enormous comparison of static und dynamic test procedure
land traffic accidents

accidents with buses

- **2012 - 03 - 13**
  - Siders – Switzerland
  - fatalities: 28
    - (24 children)
  - serious injured: 24
  - crash into tunnel wall

- **2017 – 08 – 09**
  - Shanxi – China
  - fatalities: 36
  - serious injured: >13
  - crash into tunnel wall

- **2003 - 06 - 07**
  - Erzincan – Turkey
  - fatalities: 27
  - serious injured: 33
  - crash into tunnel wall
Regulation No. 80 Rev.02 Amendment 02

This Regulation Applies To:

Passenger seats for forward-facing installation in vehicles of categories M2 and M3, of Classes II, III and B1;

Vehicles of categories M2 and M3 of Classes II, III and B1 in respect of their passenger seat anchorages and seat installation.

Does not apply to rearward-facing seats or to any head restraint fitted to these seats.

As stated in the Consolidated Resolution on the Construction of Vehicles (R.E.3.), document ECE/TRANS/WP.29/78/Rev.2, para. 2

Classification of power-driven vehicles and trailers

Vehicles of category M2 and M3 belong to:

For vehicles having a capacity exceeding 22 passengers in addition to the driver, there are three classes of vehicles:

2. **Class II**: Vehicles constructed principally for the carriage of seated passengers, and designed to allow the carriage of standing passengers in the rear, and/or in an area which does not exceed the space provided for two double seats.

3. **Class III**: Vehicles constructed exclusively for the carriage of seated passengers.

4. A vehicle may be regarded as belonging in more than one Class. In such a case it may be approved for each Class to which it corresponds.

For vehicles having a capacity not exceeding 22 passengers in addition to the driver, there are two classes of vehicles:

2. **Class B**: Vehicles not designed to carry standing passengers; a vehicle of this class has no provision for standing passengers.

2/14/2017  Systems comparison of static und dynamic test procedures within UN Regulation No. 80
Regulation No. 80 Rev.02 Amendment 02

Requirements for seats

Each type of forward-facing seat shall be subject to the test requirements of either Appendix 1 (dynamic test) or Appendices 5 and 6 (static test) at the request of the manufacturer.

The tests which the seat type has passed shall be recorded in the communication form concerning the approval of a seat type and referring to the model in Annex 1.

Every adjustment and displacement system provided shall incorporate a locking system, which shall operate automatically.

The adjustment and locking systems shall not be required to be in full working order after the test.

A head restraint shall be mounted on every outboard front seat in every vehicle of category M2 with a maximum mass not exceeding 3.5 tonnes. This head restraint shall comply with the requirements of Regulation No. 25, as amended by the 03 series of amendments.
Regulation No. 80 Rev.02 Amendment 02 - Appendix 1

Dynamic test requirements and procedure

Requirements

- Back effect by seat(s) in front of the occupant and/or by a safety belt

This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6 m from the R point of the auxiliary seat;

- Compliance with biomechanical criteria

<table>
<thead>
<tr>
<th>forward-facing seat with HYBRID II or III dummy</th>
<th>side-facing seat with dummy according to Regulation No. 95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy</td>
<td>HYBRID II or III</td>
</tr>
<tr>
<td>HIC</td>
<td>&lt; 500</td>
</tr>
<tr>
<td>Thorax acceptability criterion (ThAC)</td>
<td>&lt; 30 g (for periods &gt; 3ms)</td>
</tr>
<tr>
<td>Femur acceptability criterion (FAC)</td>
<td>&lt; 10 kN and &lt; 8 kN (for periods &gt; 20 ms)</td>
</tr>
<tr>
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<tr>
<td></td>
<td>HIC</td>
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<tr>
<td></td>
<td>&lt; 500</td>
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<tr>
<td></td>
<td>Rib Deflection Criterion (RDC)</td>
</tr>
<tr>
<td></td>
<td>≤ 42 mm</td>
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<tr>
<td></td>
<td>Soft Tissue Criterion (VC)</td>
</tr>
<tr>
<td></td>
<td>1.0 m/sec</td>
</tr>
<tr>
<td></td>
<td>Pubic Symphysis Peak Force (PSPF)</td>
</tr>
<tr>
<td></td>
<td>≤ 6 kN</td>
</tr>
<tr>
<td></td>
<td>Abdominal Peak Force (APF)</td>
</tr>
<tr>
<td></td>
<td>≤ 2.5 kN internal (equivalent to external force of 4.5 kN)</td>
</tr>
</tbody>
</table>

- Compatibility of seats and seat anchorages

- No complete separation, seat remains firmly held (partial separation ok), locking systems remain locked, no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners

- Requirements
PARATION OF THE SEAT TO BE TESTED

- Install on a testing platform (representative of the body of a vehicle or rigid).
- Anchorage on the testing platform provided for the test seat(s) shall be identified to or
  the same characteristics as that used in vehicle(s) in which the seat is intended to be
  used.
- Shall be complete
- Justable laterally, the seat shall be positioned for maximum extension.
- Back angle according to manufacturer recommendation or as near as possible to 25°
  available, a head restraint adjustable for height shall be in ist lowest position
  mounting of safety belts of an approved type
Regulation No. 80 Rev.02 Amendment 02 - Appendix 1

Dynamic test requirements and procedure

**DYNAMIC TESTS**

- **Test spacing 750 mm**
- **Height according to vehicle configuration**
- **Auxiliary seat restrained by an approved type safety belt**
- **Tested seat restrained by an approved type safety belt**

Average deceleration or acceleration between 3.0 g and 8.5 g

1. **Test 1**
   - Kinik unrestrained

2. **Test 2**
   - Kinik restrained by an approved type safety belt

*according to figure 1

*According to vehicle configurations to be tested

**Figure 1**

Systems comparison of static and dynamic test procedures within UN Regulation No. 80

2/14/2017
Regulation No. 80 Rev.02 Amendment 02 - Appendix 1

Dynamic test - kinematic of the dummy

<table>
<thead>
<tr>
<th>DUMMY UNRESTRAINED</th>
<th>DUMMY WITH TWO-POINT BELT</th>
<th>DUMMY WITH THREE-POINT BELT</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t = 0 )</td>
<td>( t = 0 )</td>
<td>( t = 0 )</td>
</tr>
</tbody>
</table>

Systems comparison of static und dynamic test procedures within UN Regulation No. 80
Regulation No. 80 Rev.02 Amendment 02 - Appendix 1

Dynamic test - kinematic of the dummy

<table>
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<tr>
<th>DUMMY UNRESTRAINED</th>
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<tr>
<td>KNEE CONTACT WITH TESTED SEAT</td>
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</tbody>
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<tr>
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<tr>
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</thead>
<tbody>
<tr>
<td>KNEE CONTACT WITH TESTED SEAT</td>
</tr>
</tbody>
</table>
Regulation No. 80 Rev.02 Amendment 02 - Appendix 1

DUMMY UNRESTRAINED
HEAD CONTACT WITH TESTED SEAT

DUMMY WITH TWO-POINT BELT
HEAD CONTACT WITH TESTED SEAT

DUMMY WITH THREE-POINT BELT
HEAD CONTACT WITH TESTED SEAT

mic test - kinematic of the dummy
Regulation No. 80 Rev.02 Amendment 02 - Appendix 5

seat test requirements and procedure

- back effect by seat(s) in front of the occupant

- maximum displacement of the central of application of each force does not exceed 400mm

- occupant injury risk

- minimum displacement of the central of application of each force (upper/lower) 100mm / 50mm

- radii-requirement $R > 5mm$ for Shore 50 A

- no radii-requirements (seat and accessories) below a horizontal plane 400mm above the reference plane, even if the occupant may contact them

- distance of seats and seat mountings

- no complete separation

- seat remains firmly held (partial separation ok)

- locking systems remain locked

- no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners
H1 test requirements and procedure

**STATIC TEST**

- Force: 1000/H1 ± 50 N
- Height: H1 between 0.70 m and 0.80 m above the reference plane, respectively determination by the manufacturer.

- Load: 1000/H2 ± 50 N
- Height: H2 between 0.45 m and 0.55 m above the reference plane, respectively determination by the manufacturer.

- Load of at least 20 N
- Forces indicated above shall be applied as rapidly as possible and shall be maintained together at the specified value, whatever the deformation, for at least 10 seconds.
Regulation No. 80 Rev.02 Amendment 02 - Appendix 5

Basic test requirements and procedure

<table>
<thead>
<tr>
<th>t = 0</th>
<th>$F_{\text{max}}$</th>
</tr>
</thead>
</table>

2/14/2017  Systems comparison of static und dynamic test procedures within UN Regulation No. 80
### APPENDIX 1 – DYNAMIC TEST

| hold-back effect by seat(s) in front of the occupant and/or by a safety belt | hold-back effect by seat(s) in front of the occupant |
| compliance with biomechanical criteria | occupant injury risk |
| resistance of seats and seat anchorages | resistance of seats and seat anchorages |
| radii-requirements | |

### APPENDIX 5 – STATIC TEST
Comparison static/dynamic test

APPENDIX 1 – DYNAMIC TEST

APPENDIX 5 – STATIC TEST
### APPENDIX 1 – DYNAMIC TEST

- testing of belted and unbelted occupants
- analysis of the kinematics (interaction) of dummy and seat
- inertia of dummy and seat
- test of seat anchorages – slide effect
- high relevance to actual accident occurrence due to the use of dummies (see road traffic accidents)

- acceptable forward displacement (1.6m) is too critical
- longitudinal seat displacement is not limited (occupant rescue space)

### APPENDIX 5 – STATIC TEST

- testing of seat strength

- force absorption test only
- interaction dummy/seat (belted, unbelted) is not considered
- no dynamic effects (inertia, sliding, kinematics etc.)
Regulation No. 80 Rev.02 Amendment 02

Summary

The performance of the seat in a real crash depends on the chosen test procedure (static or dynamic). The dynamic test has a higher relevance to actual accident occurrence because of the evaluation of biomechanical criteria. The assessment of the kinematics of dummy and seat analysis of the crash performance of unbelted and belted occupants. The static test analyzes the force absorption of the seat only.

Knowledge on both procedures from over 500 type approval tests.

To increase the safety of occupants in buses in case of a collision, it is recommended to:

- delete the static test and thereby the choice between two different test procedures of UN Regulation No.80
- modify UN Regulation No.80 in certain paragraphs
Appendices

Appendix 1  Test procedures for seats according to paragraph 5. and/or anchorages according to paragraph 6.1.2. and/or the installation of side-facing seats according to paragraph 3. of Appendix 7 ........................................ 11

Appendix 2  Test procedure for the anchorages of a vehicle in application of paragraph 6.1.1 ................................................. 16

Appendix 3  Measurements to be made ......................................................................................................................................................... 17

Appendix 4  Determination of acceptability criteria .......................................................................................................................... 18

Appendix 5  **Static test requirements and procedure reserved.** ........................................................................................................... 20

Appendix 6  Energy absorption characteristics of the rear part of seatbacks ......................................................................................... 23

Appendix 7  Requirements for the safeguarding of passengers in side-facing seats according to paragraph 7.4.4. ................................................................................................................................. 24
1. **Scope**

1.1. This Regulation applies to:

(a) Passenger seats for forward-facing installation in vehicles of categories M2 and M3, of Classes II, III and B 1);

(b) Vehicles of categories M2 and M3 of Classes II, III and B 1) in respect of their passenger seat anchorages and their installation.

(c) It does not apply to rearward-facing seats or to any head restraint fitted to these seats.

1.2. At the request of the manufacturer, vehicles of category M2 1) approved to Regulation No. 17 shall be deemed to meet the requirements of this Regulation.

1.3. Vehicles where some seats benefit from the derogation provided in paragraph 7.4. to Regulation No. 14 shall be approved to Regulation No. 80.

1.4. The installation of side-facing seats shall be prohibited in vehicles of categories M2 (of classes II, III and B) and M3 (of classes II, III and B) with the exception of vehicles of category M3 (of classes II, III and B) of a technically permissible maximum laden weight exceeding 10 tonnes provided the requirements of paragraph 7.4. are met.

1.5. Paragraph 1.4. shall not apply to ambulances or to vehicles intended for use by the armed services, civil defense, fire services and forces responsible for maintaining public order.

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1. 1) as defined in the Commission Regulation on the co-ordination of vehicle (E.E.C.), document DC/73/616/79/758/Rev. 2, point 2.
4. Approval

4.1. If the seat submitted for approval under this Regulation meets the relevant requirements of paragraph 5. below, approval of that seat type shall be granted.

4.2. If the vehicle submitted for approval under this Regulation meets the relevant requirements of paragraphs 6. and 7. below, approval of that vehicle type shall be granted.

4.3. An approval number shall be assigned to each type approved. Its first two digits (at present 03 04, corresponding to the series of amendments) shall indicate the series of amendments incorporating the most recent major technical amendment to the Regulation at the time of issue of the approval. The same Contracting Party shall not assign the same number to any other seat type or any other vehicle type.

4.4. Notice of approval or of extension or refusal of approval of a seat type and/or a vehicle type pursuant to this Regulation shall be communicated to the Parties to the 1958 Agreement applying this Regulation, by means of a form conforming to the model in Annex 1 and/or Annex 2 to this Regulation.
5. Requirements for seats

5.1. Each type of forward-facing seat shall be subject to the test requirements of either Appendix 1 (dynamic test) or Appendix 2, if applicable Appendix 1 in combination with Appendix 6 (static test) at the request of the manufacturer.

5.2. The tests which the seat type has passed shall be recorded in the communication form concerning the approval of a seat conforming to the model in Annex 1.

5.3. Every adjustment and displacement system provided shall incorporate a locking system, which shall operate automatically.

5.4. The adjustment and locking systems shall not be required to be in full working order after the test.

5.5. A head restraint shall be mounted on every outboard front seat in every vehicle of category M2 with a maximum mass exceeding 3,500 kg. This head restraint shall comply with the requirements of Regulation No. 25, as amended by the 04 series of amendments.
7.1.3. The torque to attach the seat anchorages in order to meet the requirements of Appendix 1 shall be specified by the vehicle manufacturer. This requirement does not apply to interlocking seat fixations and seat fixations with a center force application.

7.1.3.1. If applicable the torque to attach the seat anchorages specified by the vehicle manufacturer shall be shown by a pictogram fixed to the seat.

7.1.3.2. The procedure to attach the seat and if applicable the torque to attach the seat shall be contained in the owner’s manual of the vehicle.

7.3. When approved to Appendices 5 and 6, all tests shall apply, except as follows:

7.3.1. The test of Appendix 5 shall not apply if the rear of the seat cannot be struck by an unrestrained passenger (i.e. there is no forward or side-facing seat directly behind the seat to be tested).

7.3.2. The test of Appendix 6 shall not apply:

7.3.2.1. If the rear of the seat cannot be struck by a restrained passenger; or

7.3.2.2. If the seat behind is a forward-facing seat fitted with a 3-point belt with anchorages that comply fully with Regulation 14 (without derogation).

7.4. Renumbering to 7.3., 7.3.1., 7.3.2., 7.3.3. and 7.3.4.
12.5. Even after the date of entry into force of the 02 series of amendments, approvals of the components to the 01 series of amendments to this Regulation shall remain valid and Contracting Parties applying this Regulation shall continue to accept them and shall not refuse to grant extensions of approval to the 01 series of amendments to this Regulation.

12.6. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approvals under this Regulation as amended by the 03 series of amendments.

12.7. As from 24 months after the date of entry into force of the 03 series of amendments Contracting Parties applying this Regulation shall grant approvals for new vehicle types only if the requirements of this Regulation, as amended by the 03 series of amendments, are satisfied.

12.8. Starting 60 months after the entry into force of the 03 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse national or regional type approval and may refuse first national or regional registration (first entry into service) of a vehicle which does not meet the requirements of the 03 series of amendments to this Regulation.

12.9. Even after the date of entry into force of the 03 series of amendments, approvals of components to the 01 or 02 series of amendments to this Regulation shall remain valid and Contracting Parties applying this Regulation shall continue to accept them and shall not refuse to grant extensions of approval to the 01 or 02 series of amendments to this Regulation.
12.9. Even after the date of entry into force of the 03 series of amendments, approvals of components to the 01 or 02 series of amendments to this Regulation shall remain valid and Contracting Parties applying this Regulation shall continue to accept such approvals and shall not refuse to grant extensions of approval to the 01 or 02 series of amendments to this Regulation.

12.10. As from the official date of entry into force of the 04 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept UN type-approvals under this UN Regulation as amended by the 01 and 02 series of amendments.

12.11. As from 1 September [2019], Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals to the preceding series of amendments, first issued after 1 September 20[19].

12.12. Until 1 September [2020], Contracting Parties applying this UN Regulation shall accept UN type-approvals to the preceding series of amendments, first issued before 1 September 20[19].

12.13. As from 1 September [2020], Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals issued to the preceding series of amendments to this Regulation.

12.14. Contracting Parties applying this UN Regulation shall not refuse to grant UN type-approvals according to any preceding series of amendments to this UN Regulation or extensions thereof.
Regulation No. 80 Rev.02

Proposal for the 04 series of amendments to UN Regulation No.80

1. Requirements

1.1. The tests are to determine:

1.1.1. If the seat occupant(s) is (are) correctly retained by the seat(s) in front of him (them) and/or by the use of a safety belt.

1.1.1.1. This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical planes situated at 1.6 m from the R point of the auxiliary seat.

1.1.1.2. If the seat occupant(s) is (are) not seriously injured.

1.1.2. If the seat occupant(s) is (are) not seriously injured.

1.1.2.1. This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6 m

1.2. If the seat occupant(s) is (are) not seriously injured.

1.2.1. The forward movement of any part of the trunk and the head of the manikin shall not exceed 300 mm *.

1.2.2. This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6 m from the R point of the auxiliary seat.

1.2.3. If the seat occupant(s) is (are) not seriously injured.

1.2.3.1. This requirement shall be considered satisfied if the forward movement of any part of the trunk and the head of the manikin does not pass beyond the transversal vertical plane situated at 1.6 m from the R point of the auxiliary seat.

1.2.3.2. If the seat occupant(s) is (are) not seriously injured.

1.2.3.3. If the seat occupant(s) is (are) not seriously injured.

1.2.3.4. If the seat occupant(s) is (are) not seriously injured.

*R forward-displacement of loaded seat + move
1.1.3.1.1. No part of the seat, the seat mountings or the accessories becomes completely detached during the test;

1.1.3.1.2. The seat remains firmly held, even if one or more anchorages are partly detached, and all the locking systems remain locked during the whole duration of the test;

This requirement shall be considered satisfied if no part of the anchorage of the seat has moved more than 100 mm in the direction of the test;

1.1.3.1.3. After the test no structural part of the seat or accessories has any fracture or sharp or pointed edges or corners likely to cause any bodily injury.
2. Preparation of the seat to be tested

2.1. The seat to be tested shall be mounted:

2.1.1. Either on a testing platform representative of the body of a vehicle

2.1.2. Or on a rigid testing platform.

2.2. The anchorage on the testing platform provided for the test seat(s) shall be identified to or have the same character as that used in vehicle(s) in which the seat is intended to be used.

2.3.

2.7. Renumbering as 2.2., 2.3., 2.4., 2.5., and 2.6.
Regulation No. 80 Rev.02

Proposal for the 04 series of amendments to UN Regulation No.80

3. Dynamic test

3.1. Test 1

The testing platform shall be mounted on a trolley. If applicable, the seats shall be attached to the testing platform with a torque specified by the manufacturer.
Appendix 5

Static test requirements and procedure

---

reserved
Annex 1

5.1. Brief description of the seat type, its attachment fittings and its adjustment, displacement and locking systems including the minimum distance between fitting points and if applicable, the torque for the seat fixation:

5.7. Seat approved in accordance with paragraph 5.1. of this Regulation (static test): yes/no  

5.8. Test according to Appendix 5: yes/no  

5.9. Test according to Appendix 6: yes/no
Proposal for the 04 series of amendments to UN Regulation No.80

5.1. Brief description of the vehicle type according to its anchorages and minimum value of the distance between the anchorages applicable, the torque for the seat fixation.
The above approval mark affixed to a seat shows that the seat type concerned has, with regard to the strength of the seats, being carried out in accordance with paragraph 2 of Annex 4, been approved in the Netherlands (E4) under number 032439. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 80 as amended by the 03 04 series of amendments.

80 - 03 04 2439

The above approval mark, affixed to a vehicle, shows that this type of vehicle has been approved in the Netherlands (E4) under number 032439 with regard to the strength of the anchorages on the vehicle. The approval number indicates that the approval was granted in accordance with the requirements of Regulation No. 80 as amended by the 03 04 series of amendments.