**NOTIFICATION OF CHANGE TO AN ALREADY AUTHORISED VEHICLE   
PURSUANT TO ARTICLE 16(4) OF COMMISSION IMPLEMENTING REGULATION (EU) 2018/545**

This form shall be used by the entity managing the change to submit to the Agency a notification of a change pursuant to article 16(4) of [Commission Implementing Regulation (EU) 2018/545](https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1524040548225&uri=CELEX%3A32018R0545) when the Agency would be the authorising entity if the change would require a new authorisation.

The process to follow to submit a notification is described on the website of the Agency:

[**https://www.era.europa.eu/can-we-help-you/faq/292\_en#faq1195**](https://www.era.europa.eu/can-we-help-you/faq/292_en#faq1195)

**IMPORTANT**

**This form is not enough to submit a notification 16(4) to the Authorising Entity. The notification shall be substantiated with additional evidence. Further information about the additional evidence can be found in §4 of the form.**

|  |  |
| --- | --- |
| **1. General information** | |
| 1.1. ERA Notification reference: | Click here to enter text. |
| 1.2. Type of notification: | ☐ Single vehicle  ☐ Series of vehicles |
| 1.3. Area of use: | 1.3.1. Member States: Click here to enter text.  1.3.2. Networks (per Member State): Click here to enter text.  1.3.3. Neighbouring stations (when applicable): Click here to enter text.  1.3.4. Whole EU network: Yes No |
| 1.4. Entity managing the change: | 1.4.1. Legal denomination: Click here to enter text.  1.4.2. Name: Click here to enter text.  1.4.3. Acronym: Click here to enter text.  1.4.4. Address: Click here to enter text.  1.4.5. Phone: Click here to enter text.  1.4.6. Email: Click here to enter text.  1.4.7. Website: Click here to enter text.  1.4.8. VAT number: Click here to enter text.  1.4.9. Other information: Click here to enter text. |
| 1.5. Contact person: | 1.5.1. First name: Click here to enter text.  1.5.2. Surname: Click here to enter text.  1.5.3. Title or function: Click here to enter text.  1.5.4. Language(s) to be used: Click here to enter text.  1.5.5. Address: Click here to enter text.  1.5.6. Phone: Click here to enter text.  1.5.7. Email: Click here to enter text. |
| 1.6. Vehicle type authorisation holder (when applicable) | 1.6.1. Legal denomination: Click here to enter text.  1.6.2. Name: Click here to enter text.  1.6.3. Acronym: Click here to enter text.  1.6.4. Address: Click here to enter text.  1.6.5. Phone: Click here to enter text.  1.6.6. Email: Click here to enter text.  1.6.7. Website: Click here to enter text.  1.6.8. VAT number: Click here to enter text.  1.6.9. Other information: Click here to enter text. |

|  |  |
| --- | --- |
| **2. Assessment bodies**  *Please duplicate rows below as needed (e.g., more than 1 NoBo involved).* | |
| 2.1. Notified bodies (mobile subsystems): | 2.1.1. Legal denomination: Click here to enter text.  2.1.2. Name: Click here to enter text.  2.1.3. Notified body ID number (NANDO): Click here to enter text.  2.1.4. Acronym: Click here to enter text.  2.1.5. Address: Click here to enter text.  2.1.6. Phone: Click here to enter text.  2.1.7. Email: Click here to enter text.  2.1.8. Website: Click here to enter text.  2.1.9. Other information: Click here to enter text. |
| 2.2. Designated bodies: | 2.2.1. Legal denomination: Click here to enter text.  2.2.2. Name: Click here to enter text.  2.2.3. Designated body ID number (RDD): Click here to enter text.  2.2.4. Acronym: Click here to enter text.  2.2.5. Address: Click here to enter text.  2.2.6. Phone: Click here to enter text.  2.2.7. Email: Click here to enter text.  2.2.8. Website: Click here to enter text.  2.2.9. Other information: Click here to enter text. |
| 2.3. Assessment bodies (CSM RA): | 2.3.1. Legal denomination: Click here to enter text.  2.3.2. Name: Click here to enter text.  2.3.3. Assessment body EIN number (ERADIS): Click here to enter text.  2.3.4. Acronym: Click here to enter text.  2.3.5. Address: Click here to enter text.  2.3.6. Phone: Click here to enter text.  2.3.7. Email: Click here to enter text.  2.3.8. Website: Click here to enter text.  2.3.9. Other information: Click here to enter text. |

|  |  |
| --- | --- |
| **3. Details of the notification** | |
| 3.1. Description of the vehicle type (when applicable): | 3.1.1. Type or variant or version ID: Click here to enter text.  3.1.2. Date of record in ERATV: Click or tap to enter a date.  3.1.3. Type name: Click here to enter text.  3.1.4. Alternative name (when applicable): Click here to enter text.  3.1.5. Category: Click here to enter text.  3.1.6. Subcategory: Click here to enter text. |
| 3.2. Description of the vehicle (when there is no vehicle type): | Click here to enter text. |
| 3.3. Identification of the concerned vehicle(s): | 3.3.1. EVN(s)[[1]](#footnote-1): Click here to enter text. |
| 3.4. Brief description of the changes as compared to the authorised vehicle and/or vehicle type: | Click here to enter text. |
| 3.5. Conditions for use of the vehicle and other restrictions: | 3.5.1. Coded restrictions[[2]](#footnote-2): Click here to enter text.  3.5.2. Non-coded restrictions: Click here to enter text. |
| 3.6. Applicable rules for the changes (and interfaces with the unchanged parts): | 3.6.1. TSIs including the legal reference in the Official Journal of the European Union:  Click here to enter text.  Are the TSIs mentioned above the ones in force? Yes No  3.6.2. National rules (when applicable):  Click here to enter text.  Are the national rules mentioned above the ones in force? Yes No  3.6.3. Non-applications of TSIs according to the provisions of Article 7 of Directive (EU) 2016/797 (when applicable):  Click here to enter text.  3.6.4. Other EU law (when applicable):  Click here to enter text. |
| 3.7 Previous notifications pursuant to Article 16(4) of Regulation (EU) 2018/545 | 3.7.1 Is this the first time you submit a 16(4) notification for this vehicle? Yes No  3.7.2 IDs of previous notifications: Click here to enter text.  3.7.3 Date of submission of previous notifications: Click here to enter text.  3.7.4 Short description of previous notifications: Click here to enter text. |
| 3.8. Category of the change pursuant to Article 15(1) of Regulation (EU) 2018/545: | 3.8.1. Category: ☐ 15(1)(b) ☐ 15(1)(c)  3.8.2. Rationale for the classification[[3]](#footnote-3): Click here to enter text. |
| 3.9. Article 21(12) of Directive (EU) 2016/797 (see Annexes I & II) | 3.9.1 Applicable rules (TSIs, national rules, other Union law) require Yes No  renewal/new authorisation[[4]](#footnote-4)?:  3.9.2 Article 21(12)(b) of Directive (EU) 2016/797 triggered ? ☐Yes ☐No  (see Annex II)  3.9.3 Rationale for answer in 3.9.2 [[5]](#footnote-5): Click here to enter text.  3.9.4 Does the change impact basic design characteristics[[6]](#footnote-6)? ☐Yes ☐No  3.9.5 Are the values for the parameters related to basic design ☐Yes ☐No  characteristics impacted below the thresholds set-out in TSIs  for a new authorisation? (fill in Annex I ) |
| 3.10. Reference to the written declaration by the proposer pursuant to Article 13 of Regulation (EU) 2018/545 | Click here to enter text. |
| 3.11. Reference(s) to the EC certificate(s) for the mobile subsystems (EC type or design examination certificate(s), QMS approval certificate(s) and EC certificate(s) of verification) | Click here to enter text. |
| 3.12 Reference(s) to the EC declaration(s) of verification for the mobile subsystem(s) | Click here to enter text. |
| 3.13 Reference(s) to the certificates for national rule(s) | Click here to enter text. |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **4. Mapping table**  *Please describe below where each aspect to be assessed is covered in the documentation supporting your notification and uploaded in the dedicated extranet space.* | | | | |
| **ID** | **Assessment aspect** | **Documentary evidence**  *Filename(s) and/or document reference(s) with date and version* | **Reference**  *Page, chapter, section, etc.* | **Comments** |
| 1 | Non-application(s) of TSI(s) in accordance with the provision of Article 7 of Directive (EU) 2016/797 (when applicable): |  |  |  |
| 2 | Methodology for the requirements capture: |  |  |  |
| 3 | Evidence from the methodology used for the requirements capture (safety assessment report and written declaration): |  |  |  |
| 4 | EC Declaration(s) and EC certificates of verification (subsystems): |  |  |  |
| 5 | Certificates for national rules: |  |  |  |
| 6 | Original vehicle authorisation and/or vehicle type authorisation: |  |  |  |
| 7 | Description and consistency of the change: |  |  |  |
| 8 | Categorisation of the change: |  |  |  |

Request date: Click here to enter a date.

Requestor´s e-mail: Click here to enter text.

Requestor´s signature:

***Annex I: Basic Design Characteristics impacted by the change***

***I.1. General basic design characteristics***

|  |  |
| --- | --- |
| **Basic design characteristics according to Article 48(1)(c) of Regulation (EU) 2018/545** | **Basic design characteristic impacted?** |
| Area of use of the vehicle  *(\*) Please notice that If the area of use of the vehicle is extended, it is not possible to register a version in ERATV; an authorisation for the extended area of use is required.* | Yes (\*)  No |
| Conditions for use of the vehicle and other restrictions (coded and non-coded restrictions in ERATV)  *(\*\*) Please notice that when declaring whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered or not in section 3.9.2 of the form, the impact of changes in the conditions for use and other restrictions (if any) shall be taken into account. If Article 21(12)(b) is triggered because of the change in conditions for use and other restrictions, it is not possible to register a version in ERATV; a new authorisation is required.* | Yes (\*\*)  No |
| Reference, pursuant to the provisions of Article 16 of Regulation (EU) No 402/2013, including the document identification and the version, to the written declaration by the proposer referred to in Article 3(11) of Regulation (EU) No 402/2013, covering the vehicle type  *(\*\*\*) If the reference to the risk declaration by the proposer concerning the change is different as compared to the type, and this is not caused by editorial aspects but by the fact that the risk assessment or the assessment report from the assessment body (AsBo) has been changed, please double check how did you arrive to the conclusion that Article 21(12)(b) is triggered (potential impact on safety requiring an update of the risk analysis and AsBo assessment) and provide the necessary description in field 3.9.3* | Yes (\*\*\*)  No |

# I.2. Vehicles in the scope of Regulation (EU) 1302/2014 LOC&PAS TSI

**I.2.1. Basic design characteristics**

Table 17a Regulation (EU) 1302/2014 LOC&PAS TSI

Basic design characteristics related to basic parameters set out in the LOC&PAS TSI

| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and not classified as 21(12)(a) of Directive (EU) 2016/797** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| --- | --- | --- | --- | --- | --- |
| 4.2.2.2.3 End coupling | Type of end coupling | 4.9.1 Type of end coupling | Yes  No | Change of end coupler type | N/A |
| 4.2.2.10 Load conditions and weighed mass  4.2.3.2.1 Axle load parameter | Design mass in working order | 4.5.2.1 Design mass in working order | Yes  No | Change in any of the corresponding basic design characteristics resulting in a change of the line category(ies) the vehicle is compatible with | N/A |
| Design mass under normal payload | 4.5.2.2 Design mass under normal payload | Yes  No |
| Design mass under exceptional payload | 4.5.2.3 Design mass under exceptional payload | Yes  No |
| Maximum design speed (km/h) | 4.1.2.1 Maximum design speed | Yes  No |
| Static axle load in working order | 4.5.3.1 Static axle load in working order | Yes  No |
| Static axle load under exceptional payload | 4.5.3.3 Static axle load under exceptional payload | Yes  No |
| Vehicle length | 4.8.1 Vehicle length | Yes  No |
| Static axle load under normal payload | 4.5.3.2 Static axle load under normal payload | Yes  No |
| Position of the axles along the unit (axle spacing) | 4.5.3.4 Position of the axles along the unit (axle spacing) | Yes  No |
| Total vehicle mass (for each vehicle of the unit) | 4.5.5 Total vehicle mass (for each vehicle of the unit) | Yes  No | Change in any of the corresponding basic design characteristics resulting in a change of the line category(ies) the vehicle is compatible with | Change of more than ± 10 % |
| Mass per wheel | 4.5.6 Mass per wheel | Yes  No | Change in any of the corresponding basic design characteristics resulting in a change of the line category(ies) the vehicle is compatible with or  Change of more than ± 10 % | N/A |
| 4.2.3.1 Gauging | Reference profile | 4.2.1 Reference profile | Yes  No  (If yes, version not allowed) | N/A | Change of reference profile the vehicle is conform to |
|  | Minimum vertical convex curve radius capability | 4.8.5 Minimum vertical convex curve radius capability | Yes  No | Change in minimum vertical convex curve radius capability the vehicle is compatible with of more than 10 % | N/A |
|  | Minimum vertical concave curve radius capability | 4.8.6 Minimum vertical concave curve radius capability | Yes  No | Change in minimum vertical concave curve radius capability the vehicle is compatible with of more than 10 % | N/A |
| 4.2.3.3.1 Rolling stock characteristics for the compatibility with train detection systems | Compatibility with train detection systems | 4.14.1 Type of train detection systems for which the vehicle has been designed and assessed | Yes  No  (If yes, version not allowed) | N/A | Change of declared compatibility with one or more of the three following train detection systems:   * Track circuits * Axle counters * Loop equipment |
| 4.2.3.3.2 Axle bearing condition monitoring | On-board detection system | 4.9.2 Axle bearing condition monitoring (hot axles box detection) | Yes  No | Fitting of detection system on-board | Removal of declared on- board detection system |
| 4.2.3.4. Rolling stock dynamic behaviour | Combination of maximum speed and maximum cant deficiency for which the vehicle was assessed | 4.6.4 Combination of maximum speed and maximum cant deficiency for which the vehicle was assessed | Yes  No  (If yes, version not allowed) | N/A | Increase in maximum speed of more than 15 km/h or change of more than ± 10 % in maximum admissible cant deficiency |
|  | Rail inclination | 4.6.5 Rail inclination | Yes  No  (If yes, version not allowed) | N/A | Change of rail inclination(s) the vehicle is conform to (\*) |
| 4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets | Wheelset gauge | 4.1.3 Wheel set gauge | Yes  No  (If yes, version not allowed) | N/A | Change of track gauge the wheelset is compatible with |
| 4.2.3.5.2.2 Characteristics of wheels | Minimum required in- service wheel diameter | 4.8.2 Minimum in-service wheel diameter | Yes  No | Change of minimum required in-service diameter of more than ± 10 mm | N/A |
| 4.2.3.5.2.3 Automatic variable gauge systems | Wheelset gauge changeover facility | 4.1.11 Wheelset gauge changeover facility | Yes  No | Change in the vehicle leading to a change in the changeover facility(ies) the wheelset is compatible with | Change of track gauge(s) the wheelset is compatible with |
| 4.2.3.6. Minimum curve radius | Minimum horizontal curve radius capability | 4.8.4 Minimum horizontal curve radius capability | Yes  No | Increase of minimum horizontal curve radius of more than 5 m | N/A |
| 4.2.4.5.1 Braking performance - General requirements | Maximum average deceleration | 4.7.1 Maximum average deceleration | Yes  No | Change of more than ± 10 % on the maximum average brake deceleration | N/A |
| 4.2.4.5.2 Braking performance – Emergency braking | Stopping distance and deceleration profile for each load condition per design maximum speed. | 4.7.5 Emergency brake: Stopping distance and deceleration profile for each load condition per design maximum speed  4.7.6 For general operation: Brake weight percentage (lambda) or Braked mass | Yes  No | Change of stopping distance of more than ± 10 %.  Note: Brake weight percentage (also called ‘lambda’ or ‘braked mass percentage’) or braked mass may also be used and can be derived (directly or via stopping distance) from deceleration profiles by a calculation.  The allowed change is the same (± 10 %) | N/A |
| 4.2.4.5.3 Braking performance – Service braking | Stopping distance and maximum deceleration for the load condition ‘design mass under normal payload’ at the design maximum speed | 4.7.7 Service brake: At maximum service brake: Stopping distance, Maximum deceleration, for the load condition “design mass under normal payload” at the design maximum speed. | Yes  No | Change of stopping distance of more than ± 10 % | N/A |
| 4.2.4.5.4 Braking performance – Thermal capacity | Maximum brake thermal energy capacity  or  Thermal capacity in terms of maximum line gradient, associated length, and operating speed | 4.7.2.1.1 Reference case of TSI | Yes  No | N/A  Change of maximum gradient, associated length, or operating speed for which the brake system is designed in relation with brake thermal energy capacity | Change of maximum brake thermal energy >= 10 % |
| 4.7.2.1.2 Speed (if no reference case is indicated) | Yes  No |
| 4.7.2.1.3 Gradient (if no reference case is indicated) | Yes  No |
| 4.7.2.1.4 Distance (if no reference case is indicated) | Yes  No |
| 4.7.2.1.5 Time (if distance is not indicated) (if no reference case is indicated) | Yes  No |
| 4.7.2.1.6 Maximum brake thermal energy capacity | Yes  No  (If yes, version not allowed) |
| 4.2.4.5.5 Braking performance – Parking brake | Maximum gradient on which the unit is kept immobilized by the parking brake alone (if the vehicle is fitted with it) | 4.7.3.3 Maximum gradient on which the unit is kept immobilized by the parking brake alone (if the vehicle is fitted with it) | Yes  No | Change of declared maximum gradient of more than ± 10 % | N/A |
| 4.2.4.6.2. Wheel slide protection system | Wheel slide protection system | 4.7.8 Wheel slide protection system | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of WSP function | WSP |
| 4.2.4.8.2 Magnetic track brake | Magnetic track brake | 4.7.4.2.1 Magnetic track brake fitted | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of magnetic track brake function |
| Possibility of preventing the use of the magnetic track brake | 4.7.4.2.2 Possibility of preventing the use of the magnetic track brake (only if fitted with magnetic brake) | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of the brake control allowing the activation/deactivation of magnetic track brake |
| 4.2.4.8.3 Eddy current track brake | Eddy current track brake | 4.7.4.1.1 Eddy current track brake fitted | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of the eddy current track brake function |
| Possibility of preventing the use of the eddy current track brake | 4.7.4.1.2 Possibility of preventing the use of the eddy current track brake (only if fitted with eddy current track brake) | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of the brake control allowing the activation/deactivation of eddy current track brake |
| 4.2.6.1.1 Temperature | Temperature range | 4.3.1 Temperature range | Yes  No | Change of temperature range (T1, T2, T3) | N/A |
| 4.2.6.1.2 Snow, ice and hail | Snow, ice and hail conditions | 4.3.3 Snow, ice and hail conditions | Yes  No | Change of the selected range ‘snow, ice and hail’ (nominal or severe) | N/A |
| 4.2.8.2.2 Operation  within range of voltages and frequencies | Energy supply system (voltage and frequency) | 4.10.1 Energy supply system (voltage and frequency) | Yes  No  (If yes, version not allowed) | N/A | Change of voltage(s)/ frequency(ies) of the energy supply system (AC 25 kV-50 Hz, AC 15 kV-16,7 Hz, DC 3 kV, DC 1,5 kV, DC 750 V, third rail, others) |
| 4.2.8.2.3 Regenerative brake with energy to the overhead contact line | Regenerative brake | 4.7.4.3.1 Regenerative brake fitted | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of regenerative brake function |
|  | Possibility of preventing the use of the regenerative brake when fitted | 4.7.4.3.2 Possibility of preventing the use of the regenerative brake (only if fitted with regenerative brake) | Yes  No | Fitting/removing the possibility of preventing the use of regenerative brake | N/A |
| 4.2.8.2.4 Maximum power and current from the overhead contact line | *Applicable to Electric units with power higher than 2 MW only:*  Power or current limitation function | 4.10.14 Electric units equipped with power or current limitation function | Yes  No | Power or current limitation function fitted/removed | N/A |
| 4.2.8.2.5 Maximum current at standstill for DC systems | Maximum current at standstill per pantograph for each DC system the vehicle is equipped for | 4.10.4 Maximum current at standstill per pantograph (to be indicated for each DC systems the vehicle is equipped for) | Yes  No | Change of the maximum current value by 50 A without exceeding the limit set in the TSI | N/A |
| 4.2.8.2.9.1.1 Height of interaction with contact wires (RST level) | Height of interaction of pantograph with contact wires (over top of rail) | 4.10.5 Height of interaction of pantograph with contact wires (over top of rail) (to be indicated for each energy sup- ply system the vehicle is equipped for) | Yes  No | Change of height of interaction allowing/no longer allowing mechanical contact with one of the contact wires at heights above rail level between:  4 800 mm and 6 500 mm  4 500 mm and 6 500 mm  5 550 mm and 6 800 mm  5 600 mm and 6 600 mm | N/A |
| 4.2.8.2.9.2 Pantograph head geometry (IC level) | Pantograph head geometry | 4.10.6 Pantograph head geometry (to be indicated for each energy supply system the vehicle is equipped for) | Yes  No  (If yes, version not allowed) | N/A | Change of pantograph head geometry to or from one of the types defined in clauses 4.2.8.2.9.2.1, 4.2.8.2.9.2.2 or 4.2.8.2.9.2.3 |
| 4.2.8.2.9.4.2 Contact strip material | Contact strip material | 4.10.10 Material of pantograph contact strip the vehicle may be equipped with (to be indicated for each energy supply system the vehicle is equipped for) | Yes  No | New contact strip as per 4.2.8.2.9.4.2(3) | N/A |
| 4.2.8.2.9.6 Pantograph contact force and dynamic behaviour | Mean contact force curve | 4.10.15 Mean contact force | Yes  No | Change requiring a new assessment of pantograph dynamic behaviour. | N/A |
| 4.2.8.2.9.7 Arrangement of pantographs (RST level) | Number of pantograph and shortest distance between two pantographs | 4.10.7 Number of pantographs in contact with the overhead contact line (OCL) (to be indicated for each energy supply system the vehicle is equipped for) | Yes  No  (If yes, version not allowed) | N/A | Where the spacing of 2 consecutive pantographs in fixed or predefined formations of the assessed unit is reduced by means of removing a vehicle |
| 4.10.8 Shortest distance between two pantographs in contact with the OCL (to be indicated for each energy supply system the vehicle is equipped for; to be indicated for single and, if applicable, multiple operation) (only if number of raised pantographs is more than 1) | Yes  No  (If yes, version not allowed) |
| 4.2.8.2.9.10 Pantograph lowering (RST level) | Automatic dropping device (ADD) | 4.10.11 Automatic dropping device (ADD) fitted (to be indicated for each energy supply system the vehicle is equipped for) | Yes  No | Automatic dropping device (ADD) function fitted/ removed | N/A |
| 4.2.10.1. General and categorisation | Fire safety category | 4.4.1 Fire safety category | Yes  No  (If yes, version not allowed) | N/A | Change of fire safety category |
| 4.2.12.2. General documentation -number of units in multiple operation | Maximum number of trainsets or locomotives coupled together in multiple operation. | 4.1.5 Maximum number of trainsets or locomotives coupled together in multiple operation. | Yes  No  (If yes, version not allowed) | N/A | Change of maximum allowed number of trainsets or loco­ motives coupled together in multiple operation |
| 4.2.12.2. General documentation – number of vehicles in a unit | For fixed formations only: Vehicles composing the fixed formation | 4.1.12 Number of vehicles composing the fixed formation (for fixed formation only) | Yes  No  (If yes, version not allowed) | N/A | Change in the number of vehicles composing the fixed formation |

Table 17b Regulation (EU) 1302/2014 LOC&PAS TSI.

Basic design characteristics related to basic parameters set out in the PRM TSI

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and not classified as 21(12)(a) of Directive (EU) 2016/797** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| 4.2.2.11. Step position for vehicle access and egress | Platform heights for which the vehicle is designed | 4.12.3.1 Platform heights for which the vehicle is designed. | Yes  No  (If yes, version not allowed) | N/A | Change of platform height the vehicle is compatible with |

Table 17c Regulation (EU) 1302/2014 LOC&PAS TSI.

Changes to basic parameters for which compliance with TSI requirements is mandatory for rolling stock not holding an EC type or design examination certificate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| 4.2.3.1 Gauging | Reference profile | 4.2.1 Reference profile | Yes  No | Change of reference profile the vehicle is conform to |
| 4.2.3.3.1 Rolling stock characteristics for the compatibility with train  detection systems | Compatibility with train detection systems | 4.14.1 Type of train detection systems for which the vehicle has been designed and assessed | Yes  No | Change of declared compatibility with one or more of the three following train detection systems:   * Track circuits * Axle counters * Loop equipment |
| 4.2.3.3.2 Axle bearing condition monitoring | On-board detection system | 4.9.2 Axle bearing condition monitoring (hot axles box detection) | Yes  No | Fitting/Removal of declared on-board detection system |
| 4.2.3.5.2.1. Mechanical and geometric characteristics of wheelsets | Wheelset gauge | 4.1.3 Wheel set gauge | Yes  No | Change of track gauge the wheelset is compatible with |
| 4.2.3.5.2.3 Automatic variable gauge systems | Wheelset gauge changeover facility | 4.1.11 Wheelset gauge hangeover facility | Yes  No | Change of track gauge(s) the wheelset is compatible with |
| 4.2.8.2.3 Regenerative brake with energy to the overhead contact line | Regenerative brake | 4.7.4.3.1 Regenerative brake fitted | Yes  No | Fitting/removal of regenerative brake function |

Table 17d Regulation (EU) 1302/2014 LOC&PAS TSI.

Changes to basic parameters of the PRM TSI for which compliance with TSI requirements is mandatory for rolling stock not holding an EC type or design examination certificate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| 4.2.2.11. Step position for vehicle access and egress | Platform heights for which the vehicle is designed | 4.12.3.1 Platform heights for which the vehicle is designed | Yes  No | Change of platform height the vehicle is compatible with |

**I.2.2. Aspects to be taken into account when assessing Article 21(12)(b)**

**I.2.2.1 Changes requiring reassessment of safety requirements**

Please notice that Regulation (EU) 1302/2014 LOC&PAS TSI states in section 7.1.2.2 paragraph 4, “*Without prejudice of the general safety judgement mandated in article 21(12)(b) of Directive (EU) 2016/797, in case of changes requiring reassessment of the safety requirements set out in clauses 4.2.3.4.2, 4.2.3.5.3, 4.2.4.2.2, 4.2.5.3.5, 4.2.5.5.8 and 4.2.5.5.9, the procedure set out in clause 6.2.3.5 shall be applied. Table 17 sets out when a new authorisation is required*.”

Table 17 Regulation (EU) 1302/2014 LOC&PAS TSI

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Vehicle originally assessed against… | | | | |
|  | | First method of clause 6.2.3.5(3) | Second method of clause 6.2.3.5(3) | No CSM on  RA applied |
| Change assessed against… | First method of clause 6.2.3.5(3) | No new authorisation required | Check (1) | No new authorisation required |
| Second method of clause 6.2.3.5(3) | Check (1) | Check (1) | Check (1) |
| No CSM on RA applied | Not possible | Not possible | Not possible |

(1) The word ‘Check’ means that the applicant will apply Annex I of the CSM on RA in order to demonstrate that the changed vehicle ensures an equal or higher level of safety. This demonstration shall be independently assessed by an assessment body as defined in CSM on RA. If the body concludes that the new safety assessment demonstrates a lower level of safety or the result is unclear, the applicant shall request an authorization for placing on the market.

The conditions above are linked to Article 21(12)(c) of Directive (EU) 2016/797: particular conditions laid down in the TSIs that trigger a new authorisation. The analysis on whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered or not should be performed independently. In other words, meeting the requirements in clause 7.1.2.2 of LOC&PAS TSI does not automatically mean that Article 21(12)(b) of Directive (EU) 2016/797 is not triggered.

Both aspects shall be taken into account when declaring whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered when answering field 3.9.2 & 3.9.3 of the request form.

**I.2.2.2 Changes requiring a new reliability study**

Similarly, paragraph (4a) of section 7.1.2.2 of LOC&PAS TSI states “*Without prejudice of the general safety judgement mandated in Article 21(12)(b) of Directive (EU) 2016/797, in case of changes impacting requirements set out in 4.2.4.9, 4.2.9.3.1 and 4.2.10.3.4 which require a new reliability study, a new authorisation for placing in the market shall be required unless the NoBo concludes that the safety-related requirements covered by the reliability study are improved or maintained. The NoBo will consider in its judgement the revised maintenance and operation documentation, where required.*”

The conditions above are linked to Article 21(12)(c) of Directive (EU) 2016/797: particular conditions laid down in the TSIs that trigger a new authorisation. The analysis on whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered or not should be performed independently. In other words, meeting the requirements in clause 7.1.2.2 of LOC&PAS TSI does not automatically mean that Article 21(12)(b) of Directive (EU) 2016/797 is not triggered.

Both aspects shall be taken into account when declaring whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered when answering field 3.9.2 & 3.9.3 of the request form.

# I.3. Vehicles in the scope of Regulation (EU) 321/2013 WAG TSI

**I.3.1. Basic design characteristics**

Table 11a Regulation (EU) 321/2013 WAG TSI

Basic design characteristics related to basic parameters set out in the WAG TSI

| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and not classified as 21(12)(a) of Directive (EU) 2016/797** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| --- | --- | --- | --- | --- | --- |
| 4.2.2.1.1 End coupling | Type of end coupling | 4.9.1 Type of end coupling | Yes  No | Change of end coupler type | N/A |
| 4.2.3.1 Gauging | Reference profile | 4.2.1 Reference profile | Yes  No  (If yes, version not allowed) | N/A | Change of reference profile the vehicle is conform to |
|  | Minimum vertical convex curve radius capability | 4.8.5 Minimum vertical convex curve radius capability | Yes  No | Change in minimum vertical convex curve radius capability the unit is compatible with of more than 10 % | N/A |
|  | Minimum vertical concave curve radius capability | 4.8.6 Minimum vertical concave curve radius capability | Yes  No | Change in minimum vertical concave curve radius capability the unit is compatible with of more than 10 % | N/A |
| 4.2.3.2. Compatibility with load carrying capacity of lines | Permissible payload for different line categories | 4.5.1 Permissible payload for different line categories | Yes  No | Change of any of the vertical loading characteristics resulting in a change of the line category(ies) the wagon is compatible with | N/A |
| 4.2.3.3 Compatibility with train detection systems | Compatibility with train detection systems | 4.14.1 Type of train detection systems for which the vehicle has been designed and assessed | Yes  No  (If yes, version not allowed) | N/A | Change of declared compatibility with one or more of the three train detection systems:   * Track circuits * Axle counters * Loop equipment |
| 4.2.3.4 Axle bearing condition monitoring | On-board detection system | 4.9.2 Axle bearing condition monitoring (hot axles box detection) | Yes  No  (If yes, version not allowed) | N/A | Fitting/Removal of on-board detection system |
| 4.2.3.5 Running safety | Combination of maximum speed and maximum cant deficiency for which the unit was assessed | 4.6.4 Combination of maximum speed and maximum cant deficiency for which the vehicle was assessed | Yes  No  (If yes, version not allowed) | N/A | Increase in maximum speed of more than 15 km/h or change of more than ± 10 % in maximum admissible cant deficiency |
|  | Rail inclination | 4.6.5 Rail inclination | Yes  No  (If yes, version not allowed) | N/A | Change of rail inclination the vehicle is conform to |
| 4.2.3.6.2 Characteristics of wheelsets | Wheelset gauge | 4.1.3 Wheel set gauge | Yes  No  (If yes, version not allowed) | N/A | Change of track gauge the wheelset is compatible with |
| 4.2.3.6.3 Characteristics of wheels | Minimum required in-service wheel diameter | 4.8.2 Minimum in-service wheel diameter | Yes  No | Change of minimum required in-service diameter of more than 10 mm | N/A |
| 4.2.3.6.6 Automatic variable gauge systems | Wheelset gauge changeover facility | 4.1.11 Wheelset gauge changeover facility | Yes  No | Change in the unit leading to a change in the changeover facility(ies) the wheelset is compatible with | Change of track gauge(s) the wheelset is compatible with |
| 4.2.4.3.2.1 Service brake | Stopping distance | 4.7.6 For general operation: brake weight percentage (lambda) or Braked mass  4.7.7 Service brake: At maximum service brake: Stopping distance, Maximum deceleration, for the load condition “design mass under normal payload” at the design maximum speed. | Yes  No | Change of stopping distance of more than ± 10 %  *Note:* Brake weight percentage (also called ‘lambda’ or ‘braked mass percentage’) or braked mass may also be used and can be derived (directly or via stopping distance) from deceleration profiles by a calculation.  The allowed change is the same (± 10 %) | N/A |
|  | Maximum deceleration for the load condition ‘design mass under normal payload’ at the maximum design speed | 4.7.7 Service brake: At maximum service brake: Stopping distance, Maximum deceleration, for the load condition “design mass under normal payload” at the design maximum speed. | Yes  No | Change of more than ± 10 % on the maximum average brake deceleration | N/A |
| 4.2.4.3.2.2 Parking brake | Parking brake | 4.7.3.4 Parking brake | Yes  No | Parking brake function installed/removed | N/A |
| 4.2.4.3.3 Thermal capacity | Thermal capacity expressed in terms of   * Speed * Gradient * Brake distance | 4.7.2.1.1 Reference case of TSI | Yes  No  (If yes, version not allowed) | N/A | New reference case declared |
| 4.7.2.1.2 Speed (if no reference case is indicated) | Yes  No  (If yes, version not allowed) |
| 4.7.2.1.3 Gradient (if no reference case is indicated) | Yes  No  (If yes, version not allowed) |
| 4.7.2.1.4 Distance (if no reference case is indicated) | Yes  No  (If yes, version not allowed) |
| 4.7.2.1.5 Time (if distance is not indicated) (if no reference case is indicated) | Yes  No  (If yes, version not allowed) |
| 4.2.4.3.4 Wheel slide protection (WSP) | Wheel slide protection | 4.7.8 Wheel slide protection system | Yes  No  (If yes, version not allowed) | N/A | Fitting/removal of WSP function |
| 4.2.5 Environmental conditions | Temperature range | 4.3.1 Temperature range | Yes  No | Change of temperature range (T1, T2, T3) | N/A |
|  | Snow, ice and hail conditions | 4.3.3 Snow, ice and hail conditions | Yes  No | Change of the selected range ‘snow, ice and hail’ (nominal or severe) | N/A |

Table 11b Regulation (EU) 321/2013 WAG TSI

Changes to basic parameters for which compliance with TSI requirements is mandatory for rollingstock not holding an EC type or design examination certificate

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes impacting the basic design characteristic and classified as 21(12)(a) of Directive (EU) 2016/797** |
| 4.2.3.1 Gauging | Reference profile | 4.2.1 Reference profile | Yes  No | Change of reference profile the vehicle is conform to |
| 4.2.3.3 Compatibility with train detection system | Compatibility with train detection systems | 4.14.1 Type of train detection systems for which the vehicle has been designed and assessed | Yes  No | Change of declared compatibility with one or more of the three train detection systems:   * Track circuits * Axle counters * Loop equipment |
| 4.2.3.4 Axle bearing condition monitoring | On-board detection system | 4.9.2 Axle bearing condition monitoring (hot axles box detection) | Yes  No | Fitting/Removal of on-board detection system |
| 4.2.3.6.2 Characteristics of wheelsets | Wheelset gauge | 4.1.3 Wheel set gauge | Yes  No | Change of track gauge the wheelset is compatible with |
| 4.2.3.6.6 Automatic variable gauge systems | Wheelset gauge changeover facility | 4.1.11 Wheelset gauge changeover facility | Yes  No | Change of track gauge(s) the wheelset is compatible with |

**I.3.2. Aspects to be taken into account when assessing Article 21(12)(b)**

Without prejudice of the general safety judgement mandated in article 21(12)(b) of Directive (EU) 2016/797, in case of changes requiring reassessment of the safety requirements set out in clauses 4.2.4.2 for the brake system, a new authorization for placing on the market will be required unless one of the following conditions are met:

* + The brake system fulfils the conditions of C.9 and C.14 of Appendix C after change or,
  + Both the original and changed brake systems fulfil the safety requirements set out in clause 4.2.4.2.

The conditions above are linked to Article 21(12)(c) of Directive (EU) 2016/797: particular conditions laid down in the TSIs that trigger a new authorisation. The analysis on whether Article 21(12)(b) of Directive (EU) 2016/797 is triggered or not should be performed independently. In other words, meeting the requirements in clause 7.2.2.2 (and 4.2.4.2) of WAG TSI does not automatically mean that Article 21(12)(b) of Directive (EU) 2016/797 is not triggered.

# I.4. Vehicles in the scope of Regulation (EU) 2016/919 CCS TSI

**I.4.1. Basic design characteristics**

Table 7.1 Regulation (EU) 2016/919 CCS TSI

| **TSI clause** | **Related basic design characteristic(s)** | **ERATV parameter** | **Basic design characteristic impacted?** | **Changes not impacting the basic design characteristics 15(1)(b) of Regulation (EU) 2018/545** | **Changes impacting the basic design characteristic inside acceptable range 15(1)(c) of Regulation (EU) 2018/545** | **Changes impacting the basic design characteristic outside acceptable range 15(1)(d) of Regulation (EU) 2018/545** |
| --- | --- | --- | --- | --- | --- | --- |
| 4.2.2 On-board ETCS functionality | Set of specification of Annex A | 4.13.1.1 ETCS equipment on-board and the set of specifications from CCS TSI Annex A | Yes  No  (If yes, version not allowed) | Not Applicable | Not Applicable | Use another Annex A set of specifications |
| On-board ETCS implementation | 4.13.1.7 ETCS on-board implementation | Yes  No  (If yes, version not allowed) | Fulfilling all the conditions in point 7.2.1a.2 (change of realisation) | Not Applicable | Not fulfilling all the conditions in point 7.2.1a.2 (Functional change) |
| Managing information about the completeness of the train | 4.13.1.9 Managing information about the completeness of the train | Yes  No | Not Applicable | Adding or removing train integrity supervision | Not Applicable |
| 4.2.17.1 ETCS System Compatibility | ETCS System Compatibility | 4.13.1.8 ETCS System Compatibility | Yes  No | Not Applicable | Adding or removing ESC statements, after checking by a NoBo | Not Applicable |
| 4.2.4 Mobile communication  functions for railways GSM-R  4.2.4.2 Voice and operational communication application | GSM-R Baseline | 4.13.2.1 GSM-R Radio voice on board and its Baseline | Yes  No  (If yes, version not allowed) | Use another Baseline fulfilling all the conditions in point 7.2.1a.3 | Not Applicable | Use another Baseline not fulfilling all the conditions in point 7.2.1a.3. |
| Voice and operational communication implementation | 4.13.2.6 Voice and operational communication implementation | Yes  No  (If yes, version not allowed) | Fulfilling all the conditions in point 7.2.1a.3 (change of realisation) | Not Applicable | Not fulfilling all the conditions in point 7.2.1a.3 (Functional change) |
| SIM Card support of Group ID 555 | 4.13.2.12 Voice SIM Card support of Group ID 555 | Yes  No | Not Applicable | Change the SIM Card support of group ID 555 | Not Applicable |
| 4.2.17.2 Radio System Compatibility | Radio Voice System  Compatibility | 4.13.2.5 Radio Voice System Compatibility | Yes  No | Not Applicable | Adding or removing  RSC statements, after  checking by a NoBo | Not Applicable |
| 4.2.4 Mobile communication  functions for railways GSM-R  4.2.4.3 Data communication applications for ETCS | GSM-R Baseline | 4.13.2.7 GSM-R Radio Data communication on board and its Baseline | Yes  No  (If yes, version not allowed) | Use another Baseline fulfilling all the conditions in point 7.2.1a.3. | Not Applicable | Use another Baseline not fulfilling all the conditions in point 7.2.1a.3 |
| Data communication  for ETCS implementation | 4.13.2.9 Data communication application for ETCS implementation | Yes  No  (If yes, version not allowed) | Fulfilling all the conditions in point 7.2.1a.3 (change of realisation) | Not Applicable | Not fulfilling all the conditions in point 7.2.1a.3 (Functional change) |
| 4.2.17.2 Radio System Compatibility | Radio Data System Compatibility | 4.13.2.8 Radio Data System Compatibility | Yes  No | Not Applicable | Adding or removing RSC statements, after checking by a NoBo | Not Applicable |
| 4.2.4 Mobile communication functions for railways GSM-R  4.2.4.1 Basic communication function | IM Card GSM-R Home Network | 4.13.2.10 Voice SIM Card GSM-R Home Network | Yes  No | Not Applicable | Replacement of a TSI compliant GSM-R SIM Card by another TSI compliant GSM-R SIM Card with a different GSM-R Home Network | Not Applicable |
| 4.2.6.1 ETCS and Class B train protection | Class B train protection legacy system | 4.13.2.11 Data SIM Card GSM-R Home Network | Yes  No | The requirements for Class B system are the responsibility of the relevant Member State. | The requirements for Class B system are the responsibility of the relevant Member State. | Add or remove Class B train protection systems. The requirements for Class B system are the responsibility of the relevant Member State. |
| 4.2.5.1 Radio communication with the train | Class B radio legacy system | 4.13.2.3 Class B or other radio systems installed (system and, if applicable, version) | Yes  No | The requirements for Class B system are the responsibility of the relevant Member State. | The requirements for Class B system are the responsibility of the relevant Member State. | Add or remove Class B radio legacy systems. The requirements for Class B system are the responsibility of the relevant Member State. |

**I.4.2. Conditions for a change in the on-board ETCS not impacting basic design characteristics**

CCS TSI 7.2.1a.2. Conditions for a change in the On-board ETCS functionality that does not impact the basic design characteristics

|  |  |
| --- | --- |
| **Conditions for a change in the On-board ETCS functionality that does not impact the basic design characteristics** | **Condition fulfilled?** |
| 1. The target functionality[[7]](#footnote-7) remains unchanged or is set to the state already expected during the original certification or authorisation | Yes  No |
| 2. The interfaces relevant for safety & technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation. | Yes  No |
| 3. The result of the safety judgement (e.g., safety case according to EN 50126) remains unchanged | Yes  No |
| 4. No new safety related application conditions (SRAC) or interoperability constraints have been added due to the change. | Yes  No |
| 5. An Assessment Body (CSM RA) as specified in point 3.2.1 has independently assessed the applicant's risk assessment and within it the demonstration that the change does not adversely affect safety. The applicant's demonstration shall include the evidence that the change actually corrects the causes of the initial deviation of the functionality | Yes  No |
| 6. The change is performed under a quality management system approved by a notified body (e.g., according to modules CH1, SH1, CD, SD). For other modules (e.g., CF, SF) it shall be justified that the verification performed remains valid[[8]](#footnote-8) | Yes  No |
| 7. The individual configuration management defines a ‘system identifier’ (as defined in 7.2.1a.1.11) and the functional part has not been changed after the change. | Yes  No |
| 8. The change shall be part of the configuration management required by Article 5 of Regulation (EU) 2018/545. | Yes  No |

**I.4.3. Conditions for a change in the on-board mobile communications functions (EDOR and/or cab radio) not impacting basic design characteristics**

CCS TSI 7.2.1a.3. Conditions for a change in the on-board mobile communication

functions for railways that does not impact the basic design characteristics

|  |  |
| --- | --- |
| **Conditions for a change in the on-board mobile communication functions**  **for railways that does not impact the basic design characteristics** | **Condition fulfilled?** |
| The target functionality[[9]](#footnote-9) remains unchanged or is set to the state already expected during the original certification or authorisation. | Yes  No |
| 2. The interfaces relevant for technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation | Yes  No |
| 3. The change is performed under a quality management system approved by a notified body (e.g., according to modules CH1, SH1, CD, SD). For other modules (e.g., CF, SF) it shall be justified that the verification performed remains valid [[10]](#footnote-10) | Yes  No |
| 4. The change shall be part of the configuration management required by Article 5 of the Regulation (EU) 2018/545. | Yes  No |

1. More information on EVN (especially the Decision 2007/756/EC) can be found at: <https://www.era.europa.eu/registers_en#ecvvr>. All the vehicles concerned should be identical between them. Should you wish to submit notifications for different batches of vehicles, please submit independent notifications. [↑](#footnote-ref-1)
2. Coded restrictions to be specified according to Annex II of Decision 2011/665/EU (as amended by Regulation (EU) 2019/776) and technical document ERA/TD/2011-09/INT (available in ERA website). [↑](#footnote-ref-2)
3. Describe briefly the rational and reasons for arriving to the category for the change pursuant to Article 15(1) of Regulation (EU) 2018/545. The evidence of the categorisation of the change are to be included in the file accompanying the application for authorisation, see point 14.7 of Annex XIV of the [VA Guidelines](http://www.era.europa.eu/sites/default/files/applicants/docs/application_guide_vehicle_authorisation_en.pdf). [↑](#footnote-ref-3)
4. Please verify that the applicable rules (TSIs, national rules, other legislation of the union) do not render the type authorisation invalid or require a new authorisation for the change being considered. In particular, if the change concerns CCS, please notice that CCS TSI, as amended by Regulation (EU) 2019/776, requires that all types with an on-board ERTMS with baseline 2 (B2) are renewed. [↑](#footnote-ref-4)
5. Please describe the process followed to arrive to the conclusion that the change does not have the potential for impacting safety adversely (before its implementation, verification and validation). In particular, when the written declaration referred to in 3.10 and Annex I I.1 is different, and this is due to a change in the AsBo report [↑](#footnote-ref-5)
6. Basic Design Characteristics, as described in tables 17a & 17b of LOC&PAS TSI (Regulation (EU) 1302/2014 , table 11a of WAG TSI (Regulation (EU) 321/2013), table 7.1 of CCS TSI (Regulation (EU) 2016/919) and Article 48(c) of Regulation (EU) 2018/545. [↑](#footnote-ref-6)
7. Target functionality refers to the ETCS functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation [↑](#footnote-ref-7)
8. All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body. [↑](#footnote-ref-8)
9. Target functionality refers to the mobile communication functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation. [↑](#footnote-ref-9)
10. All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body. [↑](#footnote-ref-10)