teplôt bude celkovo menej odolný voči pôsobeniu vlhkosti a vplyvom prostredia, napr. pôsobeniu CO_2 a ďalších polutantov. Tým sa môže iniciovať karbonatácia a iné korozívne procesy a dochádza k znižovaniu trvanlivosti a životnosti.

Záver. Experimentálne bolo dokázané, že druh kameniva podstatne neovplyvňuje mechanické vlastností betónu po ochladnutí z vysokých teplôt. Napriek rozdielnym typom kamenív majú zmeny v mechanických vlastnostiach betónov zhodné tendencie. Pri ohreve vzoriek do 200 ^{0}C boli v zmrašťovaní betónov len minimálne rozdiely. Nad touto teplotou je napučiavanie najnižšie pri betóne z andezitového kameniva a dolomitického a výrazne najväčšie pri betóne z ťaženého kameniva. Modul pružnosti, pevnosť v tlaku pri betónoch zo všetkých druhov kameniva klesá a po ohreve 800 ^{0}C nadobúda prakticky nulové hodnoty.

Výsledky stanovení by mali poslúžiť aj ako podklady pre realizáciu sanácií a rekonštrukcií v prípade poškodenia betónov účinkom vysokých teplôt.

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SUSTAINABLE BUILDING ASSESSMENT SYSTEMS SUMMARY

In the past decade, building environmental assessment methods have been developed in different countries for evaluating the building performance. Seven models used world wide in relation to environmental assessment of buildings, were compared on the basis of their covered. In this paper will be presented the summary of sustainable building assessment systems and the proposal of system applicable in Slovakia.

Introduction. Since 1990s building environmental assessment systems or methods have emerged as a legitimate means to evaluate the performance of buildings in many countries. Sustainable building assessment and certification systems are intended to foster more sustainable building design, construction and operations by promoting and making possible a better integration of environmental concerns with cost and other traditional decision criteria. Different building assessment systems approach this task from somewhat different perspectives, but they have certain elements in common. Most, if not all, deal in one way or another with site selection criteria, the efficient use of energy and water resources during building operations, waste management during construction and operations, indoor environmental quality, demands for transportation services, and the selection of environmentally preferable materials [1]. The assessment of building environmental performance covers a wide range of issues and may involve not only a number of environmental, but also economical and socio-cultural factors.

The field of building environmental assessment has matured remarkably quickly since the introduction of BREEAM, and the past thirteen years have witnessed a rapid increase in the number of building environmental assessment methods in use world-wide (e.g. CASBEE, BREEAM, GBTool, Green Globes US, LEED, NABERS, HK-BEAM, etc.)[2].

In East Block countries building environmental assessment and certification systems are still not developed. The existing systems of building environmental assessment could be the base of development for new systems available in Slovakia.

The most significant building environmental assessment methods. In this paper are presented the most considerable building environmental assessment methods and systems used world wide to compare them on the basis of their covered.

CASBEE (*Comprehensive Assessment System for Building Environmental Efficiency*) was developed in Japan, beginning in 2001. The family of assessment tools is based on the building's life cycle: pre-design, new construction, existing buildings, and renovation. CASBEE presents a new concept for assessment that distinguishes environmental load from quality of building performance. By relating these two factors, CASBEE results are presented as a measure of eco-efficiency or BEE (Building Environmental Efficiency). Results are description on a graph, with environmental load on one axis and quality on the other – the best buildings will fall in the section representing lowest environmental load and highest quality. Each criterion is scored from level 1 to level 5, with level 1 defined as meeting minimum requirements, level 3 defined as meeting typical technical and social levels at the time of the assessment, and level 5 representing a high level of achievement. The CASBEE Technical Manual presents detailed definitions of each level for each criterion and includes reference material and calculation tools where needed.

CASBEE major categories of criteria include the following:

Building Environmental Quality and Performance

- Indoor environment (noise and acoustics, thermal comfort, lighting and illumination, and air quality);
- Quality of services (functionality and usability, amenities, durability and reliability, flexibility and adaptability);
- Outdoor environment on site (preservation and creation of biotope, townscape and landscape, and outdoor amenities).

Building Environmental Loadings

- Energy (thermal load, use of natural energy, efficiency of systems, and efficient operations);
- Resources and materials (water conservation, recycled materials, sustainable harvested timber, materials with low health risks);
- Reuse and reusability, and avoidance of CFCs and halons);
- Off-site environment (air pollution, noise and vibration, odor, sunlight obstruction, light pollution, heat island effect, and local on local infrastructure) [3].

BREEAM (*Building Research Establishment's Environmental Assessment Method*) as the building environmental assessment method was developed in the United Kingdom in 1990. BREEAM covers a range of building types including: offices, homes, industrial units, retail units, and schools. Other building types can be assessed using Bespoke BREEAM ("bespoke" is another word for custom-made). When a building is assessed, points are awarded for each criterion and the points are added for a total score. The overall building performance is awarded a "Pass", "Good", "Very Good" or "Excellent" rating based on the score.

BREEAM major categories of criteria for Design and Procurement include the following:

- Management (commissioning, monitoring, waste recycling, pollution minimization, materials minimization);
- Health & Wellbeing (adequate ventilation, humidification, lighting, thermal comfort);
- Energy (sub-metering, efficiency and CO_2 impact of systems);
- Transport (emissions, alternate transport facilities);
- Water (consumption reduction, metering, leak detection);
- Materials (asbestos mitigation, recycling facilities, reuse of structures, facade or materials, use of crushed aggregate and sustainable timber);
- Land Use (previously used land, use of remediate contaminated land);
- Ecology (land with low ecological value or minimal change in value, maintaining major ecological systems on the land, minimization of biodiversity impacts);
- Pollution (leak detection systems, on-site treatment, local or renewable energy sources, light pollution design, avoids use of ozone depleting and global warming substances) [4].

GBTool was developed by the International Framework Committee for the Green Building Challenge, an international project that has involved more than 25 countries since 1998. GBTool is designed to be adapted by sponsors to reflect regional conditions and context. It includes criteria in categories such as Site Selection, Project Planning and Development; Environmental Loadings; Energy and Resource Consumption; Indoor Environmental Quality; Functionality; Long-Term Performance; and Social and Economic Aspects. Criteria are assessed using scales that are based on local benchmarks of "typical" practice; buildings can score -1 if below typical practice or from +1 to +5, representing good to very high performance. All criteria must be scored, thus providing a complete assessment of the building. Both benchmarks of typical practice and weightings of criteria are established by the sponsoring organization to represent national, regional, or local codes, practice, context, conditions, and priorities. GBTool has evolved over time as it has been tested by participating countries and results have been presented at a series of international conferences. Originally addressing only an as-designed assessment, GBTool is developing versions to address pre-design, design, as built, and operations. The tool itself comprises two spreadsheets, one for data entry (to be completed by the project team) and one for establishing weights and benchmarks and completing the assessment (to be completed by third party sponsors or assessors).

GBTool major categories of criteria include the following:

- Energy consumption is assessed through total use of non-renewable energy (embodied and operational), electrical peak demand for operations, use of renewable energy, and commissioning.
- Resource consumption is assessed through materials use (salvaged, recycled, bio-based and sustainable harvested, locally produced, designed for disassembly, re-use, or recycling) and water use for irrigation, building systems, and occupant use.
- Environmental loadings include greenhouse gas emissions, other atmospheric emissions, solid wastes, stormwater, wastewater, site impacts, and other local and regional impacts.
- Indoor environmental quality is assessed through indoor air quality, ventilation, temperature and relative humidity, daylight and illumination, and noise and acoustics.
- Other criteria include selection of appropriate site (in terms of land use, brownfields, access to transportation and amenities), project planning, urban design (density, mixed uses, compatibility, native plantings, and wildlife corridors), building controls, flexibility and adaptability, maintenance of operating performance, and a few social and economic measures [5].

Green Globes US was adapted from the Green Globes Canada rating system in 2004. Green Globes Canada was developed as a web-based version of the combination of BREEAM Canada and Green Leaf. The development of Green Globes US is funded by The Green Building Initiative. The Green Globes US system is an on-line tool designed for use by architects and builders for any size commercial building. The preliminary assessment occurs after conceptual design and the final assessment occurs after the construction documentation stage. Green Globes allows its users to evaluate their systems based on the amount of applicable available points, having the option of "not applicable" in some categories. Projects that are third-party verified and have achieved over 35% of the points can earn a rating of 1 to 4 Green Globes.

Green Globes major categories of criteria include the following:

- Project Management (integrated design, environmental purchasing, and commissioning, emergency response plan);
- Site (site development area, reduce ecological impacts, enhancement of watershed features, site ecology improvement);
- Energy (energy consumption, energy demand minimization, "right sized" energy-efficient systems, renewable sources of energy, energy-efficient transportation);
- Water (flow and flush fixtures, water-conserving features, reduce off-site treatment of water);
- Indoor Environment (effective ventilation systems, source control of indoor pollutants, lighting design and integration of lighting systems, thermal comfort, acoustic comfort);
- Resource, Building Materials and Solid Waste (materials with low environmental impact, minimized consumption and depletion of material resources, re-use of existing structures; building durability, adaptability and disassembly; and reduction, re-use and recycling of waste) [6].

LEED (*Leadership in Energy and Environmental Design*) was developed and piloted in the U.S. in 1998 as a consensus-based building rating system based on the use of existing building technology. The development of LEED has been through the U.S. Green Building Council member committees. The rating system addresses specific environmental building related impacts using a whole building environmental performance approach. In addition to LEED-NC (for new construction and major renovations), there are versions for existing buildings, commercial interiors, core and shell, homes, and neighborhood development. There are also application guides that can be used to increase the applicability and flexibility of LEED (e.g., multiple buildings and campuses, schools, health care, laboratories, lodging, and retail (pilot)).

The LEED Reference Guide presents detailed information on how to achieve the credits within the following major categories:

- Sustainable Sites (construction related pollution prevention, site development impacts, transportation alternatives, stormwater management, heat island effect, and light pollution);
- Water Efficiency (landscaping water use reduction, indoor water use reduction, and wastewater strategies);
- Energy and Atmosphere (commissioning, whole building energy performance optimization, refrigerant management, renewable energy use, and measurement and verification);
- Materials and Resources (recycling collection locations, building reuse, construction waste management, and the purchase of regionally manufactured materials, materials with recycled content, rapidly renewable materials, salvaged materials, and sustainable forested wood products);
- Indoor Environmental Quality (environmental tobacco smoke control, outdoor air delivery monitoring, increased ventilation, construction indoor air quality, use low emitting materials, source control, and controllability of thermal and lighting systems);
- Innovation and Design Process (LEED accredited professional and innovative strategies for sustainable design) [7].

HK-BEAM is the Hong Kong industry's initiative to measure, improves, certify and label the whole-life environmental sustainability of buildings. HK-BEAM is a comprehensive standard and supporting process covering all building types including residential, commercial institutional buildings and mixed use complexes, both new and existing. HK-BEAM means by which to benchmark and improve performance in the planning, design, construction, commissioning, operation and management of buildings. HK – BEAM was adopted since 1996. Aims of the HK-BEAM is stimulate demand for more sustainable buildings in Hong Kong, giving recognition for improved performance and minimizing false claims; provide a common set of performance standards that can be pursued by developers, designers, architects, engineers, contractors and operators; reduce the environmental impacts of buildings throughout the planning, design, construction, management and demolition life cycle; and increase awareness in the building community, and ensure that environmental considerations are integrated right from the start rather than retrospectively.

HK-BEAM defines over 100 best practice environmental criteria on the key aspects of Hong Kong's buildings and provides a forum for the design/management team to work for the same environmental goals:

- Land use, site impacts and transport (Land use; Contaminated Land; Local Transport; Neighborhood Amenities; Site Design Appraisal; Ecological impact; Cultural Heritage; Landscaping and Planters; Microclimate Around Buildings; Overshadowing and Views; Vehicular Access; Demolition/ Construction Management Plan; Air Pollution During Construction; Noise During Construction; Water Pollution During Construction; Emissions from Wet Cooling Towers; Noise from Building Equipment; Light Pollution;);
- Use of materials, recycling, and waste management (Building Reuse; Modular and Standardized Design; Off-site Fabrication; Adaptability and Deconstruction; Envelope Durability; Rapidly Renewable Materials; Sustainable Forest Products; Recycled Materials; Ozone Depleting Substances; Demolition Waste; Construction Waste; Waste Disposal and Recycling Facilities);
- Energy use, efficient systems and equipment, and energy management (Annual Energy Use in Commercial Buildings; Annual Energy Use in Hotel Buildings; Annual Energy Use in Educational Buildings; Annual Energy Use in Residential Buildings; Annual Energy Use in Mechanically Ventilated Buildings; Annual Energy Use in Other Building Types; Embodied Energy in Building Structural Elements; Ventilation Systems in Mechanically Ventilated Buildings; Lighting Systems in Mechanically Ventilated Buildings; Hot Water Supply Systems; Lift and Escalator Systems; Electrical Systems; Renewable Energy Systems; Air-conditioning Units; Clothes Drying Facilities; Energy Efficient Lighting in Public Areas; Heat Reclaim; Mechanical Ventilation in Hotel Buildings; Energy Efficient Appliances; Testing and Commissioning; Operation and Maintenance; Metering and Monitoring;);
- Water quality, conservation and recycling (Water Quality; Annual Water Use; Monitoring and Control; Water Efficient Irrigation; Water Recycling; Water Efficient Facilities and Appliances; Effluent Discharge to Foul Sewers); and
- Hygiene, health, comfort, and amenity (Fire Safety; Electromagnetic Compatibility; Security; Plumbing and Drainage; Biological Contamination; Waste Disposal Facilities; Construction IAQ Management; Outdoor Sources of Air Pollution; Indoor Sources of Air Pollution; IAQ in Car Parks; IAQ in Public Transport Interchanges; Ventilation in Air-conditioned Premises; Background Ventilation; Uncontrolled Ventilation; Localized Ventilation; Ventilation in Common Areas; Thermal Comfort in Centrally Air-conditioned Premises; Thermal Comfort in Air-conditioned/Naturally Ventilated Premises; Natural Lighting; Interior Lighting in Normally Occupied Areas; Interior Lighting in Areas not Normally Occupied; Room Acoustics; Noise Isolation; Background Noise; Indoor Vibration; Access for Persons with Disability; Amenity Features) [8].

NABERS (*National Australian Building Environmental Rating System*) project commenced in April 2001 is being designed to assess many types of new and existing buildings – particularly commercial and residential – and to enable the building owner or operator to undertake the rating annually with or without the need to hire independent assessors. This model is a voluntary system and its uptake is expected to grow as building users come to understand the importance of minimizing environmental impacts and discover the accompanying financial savings, improved comfort and health benefits. This model addresses the impact associated with both the construction of a building and its use.

NABERS major categories of criteria include the following:

• Land (nature of site for building under three year old, total site area per m^2 of building total floor area, total site area per building user; area of site planted with beneficial plants; impermeably paved area of the site);

• Materials (Cost of building per m^2 of floor area; Material types for structure, wall, floor and roofs for building under three year old; Building age for building over three years old; time since last major internal re-fit for buildings over three years old);

• Energy (Energy efficiency – total energy consumption in kWh/m^2; Greenhouse emissions of the whole building; Greenhouse emissions for high performance buildings; Renewable electricity use; Building that generate more energy than they use);

• Water (Water consumption (for whole site) from public supply per person; Source of on-site water supply);

• Interior (Nature of internal fit-out, equipment and operation; Percentage of workplaces within 5 meters of a window; Percentage of workers able to control light levels at their workplace);

• Resources (Total building area per person; Intended use of building – number of hours per day; Intended use of building – number of weeks per year);

• Transport (Distance to nearest local shop; Distance to nearest urban center; Number of car park spaces provided on site; Distance to public transport; Provision of bicycle facilities);

• Waste (Provision of on-site recycling facilities; Provision of local collection for recyclables; Wastewater re-use; Use of more sustainable sewage treatment system) [9].

Review of Applicable Rating Systems. Table 1 summarizes the data gathered for the Technical Content review criterion. The assessment in rating systems are divided on major categories by table. Weighting major categories seven selected systems are description in table too.

Table 1

Technical Content [8, 9, 10]

	Optimize Site Potential	Optimize Energy Use	Protect and Conserve Water	Use Environmentally Preferable Products	Enhance IEQ	Optimize Operational & Maintenance Practices	Other
CASBEE	15%	20%	2%	13%	20%	15%	15%
BREEAM	15%	25%	5%	10%	15%	15%	15%
GBTool	12,5 %	20,8 %	-	-	16,7 %	16,6 %	33,4 %
Green Globes US	11,5%	36%	10%	10%	20%	-	12,5%
LEED	20%	25%	7%	19%	22%	-	7%
HK-BEAM	13,2%	41,3%	6,3%	12,3%	25,9%	-	2,6%
NABERS	16,67%	16,67%	6,67%	13,33%	6,67%	-	40%

The following tables (Table 2) are organized by the review criteria. Quantifiable and comparable information was collected for each rating system. Where feasible, this information has been captured in data tables to allow for comparison and additional, relevant information is provided following the tables as appropriate. The key for the tables is the following:

Table 2

Key

✓	Does Meet Criterion
O	Under development
-	Does Not Meet Criterion
(blank)	Information Unknown

Criteria covered in each model are described in Table 3. All models reviewed in here include environmental loadings and resource consumption while none of them includes any social concerns.

Table 3

Criteria in each model considered [8, 9, 11]

Criteria\Model			CASBEE	BREEAM	GBTool	Green Globes	LEED	HK-BEAM	NABERS
Resource consumption	Energy	Embodied	-	✓	✓	-	-	✓	✓
		Operation	✓	✓	✓	✓	✓	✓	✓
	Land		-	✓	✓	-	✓	✓	✓
	Water		✓	✓	✓	✓	✓	✓	✓
	Material		✓	✓	✓	✓	✓	✓	✓
Environmental loading	Air		✓	✓	✓	✓	-	✓	✓
	Solid		✓	✓	✓	✓	✓	✓	✓
	Water		✓	✓	✓	✓	-	✓	-
	Others		✓	-	✓	✓	-	✓	✓
Indoor Environmental quality	Air		✓	✓	✓	✓	✓	✓	✓
	Thermal		✓	✓	✓	✓	✓	✓	-
	Visual		-	-	✓	-	-	-	-
	Noise		✓	-	-	-	-	✓	-
Economics	Life Cycle		-	-	✓	-	-	-	-
	Operation		-	-	-	-	-	-	-
Social concerns			-	-	-	-	-	-	-

Table 4 summarizes the data gathered for the Applicability review criterion. A Green Globes US module for existing buildings is in the pilot development stage, as an adaptation of the Green Globes Canada modules. According to The Green Building Initiative feedback, the Green Globes US existing buildings module is used for the major renovation, tenant build-out and operations and maintenance types of projects. Although none of these sustainable building rating systems have specific modules for courthouses or border stations, all of the rating system documentation implied that the office version could be or has been used for these building types.

Table 4

Applicability [8, 9, 10]

	Type of Projects				Types of Buildings		
	New Construction	Major Renovations	Tenant Build-out	Operations & Maintenance	Office Buildings	Courthouses	Border stations
CASBEE	✓	✓	-	✓	✓	✓	✓
BREEAM	✓	✓	-	✓	✓	✓	✓
GBTool	✓	✓	-	O	✓	✓	✓
Green Globes US	✓	O	O	O	✓	✓	✓
LEED	✓	✓	✓	✓	✓	✓	✓
HK-BEAM	✓	✓	✓	✓	✓	✓	✓
NABERS	✓	✓	✓	✓	✓	✓	✓

Table 5 summarizes the data gathered for the Communicability review criterion. The rating system needs to be sufficiently universal to facilitate comparison of performance across the various regions and building types. The rating system results must have a minimal range of possible interpretations and offer a consistent, unambiguous summary of results. All of the rating systems have a clear way of representing the results of the rating system assessment.

Table5

Communicability [8, 9, 10]

	Comparability	
	Results Representation	Result Product
CASBEE	Pass, Good, Very Good, Excellent	Certificate
BREEAM	“spider web” diagram, histograms	Certificate and website published result
GBTool	Range of detailed and broad Histograms	n/a *
Green Globes US	One to four globes (1=35-54 %, 2=55-69%, 3=70-84 %, 4=+85 %)	Plaque, report and case study
LEED	Certified (40 %), Silver (50 %), Gold (60 %), Platinum (80 %)	Award letter, certificate and plaque
HK-BEAM	Bronze (40 %), Silver (55 %), Gold (65 %), Platinum (75 %)	Certificate
NABERS	NABERS Basic, NABERS Green, NABERS Bronze, NABERS Silver, NABERS Gold, NABERS Platinum	NABERS Medals

** n/a Not applicable*

The proposal of building environmental assessment systems applicable in Slovak conditions. The major fields and indicators of building environmental assessment are proposed on the bases of available informations analysis from building environmental assessment and certification field and also on the base of own experiences. Pre proposed major fields and indicators of building environmental assessment and score determination are presented in the table 6.

Table 6

The fields and indicators proposal of building environmental assessment

Major fields	Max. score	Indicator
Project management	100	Strategy of integrated design – innovation.
		Environmental contribution – materials, equipments and technologies selection.
Energy	150	Operation – energy consumption for heat, cooling, ventilation, lightning and system regulation and control.
		Maintenance – periodic maintenance and control of technological equipments.
Water	100	Drinking water – supplies and distribution, consumption, quality control.
		Sewage water – sewage treatment plant, using storm water.
Waste	150	Solid waste – scrap collection, waste separation.
		Waste management – classifications and disposal waste.
Building construction	150	Material flows – built-in materials, content of environmental suitable materials, using of local materials.
		Life cycle – mining stock, materials production, construction of buildings, exploitation and demolition of buildings, utilization and reusing of building materials and constructions, land revitalization.
		Energy flows – heat transmission of building construction.
Indoor environment	200	Pollution flows – creation, transmission and distribution – environmental safety.
		Control of indoor perceived quality.
		Control of HVAC systems.
Land stability	150	Land ecological stability, climate condition, soil quality, residential density, road-traffic infrastructure, engineering networks.
		Environmental loading.

Conclusion. The presented methods and systems developed in various countries are the base for method elaboration applicable in Slovak conditions. The approaches of the presented assessment methods are principally not different. Several differences are in terminological expression, in some of them the different indicators are assessed under the same areas; as well as the ways of impact rate classification are different and mostly respect national particularity. It is possible to assume, that the assessment systems sensitivity is different and the indicators independence is not always secured. The proposal of building environmental assessment system requires a complex multidisciplinary and multicriterion approach. The aim of building environmental assessment is a sustainable building design, which demands the cooperation among civil engineers, architects, environmentalists and other experts from different areas of building environmental assessment.

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DIMINISHING OF LEGIONELLA INFECTION RISK IN HOT WATER SUPPLY

The presence of Legionella pneumophila in hot and cold water systems inside any building is to be expected. Hotels and hospitals abroad, particularly those located in old buildings, represent a major source of risk for Legionnaires' disease due to the high frequency of Legionella contamination. The most vulnerable individuals are normally the elderly, or those already weakened by sickness or disease. The subject of the paper is our investigation Legionella contamination of hot water in a cross-sectional survey in Kosice, the second biggest city of the Slovak republic.

Introduction. More than a quarter of a century has passed since more than 200 people became sick from a mysterious disease at a fateful American Legion convention in Philadelphia. Ultimately, 34 people died from that exposure, which has since become known as Legionnaires' disease.