



MARKET APPLICATION FOCUS

Buildings

Strengthening Cast-In-Place T-Beams

Structural Strengthening

Project: Braintree High School
Owner: Braintree School System
Specifier: Simpson Gumpertz & Heger, Inc.
Year: 1997

THE PROBLEM

On discovering a number of large cracks in exposed concrete joints spanning three classrooms, Braintree High School Director of Buildings, Charles Nelson, became concerned for the safety of students and called in engineers to investigate.

Engineers Simpson Gumbertz & Heger of Arlington, MA carried out a structural evaluation of the 300,000 sq. ft. three story, 30 year old building to ensure that the building was considered as a whole, not simply the isolated problem.



The structural evaluation revealed that the majority of the cracks in the visible bottom part of the joists were flexural cracks anticipated in the original structural design.

However, 34 of the roof joists, each 50 feet long, spanning four classrooms were 25% overstressed when supporting a full snow loading and needed strengthening. Two options were considered: 1) The installation of ASTM A36 steel rods to create trussed beams after removing light fixings was straightforward, but would dramatically alter the appearance of the ceiling. 2) The alternative, which would be more cost effective and could be accomplished in half the time was to use carbon fiber reinforced polymer strips (CFRP) to provide the additional bottom reinforcement needed to achieve increased fixtures strength. In this approach, the 4 inch CFRP strips would be directly bonded by an epoxy resin to the joist soffits without removing the light fixtures or changing the appearance.

Constructed in 1965, the double 'T' construction Greyhound Bus Terminal serves as the main Southern California service terminal for long distance coaches.

The 70,000 sq. foot parking deck used as staff parking, is directly above the service centre shops and offices in the complex. Problems with the ten year old traffic membrane water proofing system had been experienced for same time and with the probability of severe weather from EL NINO, Greyhound Lines Inc. decided to replace the waterproofing system and avoid more severe water urgency through the defective deck membrane.

THE SIKA SOLUTION

Sika CarboDur was chosen to strengthen the overstressed beams. The most important part of applying the system was to ensure a proper surface preparation was complete. The first step was to remove the latex coating from the bottom of the t-beam by sand blasting. The next step was to ensure that a proper profile was achieved. Since the beams were cast-in-place the surface irregularities caused by the forms were ground down to an acceptable tolerance. The surface to which the CarboDur was to be applied was then leveled using Sikadur 30 as an epoxy mortar, filling all bugholes and leveling any remaining surface irregularities. Once the epoxy used for surface profiling had cured, 1-4" strip of Sika CarboDur was applied for the full length of each beam.

The system installation process was simple once the surface preparation was completed. A primer coat of Sikadur 30 was applied to the substrate followed by a 2m thick layer applied to the surface strip. The strip is then pressed into place using finger pressure and rolled to ensure proper seating using a hard rubber roller. No post-shoring is required due to the light weight of the CarboDur strip and the thixotropic consistency of the Sikadur 30 adhesive. The repairs were accomplished in one week by a 4 man crew. A total of 10 - 50' beams were strengthened and are now in compliance with the snow load design code requirements.



CASE STUDY



For Concrete Buildings... Sika's System approach to Concrete Repair and Protection

Anti-Corrosion Primer and Bonding Bridge

Sika Armatec 110 Epo-Cem - protects the steel from corrosion in areas if inadequate cover. Improves bond of repair mortar to both the substrate and steel.

High-Performance Repair Mortars

SikaTop PLUS mortars - two-component, polymer-modified materials containing Sika FerroGard 901 corrosion-inhibiting admixture.

Corrosion-Inhibiting Impregnation

Sika FerroGard 903 - spray-applied to protect areas outside the repair zone against future damage. Proven to penetrate and reduce corrosion effects of cabonation and salt exposure.

Surface Levelling/Pore-Filling Mortars

Sika Top levelling mortars - achieve a level surface by filling pores, bugholes, or other irregularities in the surrounding substrate.

Anti-Carbonation Coatings

Sikagard 550W and 670W - protect concrete facades from the damaging effects of carbon dioxide (carbonation), water and pollutants. Either crack-bridging (550W) or rigid (670W), both are available in a variety of decorative colors.

Crack-Bridging Deck Coatings

Sikafloor Traffic Systems - protect decks, ramps, grandstands, and walkways with a durable wearing surface which waterproofs and prevents chloride ingress.

Joint Sealing/Waterproofing

Sikaflex, High Performance Sealants - are premium-grade polyurethane joint sealants that are fully compatible with Sika's concrete repair systems.

Epoxy Injection and Bonding

Sikadur - epoxy resins help restore structural integrity by injection into cracks and voids. The most comprehensive range of epoxy products for structural bonding and grouting.

Structural Strangthening Systems (CFRP)

Sika CarboDur - a proven system of external strengthening using epoxy-bonded Carbon Fiber Reinforced Plastic (CFRP) laminate strips. Stronger than steel, yet lightweight and non-corrosive, this system can solve unique strengthening problems in a variety of concrete structures.



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