

Surfacings for bridge decks and roof-top car parks

Description of the work area



Waterproofing and surfacing systems on bridges are effective in preserving the durability of these engineering structures and ensuring the safety and comfort of road users. The materials used in these systems are often specific (other materials than in conventional road structures) and subject to severe loading (bridge deck surfacings are often thin). This justifies the extensive research and the many actions undertaken in this field.

Watertightness is a must for roof-top car parks, especially if the underlying rooms are lived in or used for other purposes. In addition, roof-top car parks are most often heat-insulated. Furthermore, surfacings for such car parks are usually kept very thin to limit their dead weight, whereas they are subject to aggressive loading (static loads and punching). For all those reasons the design of a surfacing for a roof-top car park requires much care and warrants every research effort made.



The various aspects of BRRC's activities in the area of surfacings for bridge decks and roof-top car parks include:

- innovation support by the technological consulting unit *Surfacings for bridge decks and roof-top car parks*;
- assistance in solving specific problems;
- the preparation of a code of good practice for bridge deck surfacings;
- cooperation in drafting a technical information note on roof-top car parks;
- a leading role in the activities for the European standardization of bitumen waterproofing sheets;
- the performance of research into the applicability of European methods for the testing of bitumen waterproofing sheets for bridge decks and other surfaces trafficable by vehicles;
- the organization of a research project on mastic asphalt and European standardization;
- cooperation in developing and granting technical approvals for waterproofing products (bituminous sheets and resins) for bridge decks and similar surfaces trafficable by vehicles.

Equipment - Tests

BRRC is equipped for a great many performance tests on bitumen waterproofing sheets, resins and mastic asphalt, which are used both for research products and in testing products for third parties.

1. General

Preparation of large test slabs (NBN EN 13375): most performance tests on bituminous waterproofing sheets require the prior preparation of large slabs for sawing out test specimens. An adapted version of NBN EN 13375 (adaptations as specified in ETAG 033) must be used for liquid-sprayed resin waterproofing layers.

Reference concrete (NBN EN 1766): reference concrete is the substrate material most commonly used in preparing large test slabs. BRRC has a supplier of reference concrete and has the tools (sand patch test and pull-of tester) to check the specified concrete characteristics.

Manufacture of mastic asphalt: BRRC has a small mastic asphalt mixer for manufacturing mastic asphalt (in batches of up to 160 kg) or melting mastic asphalt blocks.

Manufacture of compacted asphalt concrete: BRRC has mixers of different capacities (25 and 80 kg) and a plate compactor for asphalt mixtures laid in small (50 by 18 cm) or large slabs (60 by 40 cm).

Infrared camera: BRRC has an infrared camera, which is useful to detect defects in the adhesion between a waterproofing sheet and its substrate.

2. Bituminous waterproofing sheets

Bond strength (NBN EN 13596): evaluation of adhesion by means of a test in which a tensile force is applied perpendicular to the sheet/concrete, the sheet/asphalt layer, and the sheet/concrete/asphalt layer system.

Shear strength (NBN EN 13653): determination of the dynamic shear strength of the concrete/ sheet/asphalt layer system.

Shear strength after thermal conditioning (NBN EN 14691): determination of the behaviour of a bitumen waterproofing sheet (applied to a concrete surface and covered with an asphalt layer) after long-lasting exposure to a higher temperature, using the shear strength test. The result is compared to the result for shear strength on specimens that have not been heat-conditioned.

Static shear test (G0001 (2006) 6.20): determination of static shear strength with a prediction of shear behaviour in time under the prevailing conditions of mass of overlying layers, slope, and temperature.

Resistance to the compaction of an asphalt layer (NBN EN 14692) (NBN EN 14692): evaluation of the preservation of watertightness after the compaction of an asphalt layer covering a waterproofing sheet.

Behaviour during the laying of mastic asphalt: determination of the resistance to bleeding of binder from a waterproofing sheet into mastic asphalt being laid on top of it.

Determination of water absorption: determination of the amount of water which can be absorbed by the reinforcement or the surface finish of a waterproofing sheet and which may affect the behaviour of the sheet.

3. Resins

The tests mentioned above for bitumen waterproofing sheets can also be performed on resin waterproofing layers where applicable.

4. Mastic asphalt

See the above item 1. *General*.

See *The development of tests for bitumens and asphalt mixtures*, item 4. *Tests on mastic asphalt* in the section Equipment – Tests.

Cooperation - Ongoing projects - Completed projects

Cooperation

Roof-top car parks are on the interface between road construction and house building. That is why the Belgian Building Research Institute (BBRI) and BRRC have decided to join forces in drafting recommendations for optimum implementations of combinations of insulating materials, waterproofing systems and surfacings on roofs. A working group gathering all the specialists in this field is preparing a joint document.

Most contractors are currently seeking a technical approval for the products they use in waterproofing bridge decks (and other surfaces trafficable by vehicles). Within CEN and the Belgian union for technical approvals in construction (UBAtc) BRRC actively participates in the updating of standards and guidelines for approvals (based on European standards) and in the performance of the necessary tests to obtain approvals.

Ongoing projects

A working group is compiling a new code of good practice for bridge deck surfacings. It will include the innovations which have appeared since 1987 (the year when the previous version was published) among other things in the design, the products, and the laying and verification methods – both for the bridge deck itself and for the waterproofing system, the protective layer, the regulating layer, the surface course, and the ancillaries to the carriageway. A major section will be devoted to renovation and repairs. The new code is due to be published in 2010.

In the IWT-subsidized consulting unit Surfacing for bridge decks and roof-top car parks a thorough technical assessment is being prepared on the effectiveness of a contractor-designed impregnation coat for bridge decks in preventing blistering in waterproofing systems.

A research project Mastic asphalt and European standards subsidized by the FPS Economy is in progress for mastic asphalt mixtures to be used in protective layers and surface courses. In this project not only the Belgian punching test, the indentation test and the uniaxial cyclic compression test (which is new in Belgium and is intended for indentations smaller than 2 mm) are used, but it is also investigated to what extent the performance tests for conventional stony and sandy skeleton mixtures (rutting, crack susceptibility, TSRST) can be used for mastic asphalt. Among the objectives of the project are a verification of the new national regulation and proposals for performance requirements.

Completed projects

The project *Research into European test methods for the performance characteristics of reinforced bitumen waterproofing sheets for bridge decks and other concrete surfaces trafficable by vehicles* subsidized by the FPC Economy was completed in 2007. This project made it possible to develop European test methods and to gain experience in their application. It provided the necessary information for the introduction of European test methods and the relevant requirements in the guidelines for technical approvals, as well as the vital information for the improvement of European test methods.

As part of the effort to support innovative initiatives of private companies, BRRC and the Walloon public service SPW set up a full-scale road experiment for a new concept with a mastic asphalt waterproofing layer bonded to the bridge deck. The experiment included five test sections with the substrate, the impregnation coat, the levelling course and the reinforcement of the mastic asphalt as variables. See the last reference under Documents for more information.

Documents - Links - Training

Links

CEN TC227/WG6:

<http://www.cen.eu/CENORM/BusinessDomains/TechnicalCommitteesWorkshops/CENTechnicalCommittees/CENTechnicalCommittees.asp?param=6208&title=CEN/TC%20227>

UBAtc: <http://www.ubatc.be/index.cfm?cat=who&sub=organisation&pag=general>

aTg: <http://info.benoratg.org/content/index.cfm?lang=fr>

Centre scientifique et technique de la construction (CSTC):

<http://www.cstc.be/homepage/index.cfm?cat=bbri&sub=presentation>

Documents

Centre de recherches routières

Code de bonne pratique pour la conception et la construction des revêtements des ponts à tablier en béton

CRR R60/87, 2 volumes, 1987

C.De Backer

Aires de stationnement pour véhicules sur toitures de bâtiment

CRR Compte rendu de recherche CR26/85, 1985

L.Glorie

Bitumineuze afdichtingsmembranen en de prestatiekenmerken volgens de Europese normen

XXIème Congrès belge de la route, Gand, septembre 2009

C.De Backer

Système d'étanchéité en asphalte coulé adhérent sur béton: chantier expérimental sur un viaduc autoroutier en Belgique

European Mastic Asphalt Association, Vittoria (Bilbao), 16-17/10/2008

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