Informal document **GRVA-05-38-Rev.1**
5th GRVA. 10-14 February 2020
Agenda item 8(c)

Alternative Approach to UN R13 Type-IIA for Battery Electric Vehicles

GRVA-05
10-14 February 2020

Background

- At the 2nd session of GRVA in January 2019, OICA and CLEPA were given the opportunity to present the document GRVA-01-27.
- At the 4th session of September 2019, OICA presented document GRVA-04-30. The document invited the Contracting Parties to provide their comments to OICA by 31st of October 2019. OICA offered to address them with relevant proposals and justifications, in a proposal for the 5th session of GRVA.
- The technical issue is that a Battery Electric Vehicle (BEV) is not able to pass the type IIA test with a fully loaded battery (the worst case for the test), unless the vehicle would be equipped with specific technical solutions like e.g. resistors with high-temp cooling system, extra batteries.
- Such solutions would negatively impact the vehicle weight and autonomy, packaging (vehicle architecture) and cost, reducing the environmental and economic interest of BEVs.
- The issue has been brought up to the table of GRVA in September 2018, OICA is now eager to make progress. What is at stake is to define a regulatory frame to enable the development of electric solutions for heavy vehicles.

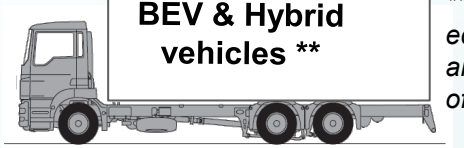
Rationales

- The main challenge is to ensure the availability of sufficient free capacity in the batteries, to be able to pass the type IIA without using the brakes.
- This can of course be done by always keeping a free capacity equivalent to the energy of a type-IIA, which would only be used manually by the driver (e.g. using a dedicated control). The major issue with that simplistic approach is that this permanently free capacity cannot be used for traction.
- The interest of the proposed alternatives approach is to permit some *smart charging strategies* (e.g. based on route planning) to optimize the use of the installed battery capacity for the purpose of traction, while ensuring the driver is informed of the available endurance braking capacity and/or being warned if the service brake performance falls below a given threshold.
- As an alternative to such *smart charging strategies*, a type-II test with increased performance is also proposed.

Rationales

- Our experience of BEVs on different type of usages (based on customers experience or simulations) shows the battery charge is in the vast majority of cases at a level providing sufficient performance for ensuring safety and users satisfaction, at a similar level as with current vehicles.
- The *worst case* which is considered in the regulation to pass type-IIA test (fully charged battery) is something very seldom that the drivers should almost never experience. The proposals we are making now are aiming at ensuring this worst case preserves the safety level of BEVs.

Current
(Requirements)



BEV & Hybrid vehicles **

*** Vehicles equipped with an ERB system of cat A or B*

M3 class II, III & B + N3 ADR + N3 towing O4 trailers

Other vehicles

Type-IIA

6km at 30kph
Slope 7%

(height -420m)

Don't use service brakes !

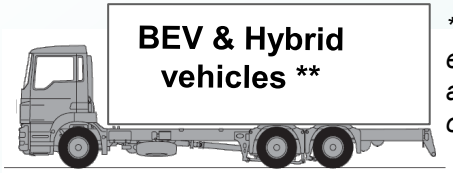
Type-II

6km at 30kph
Slope 6%

(height -360m)

Hot-stop
3.3 m/s² (N3)
3.75m/s² (M3)

Current
(Possible solutions)



** Vehicles equipped with an ERB system of cat A or B

M3 class II, III & B + N3 ADR + N3 towing O4 trailers

Other vehicles

Type-II

6km at 30kph
Slope 6%

(height -360m)

Hot-stop
3.3 m/s² (N3)
3.75m/s² (M3)

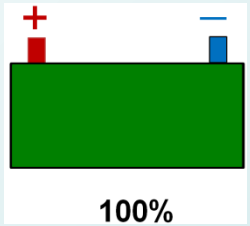
Type-IIA

6km at 30kph
Slope 7%

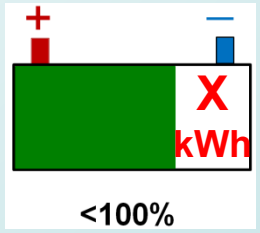
(height -420m)

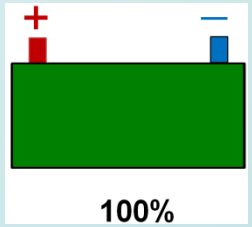
Don't use service brakes !

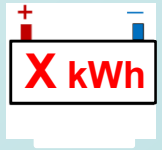
Possible Technical solutions to fulfill current Type-IIA



Add an Endurance Brake (e.g. a cooled resistor)





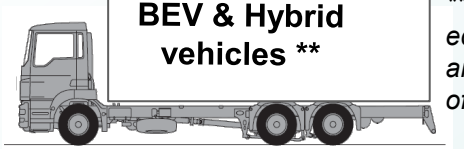


Secure X kWh in the batteries
(X kWh = Type-IIA energy)

Secure "less than X kWh" in the batteries and use a supplementary retardation means (e.g. a "small" cooled resistor)

These solutions limit the development of BEVs
(increased weight, reduced autonomy, cost...)

Proposal



BEV & Hybrid vehicles **

*** Vehicles equipped with an ERB system of cat A or B*

M3 class II, III & B + N3 ADR + N3 towing O4 trailers

Other vehicles

Type-II

6km at 30kph
Slope 6%

(height -360m)

Hot-stop
3.3 m/s² (N3)
3.75m/s² (M3)

Alternative to Type-IIA

Type-IIA

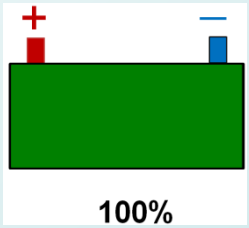
6km at 30kph
Slope 7%

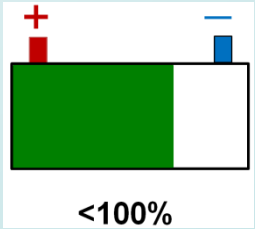
(height -420m)

Don't use service brakes !

Type-IV

Type-II * + **Type-IIA** + **Brake estimator**





Warn the driver if performance is below:
3.3 m/s² (N3)
3.75m/s² (M3)

*** Type-II with increased Performance**
Slope 7%
Hot-stop 5 m/s²

OR

Secure free battery capacity to be able to stabilize speed in the forthcoming (predicted) downhill on the route of the vehicle (the system shall be able to secure at least the energy of a type-II)
+
Inform driver about the free battery capacity (i.e. the available retardation capacity)

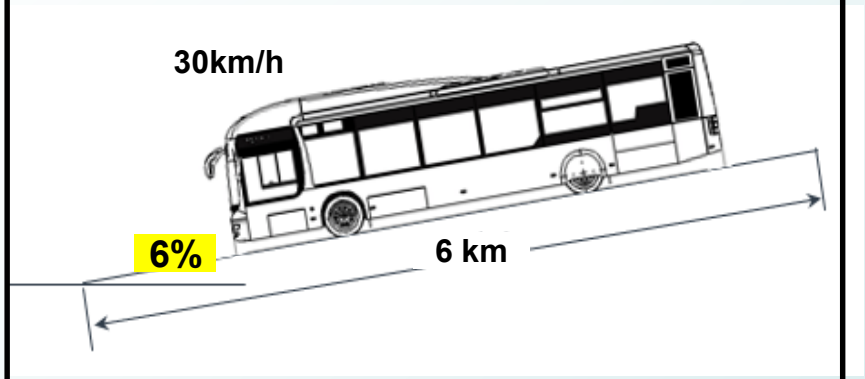
Thanks for your attention

Backup slides (reminder)

Technical background

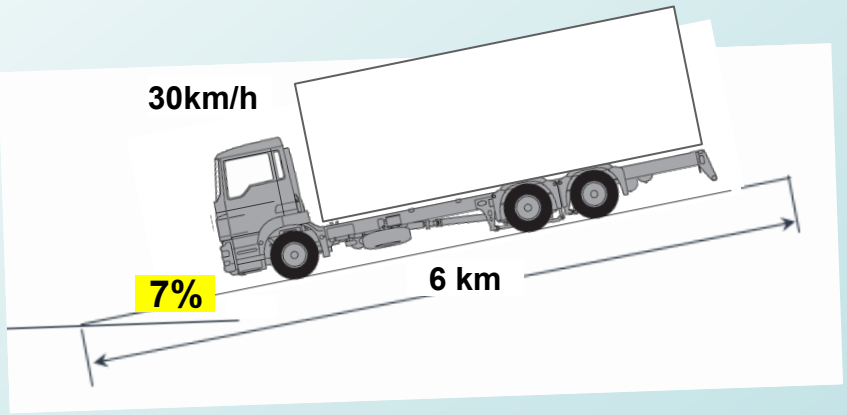
UN R13 - Type-II and IIA tests

Type-II
Downhill Behaviour Test



- **Scope**
  - M3 and N3
  - Except vehicles submitted to Type-IIA
- **Service brake**: no restriction
- **Pass criteria**: Hot-stop performance after Type-II
  - N3: 3.3 m/s²
  - M3: 3.75m/s²

Type-IIA
Endurance Braking Performance Test



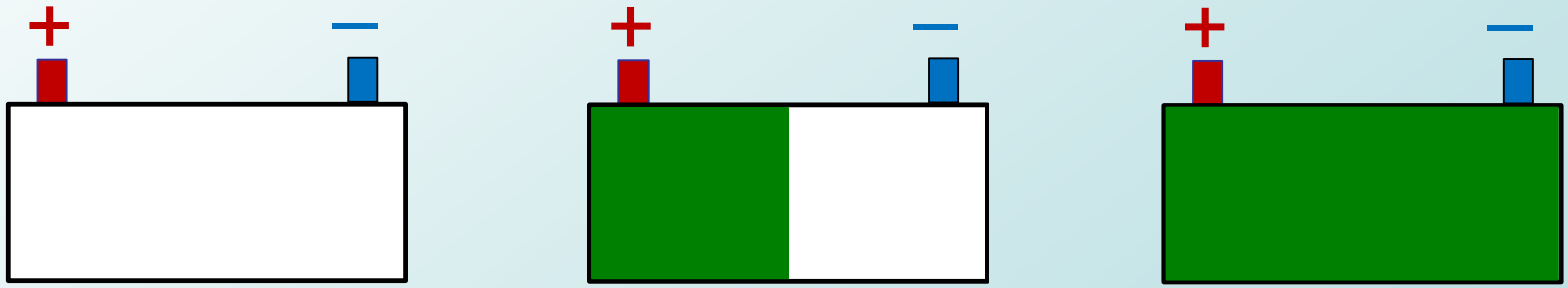
- **Scope**
  - M3 class II, III & B
  - N3 ADR and/or authorized to tow cat. O4
- **Service brake: prohibited**
- **Pass criteria**: Average speed of 30km/h (+/- 5 km/h)

Technical background

UN R13 – Definition of SoC *

** State of charge*

2.21.4. “Electrical state of charge” means the instantaneous ratio of electric quantity of energy stored in the traction battery relative to the maximum quantity of electric energy which could be stored in this battery;



SoC **0%** **50%** **100%**

Technical background

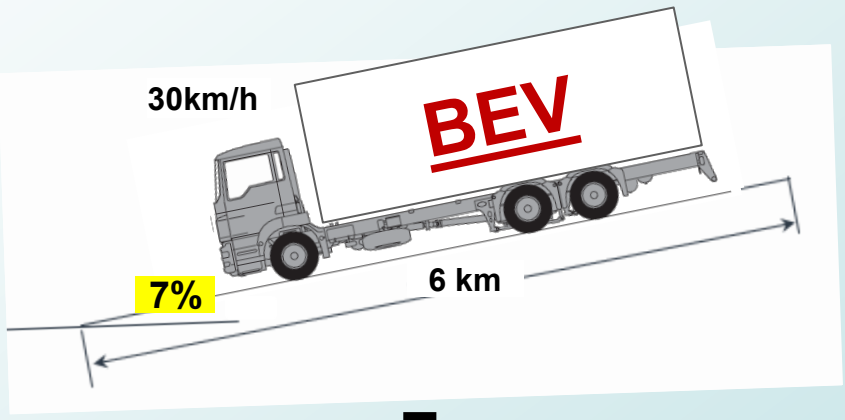
Description of the issue

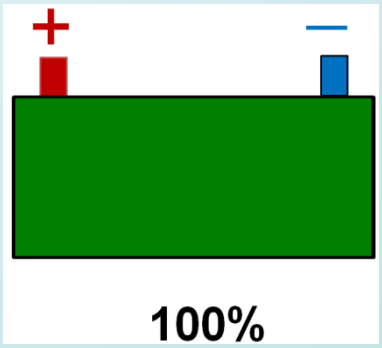
General:

UN R13 Type-IIA test is not adapted to Battery Electric vehicles (BEV) technology.

Technical issue:

- Technical Services requires Type-IIA to be conducted with a **fully charged** traction battery (i.e. the worst case).
- In these conditions:
  - The kinetic energy of the vehicle cannot be converted and stored in the traction battery,
  - No endurance braking is available.
  - **Type-IIA cannot be passed** without complex technical solutions highly impacting weight, packaging and cost, e.g. resistors and high-temp cooling system, extra batteries.
    ➔ **Such solutions kill the economical interest of BEV technology.**



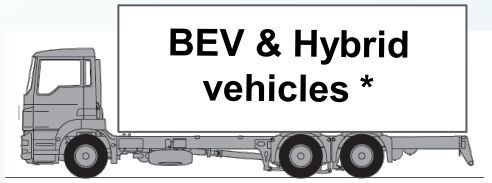


Type-IIA *not feasible*

An alternative approach is needed for BEVs

Alternative to Type IIA
Principles

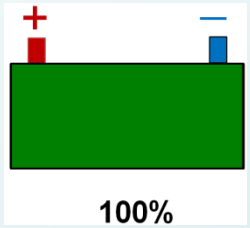
No change for vehicles not equipped with an ERB system



* *M3 class II, III & B + N3 ADR and/or authorized to tow cat. O4, equipped with an ERB system of cat A or B*

Current way

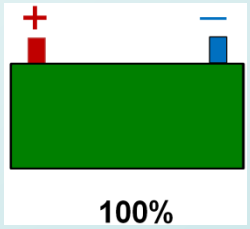
Type-IIA



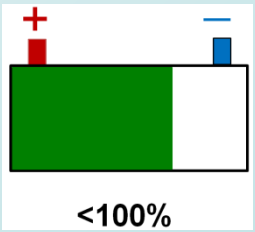
30 +/-5km/h

Alternative approach

Type-II + **Type-IIA** + **Brake estimator**



hot-stop requirements:
N3 = 3.3 m/s²
M3 = 3.75m/s²



30 +/-5km/h

Warn the driver if performance is below Type-II hot-stop requirements:
N3 = 3.3 m/s²
M3 = 3.75m/s²