Swiss Standards for Existing Structures

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Abstract

In January 2011, the Swiss Society of Engineers and Architects (SIA) published a series of standards for existing structures. The standard entitled '*existing structures—bases for examination and interventions*' specifies the principles, the terminology and the appropriate methodology for dealing with existing structures. This standard is complemented by a series of standards which treat specific items regarding 'actions on existing structures', 'existing concrete, steel, composite, timber and masonry structures' as well as 'geotechnical aspects of existing structures'. It is expected that these standards will provide effective solutions on questions such as higher live loads, accidental actions or the restoration and improvement of the durability of existing structures. This paper highlights major principles, in particular those related to risk-based safety, proportionality of interventions and updating of variables. Methodological aspects of the main activities, that is, examination of structures and intervention measures, are described.

Keywords: standards; existing structures; updating; risk-based safety; proportionality; examination; interventions.

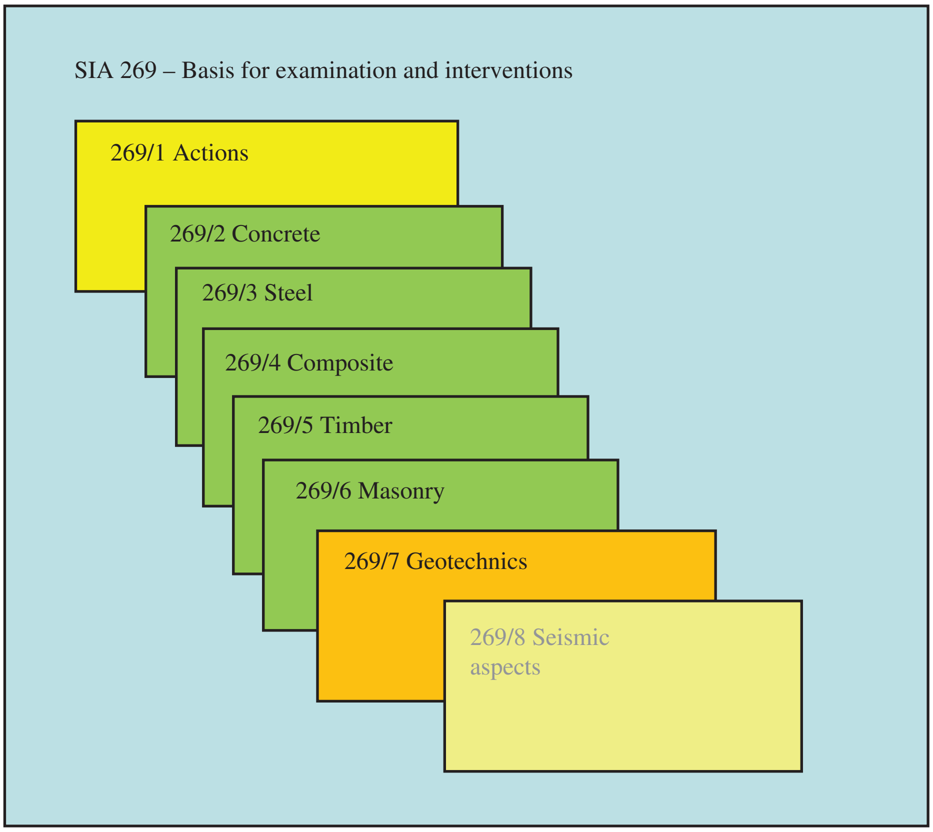

Fig. 1: General overview on the series of standards SIA 269 for existing structures

Introduction

When dealing with existing structures, most structural engineers apply standards valid for the design of new structures. This is a problematic approach as standards for new structures are in principle not, or only, analogously applicable to existing structures.

The professional approach to existing structures is based on an inherent methodology that essentially includes collecting detailed actual information as the structure already exists. The controlling parameters are determined more precisely, and for example, the structural safety of an existing structure is proven using so-called updated values for actions and resistance.

In this way, it can often be shown that an existing structure may be subjected to higher solicitation while meeting the safety requirements. Such an approach is needed to avoid rather cost-intensive or even unnecessary interventions (which are often the result of insufficient know-how and information about the existing structure).

Over the last 20 years, a methodology inherent to existing structures has evolved and has already been successfully applied. However, it has not yet been really adopted in practice by the majority of structural engineers. This is explained by the fact that there are no standards available which the engineer can rely on.

For this reason, the Swiss Society of Engineers and Architects (SIA) launched a pioneering project in 2005 to develop a series of standards for existing structures. In a country with a rather well-developed infrastructure such as Switzerland, the establishment of this series of standards is a real need arising from the fact that significantly more than half of all current and future structural engineering activities are and will be related to existing structures.

Objectives for the New Standards

The general objectives of the project consisted in editing a series of user-friendly standards dealing with all aspects of existing structures. In particular, the following typical challenges for the structural engineer are addressed:

– *Higher live loads* (such as traffic loads or live loads in buildings) are to be applied for which an existing structure has not been initially designed. The structural engineer has to prove that these can be carried by the existing structure without asking for costly strengthening interventions.
– In case the structural safety for higher live loads can be verified, the *fatigue safety*, the remaining

fatigue life (of fatigue vulnerable structures such as bridges) and the *serviceability* become predominant issues requiring advanced analysis methods.
– *Accidental actions* on structures subjected to natural or manmade hazards (e.g. earthquakes or impacts) need to be addressed. These issues often have not been considered when the existing structure was designed.
– *Durability* of structures showing major damage and deterioration needs to be restored and improved in an efficient manner.
– Operational and/or constructional *interventions* need to be optimised as often a broad range of solutions are possible. In this context, the issue of proportionality of an intervention needs to be addressed.

Consequently, the standards consider all these items to allow for a systematic and rational engineering approach to existing structures.

Organisation of Standards

Figure 1 gives a general overview of the series of standards SIA 269 for existing structures.

Standard SIA 269 '*existing structures—basis for examination and interventions*' describes the basic principles and the procedure to be followed in the treatment of existing structures and is directed at specialists in engineering activities related to existing structures. In addition, owners of the structures are addressed, mainly in the sections on examination and interventions.

Standard SIA 269 is the basic standard in the field of engineering of existing structures and is supplemented by a series of standards which treat specific items as shown in *Fig. 1*.

Standard SIA 269/1 contains updated models for actions and action effects and SIA 269/2 to SIA 269/6 give specific indications for updating material and structural parameters and models valid for the various types of structures, in particular when materials and structural systems from the past are involved. They address structural resistances and corresponding models. Standard SIA 269/7 covers geotechnical aspects specific to existing structures, and SIA 269/8 (which shall be published in 2013) refers to earthquake engineering of existing structures.

The set-up of the series of SIA 269 standards is thus analogous to the European standards for the design of new structures. Issues referring to both existing and new structures remain in the standards for new construction, that is, the standards on existing structures are complementary to the standards for the design of new structures.

The project organisation was headed by the project management team (composed of the authors of this paper) and for each standard, a working group consisting of specialists from administrations (owners), consulting engineering companies, construction companies, technical universities and research institutions edited the standard. The project was accompanied by a steering committee (composed of the main funding partners) and the SIA committee on standards for structures.

Standard SIA 269—Basis for Examination and Interventions

Content and Terminology

Figure 2 gives the table of contents of Standard SIA 269 '*existing structures—basis for examination and interventions*' for which elements were taken over from the International Standardisation Organisation[1] and from several national regulations dealing with various aspects of existing structures.

After defining the framework, the basics and activities when dealing with existing structures, were covered. The definitions of the main terms are as follows:

– *Existing structure*: Load-bearing part of a completed and accepted construction work.
– *Updating*: Process of supplementing existing knowledge with new information.
– *Proportionality of intervention measures*: Comparison of costs and benefits of planned interventions with the aim of efficient use of resources (see sections on *Structural safety* and *Proportionality of safety-related interventions*).
– *Examination* (in the literature sometimes called 'assessment'): Condition survey, condition evaluation and intervention recommendation, triggered by a specific cause.
– *Examination value*: Value determined from a characteristic or another representative value in combination with partial safety factors and conversion factors, possibly also directly defined, which is applied in a verification carried out on an existing structure.
– *Intervention*: Operational or constructional measure intended to limit hazards and to ensure the continued existence of a structure, including preservation of its material and cultural values.
– *Concept of intervention*: Concept for the implementation of intervention measures, based on a study of intervention options over a given period of time and considering local conditions.

Principles

The first principle of the standard states that activities related to existing structures are carried out while duly respecting individual and society's safety needs as well as economic, environmental, cultural and societal compatibility, thus following the principles of sustainable development of the built environment.

Preservation of an existing structure over its remaining service life has to fulfil the following objectives:

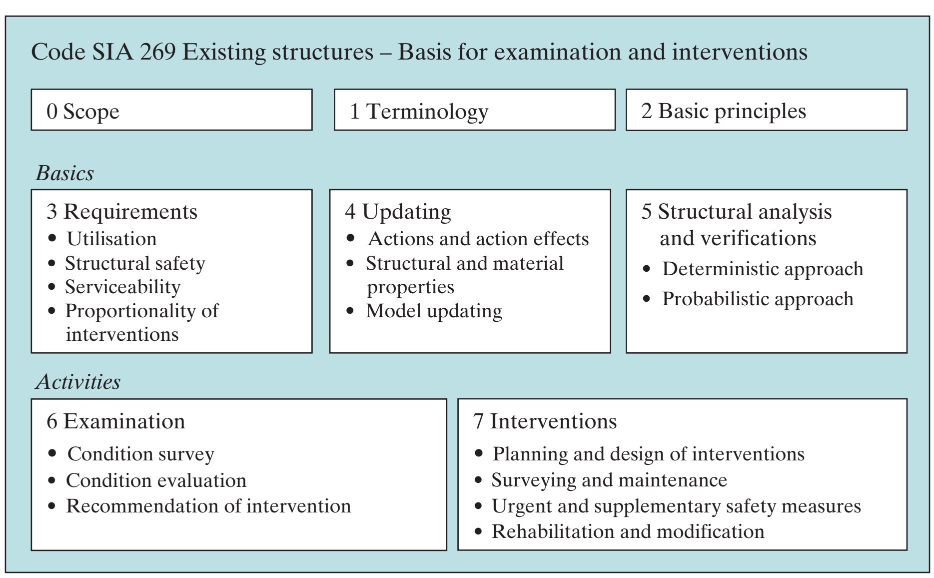

Fig. 2: Content of standard SIA 269

- satisfying the requirements for utilisation and legal aspects,
- guaranteeing structural safety and serviceability,
- preserving the material and cultural values of a structure while accounting for economy and aesthetics.

Requirements

The requirements imposed on an existing structure need to be clearly defined as they may have a major influence on the extent of interventions.

Utilisation

First, the remaining service life and the service conditions of an existing structure and its components need to be defined during the examination or when planning interventions.

Structural Safety

The structural safety is considered adequate, either if the necessary level of numerically determined structural safety is verified or if the possibility of structural failure is kept under control by means of supplementary or urgent safety measures. The deterministic verification of structural safety is provided if the conditions according to *Deterministic verification* section are fulfilled.

For semi-probabilistic and probabilistic verifications, the structural safety requirements are defined in Standard SIA 269 following a *risk-based safety approach* which was adopted from the Probabilistic Model Code of the Joint Committee on Structural Safety.[2] The requirements in terms of structural safety are defined through the target value of the reliability index or through the individual risk.

The target value of the reliability index depends on the consequences of structural failure and the efficiency of interventions according to *Table 1*.

The consequences of structural failure are expressed as the ratio ρ of direct costs C_F in the event of failure to the costs C_W necessary to restore the structure after a failure:

$$\rho = \frac{C_F}{C_W} \quad (1)$$

The acceptable risk is defined as 10^{-5}/year.

Serviceability

In general, if the utilisation of the structure remains unchanged, its serviceability is verified on the basis of the results of the condition survey. If the utilisation of the structure has changed, in particular if higher live loads will act on the structure, serviceability should be verified on the basis of updated actions and serviceability limits, using in general a deterministic verification format.

Proportionality of Interventions

The proportionality of interventions is determined through a comparison of their costs (direct and indirect costs for the fulfilment of the requirements) and benefits (reduction of risks, increase in material and cultural values, higher reliability) in relation to the remaining service life. In general, the proportionality of interventions is assessed empirically. In the case of safety-related interventions, the assessment can be supported through verifications according to *Proportionality of safety-related interventions* section.

Updating

Structural engineering in the domain of existing structures relies on an inherent methodology as the structure exists already for sometime and has its history of performance. It is thus possible to obtain and gain more or less detailed information on a specific existing structure and its elements. In this way, uncertainties in structural parameters are reduced through updating. This is a fundamental difference with respect to the methodology used for the design of new structures where uncertainties are dealt with by relying on information gained from experience.

Consequently, variables describing actions and action effects as well as material and structural behaviour in terms of structural resistance models are updated based on information gained from the existing structures. Updating takes into account the experience gained from the surveying and monitoring of a structure, the results of condition surveys (e.g. influences of damage and defects) and the foreseen modifications during the remaining service life.

The standard claims as a basic rule that relevant variables have to be updated. It provides provisions regarding updating of actions and action effects, characteristic values of material and soil properties, structural models and geometric quantities as well as structural resistance and plastic deformation capacity of structural elements.

If statistical distributions for variables are available on the basis of a series of measurements or other information, updating can be carried out by assuming that (1) the characteristic value of the variable is determined according to a fractile value or a certain probability of occurrence depending on the return period or (2) the examination value is determined according to the semi-probabilistic method described below in the *Semi-probabilistic verification* section.

Structural Analysis and Verifications

Approaches and Objectives

The objective of the structural analysis is to determine the behaviour of an existing structure regarding relevant situations and given conditions during the remaining service life for which the structure has to fulfil the requirements for structural safety and serviceability. The influencing parameters for structural analysis are obtained through the updating process.

The structural safety and serviceability verifications are performed using updated values, called examination values, with the objective to verify for the existing structure that the relevant limit states are not exceeded. In general, deterministic verification will be conducted. Probabilistic verifications are in particular appropriate in cases where either very little or a lot of information on the structure is available as well as in cases of large consequences of structural failure.

	Consequences of structural failure		
Efficiency of intervention EF_M (see section on *Proportionality of safety-related interventions*)	Minor $\rho < 2$	Moderate $2 < \rho < 5$	Serious $5 < \rho < 10$
Low: $EF_M < 0,5$	3,1	3,3	3,7
Medium: $0,5 \leq EF_M \leq 2,0$	3,7	4,2	4,4
High: $EF_M > 2,0$	4,2	4,4	4,7

Table 1: Target value of the reliability index β_0 for structural safety with a reference period of 1 year, according to SIA 269

Deterministic Verification

The notion of *degree of compliance n* is introduced in the *deterministic verification of the structural safety:*

$$n = \frac{R_{d,\text{updated}}}{E_{d,\text{updated}}} \quad (2)$$

where $R_{d,\text{updated}}$ and $E_{d,\text{updated}}$ are the examination values of resistance and action effect, respectively. The degree of compliance is a numerical statement showing the extent to which an existing structure fulfils the structural safety requirements. This formulation not only gives the information whether the structural safety is fulfilled, i.e. $n \geq 1{,}0$, it also indicates by how much the verification is fulfilled (or not). The latter is necessary for the evaluation of results and in view of the planning of interventions.

The standard also defines load factors for permanent actions on existing structures considering that uncertainties in the determination of permanent actions are reduced through the updating process.

Semi-probabilistic Verification

The examination values may also be determined directly according to the *semi-probabilistic approach* in case sufficient statistical data and probability distributions of basic variables (for action effects and ultimate resistances) are available. In general, the following assumptions are applied:

- effects of an action as a result of permanent action effects exhibit a normal distribution;
- effects of an action as a result of variable or accidental action effects exhibit a Gumbel distribution;
- variables of the ultimate resistance exhibit normal or log-normal distributions; stiffness of structural elements is normally distributed.

The examination value of *normally distributed* effects of an action (E), variables of ultimate resistance (R) and stiffness are determined as follows:

$$E_{d,\text{act}} = E_{m,\text{act}}\,(1 + \alpha_E \beta_0 v_{E,\text{act}}) \quad (3)$$

$$R_{d,\text{act}} = R_{m,\text{act}}\,(1 + \alpha_R \beta_0\, v_{R,\text{act}}) \quad (4)$$

$E_{m,\text{act}}$ and $R_{m,\text{act}}$ are updated estimates of mean values, $v_{E,\text{act}}$ and $v_{R,\text{act}}$ are updated coefficients of variation and α_E and α_R are sensitivity factors. β_0 is the target value of the reliability index and can be taken from *Table 1*.

The examination value of *log-normally distributed* effects of an action (E) and variables of the ultimate resistance (R) are determined as follows:

$$E_{d,\text{act}} = E_{m,\text{act}}\, e^{(\alpha_E \beta_0 \delta_E - 0{,}5\delta_E^2)} \quad (5)$$

$$R_{d,\text{act}} = R_{m,\text{act}}\, e^{(\alpha_R \beta_0 \delta_R - 0{,}5\delta_R^2)} \quad (6)$$

where δ_E and δ_R are parameters of the log-normal distribution:

$$\delta_E^2 = \ln(v_{E,act}^2 + 1) \quad (7)$$

$$\delta_R^2 = \ln(v_{R,act}^2 + 1) \quad (8)$$

The examination value of *Gumbel-distributed* effects of an action (E) are determined as follows:

$$E_{d,\text{act}} = E_{m,\text{act}}\,[1 - v_{E,\text{act}}\,(0{,}45 + 0{,}78\,\ln\{-\ln\,[\Phi(\alpha_E \beta_0)]\})] \quad (9)$$

If sensitivity factors cannot be updated with the aid of first order reliability method (FORM) analyses, the following factors can be used for simplified calculation:

- α_E = 0,7 for the effects of leading actions.
- α_E = 0,3 for the effects of accompanying actions.
- α_R = –0,8 for ultimate resistances, which are of key importance in the verification of structural safety.
- α_R = –0,3 for ultimate resistances, which are of secondary importance in the verification of structural safety.

Full Probabilistic Verification

If updated distributions of the basic variables X_i are available, the structural safety may be verified using the methods of reliability theory. For that purpose, a limit state function is formulated using the variables X_i:

$$G(a_0, X_1, X_2, ..., X_n) \geq 0 \quad (10)$$

The failure probability p_f is then defined as the probability that the limit state function takes values smaller than 0.

$$p_f = P\{G(a_0, X_1, X_2, ..., X_n) < 0\} \quad (11)$$

Finally, sufficient structural safety is considered as proven, if the following criterion is fulfilled for the future service life:

$$\beta = \Phi^{-1}\,(p_{f,a}) \geq \beta_0 \quad (12)$$

With $p_{f,a}$ being the failure probability of a structure or structural element (related to a 1-year return year), Φ^{-1} (...) being the inverse standard normal distribution and β_0 being the target value of the reliability index (*Table 1*).

Proportionality of Safety-related Interventions

The proportionality of interventions, in particular those related to safety, has to be verified by expressing the efficiency of intervention, that is, confrontation of effort and benefit, considering safety requirements, availability of the structure, magnitude of damage to persons, material goods and the environment, as well as the preservation of material and cultural values.

The *efficiency of interventions* EF_M is evaluated by a comparison of risk reduction ΔR_M as a result of interventions with respect to safety costs SC_M, as expressed by the following ratio:

$$\text{EF}_\text{M} = \frac{\Delta R_\text{M}}{\text{SC}_\text{M}} \quad (13)$$

A safety-related intervention is regarded as proportional when $\text{EF}_\text{M} \geq 1{,}0$ and should therefore be implemented. If safety-related interventions prove to be disproportionate, that is, $\text{EF}_\text{M} < 1{,}0$ either the planned intervention measures should be revised or the service criteria adapted to the changed circumstances. In the case of accidental situations, unsatisfactory safety verification and disproportionate interventions can be accepted; however, the individual risk must be limited to a failure probability of 10^{-5}/year.

Activities

Examination

The *examination* is the central activity when dealing with existing structures. It is triggered by a specific cause like a change in the use of a structure (e.g. increase in live loads), new hazard scenarios, new findings about the structural behaviour, doubts regarding the structural safety or unexpected conditions (after detection of important damages and deterioration). In addition, the material and cultural values of the structure need to be evaluated.

The examination is conducted following a stepwise procedure with increasing focus on details. The *general examination* comprises the whole structure with the objective to identify aspects that need to be examined in more detail. One or more *detailed examinations* follow with the focus on the identified aspects.

In the *condition survey* section, provisions are given regarding collecting information on an existing structure with respect to specific hazard scenarios, actions and structural resistances. The objectives of the study of the structure are to identify potential conceptual and constructive deteriorations and deficiencies and to collect the information for the necessary updating of structural analysis models. The material characteristics should ideally be determined by means of non-destructive testing methods (which are in general less costly and as reliable as destructive testing methods and do not damage the structure). Provisions are also given for *in situ* load testing of existing structures.

The *condition evaluation* is usually based on the quantitative information about the structural safety as expressed for example by the degree of compliance, and it includes a forecast on the condition development. In case the quantitative verifications of the structural safety are not conclusive, a so-called *empirical analysis* may be performed, that is, sufficient structural safety can be presumed if the structure is in a satisfactory condition, it shows no abnormal behaviour, the live load is not increased and an assessment rates the risk as being acceptable.

The *recommendation of intervention* comprises a wide range of potential interventions from accepting the existing condition to implementing a heavy structural intervention. This concluding part of the examination clearly is the recommendation to the owner (and *not* a design of an intervention).

Interventions

Interventions on existing structures are based on the *concept of intervention* which includes long-term considerations and which is obtained by optimisation of intervention options (as derived from the results of the examination).

The *design of an intervention* is the implementation of the concept of intervention including operational and/or structural interventions to be performed. Operational interventions may comprise intensified surveying (e.g. monitoring) or restrictions in the utilisation of the structure; structural interventions include rehabilitation or modification of the structure (i.e. adaptation or transformation to respond to the new requirements of its utilisation).

The resulting *intervention project* needs to be justified by checking it against technical, economical and operational criteria. In particular, the standard prescribes that the efficiency of measures to restore and guarantee the durability has to be demonstrated. In addition, the influence of the intervention on the aesthetics of a structure and on its cultural value needs to be assessed. The objective of this procedure is to obtain optimised interventions.

It is important to note that Standard SIA 269 implicitly requires a systematic surveying (monitoring) of *all* types of structures (i.e. not just bridges but also large span roofs or buildings with complex structures). Regular preventive maintenance is optional but obviously highly recommended.

Standard SIA 269/1—Actions on Existing Structures

Updating of actions on a given existing structure implies focused determination of characteristic values and other more detailed information by means of measurements and refined modelling. The basis are the models for actions used for the design of new structures with their geometric configuration of concentrated and uniformly distributed loads, but the characteristic values are updated depending on the specific conditions of the existing structure:

- For *permanent loads*, updated characteristic values are determined by measuring structural dimensions and specific weights of building materials. A load factor of $\gamma_{G,\text{updated}} = 1,20$ is appropriate for coefficients of variation in the domain of 0,10 to 0,20. The semi-probabilistic approach usually provides more precise load factors in particular for massive structures such as concrete and masonry structures where permanent loads are often higher than the live loads.
- For *climatic actions*, the characteristic value of snow load, wind pressure and temperature action may be updated, if reliable measurement data or other documented object-specific information is available. Otherwise, provisions valid for the design of new structures need to be considered. In all cases, local conditions have to be taken into consideration.
- Regarding *live loads*, characteristic values of live load in existing buildings are in principle the same as those applied for the design of new buildings. Standard SIA 269/1 provides updated values for road traffic depending on the type and cross section of the (bridge) structure and its span, and specific updated load models are given depending on railway line classes.[3] While updated road traffic action implicitly includes dynamic effects considering recent studies,[4] dynamic effects of rail traffic are explicitly considered depending on the span of the structural element and the train speed. For fatigue safety verification, correction factors are given to consider past and planned future road or rail traffic. Favourable load carrying effects due to kerbs, retaining walls, road pavement or railway track (e.g. continuous rails on short span bridges) may be considered for the determination of action effects relevant to fatigue.
- *Accidental actions* such as extreme forces on barriers due to crowds, vehicle impact, fire and explosion may be fixed considering the consequences of structural failure. Existing object-specific constructional devices and operational measures to resist accidental action obviously need to be assessed. In general, accidental actions are fixed after consultation of and in agreement with the owner or the supervisory authority. For earthquake, spectral micro-zoning provides appropriate information about seismic effects on an existing structure considering its site-specific conditions.

Characteristic values for actions on existing structures as given in Standard SIA 269/1 are used on the level of the general examination. More refined determination of actions is usually performed within detailed examinations.

Standards SIA 269/2 to 269/6—Existing Concrete, Steel, Composite, Timber and Masonry Structures

Standards SIA 269/2 to SIA 269/6 deal with existing reinforced concrete, steel, steel–concrete composite, timber and masonry structures, respectively. These standards provide provisions regarding characteristic values of building materials from the past as well as connections and structural details frequently used in existing structures. They mainly deal with structural resistances and comprise issues of structural analysis and verifications of existing structures as well as specific issues regarding focused condition survey and interventions (including methods of strengthening and for restoration of durability). In principle, resistance models valid for the design of new structures are also valid for existing structures, but specific aspects of former materials, connections and structural details used in the past need to be considered specifically.

These standards deal in particular with the following issues:

- Standard SIA 269/2 on reinforced concrete structures, covers the following topics: methods of detection and evaluation of damage in particular due to rebar corrosion and alkali–silica reaction; updating of mechanical properties of concrete and steel reinforcement; fatigue resistance of steel reinforcement; issues of structural resistance such as deformation capacity, shear (with and without transverse reinforcement, punching), anchorage and bond of rebars, principles of intervention methods to restore durability; strengthening methods (glued lamellas, external post-tensioning).
- Standard SIA 269/3 on steel structures provides mechanical properties and characteristic values as well as corresponding updated resistance factors for cast iron, wrought iron and early mild steels as well as for riveted, bolted and early welded connections. Elastic–plastic (EP) method is allowed for structural elements in wrought iron and early mild steel if they fulfil certain slenderness conditions. Truss girders may be modelled using pinned nodes. For riveted connections and structural elements, provisions are given regarding the ultimate resistance (including stability) and fatigue resistance (S-N curves).
- Standard SIA 269/4 on existing steel–concrete composite structures deals mainly with properties and characteristic values of resistance of various connectors used in the past.
- Standard SIA 269/5 regarding existing timber structures contains detailed provisions regarding the condition survey in view of determining reliable updated characteristic values of resistance of timber material and connections as well as the corresponding updated resistance factors.
- In Standard SIA 269/6 on existing masonry structures, natural stone masonry is classified and its compressive strength (as a function of the compressive strength of the natural stone) is given. Rather detailed provisions cover the condition survey and intervention methods. Regarding masonry made of artificial blocks (bricks, concrete blocks, etc.) updating of characteristic values of resistance on the basis of testing is regulated.

Standard SIA 269/7—Geotechnical Aspects of Existing Structures

Examination of an existing structure includes thorough consideration of geotechnical risks. *In situ* observations, deductive analysis of observed structural behaviour and evaluation of previous experience form the basis and usually raise the reliability when updating values of soil properties and models for the structural analysis.

The examination of existing structures has to take into account soil–structure interaction and considers possible site-specific effects of neighbouring structures and facilities. Structural analysis is conducted using updated characteristic values of geotechnical properties. In the standard, special reference is made to the observation method to be used in particular in situations where relevant properties cannot be obtained with sufficient reliability or where no comparable experiences exist.

Provisions are also given to investigate geotechnical aspects with the aid of *in situ* testing. Topical issues include formerly built piles, post-tensioned permanent anchorages as well as aspects of formerly built foundations and geotechnical structures.

Implementation of the Standards

After the publication of Standards SIA 269 on 1 January 2011, *introductory courses* have been conducted and *background documentation* was established with the objective to implement the content and methodology provided by the standards in engineering practice. The background documentation also contains case studies such as to demonstrate the application of certain articles in the standards. Implementation of these standards is challenging because most structural engineers have no or only a partial education and training in structural engineering related to existing structures. Acceptance of these codes by the engineering community through various implementation initiatives makes the whole project finally a real success.

Conclusions

From a socio-economic viewpoint, novel engineering methods are needed to deal with existing structures in an efficient way responding to the principles of sustainability. In Switzerland, the series of SIA standards dealing with existing structures respond to this requirement and provide thus a reliable framework for the structural engineering community. Structural engineering in the domain of existing structures follows an inherent methodology which is addressed in these standards.

The SIA standards for existing structures provide the Swiss structural engineers with the necessary tools to react professionally and by means of efficient (and cost-effective) solutions. The standards also present an important opportunity for a thorough education and training of the structural engineering community in the domain of existing structures.

The series of SIA standards for existing structures is an original and pioneering initiative which may present a basis for similar initiatives in other countries.

The Standards SIA 269 are available at the Swiss Society of Engineers and Architects (SIA) in Zurich, Switzerland, under: http://www.webnorm.ch.

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