EC study to review the appropriateness of crash pulses used in current EU legislation

Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs

GROW I.2 Mobility Unit

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Objectives of the research

• Review crash pulses in current legislation and assess their appropriateness

• Identify potential amendments to regulations and assess the potential benefits as well as any (unintended) consequences

• Study carried out by TRL (2021 Edwards et al)
  
  • https://data.europa.eu/doi/10.2873/58935
Background – evolution of regulations

Late 70s / early 80s:
- R11 (door latches): 30-36g for >30ms
- R14 (anchorages): No crash pulse option
- R44 (CRS): corridor max 20-28g, duration 60-80ms
- R17 (seats): seat inertia strength, >20g for >30ms
- R21 (Interiors): No crash pulse requirements
- R67 (LPG): No crash pulse req

80s / early 90s:
- R16 (seatbelts): corridor max 26-32g, duration 60-80ms
- R17 (seats): seat inertia strength, >20g for >30ms
- R21 (Interiors): No crash pulse requirements
- R67 (LPG): No crash pulse req

Circa 2000
- Intro:
  - Frontal (R94) and side (R95) impact Regulations
- R110 (CNG): >20g for whole veh approval
- Updated:
  - R14 (SB anchorages): Added crash pulse option, corr max 26-32g, duration 60-80ms
  - R17 (Seats): Added protect luggage displacement, corr max 20-28g, duration 100-120ms
  - R21 (Interiors): Added cp option to define head impact zone, corr max 26-32g, duration 60-80ms
  - R67 (LPG): Added >20g for whole veh approval

Circa 2007
- Intro:
  - R126 (Partitions): corr max 20-28g, duration 100-120ms
- Updated:
  - R100 (REESS): corr max 20-28g, duration 100-120ms

Circa 2015
- Intro:
  - R134 (Hydrogen): corr max 20-28g, duration 100-120ms

Circa 2017
- Intro:
  - R144: corr max 65-77g, duration 38-60ms
Regulatory crash pulses as they exist (frontal)

Frontal: M1 & N1

- Regulation 11 lower
- Regulation 11 upper
- Regulation 14, 16, 21 lower
- Regulation 14, 16, 21 upper
- Regulation 17(1),100, 126, 134 (44 & 129) lower
- Regulation 17(1),100, 126, 134 (44 & 129) upper
- Regulation 17(2) lower

Frontal: M2/N2 & M3/N3

- Regulation 16 lower (M2 & M3)
- Regulation 16 upper (M2 & M3)
- Regulation 80 lower (M2 & M3)
- Regulation 80 upper (M2 & M3)
- Regulation 107 lower (M2 & M3)
- Regulation 107 upper (M2 & M3)
- Regulation 100, 134 lower (M2/N2)
- Regulation 100, 134 upper (M2/N2)
- Regulation 100, 134 lower (M3/N3)
- Regulation 100, 134 upper (M3/N3)

Note: Regulations 67 & 110 pulse magnitude > 20g

Note: Regulations 67 & 110 pulse magnitude: M2/N2 > 10g; M3/N3 > 6.6g
Regulatory crash pulses as they exist (side)

Side: M1 & N1

Note: Regulations 67 & 110 pulse magnitude > 8g

Side: M2/N2 & M3/N3

Note: Regulations 67 & 110 pulse magnitude > 5g
Limited data shows R100 and R80 corridors reasonably representative in terms of pulse magnitude but duration is much shorter than rigid barrier test.
Limited data shows R100 corridor not representative of current M2 buses (large van types) and that R16 corridor fits better.
Comparison M1/N1 frontal impact (example 3)

Shows R129 corridor not representative of current vehicles – average is higher and individual peaks significantly higher; focus on 50 km/h data because equivalent to R137.
Conclusions

- Refer to Table 18 of the study (pages 139 to 147) with the summary of potential updates by regulation
- Downstream alignment necessary in some cases, for example
  - If R129 pulse is increased, the R145 ISOFIX pull force is no longer representative as it is expected to then exceed 8 kN
  - The R80 equivalency between dynamic and static tests need to be reviewed as forces should also become higher
- Limited real-world issues found in literature and accident data
- Lack of concrete cost-effectiveness data (at this stage)
Discussion in GRSP

- Consideration by delegates and Contacting Parties if any action based on this research needs to be prioritized
  - The European Commission has an obligation to evaluate vehicle safety by July 2027 (Article 14 of General Safety Regulation (EU) 2019/2144) and will take this research into account at that time

- Recommendations from GRSP to GRSG
  - Notably for UN Regulation No 67 (LPG) and 110 (CNG) as covered by this research, to ensure consistency with UN Regulation No 134 / GTR No 13 (hydrogen safety)
Thank you

For further information:

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