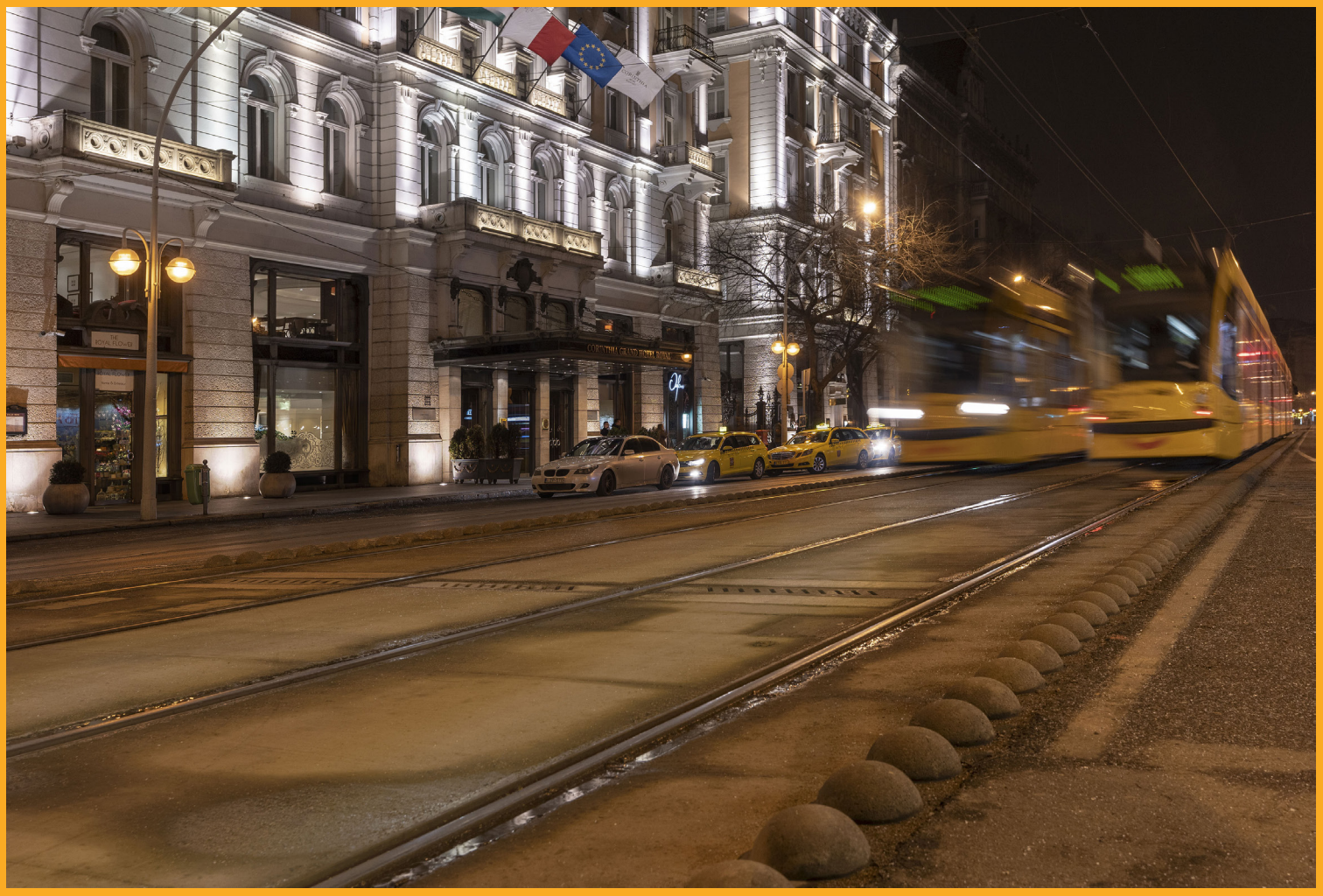


SIKA AT WORK

Grand-Boulevard tram line No.4-6 reconstruction with embedded rail fixing

The second battle on Central Europe most frequently used tram line

BUDAPEST, HUNGARY

2018

BUILDING TRUST

Budapest, Grand-Boulevard tram line No.4-

History of Icosit products on Budapest tram lines

Discrete fixation and discrete fastening systems with Icosit KC system (Icosit KC 220/60 and 340/4) have been used in Budapest from the early 1990s with high level statisfaction of the city. The Sika support need to pay special attention to the contractors on these works, especially to ensure the surface preparation, priming and also on the thicknesses were used.

Embedded superstructures had been used in Budapest during the first reconstruction works of the tram tracks at early 1990s. The first embedded sytems had been made with support of competitors (Edilon). The monopol position of the competior was firstly broken at Árpád Bridge temporary track replacement at 2010. The first major embedded superstructure works were carried out in spring 2014, using the Icosit KC 340/45 product on Tram line No.1 at Vörösvári street on appr.1000 track meter.

In 2014 a new 1100 tackmeter section of the Tram line 1. extension works done by Icosit KC embedded superstructure. In 2015, after the exceptional good result of Icosit system the embedded rail solution as a future option was approved also for Grand Boulevard.

Vörösvári street 2014

The first superstructure refurbishment of Grand Boulevard were executed in 2015 between Tatra street and Oktogon square on 2350 trackmeter lenght. At this stage, the owner also higly focused on the noise and vibration damping capability of the system with special sensitivity. Icosit system was excellence and takes what expected by the owner.

Grand-Boulevard 2015

The first concrete filler block system were constructed in 2016 at St. Gellert Square (where our competitors system were applied before (see the top page of the competiors reference book). In addition, in same year Sika got a green line for a reference track with prefabricated reinforced concrete elemet system with Icosit bonded embedded fixation of the block rails with vibration damping matts. The old structure refurbishent also shows an unexpected exceptional high level result as a top result also for company Getzner who gave the support at vibration calculation field.

In 2018 two project were under construction also with Sika Icosit solution. One of them was the Tram line No.:1 extension at Buda side with 2800 track meter embedded green track system, and the second stage of Grand Boulevard superstructure refurbishment with Icosit system.

6. reconstruction with embedded rail fixing

Grand-Boulevard Budapest Tram line 4-6.

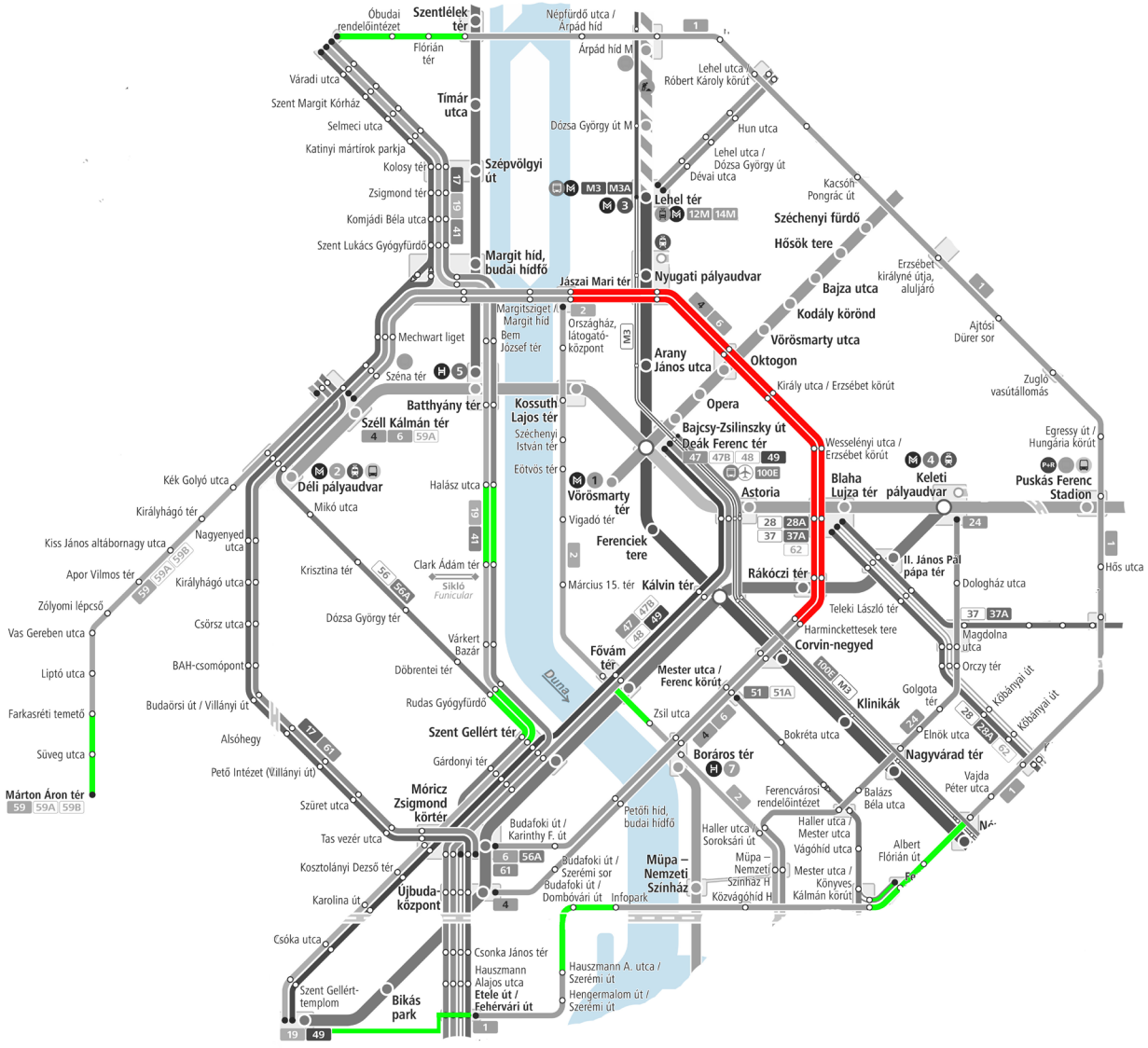
The Grand Boulevard tram line is the busiest line of Budapest and Central Europe. The longest (54 meter) and high axle loaded Siemens Combino NF12B trams follow-up scheme is less than 90 seconds.

The last fulll track refurbishment were made between 1990 and 2000 in several stages with the outdated precast element panels with bock rail placed in rubber band fixation what party were refurbished and changed again in 2006.

The passanger platforms were refurbished aslo in 2006 as well as the line network and power supply of the tram line.

The tram line and the track itself also use by emergency vehicles periodically and buses really frequently. The Grand Boulevard crossings are the highly loaded crossings in Budapest with the highly loaded buses and trolleybuses.

Budapest Tram line system map



Legend:

- Grand-Boulevard Budapest Tram line 4-6.
- Other Sika embedded rail fixing refferences

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Budapest, Grand-Boulevard tram line No.4-

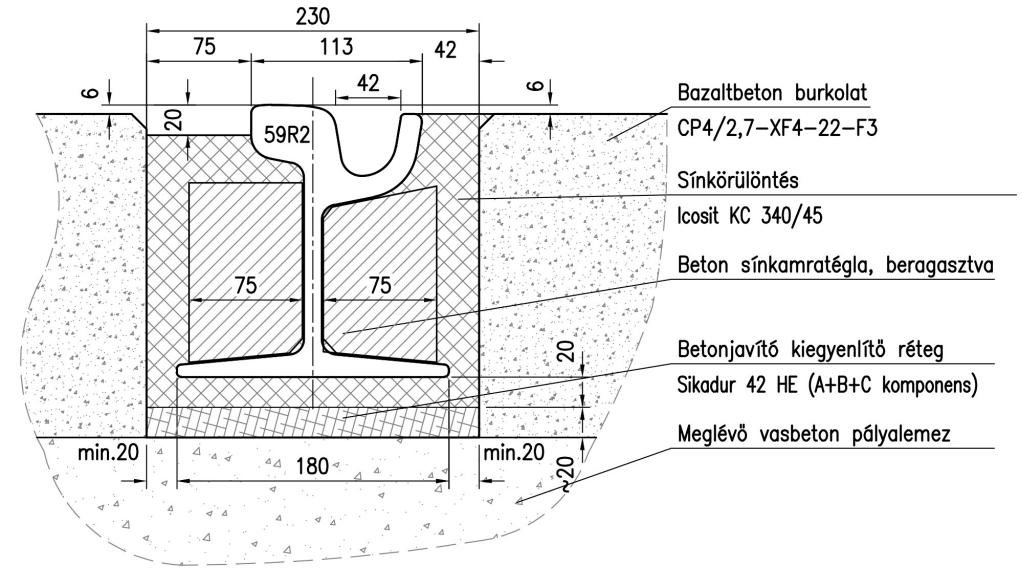
Grand Boulevard II. stage details and numbers

Project:	Grand Boulevard II. stage between Oktogon square and József street crossing
Tram line:	4.-6. Line
Construction scedule:	06.2018-09.2016
Total lenght:	3.260 track meter
Superstructure:	Monolith concre deck with embedding channel 59R2 rail with concrete filler blocks Icosit KC 340/45 embedding
Track type:	Double track, with 3,2 meter distance
Owner:	BKV Zrt. (Budapest Public Transport company)
Engineer:	BKV Zrt.
Designer:	Arcus Kft.
Main contractor:	TTD Expert Zrt.
Railway contractors:	Feratil Kft., Vasútépítő Zrt., Normálnyomtáv Kft., Triman Kft.

Project requirements:

Compatible safe system parts for application
Quick hardening and setting to elminate all relevant waiting time (priming on „fresh concrete")
Site technical support and site check
One supplier for all possible solution
Availability of the product within a short term
The main contractor has only 3 weeks for the preparation after the contract was signed

59R2 sín, sínkörülöntéssel,
meglévő vasbeton pályalemez, bazaltbeton burkolat



General detail of embedded rail fixing on Grand-Boulevard Budapest 2018

6. reconstruction with embedded rail fixing

Product used, all possible opportunity were utilized

4.000 kg
Sikadur-53 primer for rails and concrete

4.500 kg
Icosit KC330 FK bonding the concrete filler blocks

1.000 kg
Sikafloor-156 sterntghtening bonding properties

130.000kg
SikaGrout-334

25.000 pc
Concrete filler blocks (Sika type)

122.000 kg
Icosit KC340/45 flexible rail fixing and sealing

1.000 kg
SikaCor-277 primer for rails and concrete

1.100 pc cartridge
Sika Anchorfix 2+

Budapest, Grand-Boulevard tram line No.4-

The monolithic concrete structure were supported by several readymix company, defined part were done with Viscocrete technology and Sika NB 100 were used as a curing agent on the full stretch.

The main loaded crossing of the line at Astoria square were constructed by Getzner (Sylomer MFS SR-2120) vibration isolation solution supported by Sika and bonded with Sikaflex-227.

All electical straight and back connections were coated with Sika Poxicolor SW to ensure the highest safety level and protection agains stray current.

The Sikadur-41;-42; and-32 range were also used to secure the inter layer adhesions and the high loaded structural connections on the necessary places.

The rest of the connection joints were sealed with Sikaflex PRO3.

Main stages of the costruction

1. Elimination of the old concrete structure from the old concrete baseplate and cleaning of the surface.

2. New concrete slab construction in the track zone made by CP4/2,7-XF4-22 F3 concrete, connected with rebars to the old concrete baseplate with Anchorfix-2+.

3. Vertical alignment of the channel construction with Sikagrout-334 product 2-10 cm thickness.

4. Surface preparation and priming of rails and the embedded channel with SikaCor-277 and Sikadur-53 party on fresh concrete.

5. Bonding the concrete filler blocks in the rail chamber with Icosit KC 330 FK.

6. Vertical alignment of the rails with prefabricated 200x100x10-20 mm size Isocit KC 340/45 elements.

7. Horizontal alignment of the rails.

8. Pouring the Icosit KC 340/45 resin grouts in the channel.

6. reconstruction with embedded rail fixing

The main reasons of success

-Strong relationship with BKV Zrt. (Budapest Public Transport Company)
-Joint venture develpoment with the BKV Zrt. focused on LCA and maintenence free track design and exetution in reality what is make the owners more successful
-Cooperation with the designer, specification as high level, and as detailed as possible
-Continuous work and relationship with the rail fixing subcontractors
-Technical and site support with accredited laboratory for controll

Differentiate ourselves from competition

-Sika Hungária Kft. is an official subsidiary as the system producer /system distributor
-Cross selling wide range TM opportinities
-Local warehouse with appropriate safety stock,
-Site suppoort, availability
-Tailor made solution for special details (vertical alignment

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