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SIA 269/1:2011 Construction

505 269/1

Together with Code SIA 269, replaces Guideline SIA 462, 1994 edition

Erhaltung von Tragwerken – Einwirkungen
Maintenance des structures porteuses – Actions
Conservazione delle strutture portanti – Azioni

Existing structures – Actions

269/1

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FOREWORD

Code SIA 269/1 describes the specifications and the procedure to be followed in the updating of actions on existing structures and is directed at specialists in the preservation of structures and at owners of structures.

Code SIA 269/1 forms part of the SIA's structural codes relating to existing structures and is supplemented by the following codes:

- Code SIA 269 Existing structures – Bases for examination and interventions
- Code SIA 269/2 Existing structures – Concrete structures
- Code SIA 269/3 Existing structures – Steel structures
- Code SIA 269/4 Existing structures – Composite steel and concrete structures
- Code SIA 269/5 Existing structures – Timber structures
- Code SIA 269/6 Existing structures – Masonry structures
- Code SIA 269/7 Existing structures – Geotechnics.

Technical Specification SIA 2018 continues to apply to the examination of existing buildings with respect to earthquakes. However, it is planned to supplement the codes for existing structures with a Code SIA 269/8 *Existing structures – Seismic aspects*.

Code SIA 269/1 governs the various aspects of actions on existing structures that are not covered by Codes SIA 261 and SIA 261/1.

Codes SIA 269 Project Management Team and Working Group SIA 269/1

0 SCOPE

0.1 Limitations

0.1.1 Code SIA 269/1 treats the basic principles and the updating of actions on existing structures of all types and methods of construction.

0.1.2 The present code applies in combination with Codes SIA 269 and SIA 269/2 to 269/8, as well as Codes SIA 261 and SIA 261/1. The basic principles of Code SIA 269/1 shall be applied analogously for applications outside of the scope of these codes.

0.1.3 In the case of modifications, in general new structural components shall be treated according to Code SIA 261 and existing structural components according to Codes SIA 269 and 269/1. It is permissible to deviate from this rule with respect to the definition of the variable actions if different limitations are appropriate on the basis of specific considerations.

0.1.4 Code SIA 269/1 may not be used for the design and dimensioning of new structures.

0.2 References

0.2.1 Reference is made to the standards named below. These are also applicable by way of reference:

- Code SIA 261/1 *Actions on structures – Supplementary definitions*
- Technical Specification SIA 2018 *Examination of existing buildings with respect to earthquakes*
- SN EN 1991-2 *Actions on structures – Part 2: Traffic loads on bridges*.

0.2.2 Codes and guidelines that have been superseded may not be incorporated in the service criteria agreement and in the basis of design as code-related requirements, but only by way of reference, and only in order to document former basic principles.

0.3 Deviations

0.3.1 Deviations from the present code are permissible provided they are sufficiently well-founded, theoretically or experimentally, or justified by new developments and new knowledge.

0.3.2 Deviations from the code shall be clearly documented in the construction documents together with the reasons for such deviation.

1 TERMINOLOGY

1.1 Technical terms

The technical terms defined in Codes SIA 260, SIA 261, SIA 261/1 and SIA 269 are used in the present code.

1.2 Symbols

1.2.1 Latin upper case letters

$E_{act,LC}$	updated action effects as a result of standard gauge railway traffic of a particular track class
$E(Q_{k,LM1})$	action effects of the standard load model 1 for standard gauge railway traffic in accordance with Code SIA 261
G	planned future traffic volume per year and track
$G_{k,act}$	updated characteristic value for dead loads and imposed loads
K_0	coefficient of earth pressure at rest
N_0	number of vehicles >3,5 t per year and direction of travel
N_{obs}	planned future traffic volume
$P_{k,act}$	updated characteristic value for prestressing
Q_{act}	nominal axle load
$Q_{k,act}$	updated characteristic value
$QA_{k,act}$	updated characteristic value for acceleration force
$QB_{k,act}$	updated characteristic value for braking force
$QS_{k,act}$	updated characteristic value for nosing force for standard gauge railway traffic
T_{tot}	entire service life

1.2.2 Latin lower case letters

l	length, distance
l_Φ	decisive length for determination of the dynamic factor
$q_{k,act}$	updated characteristic value of a distributed load or force
q_{k1}	characteristic value for distributed load on the notional lane 1
q_{p0}	characteristic value for dynamic pressure
s	track gauge
s_k	characteristic value for the snow load on horizontal terrain
v_{max}	maximum permitted speed for rail traffic

1.2.3 Greek letters

$\alpha_{Qi,act}$ $\alpha_{qi,act}$ $\alpha_{qr,act}$	updating factors for road traffic
$\lambda_1 \ldots \lambda_4$	partial factors for operating loads
$1+\varphi$	dynamic factor for rail traffic
Φ	dynamic factor in accordance with code SIA 261

2 DEAD LOADS AND IMPOSED LOADS

2.1 General

2.1.1 The relevant geometrical properties and weight per unit volume of the structure shall be determined in order to define the updated characteristic value of dead loads and imposed loads. In general, this takes place during the condition survey. The method used to determine these variables shall be chosen according to the necessary degree of detail.

2.1.2 Dead loads shall be grouped collectively with upper or lower examination values, depending on whether the overall effect is unfavourable or favourable. In the case of imposed loads, a collective grouping or a grouping according to zones of influence shall be assumed.

2.1.3 Where rehabilitations or modifications are being carried out, it shall be checked whether the geometrical properties and volumetric applied in order to define an updated characteristic value for dead loads and imposed loads are correct.

2.1.4 In the case of a transformation or extension of structures, the dead loads of new structural components and new imposed loads shallshall be treated in accordance with the code SIA 261.

2.2 Updating of dead loads

The updated characteristic value $G_{k,act}$ for dead loads shall be determined as an average value on the basis of the determined geometrical variables and volumetric loads.

2.3 Updating of imposed loads

2.3.1 The updated characteristic value $G_{k,act}$ of imposed loads shall be determined as an average value on the basis of the determined geometrical variables as well as the volumetric and area loads.

2.3.2 Measures shall be taken to guarantee the updated characteristic value $G_{k,act}$ of imposed loads, such as soil surcharge, fill, surfacing or track ballast. These measures shall be incorporated in the basis of design, in the service instructions and in the monitoring plan.

2.3.3 It shall be determined whether a removal or increase of an imposed load is possible or planned. The effects of a possible removal or increase of the imposed load shall be investigated.

3 PRESTRESSING

3.1 General

When updating the characteristic value for the geometry and the tensioning force, the specifications in the construction documents shall be evaluated and deformations of the structures that are attributable to losses in tensioning force during the previous service life shall be taken into consideration. In general, this takes place during the condition survey.

3.2 Updating

The updated characteristic value $P_{k,act}$ for prestressing takes into account the losses in tensioning force determined during the condition survey.

4 GROUND

4.1 General

The actions arising from the ground shall be defined taking into consideration
- the updated geotechnical parameters
- the updated geotechnical and structural models
- the updated hydrogeological conditions
- the updated hydrological situation
- the updated structural behaviour and
- any creep effects or special chemical or biological influences.

4.2 Updating

The specifications of Code SIA 269/7 apply.

5 SNOW

5.1 General

5.1.1 In general, the specifications of Code SIA 261 apply. Local conditions shall be taken into consideration.

5.1.2 The snow load may be determined through analogous application of the observation method. The snow load may be reduced appropriately where supplementary safety measures guarantee compliance with the maximum snow load.

5.2 Updating

5.2.1 The characteristic value for the snow load on horizontal terrain s_k in accordance with Code SIA 261 may be updated if corresponding series of measurements and their evaluation, ensuring adequate quality, justify this.

5.2.2 When determining the characteristic value for the snow load on roofs, the roof shape coefficient, the exposure factor and the thermal factor may be updated on the basis of documented object-specific information obtained over a period of years.

5.2.3 The examination value for the action effects as a result of the snow load on roofs may be determined using the method given in Appendix C of Code SIA 269.

6 WIND

6.1 General

In general, the specifications of Code SIA 261 apply. Local conditions shall be taken into consideration.

6.2 Updating

6.2.1 The characteristic value for dynamic pressure q_{p0} in accordance with Code SIA 261 may be updated if corresponding series of measurements and their evaluation, ensuring adequate quality, justify this.

6.2.2 When determining the characteristic values for the wind pressures and wind forces that act on the surfaces of structural members, the pressure and force coefficients may be updated on the basis of wind tunnel tests.

6.2.3 The examination value for the action effects as a result of wind may be determined using the method given in Appendix C of Code SIA 269.

7 TEMPERATURE

7.1 General

In general, the specifications of Code SIA 261 apply. Local conditions shall be taken into consideration.

7.2 Updating

The characteristic values for change in temperature for structures in accordance with Code SIA 261 may be updated if documented object-specific information, corresponding series of measurements and their evaluation, ensuring adequate quality, justify this.

8 USE OF BUILDINGS

8.1 General

The values stated in Code SIA 261 apply as characteristic values for live loads in existing buildings, for the categories A – D as well as F and G.

8.2 Updating

8.2.1 The characteristic values for the categories E and H shall be defined according to the planned use.

8.2.2 The live loads in existing buildings may be limited through supplementary safety measures. These supplementary safety measures shall be listed in the service criteria agreement as well as in the monitoring plan and in the service instructions.

9 NON-MOTORISED TRAFFIC

9.1 General

9.1.1 In general, the specifications of Code SIA 261 apply.

9.1.2 If vehicular access to the construction works is not prevented by means of a permanent barrier, an unforeseen crossing by heavy vehicles shall be treated as an accidental action. The applicable load model and the characteristic values shall be defined taking into consideration the local conditions and incorporated in the basis of design.

9.2 Updating

The updated characteristic value for load model 2 may be used if it is ensured that maintenance vehicles are used that cause lower loading effects than load model 2. The updating shall be defined project-specifically and incorporated in the service criteria agreement as well as in the basis of design. However, the minimum value of $Q_{k,act}$ = 7 kN shall be complied with.

10 ROAD TRAFFIC

10.1 General

10.1.1 The load models for road traffic in accordance with Codes SIA 261 and 261/1 may be updated.

10.1.2 In general, updating of the actions as a result of road traffic involves replacing the factors for calibrating the highway loads in accordance with Code SIA 261 with the updating factors $\alpha_{Qi,act}$, $\alpha_{qi,act}$ and $\alpha_{qr,act}$. All other specifications of Code SIA 261 remain valid.

10.1.3 For spans outside of the ranges stated in Section 10.2 as well as for arched bridges, suspension bridges or cable-stayed bridges, the updating shall be defined in agreement with the owner or the supervisory authority.

10.1.4 In the case of load restrictions signposted by the traffic police, the updating may take into consideration the nominal axle loads and geometrical properties of the permitted road traffic. The updated load model shall be defined in agreement with the owner or the supervisory authority.

10.2 Updating

10.2.1 Load model 1

10.2.1.1 The updating factors in accordance with Table 1 apply to bridges with two-way traffic and bridge widths from 6 to 9 m as well as to dual carriageway motorway bridges with a carriageway width of 9 to 12 m. They apply to the road traffic permitted by law without load limits and take into account dynamic effects and other wheel load increases as well as the foreseeable development of traffic up to the year 2025.

10.2.1.2 The operating condition is covered when road works are being carried out on four-lane motorways, of which two lanes are accessible to heavy traffic.

10.2.1.3 In accordance with Code SIA 261/1, the updated load model 1 does not cover exceptional transports of types I and II.

Table 1: Updating factors for road traffic loads (load model 1) for bridges

<table>
<tr><th colspan="2">Bridge type</th><th>Span [m]</th><th>$\alpha_{Q1,act}$</th><th>$\alpha_{Q2,act}$</th><th>$\alpha_{qi,act}$, $\alpha_{qr,act}$</th></tr>
<tr><td rowspan="4">Beam</td><td>Box girder</td><td>20–80</td><td rowspan="4">0,70[1) 2)]</td><td rowspan="4">0,50[1) 2)]</td><td>0,50[1)] (0,70[2)])</td></tr>
<tr><td>Two girders</td><td>20–80</td><td rowspan="3">0,40[1)] (0,70[2)])</td></tr>
<tr><td>Multiple girders</td><td>15–35</td></tr>
<tr><td>Slab</td><td>Slab</td><td>10–30</td></tr>
<tr><td colspan="2" rowspan="2">Slab bridges and other bridge types</td><td>5,3–10</td><td>0,60</td><td>0,40</td><td>0,40</td></tr>
<tr><td>< 5,3</td><td>0,50</td><td>0,40</td><td>0,40</td></tr>
<tr><td colspan="6">[1)] The crossing of mobile cranes with a maximum total weight of 60 t is taken into consideration.
[2)] Applies to exceptional transports of type II in accordance with SIA 261/1 and mobile cranes with a maximum total weight of up to 96 t.</td></tr>
</table>

10.2.1.4 In the case of structures for roads of secondary importance with a carriageway width of up to 6 m, the updating factors may be reduced in accordance with Table 1 in agreement with the owner or the supervisory authority. However, the updating factors may not be less than $\alpha_{Q1,act}$ = 0,50, $\alpha_{Q2,act}$ = 0,40 and $\alpha_{qi,act}$ = 0,40.

10.2.1.5 For single-lane bridges with a carriageway width $b < 5.4$ m, only the notional lane 1 with the updated actions in the most unfavourable load position shall be applied.

10.2.1.6 In contrast to the specification in Code SIA 261, in the vicinity of expansion joints the axle loads shall not be increased by a dynamic factor.

10.2.2 Acceleration and braking forces

The updated characteristic values for the acceleration force $Q_{Ak,act}$ and the braking force $Q_{Bk,act}$ consist of parts that are proportional to the loads of load model 1 on the notional lane 1:

$$QA_{k,act} = QB_{k,act} = 0{,}8\ Q_{k1} + 0{,}07\ q_{k1}\ b_1\ l \leq 600 \text{ kN} \quad (1)$$

in which b_1 width of the notional lane 1
l length of the structure or distance between the expansion joints of the examined section of the structure.

10.2.3 Fatigue

10.2.3.1 When determining the fatigue stresses, the load-bearing effect of edge beams or parapet walls may be taken in account.

10.2.3.2 In the case of local fatigue actions (carriageway slabs and beams, transverse beams) the fatigue safety may be verified using the fatigue strength. The updated axle loads $\alpha_{Q1,act} Q_{k1}$ in the centre of the notional lane 1 shall be applied for verification of the fatigue strength. In the case of two-lane motorway bridges, this notional lane is located in the near side lane in the direction of travel.

10.2.3.3 The fatigue load model in accordance with Code SIA 261 shall be used for verification of the fatigue strength. The following specifications apply for the partial factors for operating loads:
– partial factors for operating loads λ_1 and λ_4: as for new structures
– partial factor for operating loads λ_2, which takes in account the planned future traffic volume:

$$\lambda_2 = \left(\frac{N_{obs}}{N_0}\right)^{1/5} \quad (2)$$

where N_0 number of vehicles > 3,5 t per year and direction of travel in accordance with Code SIA 261, Table 12
N_{obs} estimated future traffic volume up to the end of the remaining service life in number of vehicles > 3,5 t per year and direction of travel.

– partial factor for operating loads λ_3 that takes in account the entire service life:

$$\lambda_3 = \left(\frac{T_{tot}}{100}\right)^{1/5} \quad (3)$$

where T_{tot} entire service life in years, i. e. total of the previous service life taking into consideration Section 10.2.3.4 and the remaining service life.

10.2.3.4 Fatigue stresses that occurred before 1960 may generally be neglected.

11 STANDARD GAUGE RAIL TRAFFIC

11.1 General

11.1.1 The following specifications apply to loads and forces resulting from normal use by rail traffic of the track classes C3, C4, D3, D4, E4 and E5 of the International Union of Railways (UIC). The construction works are classified under a particular track class by the infrastructure operator in agreement with the supervisory authority.

11.1.2 In special cases, loading tests can be useful in determining structural behaviour. These should be planned and conducted in agreement with the supervisory authority.

11.2 Updating

11.2.1 Vertical rail traffic loads

11.2.1.1 The updated actions shall be determined using the load models (model vehicles) for the track classes C3, C4, D3, D4, E4 and E5. The model vehicles for the relevant track class shall be assumed to be unlimited in number and with the geometrical properties represented in Figure 1, acting in the least favourable position. Axle loads with a load-relieving effect may be neglected.

Figure 1: Updated load models

Track class	Nominal axle load Q_{act} [kN]	Geometrical properties of the model vehicles, dimensions in m Q_{act} Q_{act} Q_{act} Q_{act}
C3	200	1,5 ↓ 1,8 ↓ 4,50 ↓ 1,8 ↓ 1,5 11,10
C4	200	1,5 ↓ 1,8 ↓ 3,40 ↓ 1,8 ↓ 1,5 10,00
D3	225	1,5 ↓ 1,8 ↓ 5,90 ↓ 1,8 ↓ 1,5 12,50
D4	225	1,5 ↓ 1,8 ↓ 4,65 ↓ 1,8 ↓ 1,5 11,25
E4	250	1,5 ↓ 1,8 ↓ 5,90 ↓ 1,8 ↓ 1,5 12,50
E5	250	1,5 ↓ 1,8 ↓ 4,75 ↓ 1,8 ↓ 1,5 11,35

11.2.1.2 The nominal axle load of the model vehicles shall be increased by 10% to take into account any exceeding of the axle load as a result of improper loading. The increase in the nominal axle load may be omitted in the case of structural components whose main direction of support runs parallel to the track and whose span or width between supports is greater than 20 m.

11.2.1.3 The dynamic effects as a result of irregularities in the track and rolling stock shall be taken into account using the speed-dependent dynamic factors in accordance with Appendix A.

11.2.1.4 For passenger trains with v_{max} > 200 km/h, the necessity of a structural dynamics analysis shall be examined. The procedure is based on SN EN 1991-2.

11.2.2 Horizontal rail traffic loads

11.2.2.1 The updated characteristic braking forces shall be determined with reference to Table 2.

Table 2: Updated characteristic values for braking forces for standard gauge (l: length in m on which the rail traffic loads act)

Track class	$QB_{k,act}$ [kN]
C3/D3	$18l \leq 5400$
C4/D4/E4	$20l \leq 6000$
E5	$22l \leq 6600$

11.2.2.2 The acceleration force shall be taken into consideration in accordance with Code SIA 261.

11.2.2.3 The centrifugal force is updated, analogously to Code SIA 261, with the axle loads of the model vehicles acting in accordance with Figure 1. For sections of line with a speed of $v_{max} \geq 120$ km/h, the updated centrifugal force may be determined using the reduction factor η in accordance with Code SIA 261.

11.2.2.4 The updated characteristic value $QS_{k,act}$ for the nosing force is 80 kN.

11.2.3 Fatigue

11.2.3.1 When determining the fatigue stresses, the load-bearing effect of kerbs and other equipment which increases rigidity, as well as the favourable effect of the track superstructure with continuously welded rails throughout may be taken in account.

11.2.3.2 The verification with respect to the fatigue limit shall be carried out with the updated actions in accordance with Section 11.2.1 and the dynamic factor in accordance with Appendix A.

11.2.3.3 The verification with respect to the fatigue strength shall be carried out in accordance with Code SIA 261 using load model 1 and the dynamic factor Φ.

For verification with respect to the fatigue strength, the following specifications apply for the partial damage equivalence factors:

- partial damage equivalence factor λ_1: as for new structures
- partial damage equivalence factor λ_2, which takes in account the estimated future traffic volume, shall be determined as follows:

$$\lambda_2 = \left(\frac{G}{25}\right)^{1/5} \tag{4}$$

where G represents the estimated future traffic volume in 10^6 t per year and track up the end of the remaining service life.

- partial damage equivalence factor λ_3, which takes in account the entire planned service life, shall be determined as follows:

$$\lambda_3 = \left(\frac{T_{tot}}{100}\right)^{1/5} \tag{5}$$

where T_{tot} represents entire service life in years, i.e. total of the previous service life taking into consideration Section 11.2.3.4 and the remaining service life.

- partial damage equivalence factor λ_4: as for new structures.

11.2.3.4 Fatigue stresses that occurred before 1940 may be neglected.

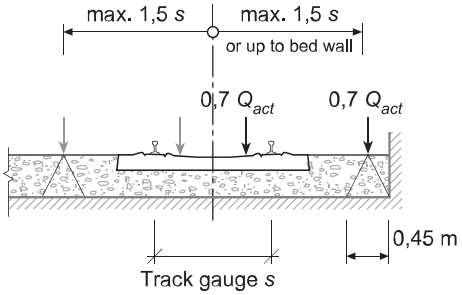
11.2.4 Derailment

11.2.4.1 The derailment of rail vehicles shall be treated as an accidental examination situation. The updated loads of derailed rail vehicles shall be taken into consideration with the derailment load models represented in Figure 2. Otherwise, the relevant specifications in Code SIA 261 apply analogously.

Figure 2: Derailment load models

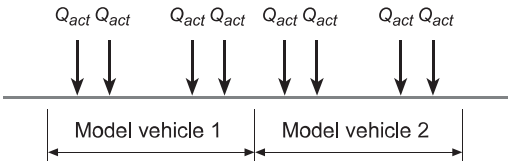
Derailment load model 1

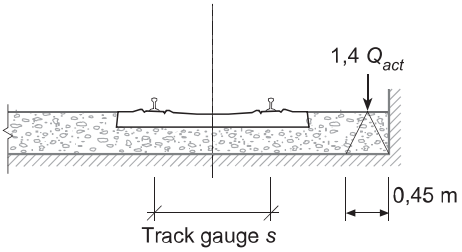
In a longitudinal direction, an unlimited number of model vehicles with the geometrical properties represented in Figure 1, acting in the least favourable position, shall be taken into consideration. Axle loads with a load-relieving effect shall be neglected.



Derailment load model 2

In a longitudinal direction, two model vehicles with the geometrical properties represented in Figure 1, acting in the least favourable position, shall be taken into consideration.





12 NARROW GAUGE RAIL TRAFFIC

12.1 General

12.1.1 Fundamentally, the specifications in accordance with Code SIA 261 apply.

12.1.2 In special cases, loading tests can be useful in determining structural behaviour. These shall be planned and conducted in agreement with the supervisory authority.

12.2 Updating

12.2.1 Vertical rail traffic loads

12.2.1.1 For situations involving a limited number of train types, the updating may be carried out taking into consideration the nominal axle loads and the geometrical properties of the trains permitted on the route network. Axle loads with a load-relieving effect shall be neglected. The load models for the trains shall be defined in consultation with the infrastructure operator and in agreement with the supervisory authority.

12.2.1.2 The dynamic effects as a result of irregularities in the track and rolling stock shall be taken into account with the speed-dependent dynamic factors in accordance with Appendix A.

12.2.2 Horizontal rail traffic loads

12.2.2.1 The updated characteristic braking force may be determined from the vertical loads of the applicable train. Acceleration force and nosing force shall be taken into consideration in accordance with Code SIA 261.

12.2.2.2 The centrifugal force shall be updated, analogously to Code SIA 261, with the nominal axle loads and the geometrical properties of the applicable train.

12.2.3 Fatigue

12.2.3.1 When determining the fatigue stresses, the load-bearing effect of kerbs and other equipment that increases rigidity, as well as the favourable effect of the track superstructure with continuously welded rails throughout, may be taken in account.

12.2.3.2 The verification with respect to the fatigue limit shall be carried out with the nominal axle loads and the geometrical properties of the applicable train as well as the dynamic factor in accordance with Appendix A.

12.2.3.3 The verification with respect to the fatigue strength shall be carried out with load models 4 or 5 and the dynamic factor Φ in accordance with Code SIA 261.

For verification with respect to the fatigue strength, the following specifications apply for the partial damage equivalence factors:
- partial damage equivalence factor λ_1: as for new structures
- partial damage equivalence factor λ_2: 1,0
- partial damage equivalence factor λ_3: in accordance with Section 11.2.3.3
- partial damage equivalence factor λ_4: as for new structures.

12.2.4 Derailment

The derailment of rail vehicles shall be treated as an accidental examination situation. The updating is carried out with the nominal axle loads of the applicable train and analogously in accordance with Section 11.2.4.

13 BARRIERS

13.1 General

13.1.1 The actions caused through crowding and the resulting forces imposed on barriers shall be defined in relation to the consequences of structural failure. The consequences of structural failure shall be estimated in accordance with Appendix B of Code SIA 269.

13.1.2 The existing measures (of a structural or operational nature) for resisting forces on barriers shall be evaluated.

13.2 Updating

13.2.1 In cases where the consequences of structural failure are serious, the characteristic values for the horizontal forces on barriers caused by persons during normal use correspond to those specified in Code SIA 261.

13.2.2 In cases where the consequences of structural failure are moderate or minor, the characteristic values for the horizontal forces on barriers caused by persons during normal use may be reduced by 50% in accordance with Code SIA 261.

13.2.3 Where crowds are present and the consequences of structural failure are serious, the examination value for the horizontal force on barriers is $q_{k,act}$ = 3,0 kN/m. In cases where the consequences of a structural failure are moderate or minor, $q_{k,act}$ = 2,0 kN/m.

14 IMPACT

14.1 The accidental actions as a result of impacts by road and rail vehicles as well as ships shall be defined in relation to the consequences of structural failure and in agreement with the owner or the supervisory authority.

14.2 The existing measures (of a structural or operational nature) for resisting forces resulting from impacts shall be evaluated.

15 FIRE

15.1 General

15.1.1 The updated accidental actions in the event of fire shall be defined on the basis of possible fire situations. The consequences of structural failure shall be taken into consideration when evaluating proportionality.

15.1.2 The existing active and passive fire protection measures shall be evaluated during the course of the examination.

15.1.3 The influence of high temperatures on the properties of the construction materials and the geometrical properties of the structure shall be taken into consideration in accordance with the specifications in Codes SIA 269/2 to SIA 269/6.

15.1.4 The specifications concerning fire protection in Code SIA 261 apply analogously to existing structures. However, fire protection measures may be defined on the basis of a risk analysis.

15.1.5 Verification with natural fires and the fire protection measures defined on the basis of a risk analysis require the approval of the authorities.

15.2 Updating

15.2.1 The thermal action may be updated as a heat-release curve, temperature-time curve or a fire curve taking into consideration the fire load to be anticipated in the given case.

15.2.2 When defining parameter-dependent temperature-time curves, so-called natural fire curves, the type and quantity of the combustible material, the ventilation conditions in the room, the thermal properties of the enclosing structural members and any fire extinguishing measures shall be taken into consideration.

16 EARTHQUAKE

Until publication of Code SIA 269/8, the Technical Specification SIA 2018 applies to the earthquake examination situation.

17 EXPLOSION

17.1 The accidental actions as a result of an explosion shall be defined in relation to the consequences of structural failure.

17.2 During the examination, the construction works category in accordance with Code SIA 261 shall be defined and the probability of occurrence of an explosion and its action effects shall be analysed and evaluated on the basis of risk considerations.

17.3 Measures for reducing the probability of an explosion may be defined on the basis of a risk analysis. The specifications concerning measures in accordance with Code SIA 261 apply analogously to existing structures.

17.4 The pressures and temperatures caused as a result of an explosion shall be treated as an accidental leading action. They may be updated object-specifically.

APPENDIX A (normative)

DYNAMIC FACTORS FOR LOAD MODELS OF THE TRACK CLASSES AND OPERATING TRAINS

Table 3: Dynamic factors $1+\varphi$ in accordance with SN EN 1991-2, Appendix C, for verification of structural safety in the limit state type 2 and for verification of serviceability

l_Φ [m]	Permitted maximum speed for the track class or operating trains [km/h]														
	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200
1	1,06	1,11	1,17	1,23	1,28	1,34	1,40	1,46	1,48	1,49	1,54	1,60	1,66	1,73	1,80
2	1,06	1,12	1,18	1,24	1,30	1,36	1,42	1,48	1,50	1,51	1,54	1,59	1,65	1,72	1,79
4	1,06	1,12	1,18	1,25	1,31	1,37	1,43	1,49	1,50	1,52	1,54	1,57	1,62	1,69	1,76
6	1,06	1,12	1,18	1,24	1,30	1,36	1,42	1,47	1,48	1,49	1,52	1,54	1,58	1,64	1,72
8	1,05	1,11	1,16	1,22	1,27	1,33	1,38	1,44	1,45	1,46	1,48	1,50	1,53	1,60	1,67
10	1,05	1,10	1,15	1,20	1,24	1,29	1,34	1,39	1,40	1,41	1,43	1,45	1,48	1,55	1,62
15	1,04	1,07	1,11	1,14	1,18	1,21	1,25	1,28	1,29	1,30	1,32	1,35	1,41	1,48	1,55
20	1,03	1,05	1,08	1,10	1,13	1,15	1,18	1,20	1,21	1,22	1,27	1,32	1,39	1,45	1,53
25	1,02	1,04	1,05	1,07	1,09	1,11	1,13	1,15	1,17	1,19	1,24	1,29	1,34	1,40	1,46
30	1,02	1,03	1,05	1,06	1,08	1,10	1,12	1,14	1,16	1,18	1,22	1,26	1,31	1,36	1,42
40	1,01	1,03	1,04	1,06	1,07	1,09	1,10	1,12	1,13	1,15	1,19	1,23	1,27	1,31	1,35
50	1,01	1,02	1,04	1,05	1,06	1,08	1,09	1,11	1,12	1,14	1,17	1,20	1,24	1,27	1,31
60	1,01	1,02	1,03	1,05	1,06	1,07	1,08	1,10	1,11	1,12	1,15	1,18	1,22	1,25	1,28
70	1,01	1,02	1,03	1,04	1,05	1,07	1,08	1,09	1,10	1,12	1,14	1,17	1,20	1,23	1,26
80	1,01	1,02	1,03	1,04	1,05	1,06	1,07	1,09	1,10	1,11	1,13	1,16	1,19	1,22	1,25
100	1,01	1,02	1,03	1,04	1,05	1,06	1,07	1,08	1,09	1,10	1,12	1,14	1,17	1,19	1,22

l_Φ decisive length in accordance with code SIA 261

Table 4: Dynamic factors $1+\varphi$ in accordance with SN EN 1991-2, Appendix D, for verification of structural safety in the limit state type 4 (fatigue strength)

l_Φ [m]	Permitted maximum speed for the track class or operating trains [km/h]														
	10	20	30	40	50	60	70	80	90	100	120	140	160	180	200
1	1,03	1,06	1,08	1,11	1,14	1,17	1,20	1,23	1,24	1,25	1,27	1,30	1,33	1,36	1,40
2	1,03	1,06	1,09	1,12	1,15	1,18	1,21	1,24	1,25	1,26	1,27	1,29	1,33	1,36	1,39
4	1,03	1,06	1,09	1,12	1,15	1,19	1,22	1,25	1,25	1,26	1,27	1,29	1,31	1,34	1,38
6	1,03	1,06	1,09	1,12	1,15	1,18	1,21	1,24	1,24	1,25	1,26	1,27	1,29	1,32	1,36
8	1,03	1,05	1,08	1,11	1,14	1,16	1,19	1,22	1,22	1,23	1,24	1,25	1,26	1,30	1,33
10	1,02	1,05	1,07	1,10	1,12	1,15	1,17	1,20	1,20	1,20	1,21	1,23	1,24	1,28	1,31
15	1,02	1,04	1,05	1,07	1,09	1,11	1,12	1,14	1,15	1,15	1,16	1,17	1,21	1,24	1,27
20	1,01	1,03	1,04	1,05	1,06	1,08	1,09	1,10	1,11	1,11	1,13	1,16	1,19	1,23	1,26
25	1,01	1,02	1,03	1,04	1,04	1,05	1,06	1,08	1,09	1,10	1,12	1,14	1,17	1,20	1,23
30	1,01	1,02	1,02	1,03	1,04	1,05	1,06	1,07	1,08	1,09	1,11	1,13	1,16	1,18	1,21
40	1,01	1,01	1,02	1,03	1,04	1,04	1,05	1,06	1,07	1,08	1,09	1,11	1,13	1,15	1,18
50	1,01	1,01	1,02	1,03	1,03	1,04	1,05	1,05	1,06	1,07	1,08	1,10	1,12	1,14	1,16
60	1,01	1,01	1,02	1,02	1,03	1,04	1,04	1,05	1,06	1,06	1,08	1,09	1,11	1,12	1,14
70	1,01	1,01	1,02	1,02	1,03	1,03	1,04	1,05	1,05	1,06	1,07	1,09	1,10	1,12	1,13
80	1,00	1,01	1,02	1,02	1,03	1,03	1,04	1,04	1,05	1,05	1,07	1,08	1,09	1,11	1,12
100	1,00	1,01	1,01	1,02	1,02	1,03	1,03	1,04	1,04	1,05	1,06	1,07	1,08	1,10	1,11

l_Φ decisive length in accordance with code SIA 261

Abbreviations of organisations represented in the commission SIA 261

EPFL	Swiss Federal Institute of Technology, Lausanne
FEDRO	Federal Roads Office
FOEN	Federal Office for the Environment
FOT	Federal Office of Transport
VKF	Association of Cantonal Fire Insurers
WSL/SLF	Swiss Federal Institute for Forest, Snow and Landscape Research, Institute for Snow and Avalanche Research

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Approval and validity

The SIA's central committee for codes and regulations approved the present Code SIA 269/1 on 23rd November 2010.

It is valid as from 1st January 2011.

Together with Code SIA 269 *Existing structures – Bases for examination and interventions*, it replaces Guideline SIA 462 *Assessment of the structural safety of existing construction works*, 1994 edition.