# Economic Commission for Europe

Inland Transport Committee

**World Forum for Harmonization of Vehicle Regulations**

**Working Party on Lighting and Light-Signalling**

**Ninety-second session**
Geneva, 22–25 April 2025
Item 7 (a) of the provisional agenda
**Device UN Regulations:**
**UN Regulation No. 148 (Light-Signalling Devices)**

## Proposal for a Supplement to the 01 series of amendments to UN Regulation No. 148 and to the 06, 07, 08 and 09 series of amendments to UN Regulation No. 48

### Submitted by the expert from the International Automotive Lighting and Light-Signalling Expert Group *

The text reproduced below was prepared by the expert from the International Automotive Lighting and Light-Signalling Expert Group (GTB) with the aim to introduce reversing projections. This revised proposal is based on document ECE/TRANS/WP.29/GRE/2024/20 as amended by informal document GRE-91-25. The modifications to the existing text of the UN Regulation are marked in bold for new or strikethrough for deleted characters.

* In accordance with the programme of work of the Inland Transport Committee for 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

# I. Proposal

## A. Proposal for a Supplement to the 06, 07 and 08 series of amendments to UN Regulation No. 48

*Insert a new paragraph 2.5.21.* to read:

**"2.5.21. "*Reversing projector*" means a device used to provide reversing projection."**

*Insert new paragraphs 2.7.10. and 2.7.11.,* to read:

**"2.7.10. "*Basic element*" of a reversing projection means the single shape composing the projected patterns.**

**2.7.11. "*Reversing projection*" means light signal projected on the ground by reversing projectors to provide enhanced recognition of reversing indication to other road users."**

*Insert a new paragraph 5.9.4.,* to read:

**"5.9.4. Reversing projection may vary according to the steering wheel angle and/or the speed of the vehicle and/or the proximity to an obstacle."**

*Paragraph 5.10.3.,* amend to read:

"5.10.3. No account shall be taken of lighting devices fitted for the interior lighting of the vehicle **nor of reversing projections**."

*Paragraph 5.15.,* amend to read:

"5.15. The colours of the light emitted by the lamps are the following:

| | |
|---|---|
| Main-beam headlamp: | White |
| … | … |
| Manoeuvring lamp: | White |
| **Reversing projection:** | **White"** |

*Insert a new paragraph 5.36. and related sub-paragraphs,* to read:

"**5.36. General provision relating to reversing projection.**

**5.36.1. The patterns shall be explained in the owner's handbook.**

**5.36.2. When reversing projection are provided,**

**5.36.2.1. only the basic elements listed in Annex 17 shall be used;**

**5.36.2.2. the pattern of each projection shall be constituted by one or more basic element(s) of the same type in a line;**

**5.36.2.3. the number, size, ratio and the spacing between the basic elements in the pattern are not restricted, provided that the requirements of paragraph 6.27.5. are met.**

**5.36.3. The light transmitted downwards by light-signalling devices is not considered a reversing projection.**

**5.36.4. When more than one projection is switched ON simultaneously, the projected patterns shall not overlap each other.**

**5.36.5. When the windshield wiper is switched ON and its continuous operation has occurred for a period of at least two minutes, the reversing projection(s) whose luminous intensity exceeds $8.00 \cdot 10^3$ cd shall either be switched OFF, or have its luminous intensity reduced to a value less than or equal to $8.00 \cdot 10^3$ cd. The conformity to this requirement shall be verified at the time of the reversing projector type approval and indicated in the related communication form.**

**5.36.6.** **The applicant shall provide sufficient evidence that the reversing projection ~~shall~~ will not negatively affect rear camera system performance as defined in UN Regulation No. 158."**

*Insert a new paragraph 6.27. and related sub-paragraphs,* to read:

"**6.27.** **Reversing projection**

**6.27.1.** **Presence**

**Optional**

**6.27.2.** **Number**

**One or two reversing projection(s).**

**The reversing projector(s) shall be type approved according to the 01 or subsequent series of amendments to UN Regulation No. 148.**

**6.27.3.** **Arrangement**

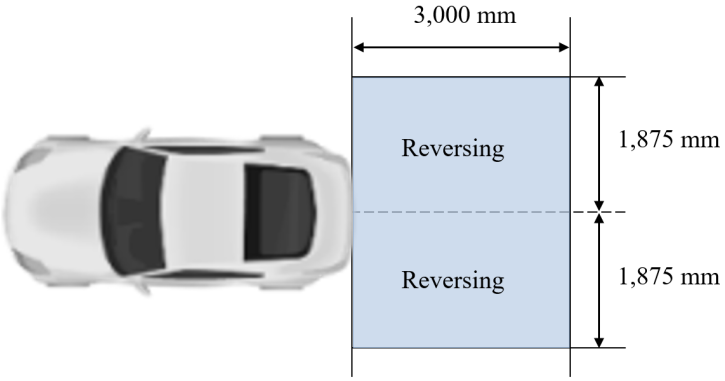
**Such that the provisions of paragraphs 6.27.5., 6.27.6. and 6.27.9. are fulfilled.**

**6.27.4.** **Position**

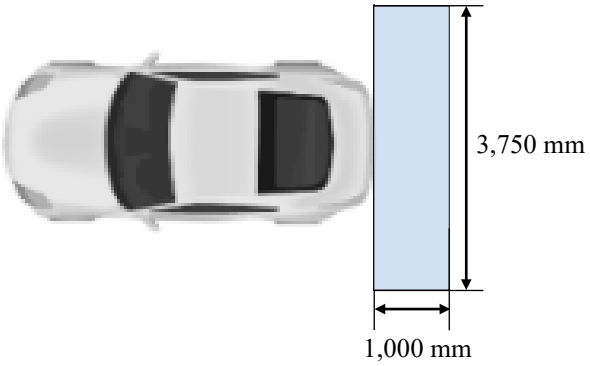
**Such that the provisions of paragraphs 6.27.5., 6.27.6. and 6.27.9. are fulfilled.**

**6.27.5.** **Projection area**

**6.27.5.1.** **The lateral distance from the outer edge of the projection with respect to the longitudinal plane of the vehicle shall not be more than 1,875 mm. The longitudinal distance from the farthest edge of the projection shall not be more than 3,000 mm from the backward extreme outer edge of the vehicle (see figure below).**




**6.27.5.2.** **The patterns of the reversing projections shall start with their closest edge within a rectangle, symmetrical to the median longitudinal plane and adjacent to the extreme outer edge of the vehicle, having a length of 1,000 mm and a width of 3,750 mm (see figure below).**




**6.27.6. Orientation**

**Rearwards**

**6.27.7. Electrical connections**

**6.27.7.1. If provided, the reversing projections shall be switched ON only when the reversing lamp(s) is/are switched ON.**

**6.27.7.2. The system which operates the reversing projections may be automatically and/or manually deactivated and/or reactivated.**

**6.27.8. Tell-tale**

**Optional**

**6.27.9. Other requirements**

**6.27.9.1. The technical service shall, to the satisfaction of the Type Approval Authority, perform a visual test to verify that there is no direct visibility of the apparent surface of any reversing projector, if viewed by an observer moving on the boundary of a zone on a transverse plane 10 m from the front of the vehicle, a transverse plane 10 m from the rear of the vehicle , and two longitudinal planes 10 m from each side of the vehicle; these four planes to extend from 1 m to 3 m above and perpendicular to the ground as shown in Annex 14.**

**This requirement shall be deemed to be satisfied if the installation conditions comply with paragraph 5.12.1.2. (a) in the 01 series of amendments to UN Regulation No. 148.**

**At the request of the applicant and with the consent of the Technical Service, this requirement may also be verified by a drawing or simulation.**

**6.27.9.2. If the requirement of paragraph 6.27.9.1. is not fulfilled, the requirement of paragraph 5.12.1.2. (b) in the 01 series of amendments to UN Regulation No. 148 applies. The related indication shall be made in the Communication Form in Annex 1."**

*Annex 1,*

*Insert new a item 9.31. and related sub-items,* to read:

"**9.31. Reversing projection: yes/no[2]**

**9.31.1. According to paragraph 6.27.9., the reversing projector fulfils the requirements of paragraph**

**(a) 5.12.1.2. (a) of UN Regulation No. 148 yes/no[2]**

**(b) 5.12.1.2. (b) of UN Regulation No. 148 yes/no[2]"**

*Annex 14,*

*Title,* amend to read:

"Observing area towards the apparent surface of manoeuvring lamps, exterior courtesy lamps

**and reversing projectors"**

*Insert a new Annex 17,* to read:

## "Annex 17

## Basic element to be used for reversing projection patterns

| Basic element | | Applicable function |
|---|---|---|
| **Rectangle** |  | **Reversing projection**<br>**• Colour of the Basic element: White** |
| **Note: Minor deviations from the shape of the basic element when projected on the road, due to technical restrictions or environmental conditions are considered to comply with the shape of the basic element.** | | |

**"**

## B. Proposal for a Supplement to the 09 series of amendments to UN Regulation No. 48

*Insert a new paragraph 2.5.21.* to read:

**"2.5.21. "*Reversing projector*" means a device used to provide reversing projection."**

*Insert new paragraphs 2.7.10. to 2.7.11.,* to read:

**"2.7.10. "*Basic element*" of a reversing projection means the single shape composing the projected patterns."**

**"2.7.11. "*Reversing projection*" means light signal projected on the ground by reversing projectors to provide enhanced recognition of reversing indication to other road users."**

*Insert a new paragraph 5.9.5.,* to read:

**"5.9.5. Reversing projection may vary according to the steering wheel angle and/or the speed of the vehicle and/or the proximity to an obstacle."**

*Paragraph 5.10.3.,* amend to read:

"5.10.3. No account shall be taken of lighting devices fitted for the interior lighting of the vehicle **nor of reversing projections**."

*Paragraph 5.15.,* amend to read:

"5.15. The colours of the light emitted by the lamps are the following:

| | |
|---|---|
| Main-beam headlamp: | White |
| … | … |
| Answer-back signal: | In accordance with the individual specifications applicable to the specific lamp used for the answer-back signal. |
| **Reversing projection:** | **White"** |

*Insert a new paragraph 5.36. and related sub-paragraphs,* to read:

"**5.36. General provision relating to reversing projection.**

**5.36.1. The patterns shall be explained in the owner's handbook.**

**5.36.2. When reversing projection are provided,**

**5.36.2.1.** **only the basic elements listed in Annex 17 shall be used;**

**5.36.2.2.** **the pattern of each projection shall be constituted by one or more basic element(s) of the same type in a line;**

**5.36.2.3.** **the number, size, ratio and the spacing between the basic elements in the pattern are not restricted, provided that the requirements of paragraph 6.28.5. are met.**

**5.36.3.** **The light transmitted downwards by light-signalling devices is not considered a reversing projection.**

**5.36.4.** **When more than one projection is switched ON simultaneously, the projected patterns shall not overlap each other."**

**5.36.5.** **When the windshield wiper is switched ON and its continuous operation has occurred for a period of at least two minutes, the reversing projection(s) whose luminous intensity exceeds $8.00 \cdot 10^3$ cd shall either be switched OFF, or have its luminous intensity reduced to a value less than or equal to $8.00 \cdot 10^3$ cd. The conformity to this requirement shall be verified at the time of the reversing projector type approval and indicated in the related communication form.**

**5.36.6.** **The applicant shall provide sufficient evidence that the reversing projection ~~shall~~ will not negatively affect rear camera system performance as defined in UN Regulation No. 158."**

*Insert a new paragraph 6.28. and related sub-paragraphs,* to read:

"**6.28.** **Reversing projection**

**6.28.1.** **Presence**

**Optional**

**6.28.2.** **Number**

**One or two reversing projection(s).**

**The reversing projector(s) shall be type approved according to the 01 or subsequent series of amendments to UN Regulation No. 148.**

**6.28.3.** **Arrangement**

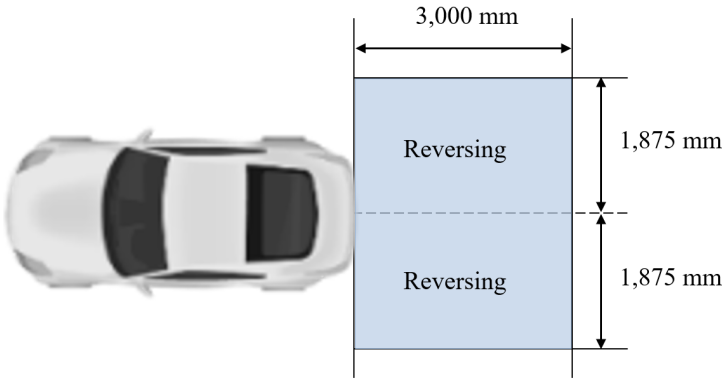
**Such that the provisions of paragraphs 6.28.5., 6.28.6. and 6.28.9. are fulfilled.**

**6.28.4.** **Position**

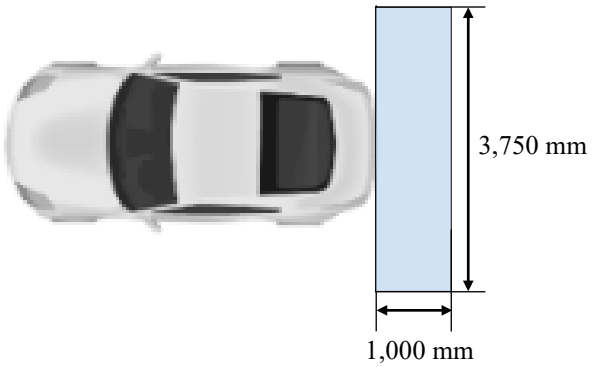
**Such that the provisions of paragraphs 6.28.5., 6.28.6. and 6.28.9. are fulfilled.**

**6.28.5.** **Projection area**

**6.28.5.1.** **The lateral distance from the outer edge of the projection with respect to the longitudinal plane of the vehicle shall not be more than 1,875 mm.**
**The longitudinal distance from the farthest edge of the projection shall not be more than 3,000 mm from the backward extreme outer edge of the vehicle (see figure below).**




**6.28.5.2.** **The patterns of the reversing projections shall start with their closest edge within a rectangle, symmetrical to the median longitudinal plane and adjacent to the extreme outer edge of the vehicle a width of 1,000 mm and a length of 3,750 mm (see figure below).**




**6.28.6.** **Orientation**

**Rearwards**

**6.28.7.** **Electrical connections**

**6.28.7.1.** **If provided, the reversing projections shall be switched ON only when the reversing lamp(s) is/are switched ON.**

**6.28.7.2.** **The system which operates the reversing projections may be automatically and/or manually deactivated and/or reactivated.**

**6.28.8.** **Tell-tale**

**Optional**

**6.28.9.** **Other requirements**

**6.28.9.1.** **The technical service shall, to the satisfaction of the Type Approval Authority, perform a visual test to verify that there is no direct visibility of the apparent surface of any reversing projector, if viewed by an observer moving on the boundary of a zone on a transverse plane 10 m from the front of the vehicle, a transverse plane 10 m from the rear of the vehicle , and two longitudinal planes 10 m from each side of the vehicle; these four planes to extend from 1 m to 3 m above and perpendicular to the ground as shown in Annex 14.**

**This requirement shall be deemed to be satisfied if the installation conditions comply with paragraph 5.12.1.2. (a) in the 01 series of amendments to UN Regulation No. 148.**

**At the request of the applicant and with the consent of the Technical Service, this requirement may also be verified by a drawing or simulation.**

**6.28.9.2.** **If the requirement of paragraph 6.28.9.1. is not fulfilled, the requirement of paragraph 5.12.1.2. (b) in the 01 series of amendments to UN Regulation No. 148 applies. The related indication shall be made in the Communication Form in Annex 1."**

*Annex 1,*

*Insert new items 9.32. and related sub-items,* to read:

"**9.32.** **Reversing projection:** **yes/no[2]**

**9.32.1.** **According to paragraph 6.28.9., the reversing projector fulfils the requirements of paragraph**

**(a) 5.12.1.2. (a) of UN Regulation No. 148** **yes/no[2]**

**(b) 5.12.1.2. (b) of UN Regulation No. 148** **yes/no[2]"**

*Annex 14,*

*Title,* amend to read:

"Observing area towards the apparent surface of manoeuvring lamps, exterior courtesy lamps **and reversing projectors"**

*Insert a new Annex 17,* to read:

## "Annex 17

## Basic element to be used for reversing projection patterns

| **Basic element** | | **Applicable function** |
|---|---|---|
| **Rectangle** |  | **Reversing projection**<br>**• Colour of the Basic element: White** |
| **Note: Minor deviations from the shape of the basic element when projected on the road, due to technical restrictions or environmental conditions are considered to comply with the shape of the basic element.** | | |

"

## C. Proposal for a Supplement to the 01 series of amendments to UN Regulation No. 148

*Paragraph 1.,* amend to read:

*"***1** **Scope**

This Regulation applies to the following light-signalling devices (lamps):

- Rear-registration plate illuminating lamps
- Direction indicator lamps
- Position lamps
- Stop lamps
- End-outline marker lamps
- Reversing lamps
- Manoeuvring lamps
- Rear fog lamps
- Parking lamps

- Daytime running lamps
- Side marker lamps
- **Reversing projectors."**

*Insert a new paragraph 3.1.2.9.,* to read:

"**3.1.2.9. In the case of a reversing projector tested together with the reversing lamp according to the requirements of paragraph 5.12.1.2. (b), drawings showing the relative position of the projector and the lamp and the associated measurement report."**

*Table 1,* amend to read:

"

| ***Lamp (function)*** | ***Symbol*** | ***Paragraph*** |
|---|---|---|
| Daytime running lamp | RL | 5.4. |
| … | | |
| Stop lamp (variable) | S2 | 5.5. |
| **Reversing projector** | **RP** | **5.12.** |

"

*Table 2,* amend to read:

"

| ***Series of amendments to the Regulation*** | ***00*** | ***01*** | |
|---|---|---|---|
| ***Lamp (function)*** | ***Change Index for the specific Lamp (function)*** | | |
| Daytime running lamp | 0 | 1 | |
| … | | | |
| Stop lamp (central high mounted) | 0 | 1 | |
| **Reversing projector** | **-** | **0** | |

"

*Insert new paragraphs 5.12. and related sub-paragraphs,* to read:

**"5.12. Reversing projector (RP)**

**5.12.1. Luminous intensity and standard light distribution:**

**5.12.1.1. The intensity of light emitted shall not exceed $1.20 \cdot 10^4$ cd within the projection area as defined by the individual specifications of UN Regulation No. 48, when installed in any mounting position specified by the applicant.**

**5.12.1.2. In addition, outside of the projection area as defined by the individual specifications of UN Regulation No. 48, one of the following conditions shall be fulfilled:**

**(a) The light emitted directly towards the rear of the vehicle shall not exceed $5 \cdot 10^{-1}$ cd within the angular field as defined below.**

**(i) The vertical minimum angle φmin (in degrees) is:**
**φmin = arctan ((1-h)/10); where h is mounting height in m**

**(ii) The vertical maximum angle φmax (in degrees) is:**
**φmax = φmin + 11.3**

**The measurement shall be limited to a horizontal angle ranging from +90° to -90° with respect to the line which cuts the reference axis and which is perpendicular to the vertical transversal plane of the vehicle.**

**(b) When the apparent surfaces of the reversing projector and the apparent surface of the reversing lamp are arranged in such a way that:**

**(i) Either the projection of the apparent surfaces in the direction of the reference axis of them occupies not less than 60 per cent of the smallest quadrilateral circumscribing the projections of the said apparent surfaces in the direction of the reference axis; or**

**(ii) The minimum distance between the facing edges of the apparent surfaces in the direction of the reference axis of them does not exceed 75 mm when measured perpendicularly to the reference axis,**

**the reversing projector shall be tested together with the reversing lamp and the integrated luminous intensity shall not exceed the maximum luminous intensity required in the Table 10.**

**5.12.2. Minimum luminous intensity within the angles of geometric visibility**

**No requirement.**

**5.12.3. Minimum or maximum area of apparent surface:**

**No requirement.**

**5.12.4. Measurement:**

**No additional requirement.**

**5.12.5. Additional specific requirements:**

**None**

**5.12.6. Failure provisions:**

**No requirement.**

**5.12.7. Colour:**

**The colour of light emitted shall be white."**

*Annex 1,*

*Initial table,* amend the list of lamps to read:

"

| | |
|---|---|
| Lamp:[2] | Rear-registration plate illuminating lamp |
| | Direction indicator lamp |
| | Stop lamp |
| | Position lamp |
| | End-outline marker lamp |
| | Reversing lamp |
| | Manoeuvring lamp |
| | Rear fog lamp |
| | Parking lamp |
| | Daytime running lamp |
| | Side marker lamp |
| | **Reversing projector** |

”

*Annex 1,*

*Insert a new item 9.1.7.,* to read:

**“9.1.7. Reversing projector:**

**9.1.7.1. Tested together with reversing lamp: .....yes/no[2]**

**9.1.7.2. The luminous intensity of reversing projector is intended to be reduced to not exceed $8.00 \cdot 10^3$ cd: .....yes/no[2]** ”

# II. Justification

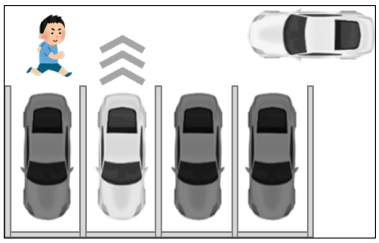
*General*

1. This proposal intends to introduce the possibility of light-signalling, in form of projection of patterns on the road, for other road users through new light-signalling function "Reversing projection".

2. Concerning the reverse projection, several studies have been done and have shown its effectiveness:

- International Symposium on Automotive Lighting (ISAL) 2019: Safety Enhancement Effect of Back-up Guide Lamps (Yeungnam University, SL Corporation).
- ISAL 2019: Impact of advanced lighting function based on road projection for departing indication in parking lots (Embedded Lighting Systems (ELS), Karlsruhe Institute of Technology (KIT))
- Société des Ingénieurs de l'Automobile (SIA) Vision 2021 Conference: Detection rate of projected light signals by lighting condition and Activation modes (Koito, Shinshu university)

3. For example, under the following situations the reversing projection is very effective:



Note: additional justification, with real data and statistical information, will be provided as an informal document to support the discussion at the ninety-second session of GRE.

*Relationship between Signal Road Projection and Signal Road Projector*

4. The reversing projection is an intentional projection onto the road surface for proving enhanced recognition of the reversing signal. Therefore, it is proposed as a new light signalling function in UN Regulation No. 48 to ensure appropriate usage permissions and limitations.

5. Complementary updates to UN Regulation No. 148 are also required, to ensure appropriate device performance permissions and limitations.

6. Any downwards directed light from existing light-signalling devices, that may also cause reflections from the road surface, is not regulated as reversing projection. It is not intended to change any existing requirements of reversing lamps, as their performance is already known and regulated. This proposal allows the introduction of reversing projection as a supplement to the current regulations.

*Photometric requirement and test method of Signal Road Projector*

7. Higher intensity of light on the road surface allows better recognition of a projected pattern. However, a maximum limit is required to prevent excessive reflections. To avoid creating unique limits, the existing limit of 12,000 cd for a front fog lamp of Category F3 is proposed as a maximum limit for reversing projection, as this is an already known value.

8. The reversing projector may be installed in any location of the vehicle if it is invisible to other road users. To confirm this, the same requirements as for other lamps defined as invisible (e.g. exterior courtesy lamp or manoeuvring lamp) shall apply. In this way, the reversing projector does not confuse other road users about the number of light-signalling devices.

9. Alternatively, it may be permitted for the reversing projector to be visible to other road users if its installation complies with the requirements of paragraph 5.7.2., single lamps. In this case, to ensure the compliance with the requirements of the corresponding lamp, the

projector shall be tested in combination with the related light-signalling device as suggested in paragraph 5.12.1.2. (b).

*Projection area of Reversing Projector*

10. As for the projection area, in UN Regulations No. 48 the appropriate and effective area is specified without causing discomfort, distraction or glare.

11. The requirements in paragraphs 6.27.5. or 6.28.5. of UN Regulation No. 48 proposed in this document are based on the findings of the research studies. The proposed width limit of 1,875 mm and length value of 3,000 mm guarantee that observers are able to recognize the signal, to identify the correct relation between the reversing projector and a projecting vehicle and that the projection does not extend excessively beyond the vehicle.

*Principle of the anti-glare restriction for projectors*

12. The projector might project into all areas of the projection zone with full intensity of 12,000 cd. Outside of the projection zone, the intensity is limited by the maximum intensity of the related light-signalling device when both the related light-signalling device and projector are switched ON.

*Basic element of Reversing Projection pattern*

13. GTB defined basic elements of pattern that provide a clear information and cannot be confused with road signs/markings. The selected basic element for Reversing Projection is a rectangle (see Annex 17).

14. Several Signal Road Projection studies have been conducted during the past years considering different pattern elements, with similar positive results regarding visibility of the signal, comprehension of the driver's intention and perceived safety. Specifically, the selected rectangular shape has been included in GTB internal and external research (ISAL, SIA Vision, SAE International, etc). Although the research objective was not to evaluate the pattern shape, there was no negative opinion or result about the proposed pattern shapes. It means that the safety of the pattern shape has been proved by indirect way. A rectangle is proposed as the basic element of Reversing projection because it is generally understood as a trajectory indicator.

15. The pattern shall be constituted with one or more basic element(s) of the same type in a line. However, the number, size, ratio and spacing between the basic elements in the pattern are not restricted if it meets the related projecting area requirements.

*Flashing and Variation of Reversing Projection*

16. The flashing and/or variation of pattern of the reversing projection(s) were originally proposed with the intention to raise the attention of the other road users to the patterns specially in the case where the projection is the only visible remaining source of information, for instance when the vehicle is hidden. Although flashing is prohibited for reversing lamps, the "flashing" and/or "movement" of the reversing projection pattern on the ground is more obvious and easier to recognize, and deemed beneficial to understand the vehicle intention. Following the discussion and comments received during the 91st GRE session, the possibility of a flashing projection was removed.

17. The variation of the pattern of the reversing projection is allowed according to 3 relevant parameters: speed of the vehicle backward, steering wheel angle, detection of an obstacle. The first parameter gives information on the movement of the vehicle to the road users who are located behind the car. The second one provides information on the predictive trajectory of the vehicle backwards, especially to the vulnerable road users. The third warns the driver about the presence of an obstacle behind the car: the driver can see the projection(s) thanks to the rear-view camera/rear view mirror, for instance.

*Activation under adverse weather conditions*

18. Since Reversing Projection is used only in a very specific situation when the vehicles are reversing and moving at low speed, there is no need to limit the activation under adverse weather conditions.

*Interaction with other vehicle components*

19. In order to avoid possible conflicts in case of rear camera system as defined in UN Regulation No. 158, a general provision was added that the reversing projections shall not interfere with the performance of such a system.

*Improvements made to the original GTB proposal*

20. Compared to the original GTB proposal in ECE/TRANS/WP.29/GRE/2024/20, the following improvements have been made:

- Possibility to flash removed.
- Light output limitation in case of wet road as in direction indicator projections added.
- Provisions to avoid negative impact on rear view systems added.