / free acceleration test
  - Type V test – Durability of pollution control devices[5]
  - Type VII test – Energy efficiency in terms of CO_2 emissions, fuel/energy consumption, and electric range
- **Emissions 1a (tailpipe related)**
  - Type V test - Durability of pollution control devices (Standalone)
- **Emissions 2 (other)**
  - Type III test – Crankcase emissions
  - Type IV test – Evaporative emissions
- **On-Board Diagnostics**
  - Type VIII test – OBD (on-board diagnostics) (environmental part)
- **Propulsion unit Performance Requirements (PPR)**
  - Maximum design vehicle speed test
  - Maximum net power (engine/motor) test
  - Maximum net torque (engine/motor) test
  - Maximum 30 minutes power test
- **Vehicle categories and definitions**
  - R.E.3
  - S.R.1

Following discussions and agreements with the Informal Working Group, the test areas were grouped as set-out in Figure 4-1.

[5] At the time of finalising the study the L-EPPR group was still discussing and deciding whether the type V durability requirements would be incorporated in the revised GTR No 2 or if these requirements should be included in a stand-alone GTR.

The Options documents were drafted for each of the boxes on the left hand side of Figure 4 1 (for example 'Categories – Definitions'). Following the iterative review process explained in Section 3, the preferred options were then ultimately taken and drafts for 1958 and 1998 Agreement Regulations written by TRL and the EC. The Options and GTR documents are published separately to this report due to their size, formatting requirements and complexity.

At the time of writing, discussion is on-going within the Informal Working Group as to whether Test Type V should be included in GTR No. 2 or should be a stand-alone test.

In addition, Regulation R47 was updated in line with the comments and guidance of the EC and the Informal Working Group.

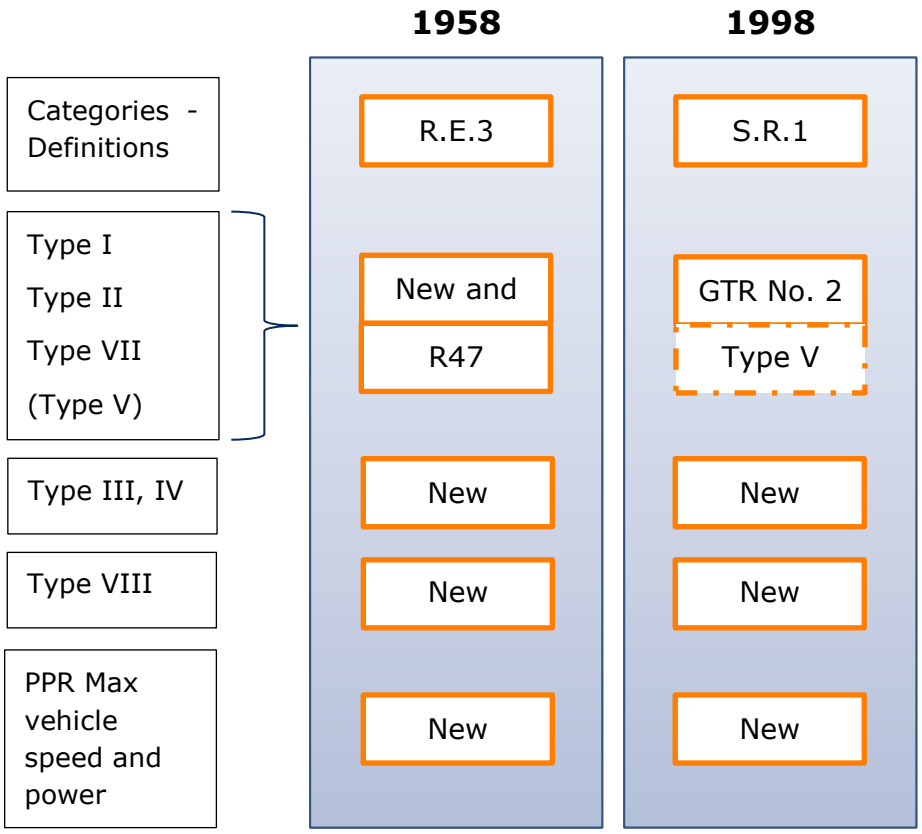


Figure 4-1: Known legislation locations

5 Impacts of harmonisation of Environmental and Propulsion unit Performance Requirements (EPPR) regulation

5.1 Introduction

In the previous sections technical proposals for Environmental and Propulsion unit Performance Requirements (EPPR) regulation have been discussed. If they are implemented, these proposals have different impacts on all involved stakeholders at EPPR-regulation: manufacturers, type approval authorities, customers, etc. In this section the impacts of a limited amount of these proposals are assessed and the costs and benefits of the proposals are further elaborated.

An outline of the approach taken is given, defining the scope and methodology applied for the assessment of impacts (Section 5.2). In Section 5.3 the costs of type approval in the current situation are described, which is extended in Section 5.4 with the EPPR costs. In Section 5.5 the baseline scenario is described against which the impacts are assessed. Section 5.6 describes the impacts of introducing internationally harmonised EPPR-regulation. This is the first part of assessing the impacts of harmonisation. Section 5.7 then proceeds with the second part, going into more detail on the impacts of two test types in particular: Test Type IV (evaporative emissions) and Test Type VII (energy efficiency). Section 5.8 draws conclusions based on the assessment of impacts.

The section follows as much as possible the approach of the European Commission for Impact Assessments and prescribed by the Impact Assessment Guidelines of the European Commission. This report does however deviate from the formal guidelines. A full-fledged Impact Assessment would entail the determination of the impacts across the world of each separate option as described in chapter 4 and would require much data. However, this data is scarce and very often also confidential. Due to limited data available it is not deemed possible to perform this assessment in conformance with the Impacts Assessment Guidelines. As a consequence, this study focusses on the impact of harmonisation of EPPR regulation in general, partly in a qualitative and partly in a quantitative way, but by following the approach in the guidelines. Compared to the guidelines a much more general approach is applied.

5.2 Assessing the impacts of the globally harmonised regulations

For the global EPPR-regulations impacts have been assessed. This assessment describes the main basic costs and benefits of the proposed EPPR-regulations. The impacts are described in two parts.

5.2.1 Part 1: Impacts of EPPR-regulations in general

The first part (Sections 5.3 to 5.6) focusses on the impacts of the globally harmonised EPPR-regulation in general. The previous paragraph shows that much of the global EPPR-regulations is on the introduction of new test type procedures as a basis for international harmonisation of regulation. Both key elements (new test types and harmonisation) can have a cost impact on manufacturers. This could be either in a negative sense, in the form of a cost increase due to increasing costs per test, or in a positive sense: decreasing costs due to fewer type approvals. The resulting cost level will depend

strongly on whether or not EPPR-regulation will be internationally harmonised and on the question whether or not manufacturers are active locally or globally. If so, the costs for a specific type approval may increase, but as fewer type approvals are needed due to harmonisation, costs as a whole may decrease.

As described before EPPR is one of the elements of type approval. When, alongside EPPR, all test type procedures within type approval are harmonised the impacts of harmonisation will increase. As harmonisation of regulation is a key element of the global regulation, this impact assessment not only analyses the impacts of worldwide harmonised EPPR-regulation but also gives an indicative overview of the impacts of worldwide harmonisation of all 'type approval test procedures' in general.

5.2.1.1 Focussing on different groups of manufacturers

The EPPR-regulation affects the type-approval costs for manufacturers. As indicated by ACEM these type-approval costs widely vary between manufacturers in function of a number of parameters, including:

The nature and number of markets targeted by the manufacturer (local, regional, international)

The nature of the product (high end or low cost L-category vehicle)

The perimeter of the costs applied by each manufacturer's accounting procedure (test only, + vehicle(s), components, and consumables involved, transport, direct man power, indirect costs linked to type-approval costs etc.)

The product planning policy implemented by each manufacturer

The company itself, its type-approval process (testing in-house or via a testing house)

The type-approval authorities and laboratories selected

The overview shows that it is desirable to distinguish different groups of manufacturers to evaluate the impacts of the proposed EPPR-regulation in a good way. This study does this in two ways to give account for a number of the parameters.

To assess the differences in impact we have defined four groups of manufacturers, varying in two crucial aspects;

the (production) size of the manufacturer;

the type of product.

First of all much of the size of the impacts depends on the **size of the manufacturer** (i.e. number of L-categories sold) and the **type of L-category vehicles** sold. In general it is assumed that the smaller the manufacturer the higher the cost impact of type approval will be, as the costs for type approval procedures has to be spread out over a lower number of vehicles compared to a large manufacturer. As a consequence a small

or medium enterprise[6] (SME) may be more sensitive for global EPPR-regulation than large manufacturers[7], but may also to a relatively larger extent benefit from internationally harmonised legislation as this may support foreign market access that was not possible before. Given this, it makes sense to distinguish these two types of manufacturers.

Secondly as mopeds and motorcycles concern most of the L-category vehicles in use in Europe (and worldwide) it also makes sense to look into these vehicles in particular. In addition to this, prices levels of mopeds are in general substantial lower than for (high performance) motorcycles, which suggest that mopeds could also be more sensitive to new EPPR-regulation.

By combining these elements the following four groups of manufacturers result:

SME-manufacturer of high performance motorcycles

Large manufacturer of high performance motorcycles

SME-manufacturer of mopeds

Large manufacturer of mopeds

These groups only differ in the amount of production and in type of vehicles, just to show the (cost) impacts of the global regulation. These four groups concern manufacturers for which the European Union is an important market; a substantial part of the products are sold to European consumers. It can be a European company but this isn't necessary the case. As is the case in the present situation, several Japanese and American manufacturers, which develop and produce vehicles in the EU market, sell substantial volumes to European customers and can therefore not be considered purely as foreign manufacturers.

The table below shows the key figures that have been applied in the calculations for each of these four types of manufacturers. Please note that the applied figures are indicative figures but do reflect average figures for these types of manufacturers as good as possible. The figures are based on questionnaire output, desk research and interviews, with different stakeholders from the L-category industry. The exact numbers are explained in more detail in Section 5.3.

[6] An SME-manufacturer is assumed to produce about 2,500 motorcycles or 10,000 mopeds annually, predominantly for the European market but also with sales world-wide.

[7] A large manufacturer is assumed to produce at least 100,000 motorcycles or 250,000 mopeds annually. These vehicles are sold world-wide.

Table 5-1: Annual sales of motorcycles and mopeds

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Total sales[8]:				
-Number of models available for sale	5-10	25-35	5-10	25-35
- Total annual sales	2,000-4,000	100,000-200,000	8,000-12,000	250,000-500,000
Markets:	Predominantly Europe	Europe and worldwide	Predominantly Europe	Europe and worldwide
- Number of type approvals needed annually to serve markets	3-20	60-100	3-20	60-100

These four groups of manufacturers are at the heart of the first part of the impact assessment. As described it concerns manufacturers for which the European Union is an important market. There are also manufacturers, mainly in developing countries like India and China that mainly produce for the domestic market and for other developing countries. Additionally to the four groups of manufacturers mentioned before, and in a more illustrative and imaginary way, the impacts of a more harmonised EPPR-regulation are discussed for these manufacturers as well. The assumptions for these groups of manufacturers are described in the specific paragraphs.

5.2.2 Part 2: Impacts of test type IV and VII

In the second part of the Impact Assessment (Section 5.7) two specific test types are reviewed in more detail:

Test Type IV (evaporative emissions)

Test Type VII (energy efficiency).

In particular for these two test types there are distinguishing proposals for both test types, under review at the time of writing. In coordination with the European Commission, these two test types have been chosen to be treated separately for this Impact Assessment, given that are both (partly) new and are likely to have an impact on the L-category vehicle market.

[8] Annual sales figures have been estimated on the basis of annual sales figures of several of the largest motorcycles manufacturers. Exact figures are scarce: figures shown are best estimates.

Test type IV focusses on evaporative emissions: emissions that evaporate from the fuel storage and delivery system. There are several ways of determining these emissions, each with different impacts, particularly in terms of costs. Furthermore, this test can have substantial impacts on the total emissions of L-category vehicles worldwide.

Test type VII determines the energy efficiency of L-category vehicles, and concerns tests on (1) CO_2-emissions, (2) fuel consumption, (3) energy consumption and (4) electric range for three types of vehicles: conventional, hybrid, pure electric. These are all tests with no set limits: it purely concerns the measurement and communication of the mentioned topics. Aim of these tests is thereby to improve customer information and to support the decision-making process of consumers when choosing between vehicles at the point of sale.

5.2.2.1 Impacts of regulations are determined against the baseline scenario

The impacts of the global regulations are compared to a baseline scenario, as is required for impact studies. The baseline scenario differs from the present situation in that the Co-decision act is assumed to be fully implemented in the EU, including the three delegated acts setting out test procedures and technical requirements provisions (amongst which the to be determined EPPR regulation) and one implementing act laying down the applicable administrative provisions. It is assumed that, in the baseline, **harmonisation of EPPR regulation does not take place**: comparable to the present situation 'every country outside the EU' keeps making its own regulation. This means that for a manufacturer the present situation, with multiple type-approvals required to sell a product worldwide, remains the same outside the EU.

For the assessment of impact, the situation in which the EU EPPR regulation is harmonised worldwide is added. The effects of this situation compared to the baseline scenario are determined in the impact assessment. The figure below illustrates the different situations and shows the effects to be determined by means of the assessment of impact. In Section 5.4 this is worked out in more detail.

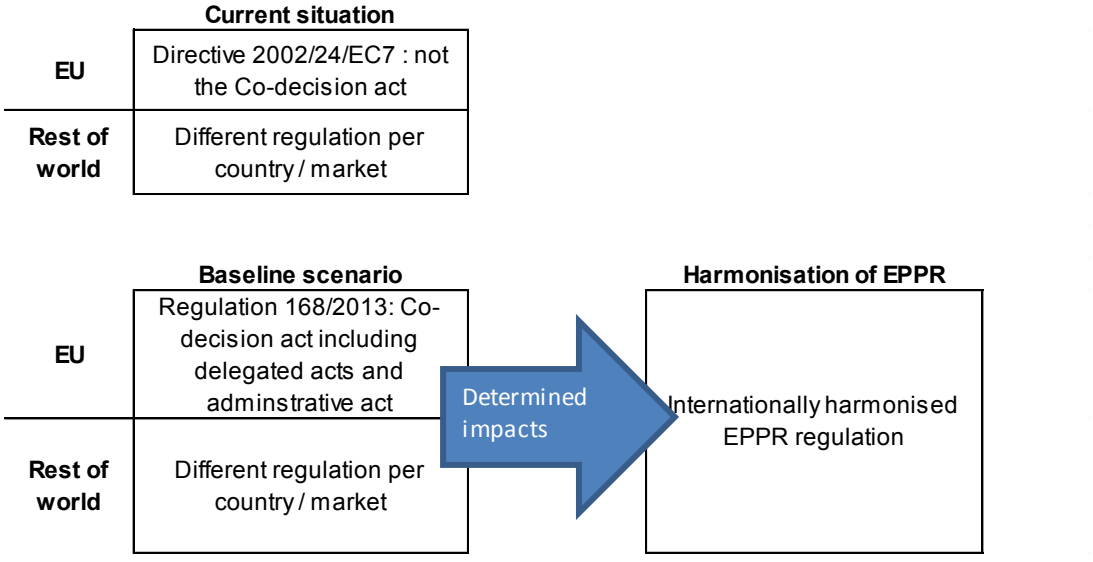


Figure 5-1: Effects to be determined by means of the assessment of impact

5.2.2.2 A basic analysis of impacts

The primary sources of information for the impact assessment are the following:

the questionnaire results, as described in Section 3;

additional interviews with several different stakeholders (see Appendix), in which specific details with regards to possible impacts were discussed;

a literature study to acquire general figures.

- As the number of sources as the amount of data acquired from these sources is limited (as described before; the response to the stakeholder analyses was small), precaution has been taken in drawing conclusions from the quantified figures. Figures have been presented anonymously and the results are most often presented in a range rather than a single figure to take account of the data uncertainties.

In addition, at the moment of writing of this report (autumn 2013) the EPPR-regulation is still developing and as a consequence not all details on the regulation are known yet. This was also an issue in the additional interviews carried out, making it not possible to calculate detailed quantitative figures.

Due to limited data available and the evolving character of the global regulation it was not possible to evaluate all the impacts in detail. The analyses carried out in part 1 of the impact assessment are basic analyses focussing on the impacts of harmonisation and on the global regulation in general. Secondly the focus is on the impacts on the number of type approval procedures and the costs of a test procedure specifically. The other impacts are, due to a lack of figures, predominantly described in a qualitative way.

The impacts of the specific test procedures (part 2 of the IA) are fully described in a qualitative way. It was not possible to gather sufficient data to come up with plausible figures.

As discussed before, in both parts of the impacts assessment the focus of the impact assessment is on mopeds (L1e-B) and high-performance motorcycles (L3e-A3). These categories are the largest group of L-category vehicles in terms of vehicles sold and currently on the road. The impacts of regulation will be most substantial in terms of absolute numbers for these categories.

Underlying most of the calculations in the next paragraphs are:

- The costs for type approval procedures in the current situation
- The costs for type approval procedures including the global EPPR-regulation.

Both costs are explained in more detail in the two following paragraphs, starting with the current situation in Section 5.3.

5.3 Costs for type approval procedures in the current situation

For the current situation the table below shows the range of average costs for type approval for the four distinguished groups of manufacturers. These figures have been derived by means of data taken from the questionnaire and through in-depth interviews

with multiple stakeholders (manufacturers, Type Approval Authorities and Technical Service Providers) in the L-category domain. The prices are applicable at the time of writing (fall 2013): the figures are indications, but are robust in terms of fluctuations in the different costs. Please note that the exact value is dependent many factors, for example the price of a single type approval is subject to economies of scale (i.e. the number of test performed by a single TA for a specific manufacturer): these kinds of effects are not taken into account in the figures shown in the table.

Table 5-2: Average costs for type approval test procedures

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Costs for one type approval	€ 20,000 - €40,000	€ 20,000 - €40,000	€15,000-€30,000	€15,000-€30,000
Number of type approvals annually for a manufacturer	3-20	60-100	3-20	60-100
Annual sales of a manufacturer to serve its markets	2,000 – 4,000	100,000-200,000	8,000-12,000	250,000-500,000
Number of models per manufacturer	5-10	25-35	5-10	25-35
Number of markets per model	3-7	7-9	3-7	7-9
Type approval costs per produced vehicle	€30-€200	€12-€20	€6-€50	€4-€6
Production costs per model	€6,000-€12,000	€6,000-€12,000	€750-€2,000	€750-€2,000
Share of type approval costs within total production costs	0.5%-1.7%	0.2%[9]	0.8%-2.5%	0.3%-0.5%

In general the following findings can be derived from the table. The table shows that **SMEs have substantially fewer type approvals** to perform than large manufacturers, due to fewer models on fewer markets. However, the impact of the **costs of type approval per vehicle is higher for SMEs** than for large manufacturers, mainly due to lower sales. The table also shows that the **type approval costs per vehicle produced is higher for motorcycle manufacturers** than for moped manufacturers, due to the higher overall testing costs.

[9] Range is from 0.17% up to 0.20%, rounded of to the number shown: 0.2%

In more detail the table shows the following. First of all the table shows that the **costs for one type approval** vary between mopeds and motorcycles, which is due to different testing costs for the different vehicles. Next to testing costs, there are the costs for the actual type approval: a Type Approval Authority (TAA) has to approve a model. This can be done by means of witness testing (i.e.: the TAA witnesses the test being performed) or by approving a test report of a Technical Service Provider (TSP). Both processes (witness testing and report approval) lead to the type approved motorcycle model, for which proof is given by a certificate. This certificate is valid for an unlimited period. Next to the testing and certification costs, a manufacturer will bear other costs: mainly preparations, such as testing before the actual type approval, but also for instance depreciation of machinery and personnel costs in case they have to be present when testing at a TSP. Some countries accept the testing report or certification of the type approval authorities from for instance Europe. This means that a manufacturer does not have to perform the testing separately for each single type approval or self-certification, and not all costs will be endured. Next to type approval there are markets/countries where the system of self-certification applies. In those countries, a manufacturer has to ensure that their products meet the requirements set in that country, risking punishment (in the form of a fine or withdrawal from that specific market of the product) if a product does not meet the requirements when tested by the dedicated authority. In this situation, a manufacturer has testing costs, but no other type approval costs than the certification costs. For the US for instance, the costs of the certificate is roughly $1.000 per year: the testing is to be performed by manufacturers themselves. No figures are known for the other certifications across the world. Therefore, to determine the total costs of type approval, the costs of EU type approval has been used for each type approval to be acquired.

In general a number a manufacturers that sells worldwide needs roughly 9 to 11 different type approvals for one motorcycle or moped model. This allows a manufacturer to serve the majority of the markets worldwide, like the EU, the USA and California, Brazil, Australia, Russia, Japan, Philippines, Thailand, Malaysia, Indonesia, China and India. On average, a large manufacturer (either moped or motorcycle) will sell its products on 7 to 9 **markets**. An SME is assumed to serve between 3 and 7 markets per model. A large manufacturer is likely to produce around 3 to 4 new models per year, and updates on type approvals are needed for existing models if alterations are made to a model. An SME on the other hand is likely to have several models, but may only need a few or even no type approvals. Combining the number of models for which type approval has to be acquired on an annual basis with the number of markets served on average provides the **total number of type approvals each year**. Shown in the table is the range of number of type approvals annually that a manufacturer is likely to acquire: 3 to 20 for an SME, 60 to 100 for a large manufacturer.

Combining the average costs for one type approval and the number of type approvals required annually provides the **total costs of type approval** that manufacturer has to make to serve its markets. In order to determine the average costs of type approval for one vehicle, the total costs for type approval have been divided by the production numbers per manufacturer. Furthermore, the assumption has been made that all annual costs of type approval are recovered by a manufacturer within the same year. Although not likely to always be the case (as most models last for more than one year), this allows for spreading the total type approval costs across the annual production.

The **total type approval costs per vehicle produced** vary, both between SMEs and large manufacturers, as well as between moped and motorcycle manufacturers. The costs for type approving a moped are lower per vehicle sold than for motorcycles in absolute terms: between €3.5 to €50 for mopeds and between €12 and €200 for motorcycles. However, the **production costs** of mopeds are lower, ranging from 750 to €2,000, compared to €6,000 to €12,000 for motorcycles. This causes the **share of type approval costs** to be higher for mopeds than for motorcycles: ranging from 0.3% to 2.5% for mopeds, compared to 0.2% to 1.7% for motorcycles. **Vehicles of SMEs are clearly more affected** by the costs of type approval than large manufacturers, both when it concerns mopeds as well as motorcycles. The highest share of type approval costs (per vehicle sold) are those concerning an SME producing mopeds: the share can be 2.5% of the production costs. Two remarks with regards to SMEs: in the L-category industry SMEs are likely to be more premium brands, meaning that their production costs will be higher than average. This in turn would decrease the share of the testing costs, given that these are equal for all manufacturers. Secondly, with globally harmonized regulation, manufacturers are able to access markets worldwide, without the burden of additional testing costs. Given that the share of testing costs for SMEs are higher than for large manufacturers, SMEs would benefit of this cost decrease more than large manufacturers.

- Summarizing, the figures provide some insight into the relatively small share of the type approval costs in the overall costs of high performance motorcycles and mopeds: both in total and per vehicle sold. Furthermore the figures indicate that although the costs are likely to be considerable higher for smaller manufacturers compared to large manufacturers, they can still be considered marginal in relation to the total costs of production.

5.3.1 Costs of environmental and propulsion unit performance regulation in type approval costs

- Within the type approval of L-category vehicles, there are tests for the environmental and propulsion unit performance requirements for the vehicles: under the Co-decision act this is referred to as the EPPR. Currently, the environmental and propulsion unit performance part of the whole-vehicle type approval consists of Test Type I (tailpipe emissions after cold start) and Test Type II (tailpipe emissions at idle and at high idle), as well as engine torque, power and maximum design vehicle speed (for which a declaration of the manufacturer will suffice in current EU type-approval legislation).
- This part of the type approval is separately looked at from a cost perspective: of the current total costs of type approval, which part constitutes of environmental and propulsion unit performance tests?

Table 5-3: Average costs for EPPR type approval test procedures

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Total costs for one type approval	€ 20,000 - €40,000	€ 20,000 - €40,000	€15,000-€30,000	€15,000-€30,000
Costs for the EPPR tests in	€5,000-€12,500	€5,000-€12,500	€4,000-€10,000	€4,000-€10,000

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
one type approval				
Share of EPPR costs in type approval costs (combining the two previous rows)	25%-31%	25%-31%	27%-33%	27%-33%
Total type approval costs per produced vehicle	€30-€200	€12-€20	€5.5-€50	€3.5-€6
Of which EPPR-costs	€7.5-€63	€3-€6	€1.5-€17	€1-€2
Share of EPPR costs in production costs	0.1%-0.5%	0.05%[10]	0.2%-0.8%	0.1%[11]

- The main message (Table 5-3) is that the costs of EPPR testing constitute around 25% to little over 30% of the total type approval costs, for each of the different manufacturers, although in absolute terms only a fraction of total production cost. The table furthermore shows that the share of EPPR costs in total type approval costs does slightly vary between moped and motorcycle manufacturers, with a higher share for moped manufacturers. Motorcycles manufacturers have higher absolute costs, but a slightly lower share in EPPR costs per type approval than moped manufacturers, due to higher overall testing costs.
- In the current testing procedure, manufacturers are charged around €2.500 for the EPPR part of the European type approval testing of one high performance motorcycle by a TSP, and around €2,000 for a moped. The manufacturer furthermore has costs for preparing the actual type approval testing, as well as costs for acquiring the actual EPPR type approval from a Type Approval Authority. Overall, this amounts to the range of €5,000 to €12,500 **costs for EPPR testing** for motorcycle manufacturers and €4,000 to €10,000 for moped manufacturers. As with the overall type approval costs, no figures are known for the EPPR costs in countries outside the EU, for which it is assumed they are equal to the EU testing costs.
- In absolute figures, this means that per vehicle sold, these costs are lower for motorcycle manufacturers than for moped manufacturers. As with the overall testing costs, the **costs of EPPR type approval per vehicle sold** are higher for moped manufacturers than for motorcycle manufacturers, given their lower production numbers per model but similar testing costs. Again, this is under the assumption that all annual costs of (EPPR) type approval are recovered by a manufacturer within the same year. This allows for spreading the total (EPPR)

[10] Range is from 0.05% to 0.052%. This figure is rounded off to the number shown: 0.5%

[11] Range is from 0.1% to 0.13%. This figure is rounded off to the number shown: 0.1%

type approval costs across the annual production. Not taken into account here is the possible difference between different sales figures of different models: one model might be produced more or less than another. The smaller the number of units of a model, the higher its costs per vehicle produced.

- Similar to the total type approval costs, the figures provide some insight into the relatively small share of the current EPPR type approval costs in the overall costs for motorcycles and for mopeds: both in total and per motorcycle sold. Furthermore the figures indicate that although the costs are likely to be considerable higher for SMEs, they can still be considered marginal in relation to the total costs of production.

5.4 The costs for type approval procedures including the global EPPR-regulation

- Currently, the environmental and propulsion unit performance part of the whole-vehicle type approval consists of Test Type I (tailpipe emissions after cold start) and Test Type II (tailpipe emissions at idle and high idle), as well as engine torque, power and maximum design vehicle speed (for which a declaration of the manufacturer is suffice). In the new situation several new tests are introduced and current tests are improved.
- Due to proposals described before the costs of type approval will increase. The new test types are more elaborate than the current test types obligatory for both mopeds and motorcycles. Some of the tests are currently not performed for motorcycles, but are so for other categories such as cars. Using data from manufacturers, and information from TAAs and TSPs, both on L-category vehicles and other categories, the tests are assumed to cost between €20,000 and €40,000. These costs are assumed equal for both mopeds and motorcycles.
- Of these total costs, the durability test is likely to make up for a large share: some stakeholders indicate that the costs for this test could be as high as €20,000. Both manufacturers and TSPs however indicate that it is hard to estimate the costs for this test (and others tests), given that it is currently not performed and the exact form in which it is to be performed is yet unknown. It should be pointed out that Regulation (EU) No 168/2013 allows three methods to demonstrate durability of pollution control devices. The mathematical method, which provides the least information on the actual durability performance testing of a vehicle, costs little to nothing (the Type I tailpipe emissions after cold start test data is multiplied by fixed deterioration factors). Consequently the vehicle manufacturers are in control of the burden of durability testing.
- As these figures show, the costs of EPPR testing are likely to increase with the introduction of the new test: from between €5,000 to €12,500 for motorcycle manufacturers, and from between €4,000 to €10,000 for motorcycle manufacturers, to the mentioned €20,000 to €40,000 for each manufacturer. Assuming similar production costs and sales figures, the costs of EPPR testing per vehicle sold consequently increase.

5.5 The baseline scenario

5.5.1 From current situation to baseline scenario

The baseline scenario differs from the present situation (with Directive 2002/24/EC in place) in that the Co-decision act is assumed to be fully implemented in the EU, including the three delegated acts setting out test procedures and technical requirements provisions (amongst which the to be determined EPPR regulation) and one implementing act laying down the applicable administrative. It is also assumed that, in the baseline scenario, other regulators do not take over the European EPPR regulation: comparable to the present situation 'every country outside the EU' keeps making its own EPPR regulation. This means that for a manufacturer the present situation, with multiple type-approvals required to market a product worldwide, remains the same outside the EU, also for environmental and propulsion unit performance requirements.

It is reasonable to assume that also in this situation there will be a pressure worldwide to overcome the mentioned issues with present type approval regulation. After all emissions of L-categories are still a significant issue for example. Also a legal framework for vehicles fitted with new technologies is still missing. It is also reasonable to assume that at different levels, comparable to the present situation, global regulation will come into place. Comparable to the present situation one may assume that the United Nations, the European Union, but also other countries experiencing similar issues with L-category vehicles (regulation) will want to improve the present situation. New type approval procedures are therefor likely to come into place but this will happen in a less harmonised way then envisaged. Every regulator determines what he regards as the best solution and acts accordingly.

As a consequence for a manufacturer, the present situation with multiple type-approvals required to market a product worldwide will also exist in the baseline scenario. But the type–approval test procedures will change. Comparable to the present proposals for EPPR-legislation more procedures will be introduced resulting in an extra workload for manufacturers to fulfil one specific type approval.

These costs have been roughly estimated by calculating the cost impacts of the EPPR-proposals (see previous paragraph) and assuming this is a good proxy for the cost increase that may happen in the baseline scenario. Furthermore, as no cost figures are known for other type approval legislation, the EU future EPPR type approval costs have been used as a proxy for the future costs of other EPPR type approvals.

Building on this the table below gives an overview of the baseline scenario, in which EPPR costs will increase due to global legislation, but type approvals for each market will still have to be acquired, also for EPPR.

Table 5-4: Average costs for type approval test procedures in the base case scenario

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Costs for the EPPR tests in one type approval	€20,000-€40,000	€20,000-€40,000	€20,000-€40,000	€20,000-€40,000
Number of EPPR type approvals annually for a manufacturer	Same as in current situation			
Annual sales of a manufacturer to serve its markets	Same as in current situation			
Number of models per manufacturer	Same as in current situation			
Number of markets per model	Same as in current situation			
EPPR type approval costs per produced vehicle	€30-€200	€12-€20	€8-€67	€5-€8
Production costs per model	€6,000-€12,000	€6,000-€12,000	€750-€2,000	€750-€2,000
Share of EPPR type approval costs within total production costs	0.5%-1.7%	0.2%	1%-3.3%	0.4%-0.6%

The table shows the **costs for EPPR type approval in the baseline scenario**. In the current situation these costs vary from €5,000 to €12,500 Euro for motorcycles and from €4,000 to €10,000 for mopeds. In the baseline scenario they have **increased** to €20,000 to €40,000 both for motorcycles and mopeds.

5.5.2 Conclusion on the baseline cost scenario

The baseline scenario describes the situation that may occur when other regulators do not take over the European EPPR regulation: no international harmonisation of EPPR-regulation takes place. As a consequence the costs for EPPR-test procedures will go up substantially, as the calculations show. The costs that occur in the base case will be used as a reference for the scenario in which the EPPR regulation is internationally harmonised (see next section).

5.6 Part 1: Impacts of harmonisation of EPPR-regulation

This paragraph describes the impacts of harmonising the EPPR-regulation. It is assumed that the global EPPR-regulation comes into place and that this regulation is applied worldwide. Based on this in the next paragraph the impacts of (specifically harmonisation) of type approval in general are described.

Please note that the impacts of the proposed EPPR-regulation are measured against the baseline scenario, not compared to the current situation.

5.6.1 Impacts of EPPR-regulation on number and costs of type approval

As a consequence of the global EPPR regulation, the total type approval costs will decrease compared to the baseline scenario. In this section a maximum impact of the global regulation is determined. The costs for specific tests will increase but due to harmonisation of these tests worldwide these elements only need to be tested once independent of the number of markets a manufacturer wants to sell its products on. It is assumed that in the new situation the same number of type approvals is required to market a vehicle worldwide as is the case in the baseline (and the present) situation; on average 9 to 11 type approvals (see also Section 5.3). But it is assumed that world-wide the same test procedures on environmental and propulsion aspects come into place. So instead of tests for 9 to 11 different type approvals world-wide or how many markets a manufacturer wants to enter: for environmental and propulsion unit performance requirements only 1 test is required. This also means that a manufacturer does not have to produce different versions of a specific model to fulfil the requirements of the different regulators for this specific part of type approval. It is still possible (and we assume that this will take place) that for the other elements of the test type procedures worldwide different regulations exist.

Based on this the same calculations for type approval test procedures have been made as before. Table 5-5 shows the results. For convenience it is assumed that the global regulation does not affect the annual sales of a manufacturer. The same accounts for the costs price per vehicle. Further on in this paragraph this is discussed into more detail.

Table 5-5: Average costs for type approval test procedures in the harmonised situation

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Costs for the EPPR tests in one type approval	€20,000-€40,000	€20,000-€40,000	€20,000-€40,000	€20,000-€40,000
Number of EPPR type approvals annually for a manufacturer per market	1-3	9-11	1-3	9-11

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Annual sales of a manufacturer to serve its markets	Same as in current situation			
Number of models per manufacturer	Same as in current situation			
Number of markets per model	Same as in current situation			
EPPR type approval costs per produced vehicle	€10-€30	€2[12]	€2.50-€10	< €1[13]
Production costs per model	€6,000-€12,000	€6,000-€12,000	€7.50-€2,000	€750-€2,000
Share of EPPR type approval costs within total production costs	0.2%-0.3%[14]	< 0.1%[15]	< 0.1%[16]	< 0.1%[17]

The table shows that compared to the baseline scenario, the number of EPPR type approvals declines. Given that the costs per EPPR type approval are the same as in the baseline, and assuming similar production numbers and costs, the costs of EPPR per produced vehicle decrease, as well as the share of EPPR type approval costs within the total production costs.

5.6.2 EPPR costs per manufacturer

The previous table describes the general impact of the harmonised regulation on type approval: the focus now turns to the EPPR costs for one manufacturer. Compared to the base case, the following decrease in **EPPR costs per produced vehicle and** in those

[12] Range is from €1.80 to €2.20. This figure is rounded off to the number shown: €2

[13] Range is from €0.72 to €0.88. This figure is rounded off to the number shown: <€1

[14] Range is from 0.17% to 0.25%. This figure is rounded off to the number shown: 0.2%-0.3%

[15] Range is from 0.02% to 0.03%. This figure is rounded off to the number shown: <0.1%

[16] Range is from 0.04% to 0.08%. This figure is rounded off to the number shown: <0.1%

[17] Range is from 0.007% to 0.012%. This figure is rounded off to the number shown: <0.1%

costs **their share in total production** applies due to international harmonisation of EPPR regulation:

Table 5-6: EPPR costs per manufacturer

	SME-manufacturer of motorcycles	Large manufacturer of motorcycles	SME-manufacturer of mopeds	Large manufacturer of mopeds
Baseline				
EPPR type approval costs per produced vehicle	€30-€200	€12-€20	€8-€67	€5-€8
Total annual EPPR costs	€60,000-€800,000	€1,200,000-€4,000,000	€60,000-€800,000	€1,200,000-€4,000,000
Share of EPPR type approval costs within total production costs	0.5%-1.7%	0.2%[18]	1%-3.3%	0.4%-0.6%
After harmonisation				
EPPR type approval costs per produced vehicle	€10-€30	€2[19]	€2.50-€10	< €1[20]
Total annual EPPR costs	€20,000-€120,000	€180,000-€440,000	€20,000-€120,000	€10,000-€180,000
Share of EPPR type approval costs within total production costs	0.2%-0.3%	< 0.1%[21]	< 0.1%[22]	< 0.1%[23]

Given the equal production costs per vehicle in both the baseline and the harmonisation scenario, the table clearly shows the declining EPPR costs per produced vehicle due to harmonisation[24], which causes a decline in number of type approvals to be performed.

[18] Range is from 0.17% to 0.20%. This figure is rounded off to the number shown: 0.2%

[19] Range is from €1.80 to €2.20. This figure is rounded off to the number shown: €2

[20] Range is from €0.72 to €0.88. This figure is rounded off to the number shown: <€1

[21] Range is from 0.02% to 0.03%. This figure is rounded off to the number shown: <0.1%

[22] Range is from 0.04% to 0.08%. This figure is rounded off to the number shown: <0.1%

[23] Range is from 0.007% to 0.012%. This figure is rounded off to the number shown: <0.1%

[24] The costs for having to re-design a vehicle are not taken into account.

5.6.3 Overview of costs and benefits of the global EPPR-regulation

Building on the impacts of EPPR-regulation on number and costs of type approval an overview has been made of the total impacts (costs and benefits) of globally harmonised EPPR regulation. The impacts of type approval legislation of the EPPR-regulation are viewed from the perspective of the different stakeholders involved:

- Manufacturers
- Type Approval Authorities (TAAs)
- Technical Service Providers (TSPs)
- Customers / Consumers
- Society
-

The table below shows these impacts:

Table 5-7: Overview of cost and benefits

Impact per stakeholder	Size of impact
Manufacturers:	
-A reduction in the costs for EPPR type approval	Substantial
-Decrease of development and production costs	Substantial
-Decrease of total production costs	Limited
-More easily market a product worldwide	Substantial
-More product diversity	Limited
Type Approval Authorities & Test houses:	
-Fewer TAA employees might be required worldwide	Substantial
-New relationship between TAAs and manufacturers	Substantial
-Need to (re)train personnel	Substantial
Customers/Consumers:	
-More product diversity	Limited
-Lower product prices	Limited
-Improved product information	Substantial
Society / Environmental:	
-Favourable conditions for more stringent norms	Substantial
-Decrease overall emissions of new vehicles	Substantial

5.6.3.1 *Impacts for manufacturers*

For **manufacturers** the following impacts are expected:

- A reduction in the costs for EPPR type approval. These costs have been discussed before. Compared to the baseline scenario the number of 'EPPR'-tests for type approvals substantially decrease.
- As a consequence also development and production costs may decrease. No adaptations to designs have to be made to fulfil the different EPPR tests for type approval in different countries and consequently less models are needed. Worldwide the same design can be applied in terms of emission abatement systems and components, which means that series sizes may increase. This could result in a decrease of the production costs owing to improvements in the economies of scale as well. These costs are not known but could be substantial as well.
- In general the impacts on the total production costs of a vehicle are assumed to be small. The previous paragraphs show that the total costs of EPPR type approval test procedures in the total product costs are relatively small.
- Manufacturers can easier (at lower costs) market a product worldwide due to less EPPR type approvals test procedures required. The costs for market access decrease. Harmonisation also creates in this way a more level playing field for manufacturers. This in turn has two possible effects:
- New competitors can enter manufacturers on their existing market, thereby increasing competition.
- New markets can be entered more easily for manufacturers, enlarging their market potential.
- It may also result in more product diversity. In the baseline scenario every regulator applies its own type approval test procedures. As discussed before in particular for SME's or for more exclusive models the type approval costs can become quite substantial per model in the baseline scenario, as there are relatively few numbers of models on which the costs could be spread. The calculations before show that these costs substantially decrease per model, which could result in more product diversity. This effect is however expected to be limited, due to the relative small share of testing costs in the production costs of vehicles.

5.6.3.2 *Impacts for manufacturers that are fully focussed on Europe*

The impacts above are for manufacturers that sell products at different geographical markets, including Europe. They benefit in general of the world-wide harmonisation of EPPR-regulation. This is not the case for manufacturers that 'only' sell products for the European market. Although, as far as known to the authors, this group of manufacturers is very small, but the impacts are much more diverse than for the other manufacturers.

An important difference is that (compared to the baseline scenario) these manufacturers do not benefit from cost decreases. Their costs for type approval will remain the same as in the baseline scenario as for the European market the regulations do not change as a consequence of harmonisation. As a consequence the impacts of worldwide harmonisation on their development and production costs may be marginally as well.

These manufacturers may in particular benefit from the fact that it becomes easier to sell their products outside Europe as the costs here for decrease. Compared to the baseline scenario, and analogue to the manufacturers producing for different geographical markets, it becomes more attractive to enter new markets. At the same time they can be confronted by more competition at the European market.

Although the impacts of harmonisation are quite limited for these manufacturers, please note that these manufacturers in the coming years may be confronted with cost increases of test procedures for each model. They are confronted with a cost increase as calculated in Section 5.4 (the costs for EPPR type approval procedures). This specific group of manufacturers can be affected disproportionally by global EPPR-regulation in either direction depending on their business strategy.

5.6.3.3 Impacts for other manufacturers producing for the non-European market

The former describes the impacts for manufacturers that sell a substantial part of their products to European customers. As described these manufacturers in general benefit from less type approval costs. The benefits increase the more manufacturers are active worldwide in different markets.

There are also manufacturers, mainly in emerging countries like India and China, who until now hardly produce for the European market but are internationally active as well. These manufacturers sell their products not only on the domestic market but also to other emerging countries. For example Chinese scooters are also very popular in counties like Thailand, Myanmar and Indonesia. As a consequence Chinese manufacturers have significant market shares in these countries as well. These manufacturers may also face impacts as a consequence of the global regulations, depending on their specific situation.

Specific figures for these manufacturers are lacking but with some examples the impacts can be described for these types of manufacturers:

Example 1: A manufacturer in an emerging country that sells 90 per cent of its products in its domestic market and exports 10 per cent of its products to a neighbouring country.

In the current and the baseline situation in both countries different regulation on environmental and propulsions applies, that is also different from European regulation. As a consequence the manufacturer needs at least two specific EPPR-tests for type-approval: one for its domestic market and one for its neighbouring country. At the same time it is difficult to export to Europe and to other markets due to different regulation in place:

Harmonisation of EPPR-regulation means for this manufacturer that:

- The costs for the specific EPPR-tests may increase, assuming that the global regulation is more comprehensive than is in place in the domestic country and the neighbouring country.
- There may also be a one-off cost increase for this manufacturer to adapt the design of the vehicle to fulfil the new type approval test procedures. These costs are not known and could be substantial. However: the overall aim of the regulation is to introduce or to improve regulation for present EPPR test procedures by the improvement of these procedures. The aim is not to ensure a minimum environmental performance of L-category vehicles by setting limit

values. At the same time, analogue to manufacturers producing for the European market, this manufacturer may benefit from a decrease of development and production costs. No adaptations have to be made to fulfil the different EPPR-tests in different countries. So in general these costs should be limited.

- Against the possible cost increases there are benefits. Test procedures between the domestic country and the neighbouring country become similar. For environmental and propulsion unit performance requirements only 1 test applies, resulting in the cost reductions shown before.
- Moreover it becomes easier (at lower costs) for these manufacturers to market a product worldwide. The costs for market access decrease. Similarly, new competitors can enter the manufacturer's existing market, thereby increasing competition.

The example shows that for these type of manufacturers there are many benefits as well but, contrary to producers for the European market, there are also initial costs at harmonisation. Where for manufacturers producing for the European market these costs are part of the baseline scenario, and always have to be made (irrespective of harmonisation), this does not account for this type of manufacturers. For these type of manufacturers these costs are a result of harmonisation. As a consequence the net impact for these manufacturers depends on whether the benefits countervail the costs. This however is supposed to happen in most cases, as against one-off costs increases, long term benefits (i.e. cost decreases) will occur. Moreover harmonisation creates conditions and chances for manufacturers to sell worldwide, possibly resulting in higher benefits.

Example 2: A manufacturer in an emerging country sells 85 per cent of its products in its domestic market and exports 15 per cent of its products to 4 different neighbouring countries (not at the European market).

In this example the same impacts occur as in the first example but impacts are more substantial. In the current and baseline situation a manufacturer needs more specific tests for type-approval compared to the first example. Also over here it is difficult to export to Europa due to different regulation in place.

Harmonisation of EPPR-regulations means for this manufacturer that:

- The costs for the specific EPPR-tests may increase in the same amount as in the first example.
- There may also be a one-off cost increase to adapt the design of the vehicle to fulfil the global type approval test procedures. But contrary to the first example this is more likely to be counterbalanced by a decrease of development and production costs. No adaptations have to be made to fulfil the different EPPR-tests in different countries. As vehicles are sold to 4 more countries (assuming with different regulation in place) instead of 1 more country as is the case in the first example, the cost savings of one type of regulation are also more substantial.
- Comparable with the decrease of the development and production costs, due to the higher number of markets (5 instead of 2, including the domestic market) on which the vehicles are sold, there are also more cost savings if only one test procedure applies.

- Also for this manufacturer it becomes easier (at lower costs) for these manufacturers to market a product worldwide

The example shows that also for these type of manufacturers there are initial costs at harmonisation but the benefits are, due to the higher number of markets on which the vehicles are sold, are much more substantial. These types of manufacturers benefit much more from harmonisation, the example in particular shows that benefits for manufacturers in emerging markets increase, the more markets they sell products currently.

Example 3: A manufacturer in an emerging country sells 85 per cent of its products in its domestic market and exports 15 per cent of its products to 4 different markets including the European market.

These manufacturers benefit the most of international harmonisation. In the baseline they do already adapt themselves to the European EPPR-legislation. Comparable to the manufacturers that sell a substantial part of their products to European customers they don't have initial costs increases as a consequence of harmonisation. Right from the moment of harmonisation they benefit from:

- A reduction in the costs for EPPR type approval
- A decrease of development and production costs
- It's becoming easier to market products worldwide

In general also manufacturers that are not producing for the non-European market, do benefit from international harmonisation as well. Harmonisation creates opportunities for world-wide sales and, however there may be initial costs (increases), these are likely to be countervailed by cost reductions in the years afterwards.

5.6.3.4 Impacts for Type Approval Authorities

For **Type Approval Authorities** the following impacts are expected:

- Fewer TAA employees might be required worldwide, due to a decrease in the amount of type approval tests[25]. As EPPR-tests concern a substantial percentage of the total type approval test costs and if it is assumed that all type approval costs demand a comparable number of personnel, the personnel consequences could be significant. The demand for 'TAA test personnel' may decrease with the same percentage.
- The former could result in different or new relationships between TAAs and manufacturers and as a consequence on the market organisation. This may happen but this not expecting to happen in the short term given that TAAs and manufacturers very often co-operate in fulfilling the test-requirement in long-term partnerships in ensuring a proper testing of vehicles. Although TAAs might need to expand their territories in support of globally harmonised approvals.

[25] It should is noted that this concerns the activities of TAAs in their traditional markets. An increase in activities could occur in developing markets, but this depends on factors such as the current presence of such a body in those countries and the possibility for foreign TAAs to operate in these countries.

- TAAs may have to (re)train personnel. This could be done (and was often the case in recent years) in co-operation with the manufacturers, as they both have to adapt.

5.6.3.5 Impacts for Test Houses and Technical Service Providers

For test houses and technical service providers the following impacts are expected:

- Comparable to Type Approval Authorities fewer employees might be required, different or new relationships with TAAs and manufacturers could result, and personnel may have be (re)trained. Test houses and technical services might need or are able to expand their markets and provide their services on the globally harmonised market. Although it should be taken into account that some countries require national testing houses, so market opportunities are sometimes restricted. As a consequence of harmonisation, and subsequently fewer EPPR tests being required and hence manufacturers being more likely to perform test in-house, witnessing of approval testing performed by the vehicle manufacturer may become the core business of technical services. This, compared to their conventional business model in which manufacturers outsource physical demonstration testing to technical services.

5.6.3.6 Impacts for consumers

For **consumers / customers** the following impacts are expected:

- More product diversity due to more product diversity of a specific manufacturer but also due to the fact that new competitors can more easily access new markets (see impacts at manufacturers).
- Lower product prices. If the regulations results in lower product costs also product prices could decrease, also resulting in an increased demand for L-category vehicles *ceteris paribus.* The previous paragraphs show that type approval costs per model are between €1 and €30. Considering this small amount, means that the impacts on the product demand are also assumed to be quite limited.
- Worldwide harmonised testing procedures also creates favourable conditions for improved information about L-category vehicles. Transparency in CO_2 emissions and fuel / energy consumption as well as electric range for electric hybrid and electrically propelled vehicles (test type VII) will make it possible for customers to easily compare different products with respect to energy efficiency. In the end this could stimulate consumers to choose more fuel efficient models.

5.6.3.7 Impacts for society and/or the environment

For **society** and/or the **environment** the following impacts are expected:

- Although the aim of harmonisation is not to ensure a minimum environmental performance of L-category vehicles (and by so lowering the emissions of vehicles) it creates favourable conditions for more stringent norms in the medium or long term. After all, the test procedures are harmonised worldwide, which simplifies discussions about emission levels. The same accounts for safety and propulsion unit performance. If so, society benefits from lower emissions and noise, and a

better quality of life. Note that as a possible risk of harmonized legislation is that due to negotiations the exact legislative content, the (future) norms might not be sufficient to create a decrease in the overall emission level of L-category vehicles.

- With regard to possible more stringent norms it is a possible risk that some contracting parties may need to conform to severer requirements whereas others may be forced to lower higher standards resulting in a decrease of the environmental performance of these light vehicles. From the questionnaire and interviews it followed that some manufacturers currently already ensure more strict standards than prescribed in test procedures, to ensure high quality products. These manufacturers are likely to maintain these high standards, irrespective of the standards.
- Although not the primarily aim of the global regulation it is anticipated that standardised testing procedures for all L-category vehicles will decrease overall emissions of new vehicles. It may be expected that this argument is particularly valid for countries which currently do not have environmental legislation in place. This will especially be the case for mopeds, low-end motorcycles and other light 3 and 4-wheel vehicles. Please note that world-wide impacts (i.e. for all countries) are related to the introduction of for instance the durability test. This test does not contain norms that have to be reached, but implicitly does improve the emissions levels of the vehicles in the long-run due to the length of the test run.

5.6.4 *Illustration of impacts of harmonisation of total type approval-regulation*

As discussed before type approval procedures consist of different test type procedures, not only on environmental and propulsion elements. If also the other elements would be harmonised, the impacts shown before will increase.

The impacts of worldwide harmonisation of all test type procedures are tentatively explored by assuming that with worldwide harmonisation, the number of type approvals for one model would become one in total. This type approval would then be valid across the globe.

In the situation with fully worldwide harmonised type approval legislation the same type of impacts will occur as in the situation with harmonised EPPR-legislation, but the size of impacts may increase. The table below shows this:

Table 5-8: Overview of cost and benefits

Impact per stakeholder	Size of impact	
	Harmonised EPPR	Harmonised type approval
Manufacturers:		
-A reduction in the costs for type approval	Substantial	Substantial
-Decrease of development and production costs	Substantial	Substantial
-Decrease of total production costs	Limited	Limited
-More easily market a product worldwide	Substantial	Substantial

Impact per stakeholder	Size of impact	
	Harmonised EPPR	Harmonised type approval
-More product diversity	Limited	Limited
Type Approval Authorities & Test houses:		
-Fewer TAA employees might be required worldwide	Substantial	Substantial
-New relationship between TAAs and manufacturers	Substantial	Substantial
-Need to (re)train personnel	Substantial	Substantial
Customers/Consumers:		
-More product diversity	Limited	Substantial
-Lower product prices	Limited	Limited
-Improved product information	Substantial	Substantial
Society / Environmental:		
-Favourable conditions for more stringent norms	Substantial	Substantial
-Decrease overall emissions of new vehicles	Substantial	Substantial

A fully harmonised type approval legislation results in the following different impacts in comparison to the situation in which 'only' EPPR-regulation is harmonised.

For manufacturers:

- A further reduction in the costs for type approval. These costs have been discussed before. Compared to 'only' harmonisation of EPPR-regulation in this situation cost decrease further.
- Manufacturers can more easily market a product worldwide as per model one type approvals test procedure is required. Not only EPPR-regulation within the type approval procedure but all elements are harmonised. Conditions are created for a much more **worldwide level-playing field** in the L-category market

For Type Approval Authorities, test houses and technical service providers the following impacts are expected:

- Even fewer TAA employees might be required worldwide, due to a decrease in the amount of tests, and the personnel consequences could be more significant. With the same assumptions as before the demand for "TAA test personnel' may decrease further than in the case of EPPR harmonisation.

- As a consequence of this there may be **more pressure for different or new relationships with manufacturers** could result, as the amount of work is decreasing to a lower level.

5.7 Part 2: Impacts of EPPR test types IV and VII

In this part, a more detailed look is taken at the options and impacts of test types IV Evaporative emissions and VII Energy consumption / CO_2 emissions.

5.7.1 Test type IV: Evaporative emissions

Currently, evaporative emission test for L-category vehicles in the EU is limited to permeability testing for vehicles equipped with non-metallic tanks[26]. The aim of the test is to determine the amount of fuel that evaporates from the fuel storage and supply system.

Two evaporative emission tests are considered for the European Union:

- **Test of fuel storage and delivery system (permeation)**: This test constitutes putting the fuelling system in a close atmosphere, connecting all the required hosing the petrol tank. By pumping air through the system, the amount of permeability of the fuel system can be measured, by determining the hydrocarbons (HCs) in the air. This means that the petrol leaking through the skin of materials is measured. The test is equivalent to the permeation test for motorcycles that is used in US federal legislation (EPA) and will be investigated in Europe whether or not it is more cost beneficial for low-end vehicles (e.g. 'mopeds') in comparison to SHED testing.
- **Whole vehicle (SHED: Sealed Housing for Evaporative Determination**): In this test, a vehicle is put inside a sealed SHED, after which fresh air is circulated though the SHED. The level of hydrocarbon mass is measured. Different settings can be tested this way:
    - Warming the fuel tank or cycling the air temperature (simulating day and night temperature variations),
    - Running the engine of the vehicle (on a dynamometer outside the SHED and then parking it back inside) to simulate the heat exposure from the engine and associated parts. After a set amount of time the hydrocarbon mass is measured within the SHED.

  This test is more advanced to the previous test, as it reflects 'real-world' conditions, and is applied to the entire vehicle (e.g. 'motorcycle') both in Europe and in the planned UN legislation. This test is worldwide, it is already used in the US ARB legislation in California and a similar test is used for M/N category legislation (light-duty motor vehicles such as cars and commercial vans) in European and in UN legislation.

Both tests first of all have an impact on the total type approval costs. Based on information from the performed questionnaire, as well as several in-depth interviews with manufacturers, Technical Service Providers and Type Approval Authorities, the

[26] Directive 97/24/EC as amended, Chapter 6

following figures on the costs impacts of the two test types have been determined. The costs of a permeation test depend on the material of the fuel tank, and are between €400 and €500 for metal tanks, and between €3,500 and €4,500 for plastic tanks. This is related to the fact that metal tanks are practically impermeable and the permeation by large would be expected from the fuel tubing and connectors, whereas plastic tanks are also permeable themselves.

The costs of SHED testing will costs between €2,500 and €10,000, depending on the required tests to be performed in the SHED. The exact costs furthermore depend on whether a manufacturer owns a SHED-facility already. As far as known manufacturers that export vehicles to California today and manufacturers that also produce cars, are likely to own such a facility. Exact costs of purchasing a SHED are unknown, but are assumed to be over €100,000. For those manufacturers that do not themselves own a SHED, these tests can be outsourced or be included as part of the contract between vehicle manufacturer and evaporative emissions control system supplier.

The costs impacts furthermore vary between manufacturers. The permeation test is already in place in several countries world-wide such as the United States. For manufacturers acting world-wide also the impacts are limited: no new tests are required. Test costs, however, do increase for manufacturers that 'only' sell products for the European market. Although, as far as know, this group of manufacturers is very small, they are confronted with additional testing costs and they may also consider changing their business strategy by starting to expert to foreign markets that used to be not accessible to them before harmonisation.

The same accounts to some extent for the SHED test. As this test is already applied in US CARB legislation the impacts should be limited for manufacturers selling world-wide but as described before much depends on the definitive result of the test. At least the manufacturers that 'only' sell products for the European market are affected.

The two emission test (permeation and SHED) furthermore differ on their impacts with regards to evaporative emissions coming from vehicles. Given that there are no world-wide applicable limits to these tests yet, the actual tests do not differ in that sense. However, if limits (such as the ones from EPA and the Euro 4 standard) are introduced, the SHED test provides more elaborate means to test the evaporative emissions coming from a vehicle.

The costs of introducing the SHED are likely to be significantly higher than those of the permeation test, meaning that high-end vehicle manufacturers will endure higher costs than low-end vehicle manufacturers. It is not possible to quantify the difference in costs between the two variations of the test type. Similarly, it is not possible to draw quantitative conclusions with regards to the environmental impacts of the two variations of the test type, but it can be stated that the SHED tests ensures less fuel evaporating from a vehicle than the permeability test. SHED provides a much more realistic picture of the entire vehicle, whereas with the permeation test it is assumed that the great majority of the evaporated hydrocarbon mass originates from fuel storage and delivery system only. Table 5-9 provides an overview of the costs and emission testing possibilities of the two variations of the test type: "-" and "+" represent a marginal effect, "- -" and "++" represent a substantial effect.

Table 5-9: Impacts of Test Type IV

	Permeability	SHED
Costs of the test	-	- -
Emission testing possibilities	+	++
Simulating real-world evaporative emission control performance	+	++

5.7.2 Test type VII: Energy efficiency

The test on energy efficiency concerns tests on (1) CO_2-emissions, (2) fuel consumption, (3) energy consumption and (4) electric range for three types of vehicles: conventional, hybrid and pure electric. These are all tests with no limits. Aim of these tests is to improve customer information and to support the decision-making process of consumers when choosing between new vehicles at the point of sale.

Please note that the tests on CO_2-emissions and fuel consumptions are applied on conventional and hybrid vehicles, and both other test types on hybrid and pure electric vehicles and this objective consumer information is only made available by a few manufacturers. These tests are new for hybrid and pure electric vehicles. For conventionally fuelled vehicles currently test type I already covers CO_2-emissions (tailpipe emissions) but is not shared with consumers, and fuel consumption is not calculated or even reported to the type-approval authority.

The cost impacts for conventionally fuelled cars are limited, as the tailpipe emissions are part of test type I. The test type VII only adds requirements to calculate and record the data and supply it to consumers. These costs are regarded as very limited. There are costs for the test for electric vehicles, given that the battery will have to be loaded and drained several times, which is not part of test type I given that electric vehicles don't have to perform this test. For hybrid vehicles, the costs will be higher than for electric vehicles, given that the energy efficiency will have to be determined both for the vehicle running of conventional fuel (CO_2-emissions and fuel consumption) and on electricity (electric range and energy consumption). Whether or not these costs will be substantial cannot be derived from the available data.

Whether or not the introduction of the test type VII will influence consumer behaviour has not been retrieved from the available data from this study either. However, as part of a recently published study on light duty electric and hybrid vehicles[27], a survey was performed to determine the factors that influence consumer behaviour when purchasing a(n) (hybrid) electric vehicle (HEV/EV). The study showed that in particular information is requested by the consumers about the 'technical performance' of EV and HEV vehicles under different scenarios: range, battery efficiency and tailpipe emissions. The stakeholders want objective and robust information about the performance of these

[27] "Light duty electric and hybrid vehicles. Lots 2: Emissions of road vehicles", TRL and Ecorys, September 2013.

vehicles in different weather conditions, on different types of trips and at different ages of the battery.

This provides reason to assume that customers will respond positive towards having the output of test type VII available upon purchasing a vehicle. From an impact perspective, this could mean that the test type could have an impact on the sales of (hybrid) electric L-category vehicles, and thus on the share of these vehicles compared to conventionally fuelled, less energy efficient vehicles. This cannot however be said with certainty, nor can it be quantified.

5.7.3 Conclusions on impacts of the introduction of test type IV and VII

The impacts of introducing test type IV depend on which actual test will be obligatory for which type of manufacturer: permeation or SHED. The impacts of each of the tests are not known in detail, other than that the SHED test will bring more costs to manufacturers than the permeation test but at the same time will also allow a much more realistic / real world assessment of the evaporative emission control performance of a vehicle. Again the SHED test determines the evaporative emissions coming from the entire vehicle whereas the permeation test only provides the possibility to assess the evaporative emissions coming from the fuel storage and part of the fuel deliver system.

Test type VII is not new for conventionally fuelled vehicles, as CO_2 emissions and fuel consumption are determined in test type I (tailpipe emissions): it's only a matter of changing the way in which the results are processed and reported. For hybrid and electric vehicles however there are impacts but at the same time allow comparison of energy efficiency between different vehicles, also understandable for the consumer. Manufacturers will endure costs for determining the energy consumption and electric range of the vehicles but can use it in a competitive way to prove to their customers that their products have reduced running costs. These costs will be higher for hybrid vehicles than for electric vehicles, given that double the amount of tests will have to be performed to cover both propulsion systems.

5.8 General findings of Impact Assessment

In this chapter the impacts of the global EPPR-regulation have been explored. The chapter first of all shows that the direction of the impacts (positive or negative) depend to a large extent whether some elements from European EPPR-legislation would be accepted by the UN Contracting Parties as a base for worldwide revision and harmonisation of approval / certification legislation of L-category vehicles.

- If not, the global legislation will result in cost increases for manufacturers. The chapter shows that the EPPR type approval costs can increase from 0.2% to 2.5% up to 0.2% to 3.3% of the total production costs of a single vehicle depending on the type of manufacturer and the size of production. Additionally, there are the one-off costs a manufacturer may need to make to change/re-design their products. These costs are unknown.
- If so, the costs for one type approval increase, but as less type approvals are required total EPPR type approval costs may decrease. Compared to the baseline scenario the calculations show that type-approval costs may decrease to nearly 0 to 0.3% if EPPR-test type procedures are applied worldwide.

In general the costs of both type approval and EPPR-testing procedure costs are limited in comparison to total production costs, although they vary substantially depending on the size and type of the production. The chapter shows that for small and medium manufacturers producing small series, the costs are likely to be higher than for large manufacturers. This is due to their small production numbers, which, especially if there are multiple markets and thus higher testing costs, leads to less vehicles to spread the costs across. Generally, the smaller the production numbers of a specific model the more the cost impacts of global regulation could be.

Due to the relatively limited share of type approval costs within the total product costs the total market impacts may also be limited. Therefore, impacts on product prices are expected to be small. In addition, Worldwide harmonisation of EPPR-regulation could contribute to a significantly more level-playing field and more competition in the L-category market and may contribute to more product diversity. Worldwide harmonisation can also create favourable conditions for improved product information for consumers and for more stringent emission norms in the near future.

Worldwide application of European EPPR-regulation may also have a substantial impact on type approval authorities, test houses and technical service provides. The workload for a specific type approval may increase but due to harmonisation the total demand for type approvals will decrease. This will put pressure on existing relationships between these organisation and manufacturers and as a consequence on the market organisation.

The specific impacts of the introduction of test type IV partly depend on which of the tests will become applicable for which type of vehicle: permeation or SHED. The latter is more expensive, but the actual costs depend on several elements, such as the specific test to be performed and whether or not a manufacturer already has a SHED. The SHED test does provide more elaborate means to determine the real-world evaporative emissions coming from a vehicle. Regarding test type VII: there will be cost increases for manufacturers of electric and hybrid vehicles, but it is not possible to quantify these.

6 Overview of proposed Regulations

6.1 Introduction

The industry producing two-, three and four-wheeled light vehicles is a global one, with companies selling their products in many different countries. The Contracting Parties to the UNECE 1958 and 1998 Agreements have all determined that work should be undertaken to address emissions from two- and three-wheeled light vehicles as a way to help improve air quality internationally. The L-EPPR informal group decided to first focus on GTRs under the 1998 Agreement and to develop UN Regulations in parallel with the aim to be as coherent as possible.

This Section sets out the background and reasoning behind the development of:

- **Emissions 1 (tailpipe related) – GTR No. 2**
  - Type I test – Tailpipe emissions after cold start (over driving cycle)
  - Type II test – Idle emissions / free acceleration test
  - (Type V test – Durability of pollution control devices)[28]
  - Type VII test - CO_2 emissions, fuel/energy consumption, and electric range
- **Emissions 2 (other) – New GTR**
  - Type III test – Crankcase emissions
  - Type IV test – Evaporative emissions
- **On-Board Diagnostics – New GTR**
  - Type VIII test – OBD (on-board diagnostics) (environmental part)
- **Propulsion unit Performance Requirements – New GTR**
  - Maximum vehicle speed
  - Maximum propulsion power and torque
  - Maximum peak power
- **Vehicle Categories and Definitions**
- **Update to UN Regulation 47**

6.2 Methodology for deriving harmonised test procedures for these revised and new GTRs and Regulations.

The European Commission launched an L-EPPR study in January 2012 with the objective to develop proposals to update GTR No 2 for technical progress and to develop proposals for harmonised EPPR legislation not yet covered at the international level for light vehicles, e.g. crankcase and evaporative emission test requirements, energy efficiency,

[28] At the time of finalising the study the L-EPPR group was still discussing and deciding whether the type V durability requirements would be incorporated in the revised GTR No 2 or if these requirements should be included in a stand-alone GTR.

on-board diagnostic requirements, propulsion unit performance requirements, etc. The output of this comprehensive study was submitted for the assessment and approval of the L-EPPR group.

The final stage of the study involved a review of the proposed harmonised test procedures by the EC, and following further discussion this feedback was incorporated and a final set of iterations undertaken, which form the technical content of the EC's proposals to revise GTR No. 2 and made available as working documents to be discussed and agreed by the L-EPPR informal working group.

The outcome of this work was, among others, the development of a new proposal to revise GTR No. 2 based on the consolidation of existing global legislation and up-to-date technical provisions.

6.3 Applicability

The Informal Working Group followed the agreed terms of reference and in principle agreed to prepare a draft GTR for all two- and three-wheeled vehicles under the 1998 Agreement as well as an equivalent UN Regulation with two-, three- and four-wheeled vehicles in its scope under the 1958 Agreement.

At the point in time of drafting this final report it was not clear whether or not Contracting Parties could accept the proposal from the EC to incorporate quadricycles in the scope of the equivalent UN Regulations and to deal with these light four-wheelers in the same way as with tricycles.

This difference was kept consistence between all draft GTRs and Regulations.

6.4 Definitions

The definitions used in the GTRs are taken from the draft common definitions incorporated in the Vehicle Categories and Definitions legislation (S.R.1) and UN VPSD group operating under GRPE with the goal to harmonise high level powertrain definitions and from other international and regional legislation. In addition, to work towards greater compatibility with similar tests on other vehicle categories; the draft On-Board Diagnostics drew on definition from UN R83 and GTR No 5 and the draft Propulsion unit Performance Requirements drew on definitions from UN R68 and UN R85.

6.5 Regulatory impact and economic effectiveness

6.5.1 Anticipated benefits

Increasingly light two-, three- and four-wheeled vehicles are being prepared for the world market. To the extent that manufacturers are preparing substantially different models in order to meet different regulations on:

- Functional requirements;
- Test procedures;
- Harmful emission;
- Methods of measuring CO2 emission; and
- Fuel or energy consumption.

Therefore testing costs and other production values are increased.

It would be more economically efficient to have manufacturers using a similar test procedure worldwide wherever possible to prove satisfactory environmental performance before placing a vehicle on the market. A prerequisite for that is a harmonised definition of the test procedures.

It is anticipated that the test procedures in this GTR will provide a common test programme for manufacturers to use in countries worldwide and thus reduce the amount of resources utilised to test light vehicles.

The potential benefits go beyond that as OBD for light vehicles can also start facilitating effective and efficient repair and maintenance and also provide improvements of functional safety in the future.

All these savings will accrue not only to the manufacturers, but more importantly, to the consumers and the authorities as well. However, developing a test programme, and in the case of OBD functional requirements, just to address the economic question does not completely address the mandate given when work on this GTR was first started. The test programme also improves the state of testing light vehicles, reflects better how light vehicles are used today and covers recent and near-future powertrain technologies, fuels and emission abatement technologies.

6.5.2 Potential cost effectiveness

At the time of writing the revision of these GTRs and Regulations, the data was not available to undertake a full impact assessment of the test types contained. This is in part because not all limit values have been set out and it is undecided to what level the proposed upgrade of test procedures will be accepted by Contracting Parties.

However, it is expected that the information required to quantify the costs and benefits can be developed by the Contracting Parties with the adoption of this regulation in national requirements.

Specific cost effectiveness values can be quite different, depending on the national or regional environmental needs and market situation. While there are no monitory values, the results of the assessment of impacts (section 5) indicates that there are clear and significant benefits, resulting from harmonised test procedures and effective and efficient repair, comparing to the justifiable, anticipated cost increases associated with this package of GTRs and Regulations.

Regarding test Types I, V, VII, and VIII allowing not only all two-wheeled light vehicles but also three- and for the Contracting Parties applying the test procedures set out in these GTRs and/or Regulations also for a selection of four-wheeled light vehicles, to be tested according to a dynamic, real-world emission laboratory test-cycle will much better reflect the actual environmental performance of light vehicles including pollutant emissions and energy efficiency measurement results, allowing the gap between claimed and actual, real-world environmental performance experienced by citizens to be narrowed.

6.6 Global Technical Regulation No. 2

REQUIREMENTS FOR TWO- AND THREE-WHEELED LIGHT MOTOR VEHICLES WITH REGARD TO TAILPIPE EMISSIONS AFTER COLDSTART, TAILPIPE

EMISSIONS AT IDLE AND FREE ACCELERATION[, DURABILITY OF POLLUTION CONTROL DEVICES] AND ENERGY EFFICIENCY.

The aim of this Global Technical Regulation (GTR) is to provide measures to strengthen the world-harmonisation of light vehicle approval and certification legislation, in order to improve the cost effectiveness of environmental performance testing, remove trade barriers, reduce the overall complexity of global legislation, remove potential areas of conflict or opposing requirements and improve the air quality.

The first step in this process in 2004 was to establish the certification procedure for motorcycle exhaust emissions in a harmonised UN GTR No 2. The current revision extends the scope to all two-wheeled vehicles as well as to all three-wheeled vehicles, updates the testing methodology for technical progress, adds a testing methodology for the durability of pollution control devices and sets out requirements to measure the energy efficiency of different types of propulsion units fitted to light two- and three-wheeled vehicles. The test procedures were developed so that they would be:

- representative of world-wide on-road vehicle operation;
- able to provide an internationally harmonised set of environmental tests to ensure efficient and practicable controls of on-road emissions;
- corresponding to state-of-the-art testing, sampling and measurement technology in the area of environmental performance testing of light vehicles;
- applicable in practice to existing and foreseeable future exhaust emissions abatement technologies;
- applicable in practice to existing and foreseeable future powertrain technologies;
- capable of providing a reliable ranking of exhaust emission levels from different engine types;
- inclusive of adequate test cycle-bypass prevention provisions.

The technical and economic feasibility of the measures contained within this GTR have been considered and are discussed further in Section 5.

This GTR covers the test types related to tailpipe emissions:

- Test Type I: Tailpipe emissions after cold start

To monitor the gaseous pollutant emissions a vehicle produces when in general use, test type I defines a test procedure to take a vehicle from cold and performing a chassis dynamometer driving cycle which has been designed as far as is practicable, to represent driving of that vehicle type, while taking into consideration the requirements of test repeatability and reproducibility.

- Test Type II: Tailpipe emissions at idle (PI engine) and free acceleration test (CI engine)

To test the idle and high idle emissions referred to in road worthiness testing, test type II defines a test procedure at two idle speeds for vehicles equipped with PI engines to measure the emissions of CO and HC and a test procedure at free acceleration for vehicles equipped with CI engines to measure opacity as a simplified verification method to verify particulate matter emissions for CI vehicles.

- [Test Type V: Durability of pollution control devices]

[To test the durability of the pollution control devices, test type V defines a procedure for identifying the deterioration trend of the pollution control devices resulting in the efficiency loss to convert pollutants in less harmless substances and comparing the full distance emissions with the applicable limit values.] This test is included in parenthesis because at the time of writing discussion was still ongoing as to whether it should be included in GTR No 2 or whether test type V should be set out in a new, standalone GTR.

- Test Type VII: Energy efficiency, i.e. CO_2 emissions, fuel/energy consumption and electric range

To provide information required by consumers to judge the energy efficiency and running costs and practicality of a vehicle, test type VII measures for publication and inclusion in vehicle literature, the energy efficiency with respect to CO_2 emissions, fuel consumption, energy consumption and electric range.

The base GTR, entering into force on [30 August 2005] build on the work of the WMTC Informal Working Group (IWG), its deliberations and conclusions, provided in the group's Technical Report (ECE/TRANS/180/Add.2/Appendix 1) [29] which produced its last amendment on the base GTR in 2011. This revision of the revised GTR No 2 is based on the work of the Informal Working Group on Environmental and Propulsion unit Performance Requirements of light vehicles (EPPR), from now on referred to as L-EPPR, which held its first meeting during the 65th GRPE in January 2013 sponsored by the European Commission (EC). Specific issues and options raised and resolved in their development are discussed in a separate options document. "Introduction issues and proposed options for harmonisation" of this document, which will be transferred into the report that accompanies the revised GTR No 2 when the final revision of GTR No 2 is adopted by the informal working group L-EPPR and sent to GRPE for adoption.

6.6.1 Procedural background

The original work on the base GTR No. 2 started in May 2000 with the establishment of the WMTC Informal Working Group. At the UN working party on pollution and energy (GRPE) 45th session in January 2003, a formal proposal by Germany for the establishment of a GTR was approved for presentation to the Executive Committee for the 1998 Agreement (AC.3). At its session on 13 November 2003, the proposal from Germany was also approved as a GTR project by AC.3.

The base GTR No. 2 was approved by AC.3 in June 2005. Amendment 1 to the base GTR No. 2 was approved by AC.3 in November 2007. The draft text of Amendment 2 to GTR No. 2 on the introduction of performance requirements (limit values for pollutant emissions for vehicles fitted with gasoline engines) was approved by GRPE in January 2011, subject to final decisions concerning the format of the text by AC.3.

At its April 2006 meeting held in Pune (India), the informal working group WMTC/FEG agreed to prepare new test cycle proposals and a new vehicle classification for draft amendments to the GTR in order to suit low-powered vehicles, such as commonly used in India and China.

[29] http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a2app1e.pdf

A small WMTC Task Force, coordinated by the International Motorcycle Manufacturers Association (IMMA), was set up to prepare a proposal on the test cycle(s) and any new classification that might be necessary to achieve this objective. The Task Force was attended by India, Italy, Japan, Germany, the EC and IMMA. Task Force meetings were held in August and October 2006.

At its November 2006 meeting held in Ann Arbor (United States of America), WMTC/FEG agreed to a modified version of one of the WMTC Task Force proposals and forwarded it to WMTC Informal Group in January 2007 where it was approved for submission to GRPE.

The intention of setting up the group was put forward by the EU and announced during the 63rd and 64th meetings of the GRPE in January and June 2012 and in the 157th session of the WP.29 in June 2012.

With the mandate (informal document: WP.29-158-15) accepted at the 158th session of the WP.29 (13-16th November 2012) to establish the environmental and propulsion unit performance requirements for light vehicles (L-EPPR) informal working group under the GRPE.

At the time of writing, the GTR has not yet been finalised and approved by the L-EPPR informal working group and therefore has not been tabled yet for adoption by the Executive Committee for the 1998 Agreement (AC.3).

6.6.2 Existing regulations, directives and international voluntary standards

- Technical references in the original development of this GTR No 2

For the original development of this GTR No 2, the following regulations contained relevant applications of exhaust emissions requirements for light vehicles which were available for technical reference:

- UN Regulation No. 40, 01 series of amendments:

Uniform provisions concerning the approval of motorcycles equipped with a positive-ignition engine with regard to the emission of gaseous pollutants by the engine

- EU:

Directive 97/24/EC amending by Directive 2002/51/EC: The reduction of the level of pollutant emissions from two-and three-wheeled motor vehicles. Note: the EU has not acceded to Regulation Nos 40 and 47, but in EU type-approval legislation for light vehicles the ECE R40 and ECE R47 vehicle speed test profile vs. test time are used as type I test to verify emissions after cold start. Alternatively the WMTC vehicle speed test profile vs. test time may be used to approve a category L3e motorcycle in the EU.

In March 2013 Regulation (EU) No 168/2013[30] was adopted as well as its delegated acts setting out technical provisions and test procedures in the course of 2013. Mid of 2014 this revised legal package is applicable for EU type-approval.

---

[30] Regulation (EU0 No 168/2013 of the European Parliament and of the Council of 15 January 2013

on the approval and market surveillance of two- or three-wheel vehicles and quadricycles (OJ L60, 2.3.2013, p. 52)

- Indian Regulation:
  - MoSRT&H/ CMVR/ TAP-115/116 and Central Motor Vehicle Rule No. 115
- Japanese Regulation:
  - Road vehicle Act, Article 41 "Systems and Devices of Motor Vehicles";
  - Safety Regulations for Road Vehicles, Article 31 "Emission Control Devices";
- United States of America Regulations:
  - US-FTP Subpart F, Emission Regulations for 1978 and Later New Motorcycles
- ISO standards:
  - ISO 11486 (Motorcycles - Chassis dynamometer setting method);
  - ISO 6460 (gas sampling and fuel consumption);
  - ISO 4106 (Motorcycles -- Engine test code -- Net power);

Most of these regulations had been in existence for many years and the methods of measurement varied significantly. The technical experts were familiar with these requirements and discussed them in their working sessions. The L-EPPR Informal Working Group therefore considered that to be able to determine a light vehicle's real impact on the environment, in terms of its exhaust pollutant emissions and energy consumption, the test procedure and consequently the GTR No 2 needs to represent modern, real-world vehicle operation for all two- and three wheeled vehicles.

Consequently, the draft GTR was based on new research into the worldwide pattern of real light vehicle use with a wide range of propulsion units.

6.6.3 Technical references in developing this revision of the GTR.

For the development of this revision to the GTR, the following legislation and technical standards contained relevant applications of requirements for light vehicles or transferable provisions for passenger cars:

Test type I:

- UN (1998 agreement, light-duty and heavy-duty vehicles): WLTP, UN S.R.1;
- UN (1958 agreement, light vehicles): UN Regulation 40, UN Regulation 47 and UN R.E.3;
- UN (1958 agreement, M/N-category vehicles): UN Regulation 83;
- EU: Regulation (EU) No 168/2013;
- EU REPPR (delegated act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013), Directive 97/24/EC supplementing Directive 2002/24/EC.

Test type II:

- UN (1958 agreement, light vehicles): UN Regulation 40, UN Regulation 47;
- UN (1958 agreement, light-duty vehicles): UN Regulation 83;
- EU: EU REPPR, Directive 2009/40/EC

Test type V:

- UN (1958 agreement, light-duty vehicles): UN Regulation 83;
- EU: Regulation (EU) No 168/2013 and EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013);
- USA: US CFR Title 40, Part 86;
- Technical standards: ISO 7116, ISO 7117, ISO 4106, ISO 4164.

Test type VII:

- UN (1958 agreement, light-duty vehicles): UN Regulation 101, UN Regulation 83;

EU: Regulation (EU) No 168/2013 and EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013).

6.6.4 Discussion of the issues addressed by the GTR

This revision of GTR No 2 brings together the tailpipe pollutant and CO_2 emissions related test types I, II[, V] and VII. This latter mentioned test type VII verifies the energy efficiency of the light vehicle in terms of setting out a test procedure required to determine the fuel consumption of vehicles equipped with a combustion engine, energy consumption of as well as the electric range for pure electric and hybrid electric light vehicles.

The issues addressed by the test procedure development group of the original GTR No 2, covering test types I, II and VII for motorcycles equipped with PI engines, are discussed in detail in the Technical Report ECE/TRANS/180/Add.2/Appendix 1. The process used to develop this GTR was based on four basic steps. First, the basis of the test cycle development was the collection and analysis of driving behaviour data and statistical information about moped and motorcycle use for the different regions of the world. These data had to include all relevant real life vehicle operations and built the basis for the cycle development. In a second step the in-use driving behaviour data were combined with the statistics on vehicle use in order to create a reference database that is representative for worldwide moped and motorcycle driving behaviour. This was achieved using a classification matrix for the most important influencing parameters. In the final classification matrix three different regions (Europe, Japan, United States of America), three different vehicle classes and three different road categories were included.

The next step was to compact this reference cycle into a test cycle of the desired length. A computer search programme then selected a number of modules (speed/time sequences between two stops) to represent by approximation this length. The statistical characteristics of this number of modules are then compared to those of the database. The comparison is done on the basis of the chi-squared method, an accepted statistical criterion.

Finally, a first draft of the World-wide Motorcycle Test Cycle (WMTC) was produced and validated on 53 mopeds[31] and motorcycles. It was foreseen that this first draft needed to be modified on the basis of an evaluation concerning driveability and practical points such as typical gear shifts concerning the measurement procedure. Since this process is iterative by nature, several adaptation rounds including the driveability tests were carried out.

In the interim period, further developments to the existing test types I, II and VII (fuel consumption only for conventional two-wheeled vehicles equipped with conventional PI and CI engines) and the test cycle were identified by the Contracting Parties as part of previous amendments and this revision, including:

- the development of the alternative cycle for low-powered two-wheeled light vehicles to take account of the use of these vehicles outside Europe, Japan and the USA, which were the sources of the original database;
- in order to take into account the performances and the use of low-powered motorcycles, additional data were supplied by India. After further analysis, it was agreed that the previously agreed reduced vehicle speed test cycles should be modified and that the class 1 vehicle subcategories could be merged;
- the comparative database of results from the different test procedures, which act as a major input for the discussion of exhaust emission limit values that are compatible with existing limit values in different regions/countries;
- the definition of pollutant emission limit values for motorcycles equipped with a PI engine;
- the need for updates to the emission sampling requirements to match current practice in emission laboratories and to harmonise those worldwide;
- the need for updates to the dynamometer provisions to match current practice;
- the correction of formulae and standardisation of measuring units;
- the inclusion of a wider range of powertrain types and the ability to cover others in development;
- the re-introduction of other light vehicles included in the original test programme within the GTR;
- the introduction of other light vehicle categories that use the same or similar powertrain technologies, i.e. light three- and four-wheeled road vehicles;
- although provisions for test type VII were included in the original GTR for vehicles equipped with a single PI and CI engine, at the time of developing this revision there is a requirement for testing procedures which provide equivalent energy

[31] Table 31 in chapter 9: http://www.unece.org/fileadmin/DAM/trans/main/wp29/wp29wgs/wp29gen/wp29registry/ECE-TRANS-180a2app1e.pdf refers to three 49 cm^3 mopeds and one 50 cm^3 moped of the total of 53 test vehicles have been used to validate the basic WMTC

efficiency data for hybrid-electric and pure electric vehicles as well as expanding to alternative gaseous fuels such as LPG, CNG and hydrogen;

At the time of creation of the base GTR No 2, durability requirements (test type V) were outside the scope of the WMTC informal group's mandate. However, Contracting Parties were expressly permitted within this section to specify durability requirements and/or useful life provisions in their national or regional legislation in relation to the emission limits set out in this GTR. This revision No 1 introduces a harmonised testing procedure for the durability of pollution control devices of light vehicles (test type V). Important elements identified for the global harmonisation of test type V were:

- driving schedules;
- test vehicle requirements;
- test distances;
- procedures for verifying durability with reduced distance accumulation;
- frequency and conduct of type I emissions tests.
- the reference to one world harmonised test type I (WMTC) to verify tailpipe emissions during and at the end of distance accumulation to compare them with the emission limits set out in the GTR No 2;
- provisions covering modern powertrain configurations, e.g. hybrid-electric powertrains.]

6.6.4.1 General Requirements

The proposed revision No 1 is based on the base GTR No. 2 (ECE/TRANS/180/Add.2 consolidated with amendments 1, 2 & 3 including relevant corrigendum and appendixes) and new research to establish efficient internationally harmonised test procedures.

The test cycle developed in the original GTR was based on research into the world-wide pattern of light two-wheeled vehicles on a variety of road types. The weighting factors, both for creating the test cycles and for calculating the overall emission results from the several cycle parts, were calculated from the widest possible worldwide statistical basis. The classification of vehicles reflects the general categories of use and real-world driving behaviour.

For test type I and VII, the draft GTR contains:

- a main cycle in three parts, which is applied to three different categories of two- and three-wheeled light vehicles;
- a specific gear shift procedure;
- the general emission test laboratory conditions, which were originally defined by an expert ISO committee and have subsequently been brought up to date by the GTR2 Informal Working Group;
- Enhanced requirements with respect to emission bench requirements and in particular with respect to particulate measurement equipment as well as requirements with respect to dilution air;
- test methodologies to measure the energy efficiency, such as CO_2 emissions, fuel/energy consumption as well as electric range for light vehicles independent of

the propulsion unit type with which such a vehicle is equipped (conventional combustion engine, hybrid-electric or pure electric propulsion units);

- the question of harmonised off-cycle emissions requirements will be considered and appropriate measures introduced in due course.

For test type II, the draft GTR contains:

- a test procedure at normal and high idle engine speeds for light vehicles equipped with PI combustion engines;
- a free acceleration test procedure for light vehicles equipped with CI combustion engines;
- provisions covering modern powertrain configurations, e.g. hybrid-electric powertrains.

For test type V, the draft GTR contains:

- three different durability test procedures proposed at the discretion of the manufacturer: Actual durability testing with full distance accumulation, actual durability testing with partial distance accumulation and a mathematical durability procedure;
- two alternative driving schedules for distance accumulation are included, including soak procedures, at the discretion of the manufacturer:
    - the Standard Road Cycle rescaled for light vehicles (SRC-LeCV) on the basis of the WMTC; see technical report[32] for background information; and
    - the Approved Mileage Accumulation Cycle (AMA); see supplementary information in US Federal Register[33] for background information;
- minimum distance accumulation requirements are split into principal requirements that fulfil the requirements of all Contracting Parties and alternative requirements that allow Contracting Parties to accept reduced distances for their region;
- clarifications on the conduct and frequency of type I emissions tests and compliance criteria for the three testing procedures;

For all test types the minimum administrative requirements have been revised and updated to reflect the revision No 1 of GTR No. 2 for technical progress.

6.6.4.2 Performance Requirements

The performance requirements from the base GTR No 2 have been carried over into the proposal for revision No 1 of GTR No 2. The principle emission limits have been transferred to the alternative performance limits section and the Euro 4 emission limits, which are to date the most stringent (confirmed) ones for two-wheeled motorcycles, have been proposed to become the new principle performance limits. The performance

---

32 http://ec.europa.eu/enterprise/sectors/automotive/files/projects/report-trl-ppr627_en.pdf

33 http://www.gpo.gov/fdsys/pkg/FR-2006-01-17/pdf/06-74.pdf

requirements for other L-category vehicles are not defined in the GTR as priority is given to update the test procedure and requirements for technical progress. Consequently these performance criteria are defined by each CP individually.

6.6.4.3 Reference Fuel

The use of this standardised reference fuel for determining compliance with the principle emission limits is set out in the GTR, and the proposed specifications were carried over from UN Regulation 83.

With respect to test type V it is considered to use representative market fuel for distance accumulation and reference fuel for test type I verification testing. The final decision on this issue will have to be taken by the L-EPPR group.

6.7 Global Technical Regulation No. [XX] (crankcase and evaporative emissions)

MEASUREMENT PROCEDURE FOR TWO- OR THREE-WHEELED LIGHT MOTOR VEHICLES EQUIPPED WITH A COMBUSTION ENGINE WITH REGARD TO THE CRANKCASE (type III test) AND EVAPORATIVE EMISSIONS (type IV test)

The aim of this draft Global Technical Regulation (GTR) is to provide measures to strengthen the world-harmonisation of light vehicle approval and certification legislation, in order to improve the cost effectiveness of environmental performance testing, remove trade barriers, reduce the overall complexity of global legislation, remove potential areas of conflict or opposing requirements and improve the air quality.

This draft GTR establishes harmonised test procedures to determine the crankcase emissions and evaporative emissions of light vehicles. The test procedures were developed so that they would be:

- Able to provide an internationally harmonised set of tests to ensure efficient and practicable testing,
- Corresponding to state-of-the-art testing, sampling and measurement technology in the area of environmental performance testing of light vehicles in the areas of crankcase and evaporative emissions, and
- Applicable in practice to existing and foreseeable future powertrain technologies.

The technical and economic feasibility of the measures contained within this draft GTR have been considered and are discussed further in Section 5.

The draft GTR covers the tests to determine the environmental performance of light vehicles:

- Test Type III: Crankcase emissions: A number of tests to demonstrate, where required, that no emissions are released from the crankcase and, if applicable, to ensure that no emissions can escape to the atmosphere from crankcase ventilation systems integrated in the combustion engine.
- Test Type IV: Evaporative emissions: To test the evaporative emissions, from either a fuel tank permeability, a fuel system permeation or from the entire vehicle.

The GTR is based on the work of the Informal Working Group (IWG) on Environmental and Propulsion unit Performance Requirements of L-category vehicles (EPPR), from now on referred to as L-EPPR, which held its first meeting during the 65th GRPE in January 2013, and on the first draft proposal by the European Commission (EC).

6.7.1 Procedural background

The EU put forward and announced their intention of setting up a group during the 63rd and 64th meetings of the GRPE in January and June 2012 and in the 157th session of the WP.29 in June 2012.

With the mandate (informal document: WP.29-158-15) accepted at the 158th session of the WP.29 (13-16th November 2012) to establish the L-EPPR IWG under the GRPE.

At the time of writing, the GTR has not yet been finalised and approved by the L-EPPR informal working group and therefore has not been tabled yet for adoption by the Executive Committee for the 1998 Agreement (AC.3).

6.7.2 Existing regulations, directives and international voluntary standards

Technical references in the development of the GTR

For the development of the GTR, the following legislation and technical standards contained relevant applications of requirements for motorcycles and other light vehicles or transferable provisions for passenger cars:

Crankcase emissions:

- UN Regulation No 83 (applicable to cars and vans)

Evaporative emissions, permeation tests

- US Federal test procedures (86.410-2006 Emission standards for 2006 and later model year motorcycles)

Evaporative emissions: SHED test

- California Air Resources board test procedure (based on the old (1978) test procedure for light-duty vehicles) (California evaporative emission standards and test procedures
- for 2001 and subsequent model motor vehicles, as amended 22 March 2012)

6.7.3 Discussion of the issues addressed by the GTR

This GTR brings together the test procedures to determine the crankcase emissions and evaporative emissions of light vehicles. The process to develop this GTR followed the methodology discussed in Section A.3(b), where important issues addressed during the development were:

- Adapt provisions to two- and three-wheeled light vehicles where necessary;
- Ageing test procedures of evaporative emission control components;
- Test fuel

- Adaptation for technical progress of powertrain technology, i.e. how to prepare a hybrid-electric propelled vehicle for the SHED test.

Provide a series of options to allow testing to be carried out involving varying degree of complexity and equipment (i.e. from a simple mass based permeability test only measuring evaporative losses from a non-metallic fuel tank to a full SHED test of the entire vehicle)

6.7.3.1 Requirements

With respect to crankcase emissions the general requirements are:

- If there is any doubt expressed by the approval authority that crankcase gases might escape to the atmosphere, the manufacturer might be required to conduct a type III test:
- The engine is run at a three specified steady state conditions
- The crankcase pressure is measured at an appropriate location
- The vehicle is deemed satisfactory if, at each condition, the pressure does not exceed the atmospheric pressure
- If the vehicle fails the initial test, then one of two additional tests can be performed at the choice of the manufacturer:
- The initial test is repeated but with a flexible bag connected to a suitable location. The vehicle is satisfactory if there is no visible inflation of the bag at each test condition.
- The crankcase of the stopped engine is pressurised to at least 5 kPa above atmospheric pressure. If the crankcase can maintain over 95% of this overpressure for 300 seconds after the air source is closed, then the engine is deemed sufficiently sealed and therefore satisfactory.

For evaporative emissions, there is a choice of three different test procedures:

- Fuel tank permeability test – the test only applies to a non-metallic fuel tank which is half filled and weighed daily over an 8 week period to determine the mass of fuel lost over that period owing to permeation of petrol through the fuel tank walls.
- Fuel system permeation test – a similar test but expanded to permeation of petrol through the fuel tank and fuel supply system, tested with additional preconditioning treatment to simulate partial deterioration of the fuel storage and supply system as would occur in normal use.
- SHED test, applicable to the entire vehicle, comprising of a diurnal test (emissions due to an increase in the temperature of the fuel and vapour in the fuel tank) and a hot soak test (evaporative emissions occurring after getting the engine up to temperature by driving over a Type I test cycle on a chassis dynamometer).

6.7.3.2 Test Fuels

For the crankcase emissions and the evaporative emissions test, the same reference fuel as specified for the Type I (exhaust emissions) test shall be used.

6.8 Global Technical Regulation No. [XX] (On Board Diagnostics)

REQUIREMENTS FOR LIGHT TWO- AND THREE-WHEELED [1958 agreement: LIGHT TWO-, THREE- AND FOUR-WHEELED] VEHICLES WITH REGARD TO ON-BOARD DIAGNOSTICS (OBD)

The aim of this Global Technical Regulation (GTR) is to provide measures to strengthen the world-harmonisation of light vehicle approval and certification legislation, in order to improve the cost effectiveness of environmental performance testing, remove trade barriers, reduce the overall complexity of global legislation, remove potential areas of conflict or opposing requirements and improve the air quality. The main goal of OBD in light and heavy duty vehicle legislation (passenger cars, utility vehicles, trucks, busses etc.) is environmental protection. OBD in category L vehicle legislation was mainly introduced to allow effective and efficient repair and is therefore could be said to be directly to the benefit of independent repairers and consumers. Different than for light and heavy duty vehicles environmental protection and possible expansion to vehicle functional safety are regarded as secondary benefits by the EC but nevertheless as important.

This GTR establishes harmonised functional requirements for OBD and a procedure to test the environmental OBD functions (test type VIII). The functional requirements and test procedures were developed so that they would be:

- Able to provide an internationally harmonised set of functional requirements with respect to hardware and software design supporting OBD, that considers technical feasibility and cost-effectiveness
- Able to provide an internationally harmonised set of tests to ensure efficient and practicable testing, the type VIII test being based on test type I requirements in UN legislation,
- Corresponding to state-of-the-art testing technology, allowing to simulate failures where technically, and
- Applicable in practice to existing and foreseeable future powertrain technologies.

The technical and economic feasibility of the measures contained within this draft GTR have been considered and are discussed further in Section A.5.

The draft GTR covers functional requirements and the environmental test procedure (test type VIII) relating to on-board diagnostics (OBD):

- Minimum monitoring requirements for OBD stage I[34]
- Minimum monitoring requirements for OBD stage II (to be introduced as separate amendment and initially proposed as a voluntary standard; see section A.4. of the draft GTR)
- Provisions regarding design and activation of the malfunction indicator (MI), fault codes, diagnostic signals and connection interfaces

[34] OBD stage I monitors electric / electronic circuits including the PCU / ECU, wires, connectors, sensors and actuators. OBD stage II monitors in addition to electric / electronic circuits faults also the degradation of systems and components.

- Provisions regarding access to OBD information
- Definition of propulsion families with regards to environmental OBD test type VIII
- OBD environmental test type VIII procedure by simulating failure of emission-relevant components in the powertrain management system and emission-control system and monitoring the OBD system reaction during a type I test cycle.

The GTR is based on the work of the Informal Working Group (IWG) on Environmental and Propulsion unit Performance Requirements of L-category vehicles (EPPR), from now on referred to as L-EPPR, which held its first meeting during the 65th GRPE in January 2013 and the initial draft proposal by the European Commission (EC). Specific issues and options raised and resolved in their development are discussed in temporary Section 0. "Introduction issues and proposed options for harmonisation" of this document, which will be transferred into the report that accompanies the GTR when it is adopted by the L-EPPR IWG and sent to GRPE for approval.

6.8.1 Existing regulations, directives and international voluntary standards

Technical references in the development of the GTR

For the development of the draft GTR, the following legislation and technical standards contained relevant applications of requirements for motorcycles and other light vehicles or transferable provisions for passenger cars:

- UN (1958 agreement, light-duty legislation): UN Regulation 83
- UN (1998 agreement, heavy-duty legislation): GTR No 5
- EU: EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013), Annex VIII and EU draft RVCR (Delegated Act on Vehicle Construction Requirements supplementing Regulation (EU) No 168/2013), Annex XII
- Japan: Safety Regulations for Road Vehicles, Article 31, Attachment 48
- USA (light-duty legislation): US CFR, Title 40, Part 86, Subpart S
- Standards:
    - International: ISO 2575, ISO 9141-2, ISO 14229-3, ISO 14229-4, ISO 14230-4, ISO 15031-4, ISO 15031-5, ISO 15031-6, ISO 15765-4, ISO 20828, ISO 22901-2
    - USA: SAE J1850

6.8.2 Discussion of the issues addressed by the GTR

This GTR brings together the functional requirements for OBD and a procedure to test the environmental OBD functions (test type VIII) of light vehicles. The process to develop this GTR followed the methodology discussed in Section A.3(b), where important issues addressed during the development were:

- Adapt provisions to two- and three-wheeled light vehicles where necessary
- Set out provisions covering modern powertrain configurations, e.g. purely electric or hybrid-electric powertrains

- Develop a staggered approach to achieve harmonised functional requirements defining reduced monitoring requirements for OBD stage I and extended monitoring requirements for OBD stage II, to be introduced in a separate amendment. OBD stage I should not oblige manufacturers to change fuelling hardware and should not impose fitting of an electronic carburettor or electronic fuel injection. Compliance with the OBD stage I requirements requires that if fuel delivery, spark delivery or intake air are electronically controlled, the applicable input or output circuits need to be monitored.
- OBD emission thresholds: It was proposed to leave the definition of OBD emission thresholds to the Contracting Parties and at the time of finalising this report the final decision from the group had not been taken.
- Harmonisation of malfunction indicator (MI) activation criteria
- Harmonisation of ISO standards to be used for fault code definition. communication protocol and standardised scan tool connector

6.8.2.1 Requirements

Regarding functional requirements for OBD, the GTR contains:

- Minimum monitoring requirements for OBD stage I
- Minimum monitoring requirements for OBD stage II (to be introduced as separate amendment)
- Provisions regarding design and activation of the malfunction indicator (MI), fault codes, diagnostic signals and connection interfaces
- Provisions regarding access to OBD information

Regarding the environmental test type VIII procedure for OBD, the GTR contains:

- Definition of propulsion families with regard to OBD
- Test vehicle requirements
- Test procedure by simulating failure of emission-relevant components in the powertrain management system and emission-control system and monitoring the OBD system reaction during a type I test cycle
- Failure modes to be tested for OBD stage I
- Failure modes to be tested for OBD stage II (to be introduced as separate amendment)

Minimum administrative requirements have been set out or updated to reflect the technical progress addressed in this GTR.

6.8.2.2 Test Fuels

For the environmental test procedure for OBD, reference fuels as defined in the applicable type I test as defined in GTR No 2 shall be used.

6.9 Global Technical Regulation No. [XX] (PuPR)

DRAFT NEW GLOBAL TECHNICAL REGULATION [1958 agreement: REGULATION] ON THE MEASUREMENT OF MAXIMUM DESIGN VEHICLE SPEED, NET TORQUE,

NET POWER AND MAXIMUM 30 MINUTES POWER OF LIGHT TWO- AND THREE-WHEELED [1958 agreement: TWO-, THREE- AND FOUR-WHEELED] VEHICLES

The aim of this draft Global Technical Regulation (GTR) is to provide measures to strengthen the world-harmonisation of light vehicle approval and certification legislation, in order to improve the cost effectiveness of environmental performance testing, remove trade barriers, reduce the overall complexity of global legislation, remove potential areas of conflict or opposing requirements and improve the air quality.

This draft GTR establishes harmonised test procedures to determine the propulsion unit performance values of light vehicles, i.e. maximum design vehicle speed, power and torque, that are referenced in GTRs covering exhaust emission test procedures. The test procedures were developed so that they would be:

- Able to provide an internationally harmonised set of tests to ensure efficient and practicable testing,
- Corresponding to state-of-the-art testing, sampling and measurement technology in the area of performance testing of light vehicles, and
- Applicable in practice to existing and foreseeable future powertrain technologies.
- Applicable only to vehicles limited in maximum vehicle speed. For higher powered motorcycles the test is replaced with a declaration from the manufacturer, which is deemed acceptable.

The technical and economic feasibility of the measures contained within this GTR have been considered and are discussed further in Section 6.7.3.

The GTR covers the tests to determine the propulsion unit performance of light vehicles:

- Maximum design vehicle speed: For vehicles that intended to have a limited in maximum vehicle speed to adhere to the requirements of categorisation. A test procedure comprising of repeated test runs over a defined distance on a test track or road to determine the maximum speed a vehicle is able to attain under standard conditions.
- Net torque, net power: Test procedures comprising of dynamometer runs at full-load (combustion engines) or maximum accelerator control position (pure electric propulsion) with measurements over a range of engine speeds to determine the power and torque curve.
- Maximum 30 minutes power: Test procedure comprising of a test run at a constant power selected by the manufacturer over 30 minutes to determine the maximum power an electric drive train is able to produce over a 30 minutes period.
- Maximum continuous rated power, switch-off distance and maximum assistance factor: Test procedure for light vehicles designed to pedal equipped with an electric motor for pedal assistance comprising of test runs on a test bench with measurements to determine the maximum continuous rated power, the driving distance with motor assistance after stopping with pedalling (switch-off distance) and the maximum ratio of motor power to rider input power (assistance factor).

The GTR is based on the work of the Informal Working Group (IWG) on Environmental and Propulsion unit Performance Requirements of L-category vehicles (EPPR), from now on referred to as L-EPPR and the initial proposal by the European Commission (EC).

Specific issues and options raised and resolved in their development are discussed in the accompanying options document which will be transferred into the report that accompanies the GTR when it is adopted by the L-EPPR IWG and sent to GRPE for approval.

6.9.1 Existing regulations, directives and international voluntary standards

Technical references in the development of the GTR

For the development of the GTR, the following legislation and technical standards contained relevant applications of requirements for motorcycles and other light vehicles or transferable provisions for passenger cars:

Maximum design vehicle speed:

- EU: EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013) and Regulation (EU) No 168/2013
- UN (1958 agreement, light-duty legislation): UN Regulation 68

Net torque, net power and maximum 30 minutes power:

- UN (1958 agreement, light-duty legislation): UN Regulation 85
- EU: EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013) and Regulation (EU) No 168/2013

Maximum continuous rated power, switch-off distance and maximum assistance factor of category 3 vehicles designed to pedal:

- EU: EU REPPR (Delegated Act on Environmental and Propulsion unit Performance supplementing Regulation (EU) No 168/2013) and Regulation (EU) No 168/2013
- Standards: EN 15194

6.9.2 Discussion of the issues addressed by the GTR

This GTR brings together the test procedures to determine the propulsion unit performance of light vehicles. The process to develop this GTR followed the methodology discussed in Section A.3(b), where important issues addressed during the development were:

- Adapt provisions to two- and three-wheeled light vehicles where necessary
- Set out provisions covering modern powertrain configurations, e.g. purely electric or hybrid-electric powertrains
- Define test procedures for vehicles designed to pedal/with pedal assistance
- Define power and torque measurement for multi-mode hybrid-electric vehicles
- Adapt mass requirements to UN definitions
- Adapt number of test runs for certain configurations of maximum design vehicle speed test.

6.9.2.1 Requirements

For the maximum design vehicle speed test, the GTR contains:

- Requirements concerning the test vehicle and test driver.
- Definitions of required characteristics of the test track or road and atmospheric conditions during testing.
- A test procedure comprising of repeated test runs over a defined distance.
- A procedure for calculating the maximum speed a vehicle is able to attain under standard conditions from the recorded test data.

For the net torque, net power and maximum 30 minutes power test, the GTR contains:

- Test procedures for net torque and net power, comprising of dynamometer runs full-load (combustion engine) or maximum accelerator control position (pure electric propulsion) with measurements over a range of engine speeds to determine the power and torque curve.
- Test procedure for maximum 30 minutes power, comprising of a test run at a constant power selected by the manufacturer over 30 minutes to determine the maximum power an electric drive train is able to produce over a 30 minutes period.
- Specific provisions for hybrid-electric vehicles and dual-fuel engines.
- Provisions on the test fuel to be used.
- Clarifications, which accessories have to be fitted or removed for the tests.
- Procedures for calculating the net torque, net power and maximum 30 minutes from the recorded test data.

For the maximum continuous rated power, switch-off distance and maximum assistance factor test, the GTR contains:

- A test procedure for light vehicles designed to pedal equipped with an auxiliary engine to aid pedalling, comprising of test runs on a test bench with measurements to determine the maximum continuous rated power, the driving distance with motor assistance after stopping with pedalling (switch-off distance) and the maximum ratio of motor power to rider input power (assistance factor).
- Procedures for calculating the maximum continuous rated power, switch-off distance and maximum assistance factor from the recorded test data.

For all test procedures the minimum administrative requirements have been set out or updated to reflect the technical progress addressed in this GTR.

6.9.2.2 Test fuels

For the maximum design vehicle speed test, fuel as recommended by the manufacturer shall be used, following the requirements UN R68. For the power and torque tests, fuel provisions are based on UN R85, requiring fuel as available on the market, but with defined reference fuels to be used in any case of dispute.

6.10 Vehicle categories and definitions (R.E.3/S.R.1)

The 1958 Agreements R.E.3 and 1998 Agreements S.R.1 documents, provide a base document which provides an overview of the respective Agreement's intentions, the vehicle categorisation and a range of key definitions required to assign the specific categorisations. It should be noted that the resolutions for vehicle construction (R.E.3) and special resolution 1 (S.R.1) are not legally binding and should therefore be perceived as guidelines on horizontally applicable requirements (applicable for multiple UN regulations or GTRs) for Contracting Parties when drafting and adopting UNECE legislation. For this project both the vehicle categorisation for light vehicles and key definitions related to them were analysed to ascertain whether changes were required and/or feasible.

Both of these documents contain information on all vehicle types, not just light vehicles, and so changes could have significant repercussions. Therefore soon in the process it was established that no changes would be made that could have effects outside of the light vehicle legislation within the scope of the informal working group's mandate. That said, one key area where a change was proposed was to bring four wheeled light vehicles within the scope of light vehicles under the 1998 Agreement, as they currently are only subject to UN regulations under the 1958 Agreement.

6.10.1 Definitions

Of the definitions within the documents those on performance, dimensions and masses were identified as needing amendment. This was because of the following reasons; discrepancies were found between the current UN GTRs and other worldwide legislation in these areas, the assignment of a specific category relies on these three, and the performance and masses are key values required for testing, especially the Type I test which is pivotal to all other emission testing.

6.10.2 Performance

Regarding propulsion performance a new GTR (and mirrored Regulation) is being developed which contains the testing methods for maximum design speed, net power, and maximum continuous rated power so references to these were added. In addition, although it is a widely accepted method there was no definition for engine capacity, therefore a definition was developed and added.

6.10.3 Dimensions

The dimensions of the vehicles are especially important to the categorisation of four wheeled light vehicles, as it is used as one of the measure to decide whether the vehicle should be classed as a motor vehicle category M (passenger car). In the current document an ISO standard is referenced that details the method of measuring the height, width and length of the vehicle. It lists the vehicle parts which should be included or excluding when deciding which surfaces to measure between. Although it was generally accepted that the use of technical standards should be avoided, the use of this one was of particular concern as due to its age it was not easily obtainable. The second issue with this standard was the fact that Japan used slightly different rules that included more items within the inclusion list, namely externally mounted spare tyres and equipment boxes, this is presumably due to the taxation legislation in Japan intended to reduce land use for parking.

Therefore the preferred option was first to transfer the parts list to the R.E.3 and S.R.1 documents, and secondly a definition to account for external storage was developed to include these items. This was done without changing the meaning of definitions already included within the legislation.

6.10.4 Mass

The changes to the definition of masses were done in a similar way to the dimensions. Depending on its use a variety exclusions and inclusions are required in the definition of the mass. The current ranges of definitions were used for LD (light duty) and HD (heavy duty) vehicles i.e. cars, vans and HGVs, while some used within current light vehicle legislation were missing or different. A gap analysis of these definitions concluded that two new definitions were needed "Actual mass" and "Unfuelled mass", in addition the definition name for mass used within GTR No. 2 was changed to match the changes made here. This was critical to keep the masses needed by other vehicle categories unchanged, while keeping the masses required technically for testing.

6.10.5 Categories

The categorisation of vehicles is done in a fundamentally different way between the 1958 Agreements R.E.3 and 1998 Agreements S.R.1 documents. R.E.3 defines light vehicles as the L-category to match regional type-approval, taxation and licencing requirements, it has 7 sub-categories covering 2, 3 and 4 wheel vehicles. The 4 wheel vehicles are excluded from the car and light van M and N categories respectively with limits on the masses, dimensions, speed and/or net power. Under the S.R.1 legislation the vehicles are categories into broad technology based groups, the equivalent light vehicle group is called Category 3, which includes only 2 and 3 wheeled vehicles, these however closely match the sub-categorisation used in R.E.3 for those vehicles.

It was initially envisioned that the two documents could be brought into alignment, however there are regions around the world which do not have a light 4 wheel vehicle grouping and so it was decided by the group that this change to S.R.1 would not be feasible.

Internally within the main category however, the criteria used for sub-categorisation could be adjusted. For this, the key change was to include a net power kW value for non-conventionally powered vehicles and to amend the definitions used for masses and definitions as mentioned above.

6.11 Amendment/Revisions to Regulation R47

UN Regulation No. 47 ("Uniform provisions concerning the approval of mopeds equipped with a positive-ignition engine with regard to the emission of gaseous pollutants by the engine") came into force on 1 November 1981. Since then there has only been one amendment, which mainly updated the list of countries. As such, some of the contents are rather dated. The following have been identified and modified as part of this work programme:

6.11.1 Other fuel types

Issue: The existing regulation only considers petrol (E0) in the "dilution factor" calculations.

Action: The calculation has been modified to include petrol (E5), diesel (B5), LPG, NG/biomethane and ethanol (E85). This is based on the procedure in the new GTR 2 proposal.

6.11.2 Dynamometers

Issue: The Regulation only caters for dynamometers with physical flywheels for reproducing the vehicle inertia. In addition, the current Regulation allows twin roller dynamometers whereas single roller dynamometers are preferable.

Action: The specifications in the main body have been revised using test from the new GTR 2 proposal. In addition, Annex 4, Appendix 4 (Method for calibration of the dynamometer bench) has been replaced with the corresponding procedures from GTR 2. However, as the GTR 2 procedure includes speed of 80 km/h, this has been revised down to 40 km/h which is more appropriate for mopeds.

6.11.3 Type II idle test

Issue: The Type II idle test specifies measuring the mass emissions of CO and HC, whereas all comparable Type II tests specify concentrations.

Action: The Type II test procedure has been copied across from the new GTR 2 procedure. This is in line with European PTI requirements. In addition, the diesel smoke test has also been included.

Issue: The original document only included the specification for petrol reference fuels (leaded and unleaded).

Action: The reference fuel specifications from the new GTR 2 proposal have been coped across, which includes petrol, diesel (B5), LPG, NG/biomethane and ethanol (E85).

7 Conclusions

The **aim** of this project was to derive cost effective measures and proposals for the UN Regulation 168/2013 and Global Technical Regulations in order to strengthen the world-harmonisation of L-category type approval legislation.

Specifically the **test types** related to Environmental and Propulsion unit Performance Requirements (EPPR) that have been reviewed and re-drafted, namely:

- The type I test: cold start tailpipe emissions;
- The type II test: tailpipe emissions at idle and fast idle;
- The type III test: crankcase emissions;
- The type IV test: evaporative emissions;
- The type V test: durability;
- The type VII test: CO_2 and fuel consumption;
- The type VIII test: On Board Diagnostics environmental tests (OBD);
- Propulsion unit Performance Requirements (PPR);
- The classification of L-category vehicles at the international level.

In addition, UN Regulation R47 has been amended and updated.

The test types were grouped as follows:

Group 1: Emissions (tail pipe)

- The type I test: cold start tailpipe emissions;
- The type II test: tailpipe emissions at idle and fast idle;
- The type V test: durability of pollution control devices;
- The type VII test: CO_2 and fuel consumption;

The original GTR 2 contained test types I, II and VII and mentioned that contracting parties should develop durability provisions (type V) within Section A. As part of this work programme it was decided to include type V within the group because it is closely related to the other tests and by doing is an administrative efficient solution.

Group 2: Emissions (other)

- The type III test: crankcase emissions;
- The type IV test: evaporative emissions;

There was no existing original GTR 2 for types III and IV, but these two tests are related as both cover vehicle emissions other than coming from the tailpipe.

Group 3: On Board Diagnostics

- The type VIII test: On Board Diagnostics environmental tests (OBD);

It was decided that this test type would form one GTR containing functional OBD as well as the environmental verification OBD test type VIII.

Group 4: Propulsive Performance Requirements (PPR)

- Propulsion unit Performance Requirements:
    - Maximum design vehicle speed
    - Maximum net power (engine/motor) test
    - Maximum net torque (engine/motor) test
    - Maximum 30 minutes power test

It was decided that this test type would form one GTR. These tests were grouped as they all relate to the performance capabilities of the vehicle

Finally, L-category vehicles classifications were updated for the 1958 and 1998 agreements, namely R.E.3 and S.R.1 respectively.

For the **Groups 1 to 4**, Options documents were written which collated all the international standards into one place. Further, initial 'preferred options' within these documents were identified for each task/test area. Information from the literature and stakeholders, followed by direct feedback on these proposals from the Informal Working Group and the EC was used to finalise the 'preferred options'. Then 1958 and 1998 Regulations were drafted for each of the **Groups 1 to 4**.

At the time of writing, the Informal Working Group has further work to undertake with respect to reviewing the draft Regulations.

8 Glossary

Term	Description
AMA	Approved Mileage Accumulation durability cycle, a driving schedule for distance accumulation defined by the EPA in the CFR
ATV	All-terrain-vehicle, a quadricycle.
Carb	Abbreviation of carburettor, an apparatus for mixing air and fuel in PI engines.
CARB	California Air Resources Board
CBS	Combined Braking System, a system which distributes braking effort between front and rear wheels irrespective of the brake level applied.
CCR	California Code of Regulations
CE	Combustion engine
CFR	Code of Federal Regulations of the United States of America
CI	Compression ignition, used in diesel engines, where the pressure and temperatures caused by compression starts the combustion process.
CO	Carbon Monoxide
CO2	Carbon Dioxide
CVT	Constantly Variable Transmission
DfT	Department for Transport, UK
DSA	Driving Standards Agency (UK)
EC	European Commission, The EU's executive body
ECU	Electronic Control Unit, electronic control unit that manages the operation of an engine.
EPA	Environmental Protection Agency
EU	European Union
GTR	Global Technical Regulation
HC	Hydrocarbon
HD	Heavy duty motor vehicle (i.e. lorries and busses)
HGV	heavy goods vehicle
ICE	Internal Combustion Engine - an engine in which the combustion of a fuel occurs with air in a combustion chamber.
L-category vehicles	family name of light vehicles with 2-, 3- or 4-wheels such as powered cycles, 2- or 3-wheel mopeds, motorcycles with and without sidecars, tricycles and quadricycles
LD	Light duty motor vehicles (i.e. passenger cars and light utility vehicles

Term	Description
LGV	Light goods vehicle
NOx	Nitrogen oxides, i.e. NO and/or NO2 (nitric oxide and nitrogen dioxide)
O2	Oxygen, in its most common naturally occurring molecule.
OBD	On Board Diagnostics, an electronics self-diagnostic system.
PCU	Powertrain Control Unit, as ECU (see ECU) but also receives additional inputs from sensors to actuate the gearbox, clutch and/or torque converter.
PI	Positive ignition, i.e. spark ignition, used in petrol engines where a 'positive' addition of energy is used to start the combustion process.
PM	Particulate matter, in extreme cases this is visible as soot or an off-colour haze from exhaust gases.
RAR	Regulation on administrative requirements for the approval and market surveillance of L-category vehicles, a draft stage EU regulation planned to become applicable as of 01 January 2016.
REPPR	Regulation on the environmental and propulsion unit performance requirements of L-category vehicles, an EU Regulation planned to become applicable as of 01 January 2016.
RPM	Revolutions per minute, a measure of engine speed.
RVCR	Regulation on the vehicle construction and general requirements for the approval and market surveillance of L-category vehicles, an EU regulation planned to become applicable as of 01 January 2016.
RVFSR	Regulation on vehicle functional safety requirements for the approval and market surveillance of L-category vehicles, an EU regulation planned to become applicable as of 01 January 2016
SbS	Side-by-side, a quadricycle where the driver and passengers are seated next to each other, as with a car.
SHED	Sealed housing for evaporative emissions determination
SRC	Standard Road Cycle for light-duty vehicles, a driving schedule for distance accumulation defined by the EPA
SRC-LeCV	Standard Road Cycle for Le-Category Vehicles, a driving schedule for distance accumulation with L-category (European) vehicles
UN	United Nations
UNECE	UNECE United Nations Economic Commission for Europe. A body of the UN of which Working Party 29 (WP.29) is tasked with world-harmonising international vehicle legislation.
Vd	Displacement volume of an internal combustion engine
Wash-coat	The coating of the catalytic converter monolith which hold the catalyst in place.
WHO	World Health Organisation

Term	Description
WLTP	Worldwide harmonized Light vehicles Test Procedure
WMTC	WLTP Worldwide harmonized Light duty vehicles Test Procedure
WOT	Wide Open Throttle, i.e. full throttle, the maximum throttle control position. This is not necessarily the highest fuel flow.
WP.29	Working party 29, World Forum for Harmonization of Vehicle Regulations. A body within the UNECE.
WTP	Willingness To Pay – measure used in cost benefit studies. Includes valuation for pain and suffering, as well as direct and indirect costs.

9 List of figures

10 Appendixes

Appendix A Roadmap

A.1 3rd Roadmap published for 1st L-EPPR meeting

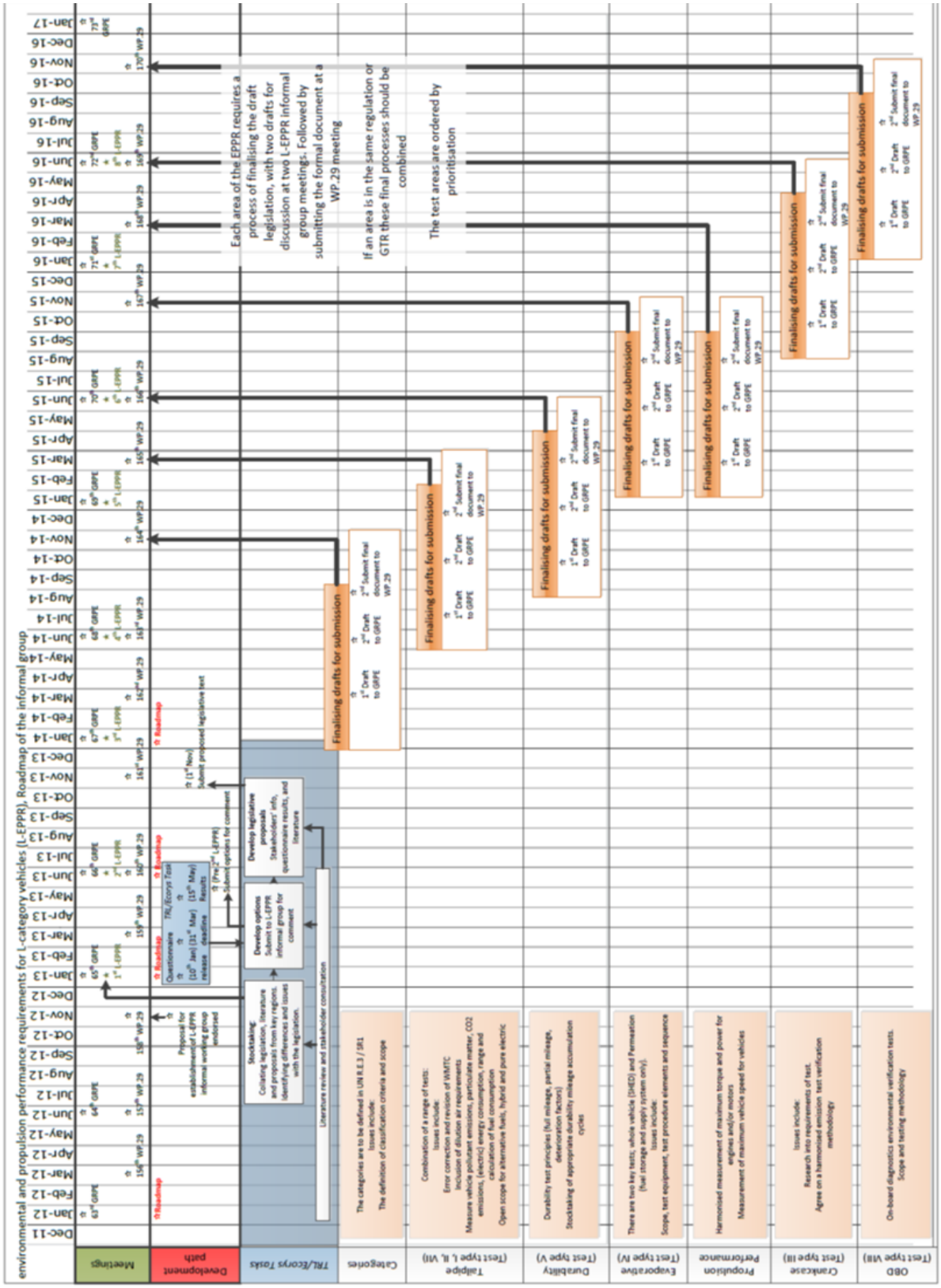


Figure 10-1: Draft roadmap January 2013, 1st L-EPPR

A.2 Aligning Type I, II, VII from REPPR to UN

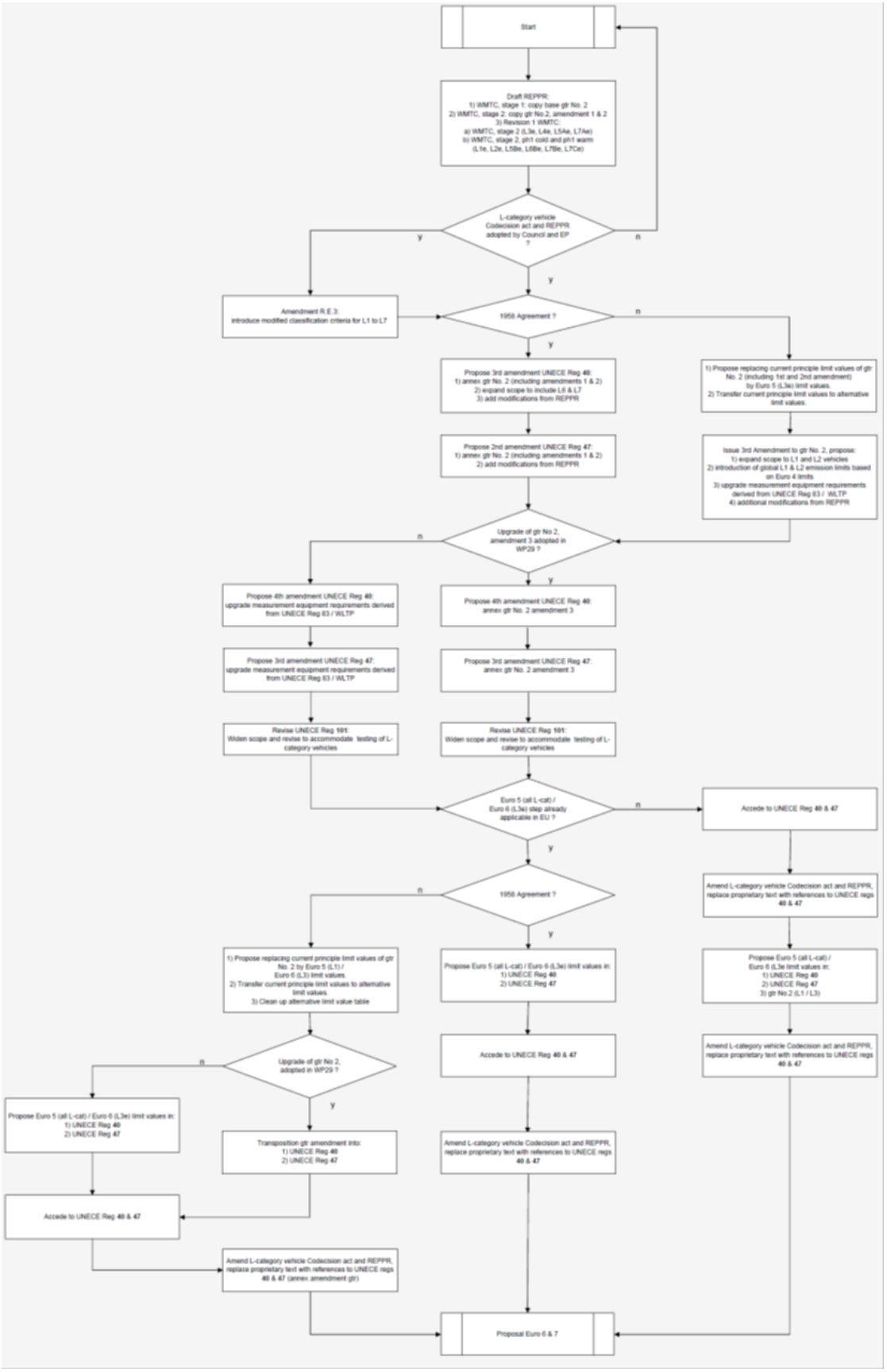


Figure 10-2: Draft roadmap aligning REPPR, R40, R47, R101 and GTR 2 (EC, 14/09/2011)

A.3 Overview of test type flow and issues

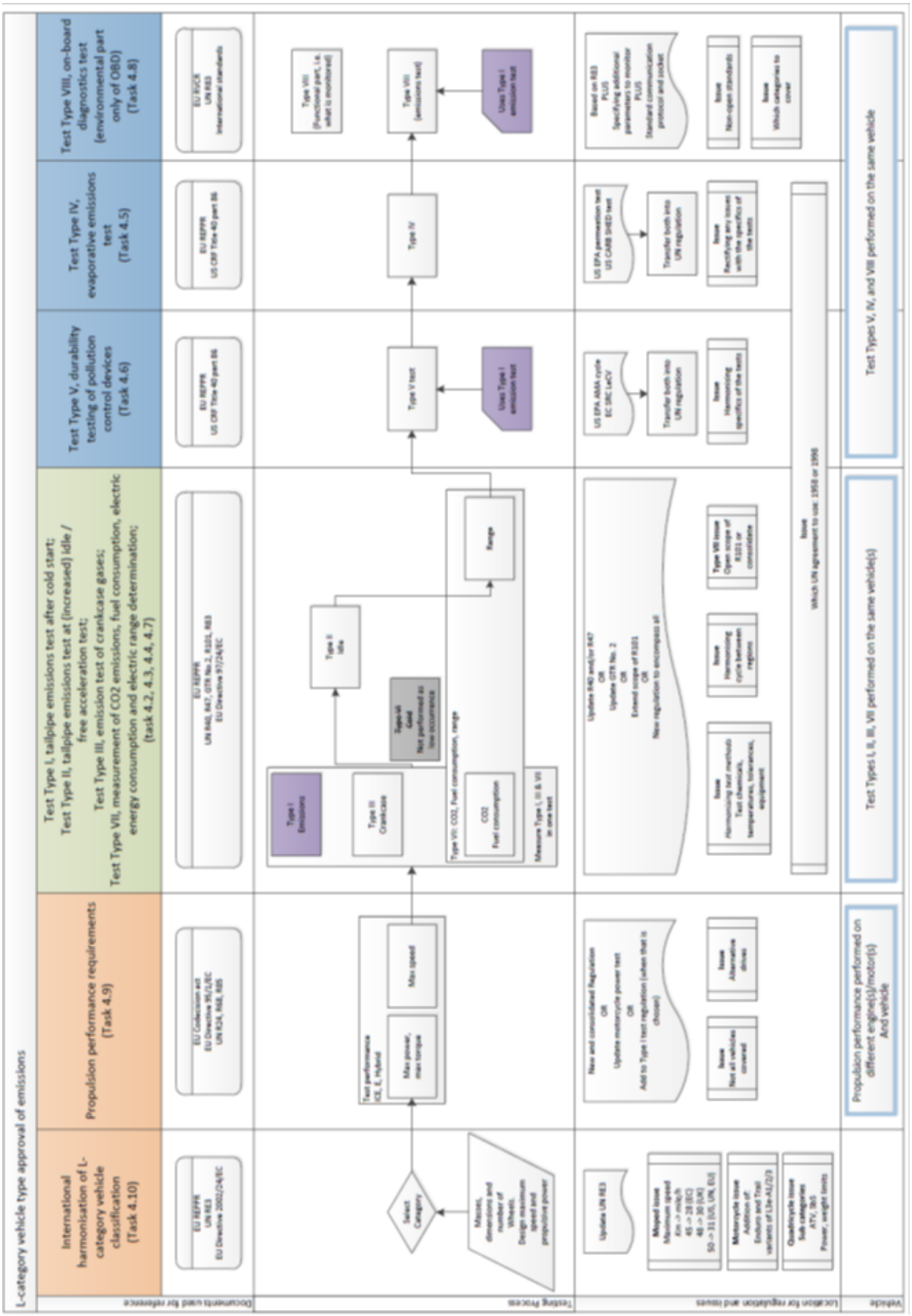


Figure 10-3: Overview diagram June 2012

Appendix B Mailing

Dear «name»,

I am writing to you and your organisation to invite you to help in establishing world harmonised requirements, in the area of environmental and propulsion performance, for L-category vehicles (L-EPPR) at the level of the United Nations Economic Commission for Europe (UNECE). L-category vehicle is the family name for light vehicles such as powered cycles, mopeds, motorcycles, tricycles and quadricycles.

To assist this process, an informal working group was established within the Working Party on Pollution and Energy (GRPE) consisting of contracting parties to both the 1958 and 1998 Agreements with various national representatives from around the globe, industry associations and NGOs. The GRPE is a subsidiary body of the World Forum for Harmonization of Vehicle Regulations (WP.29), a framework within the UNECE.

In order to support this complex task of the working group the European Commission representing the EU as contracting party of both the 1958 and 1998 Agreements has contracted an independent consortium comprising of TRL and Ecorys (based in the UK and Netherlands, respectively to perform a study in support of harmonising certain portions of this approval legislation, internationally under the remit of the UNECE (United Nations Economic Commission for Europe). The study's title is: Internationally harmonised approval requirements in the area of environmental and propulsion performance of L-category vehicles (L-EPPR).

The scope of work to be undertaken by the consortium is stocktaking and analysis of relevant national, international and European legislation as well as proposals and literature in regards to environmental and propulsion performance requirements for approval or (self) certification of L-category vehicles. Areas where harmonisation can occur will be identified, and possible options will be highlighted, first for discussion within the informal group and subsequently as draft proposals for changes and additions to both UN regulations annexed to the 1958 Agreements as well as Global Technical Regulations annexed to the 1998 Agreement, having been selected using an impact assessment and cost benefit analysis.

Request for participation

We would be very grateful for any assistance in obtaining and receiving guidance on national legislation related to L-category vehicles. In addition, proposals both new and old would be gladly received.

Participation in the informal group is welcomed for all contracting parties, industry stakeholders and NGOs that are participating in GRPE. For more details on participation in GRPE please contact the UNECE secretariat.

A questionnaire will be sent out to coincide with the first meeting of the informal group at the GRPE meeting in January 2013. This questionnaire will cover the details required to perform an impact assessment on the proposed options. It would be very helpful for you to get yours or your organisation's views across by filling this questionnaire.

The L-EPPR will cover the following areas:

Part 1: International harmonisation of L-category vehicle classification;

Part 2: Propulsion performance requirements; Maximum vehicle speed, Maximum propulsion power and torque;

Part 3: Tailpipe emissions of conventional combustion engines and energy / fuel consumption as well as electric range of hybrid electric and pure electric vehicles; test types I, II and VII;

Part 4: Crankcase emissions; test type III;

Part 5: Evaporative emissions; test type IV;

Part 6: Durability testing of pollution control devices; test type V;

Part 7: On-board diagnostics; test type VIII.

Key dates:

12-16 November 2012: World Forum for Harmonization of Vehicle Regulations (158th session of WP.29) – agreement on establishment of informal working group by adoption of the mandate regarding environmental and propulsion performance requirements for L-category vehicles (L-EPPR);

10 January 2013: Questionnaire published by Ecorys / TRL;

18 January 2013: GRPE (65th session) first proposed official meeting of the informal working group, among others review of the Rules of Procedure (RoP), Terms of Reference (ToR) and draft roadmap.

12 – 15 March 2013: WP.29 (159th session) progress report;

TBD: multiple meetings and conference calls planned to finalise the ToR, RoP and roadmap;

4-7 June 2013: GRPE (66th session), progress report, adoption RoP, ToR and roadmap of informal group. Second proposed official meeting of the informal working group. Presentation of stakeholder consultation results and first set of draft proposals;

12-15 November 2013: World Forum for Harmonization of Vehicle Regulations (158th session of WP.29), adoption of GRPE decision and progress report;

2013-2016: Meetings of the informal working group, regularly reporting to GRPE and the Administrative Committees AC.1 and AC.3 in WP29;

2016: Possible adoption of new UN Regulation(s) and Global Technical Regulation(s) and/or amendments to existing Regulations.

Contacts:

For involvement in the informal group please contact the UNECE secretariat: http://www.unece.org/environmental-policy/areas-of-work/education-for-sustainable-development-esd/envesdcontacts/unece-secretariat.html

To assist with the study please contact Ecorys/TRL via email on: Int-L-Cat-Leg@trl.co.uk

Links:

UNECE Proposal for establishment of an informal working group addressing the environmental and propulsion performance requirements for vehicles of category L: http://www.unece.org/fileadmin/DAM/trans/doc/2012/wp29/WP29-158-15.pdf

UNECE current legislation can be found at: http://www.unece.org/trans/main/welcwp29.html

It is anticipated that a dedicated webpage regarding the informal working group meetings on L-EPPR will be established under the GRPE main page in which all working documents will be published prior to discussion and review: https://www2.unece.org/wiki/pages/viewpage.action?pageId=917779
This information will be publically available.

Appendix C Questionnaire

C.1 Industry / Manufacturers survey

Shown here is the industry / manufacturer's version of the questionnaire. The other versions ((Type-)Approval Authority, Technical Service version and a version for all other stakeholders), are different in that they do not ask for specific production costs. The approval authority and technical service versions do ask for costs, but for approval/testing costs. The "other stakeholder" version contains mainly qualitative / judgement questions.

Page 1

* 1. Name:

* 2. Contact email:

* 3. Telephone number:

* 4. Organisation:

* 5. Position:

Page 2

* 6. How would you classify your organisation?

- Policy maker on environmental and propulsion requirements
- Industry (e.g. manufacturer) or industry representative
- Type approval authority (TAA)
- Technical Services provider (an organisation or body designated by the approval authority of a Member State as a testing laboratory to carry out tests, or as a conformity assessment body to carry out the initial assessment and other tests or inspections, on behalf of the approval authority)
- Other governmental organisation, not one of the types mentioned above
- Rider or user association
- Other, please specify

Page 4

8. Could you please specify your company or organization?

- ○ Association / representative organization
- ○ Vehicle manufacturer
- ○ Vehicle parts manufacturer
- ○ Aftermarket & service
- ○ Other, please specify

9. Which types of L-category vehicles does your company or organisation deal with? (multiple answers can be chosen) Please see the table below for more information on the different types.

- ☐ L1e, light two-wheel vehicle: L1e-A powered cycles
- ☐ L1e, light two-wheel vehicle: L1e-B moped
- ☐ L2e, three-wheel moped
- ☐ L3e, motorcycle: A1, A2, A3
- ☐ L4e, motorcycle with side car
- ☐ L5e, tricycles: L5e-A tricycles
- ☐ L5e, tricycles: L5e-B commercial tricycles
- ☐ L6e, light quadricycle: L6e-A light quad
- ☐ L6e, light quadricycle: L6e-B light mini car
- ☐ L7e, heavy quadricycle: L7e-A onroad quad: L7e-A1
- ☐ L7e, heavy quadricycle: L7e-A onroad quad: L7e-A2
- ☐ L7e, heavy quadricycle: L7e-B heavy all terrain quad: L7e-B1 all terrain quad
- ☐ L7e, heavy quadricycle: L7e-B heavy all terrain quad: L7e-B2 side by side buggy
- ☐ L7e, heavy quadricycle: L7e-C heavy quadri-mobile
- ☐ N/A

Types of L-category vehicles

Category & Category Name	Sub category & Sub category name	Example	
L1e, light two-wheel vehicle	L1e-A powered cycles		
	L1e-B moped		
L2e three-wheel moped			
L3e, motorcycle	A1, A2, A3		
L4e, motorcycle with side car			
L5e, tricycles	L5e-A tricycles		
	L5e-B Commercial tricycles		
L6e, light quadricycle	L6e-A Light quad		
	L6e-B Light mini car		
L7e, heavy quadricycle	L7e-A Onroad quad	L7e-A1	
		L7e-A2	
	L7e-B Heavy all terrain quad	L7e-B1 all terrain quad	
		L7e-B2 side by side buggy	
	L7e-C Heavy quadri-mobile		

10. What market or markets does your company serve? (multiple answers can be chosen)

- ☐ Worldwide
- ☐ The European Union
- ☐ The United States
- ☐ Asia
- ☐ Other, please specify

11. Can you indicate what the annual turnover of your company is (in euro)?

12. Can you indicate how many employees your company has?

- 0-250 employees
- 250-1000 employees
- > 1000 employees

13. How are approval or certification tests performed for your products? (multiple answers can be chosen)

- We have in-house testing facilities
- We outsource our testing to a technical services provider (for example a testing house)
- Other, please specify

The information provided below is related to the following questions posted on this page.

Worldwide there are three main systems of technical approval in use:
- Type-approval as used for instance in the EU
- Self-certification as used for instance in the United States and in Korea
- Approval based on United Nations legislations which is used for example in many developing countries

14. How many L-category vehicles and parts do you have to get technically approved on average per year?

- 1 - 5
- 6 - 10
- 11 - 15
- 16 - 20
- > 20
- None

15. How many technical approvals on EPPR do you have to acquire for your L-category products on average per year? Please specify. If possible, it would be very helpful if you could describe how many technical approvals are needed for each of the three main systems mentioned above. If you do not know, please make an estimated guess.

16. **Can you indicate for the total number of technical approvals for your products what the distribution is (in percentages) between the three main systems mentioned above : (1) approval on UN legislation, (2) type-approval and (3) self-certifications?**

UN approvals

Type-approvals

Self certifications

100 **Remaining value**

17. **Can you make a rough estimate of the average percentage of the costs of your product that are related to testing for technical approval regulations?**

18. **What is your overall opinion on the current Environmental and Propulsion Performance Requirements worldwide? Do the requirements in an effective way enforce environmental and propulsion performance?**

- Excellent
- Good
- Fair
- Poor
- Do not know

19. **Please explain your answer given to the previous question.**

20. **What is in general your view on the cost-effectiveness of current Environmental and Propulsion Performance Requirements? Do, in your view, the benefits weigh up against the costs?**

	Very cost effective	Cost effective	Hardly cost effective	Not cost effective	Explanation	Do not know
Level of cost effectiveness						

Page 5

We will now ask you some questions on possible changes in EPPR.

Introduction of possible changes

The aim of international collaboration under the umbrella of the UNECE is to harmonize vehicle classification and the environmental and propulsion performance requirements for L-category vehicles worldwide. This allows for one or an alternative procedure per environmental performance test type to get products type approved in this field for any market. The goal of this worldwide harmonisation is to simplify the type approval procedures for manufacturers, by allowing for one type approval procedure per product.

Please answer the following questions specifically for EPPR as much as possible.

21. What are in your view the advantages of international harmonisation compared to the current approval legislation?

22. What are in your view the disadvantages of international harmonisation compared to the current approval legislation?

23. Would you deem it feasible to recognise UNECE requirements as alternative to current approval legislation? Please explain.

	Yes	No	Do not know	Explanation
Feasibility				

The following environmental performance tests are proposed to be harmonised:
- The type I test – tailpipe emissions after cold start
- The type II test – tailpipe emissions at idle and high idle
- The type III test – crankcase emissions
- The type IV test – evaporative emissions
- The type V test – durability of pollution control devices
- The type VII test – CO2 emissions , fuel / energy consumption and range
- The type VIII test – on-board diagnostics environmental tests (OBD)

The following propulsion performance test procedures are proposed to be harmonised:
- Maximum power and torque
- Maximum design vehicle speed

24. Nowadays, a manufacturer has to produce different (sub)models for different markets, due to different test regulations. If worldwide harmonisation would be the case, what would this mean for the amount of different submodels your company would have to make for one model? Please indicate the number of submodels that your company would have to produce in comparison to the current situation.

25. If the above stated tests were to be accepted for every type approval, in other words if worldwide harmonisation would be the case, what would this mean for the level playing field of manufacturers across the world? If you feel that the level playing field would be affected, please indicate which market would be affected and why.

26. In terms of costs, could you please indicate which of the described tests is expected to be most costly to your organization in case of worldwide harmonisation? Please rank accordingly by clicking on the box in front of each test type, starting with the most costly test.

1 2 3 4 5 6 7 8 9 The type I test – cold start tailpipe emissions

1 2 3 4 5 6 7 8 9 The type II test – tailpipe emissions at idle and fast idle

1 2 3 4 5 6 7 8 9 The type III test – crankcase emissions

1 2 3 4 5 6 7 8 9 The type IV test – evaporative emissions

1 2 3 4 5 6 7 8 9 The type V test – durability

1 2 3 4 5 6 7 8 9 The type VII test – CO2 and fuel consumption

1 2 3 4 5 6 7 8 9 The type VIII test – on-board diagnostics environmental tests (OBD)

1 2 3 4 5 6 7 8 9	Propulsion performance requirements: maximum power and torque
1 2 3 4 5 6 7 8 9	Propulsion performance requirements: maximum speed

27. What are the expected costs (in euro) for one technical approval for the following tests in case of worldwide harmonisation? In addition, please indicate for each test type separately the costs divided between time and equipment costs (in percentages).

	Cost (euro)	Cost of which for equipment (percentage)	Cost of which for time (percentage)	Do not know
The type I test – cold start tailpipe emissions				○
The type II test – tailpipe emissions at idle and fast idle				○
The type III test – crankcase emissions				○
The type IV test – evaporative emissions				○
The type V test – durability				○
The type VII test – CO2 and fuel consumption				○
The type VIII test – on-board diagnostics environmental tests (OBD)				○
Propulsion performance requirements: maximum power and torque				○
Propulsion performance requirements: maximum speed				○

28. Regarding the costs you have described in the previous question, can you indicate whether you expect if there is a difference with the current costs for EPPR tests?

	Remains about the same	Increase	Decrease	N/A
The type I test – cold start tailpipe emissions	○	○	○	○
The type II test – tailpipe emissions at idle and fast idle	○	○	○	○
The type III test – crankcase emissions	○	○	○	○
The type IV test – evaporative emissions	○	○	○	○
The type V test – durability	○	○	○	○
The type VII test – CO2 and fuel consumption	○	○	○	○
The type VIII test – on-board diagnostics environmental tests (OBD)	○	○	○	○
Propulsion performance requirements: maximum power and torque	○	○	○	○
Propulsion performance requirements: maximum speed	○	○	○	○

29. If these costs increase or decrease, can you indicate how much (in euro), and what the most important cost drivers might be?

	Difference in costs (in euro)	Main cost drivers	N/A
The type I test – cold start tailpipe emissions			○
The type II test – tailpipe emissions at idle and fast idle			○
The type III test – crankcase emissions			○
The type IV test – evaporative emissions			○
The type V test – durability			○
The type VII test – CO2 and fuel consumption			○
The type VIII test – on-board diagnostics environmental tests (OBD)			○
Propulsion performance requirements: maximum power and torque			○
Propulsion performance requirements: maximum speed			○

30. Please indicate which percentage (or range of percentages: e.g. 5-10%) of the retail price of your product(s) in general is made up of the costs for testing.

31. What is your overall view on the effect of worldwide harmonisation of the described tests on the environmental or propulsion performance of the products? Would it affect the performance of the tested products?

	Strong positive effect	Positive effect	Neutral effect	Negative effect	Strong negative effect	Do not know
The type I test – cold start tailpipe emissions	○	○	○	○	○	○
The type II test – tailpipe emissions at idle and fast idle	○	○	○	○	○	○
The type III test – crankcase emissions	○	○	○	○	○	○
The type IV test – evaporative emissions	○	○	○	○	○	○
The type V test – durability	○	○	○	○	○	○
The type VII test – CO2 and fuel consumption	○	○	○	○	○	○
The type VIII test – on-board diagnostics environmental tests (OBD)	○	○	○	○	○	○
Propulsion performance requirements: maximum power and torque	○	○	○	○	○	○
Propulsion performance requirements: maximum speed	○	○	○	○	○	○

32. What is your overall view on the cost-effectiveness of worldwide harmonisation of the described tests? Do, in your view, the benefits weigh up against the costs?

	Very cost effective	Cost effective	Hardly cost effective	Not cost effective	Do not know
The type I test – cold start tailpipe emissions	○	○	○	○	○
The type II test – tailpipe emissions at idle and fast idle	○	○	○	○	○
The type III test – crankcase emissions	○	○	○	○	○
The type IV test – evaporative emissions	○	○	○	○	○
The type V test – durability	○	○	○	○	○
The type VII test – CO2 and fuel consumption	○	○	○	○	○
The type VIII test – on-board diagnostics environmental tests (OBD)	○	○	○	○	○
Propulsion performance requirements: maximum power and torque	○	○	○	○	○
Propulsion performance requirements: maximum speed	○	○	○	○	○

33. Can you, overall, explain your judgement on the cost effectiveness indicated in the previous question?

34. In order to make maximum use of the existing knowledge on EPPR tests and also from a cost point-of-view, an option could be that legislation from other vehicle categories (categories M, N, T) could be taken into account in new legislation for EPPR requirements. Do you see possible synergies between the described EPPR tests for L-category vehicles and other vehicle categories? Please indicate for each test with which vehicle category you see possible synergies. If possible, please specify.

Description category vehicles:
M: passenger vehicles (cars and buses)
N : goods vehicles (light and heavy trucks)
T : tractors

	Synergies with the following vehicle category/categories (M, N, T)	Specification	Do not know
The type I test – cold start tailpipe emissions			○
The type II test – tailpipe emissions at idle and fast idle			○
The type III test – crankcase emissions			○
The type IV test – evaporative emissions			○
The type V test – durability			○
The type VII test – CO2 and fuel consumption			○
The type VIII test – on-board diagnostics environmental tests (OBD)			○
Propulsion performance requirements: maximum power and torque			○
Propulsion performance requirements: maximum speed			○

90. The next stage of our study will look at options for updating environmental and propulsion performance requirements in more detail. Would you be open to be contacted again to comment on the impacts or specific drafts of these?

- ○ Yes
- ○ No

91. If you have any further comments relevant to Environmental and Propulsion Performance Requirements, or any additional information, please provide them below.