Rheabilitation of the coal convey bunkers

Railway bridge from Halmeu, District Satu-Mare
August – November 2003

BENEFICIARY :
Railway Convey Wagons S.A.

DESIGN, DEVELOPMENT OF DESIGN, TECHNICAL ASSISTANCE, MATERIALS: GEMITE România & GEMITE Slovakia

CONTRACTOR : Alba Iulia — SC Invest Construct S.R.L.
SUBCONTRACTOR : Iasi — SC Ro-Tech S.A.

General view of the railway bridge:

top plane – for wagons with Russian width;
ground plane – for wagons with European width.

View of the convey bunkers plane.

Plane of the convey bunkers:

deteriorations due to freeze-unfreeze phenomenon, also due to the acid rain water action, in conjunction with the soluble components from the coal.

Top plane – Russian railway width:

catastrophic deteriorations to workers access passages.

Top plane:

catastrophic deteriorations to working ways from unloading area.

- Passages was realized from thin pre-cast concrete panels.

Top plane:

deteriorations at the concrete beams of railway's structure.

- **the concrete beams of the railway's structure, are deteriorated through:**
  - impact and abrasion at the top;
  - corrosion and freeze-unfreeze phenomenon at the bottom.

Top plane:

deteriorations at the concrete beams of railway's structure – bottom view.

Photos made from bunker.

Top plane:

deteriorations at the concrete beams of railway's structure.

Top view, photos made after removing the railroad.

Top plane:

interior aspect of the coal convey bunkers, photos made after removing the rail.

The unloading process:

the unload coal is crashed by the lateral rails, by the concrete beams of the railway's structure and also by the borders of the bunkers and working way.

Inspection:

general aspect at the bunkers openings;
deteriorated edges by impact and abrasion.

Steel shields:

un-shielding the bunkers.

Sandblasting:

operation over the working ways, concrete beams structure and bunkers.

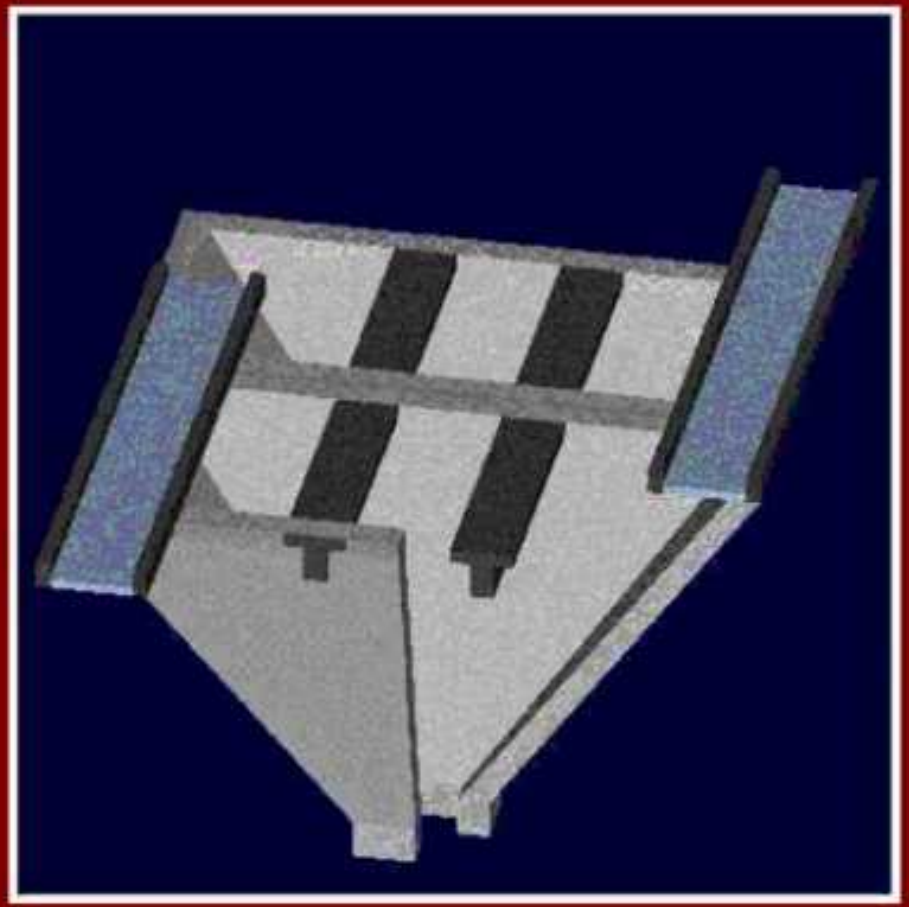
Sandblasted surfaces
and surfaces not sandblasted.

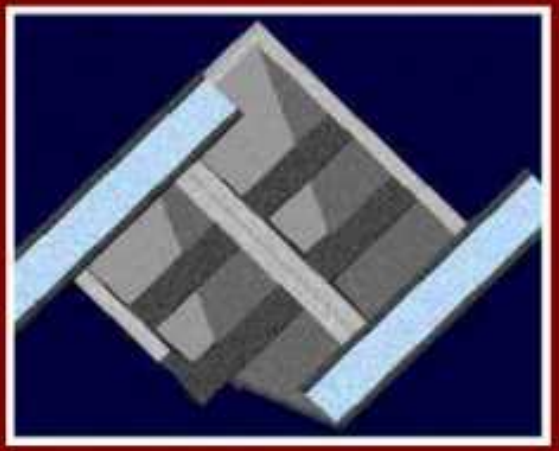
Sandblasted bunker.

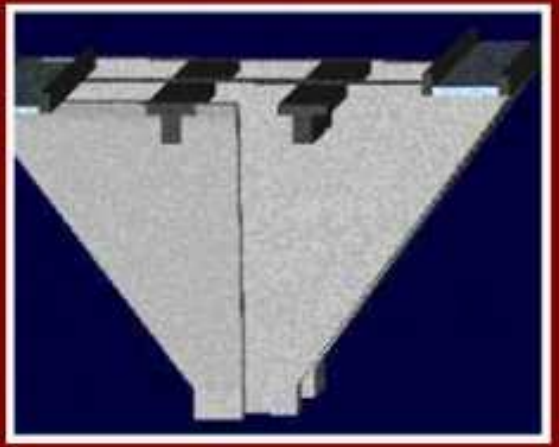
Concrete saturation with water.

The geometry of the bunkers:

position of the structural rail's concrete beams, and working ways.

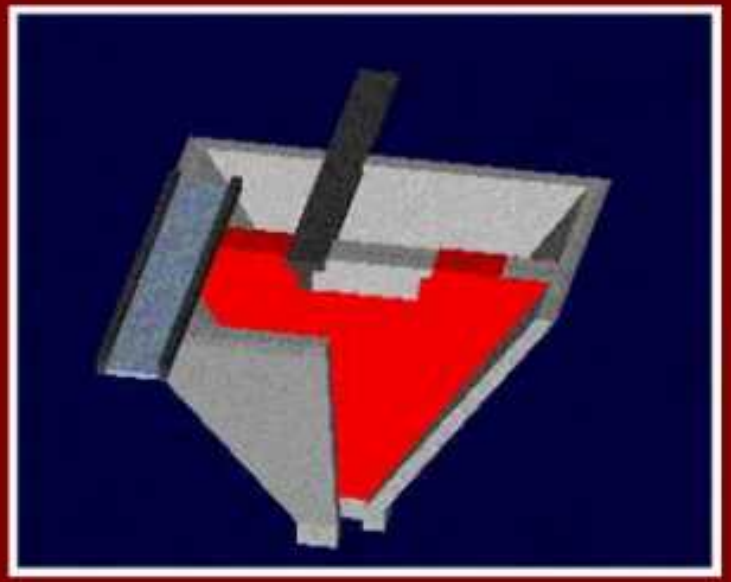




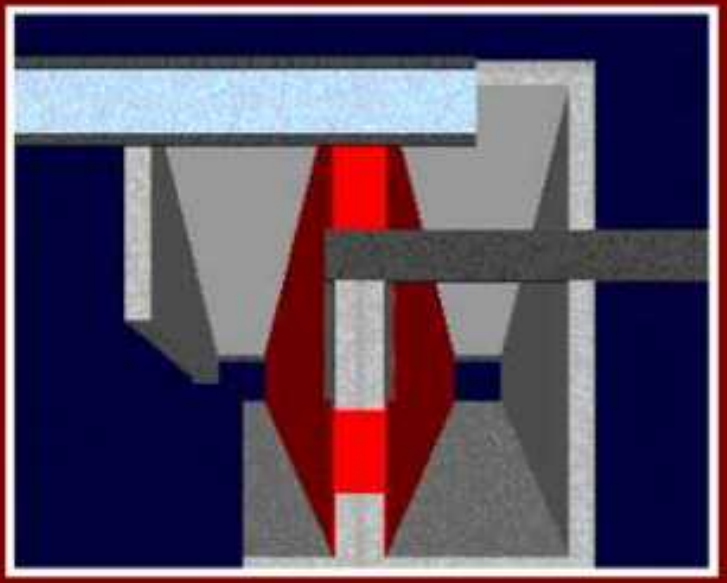


Technical solution with Gem-Crete CR ®

plating inside the bunkers.



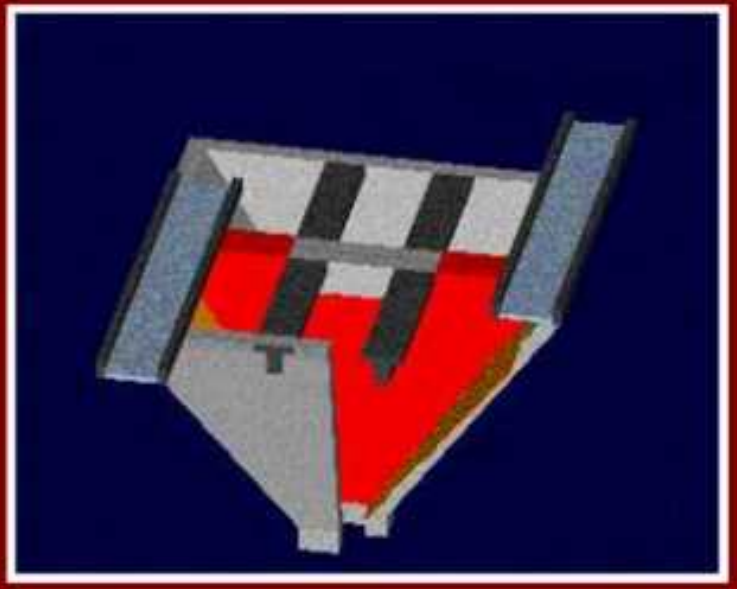
- Two transversal adjacent surfaces are plated continuously (the red area), creating two strips over the edge between the two adjacent bunkers.



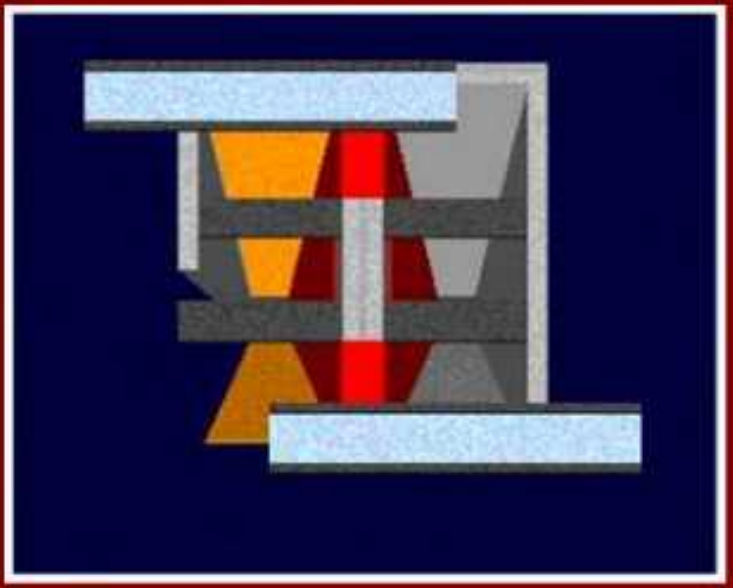
- These two strips over the edge between the two adjacent bunkers, are created in order to undertake the contraction stress that appear in the two transversal adjacent surfaces.

Technical solution with Gem-Crete CR ®

plating inside the bunkers.



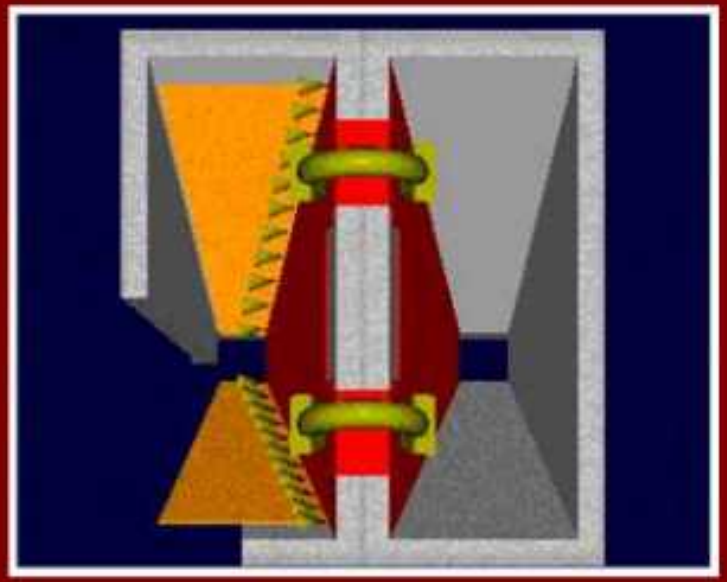
- The longitudinal walls (drawn in orange) are plated only after the Gem Crete from the transversal walls is completely dry. This way, there is created a joint at the contact edge between the walls, due to material non-adhesion along this edge.



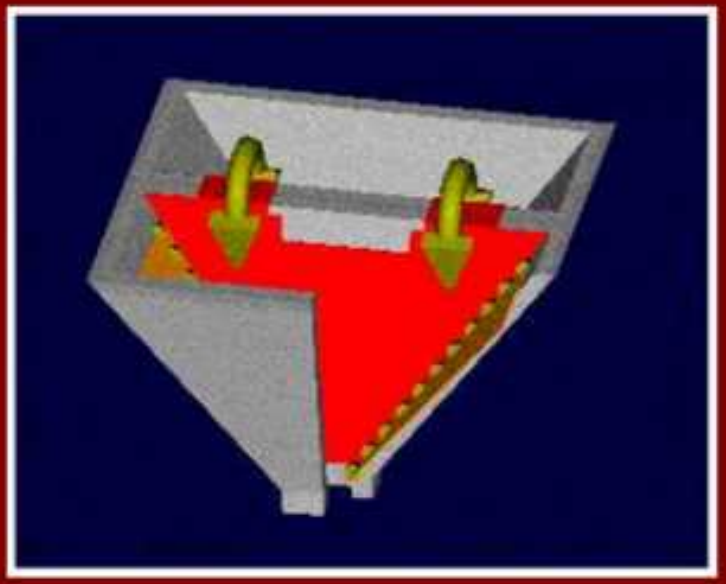
- As under the working passage there is no impact with the coal, the longitudinal walls are not plated up to the superior bunker border.

Technical solution with Gem-Crete CR ®

plating inside the bunkers.



- The two strips over the bunker's edge will support the contraction stress that appear in the two transversal adjacent surfaces.

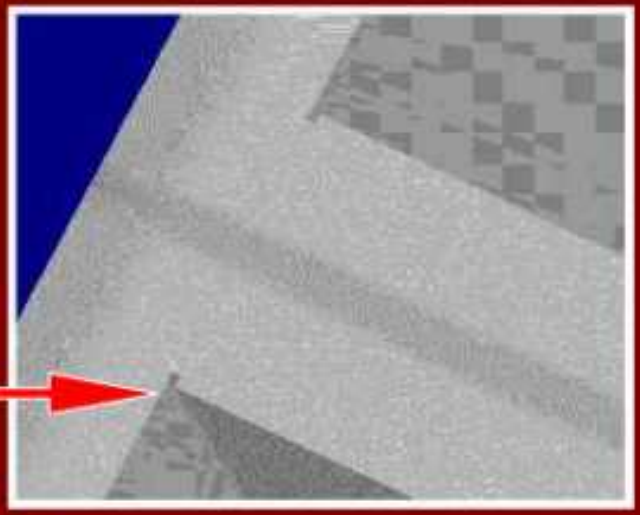


- The overlap between the longitudinal and transversal Gem-Crete plates will force the edges of the transversal plates not to de-bond and move perpendicular to this surface.

Technical solution with Gem-Crete CR

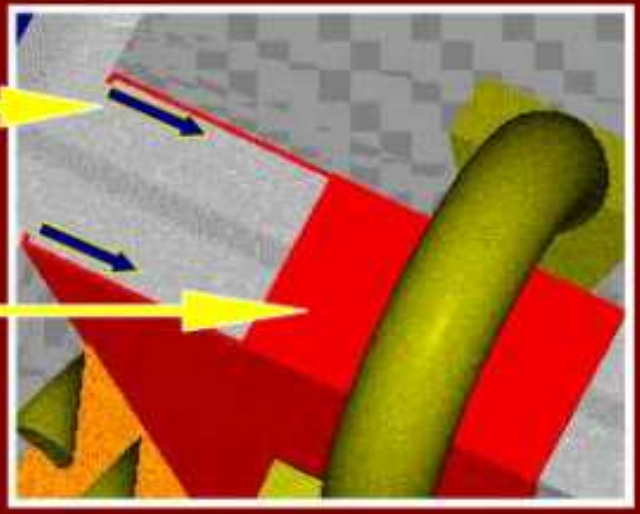
® plating inside the bunkers.

- To compensate the longitudinal contraction stress from the transversal Gem-Crete face, a key-lock is realized along the bunker's edge.



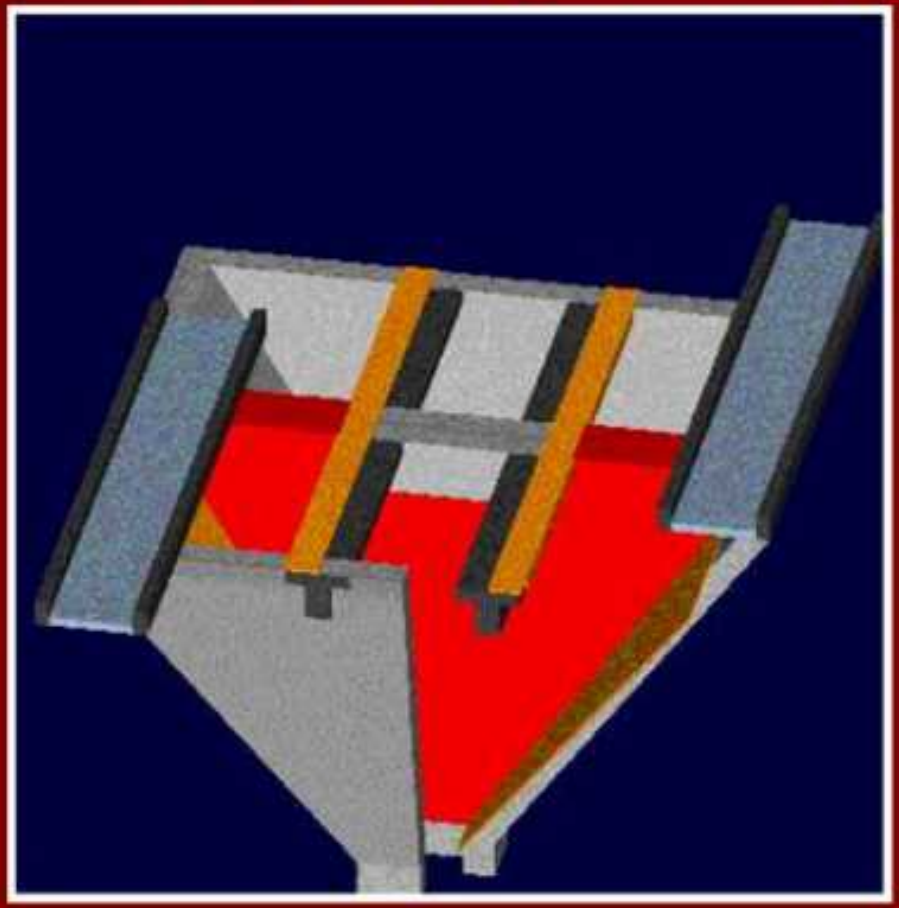
- Longitudinal stress is undertaken by Gem-Crete through the key-locks.

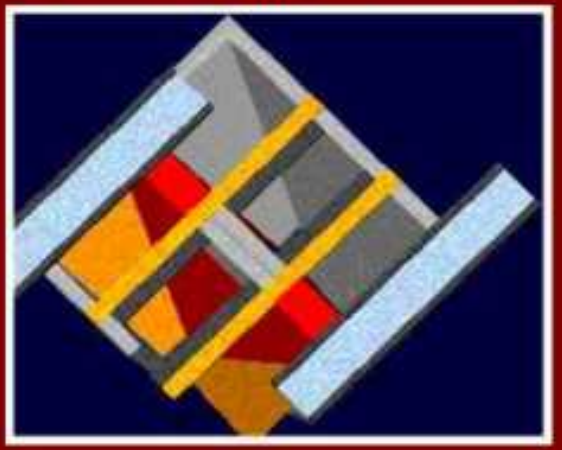
- The Gem-Crete strips carry mean time the transversal stress over the bunker's border.

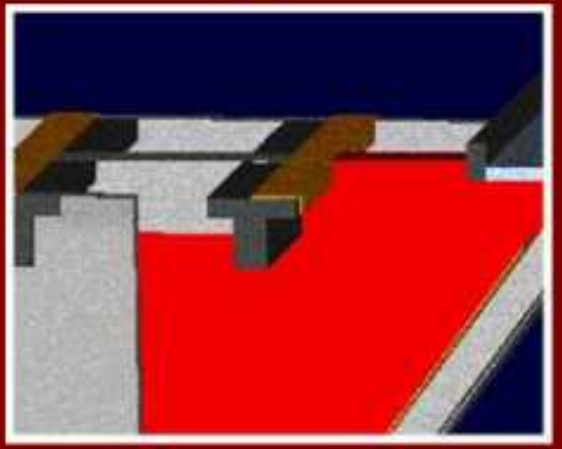


Technical solution with Gem-Crete CR ®

- The rail's concrete beam structure is protected with Gem-Crete only on exterior, on the area with maximum exposure to impact and abrasion.

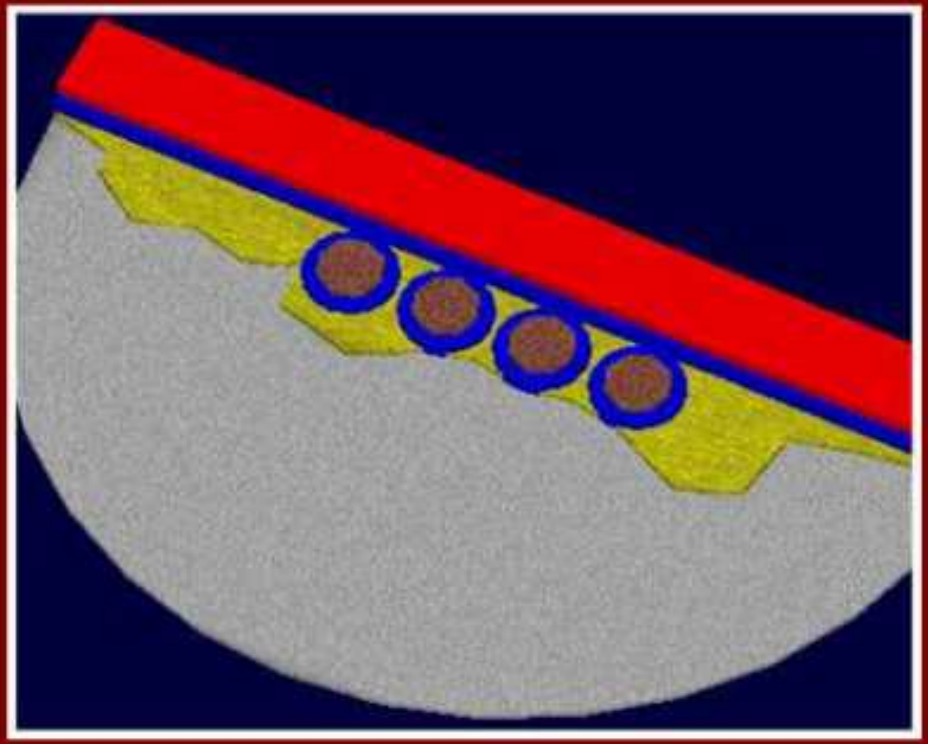






The sandwich structure of repairs

over the bunker's walls:



- The exposed reinforcing steel is protected with Fibre-Prime.
- The local repairs are done with Spray-Con WA ST.
- Over new repairs and old bunker's concrete surface, a Fibre-Prime film, used as a primer for the next layer of Gem-Crete, is applied.
- The vertical Gem-Crete CR layer, formulated with 3 mm granules of crystalline silica sand, is applied in the soft Fibre-Prime film.

Application of Fibre-Prime ®

as anticorrosion protection over the exposed steel.

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Cutting the key-locks, results in creating the necessary edge geometry in order to ensure the adhesion and stress compensation in the Gem Crete ® layer.

Spray Con WA ST ®

surface repairs over the old concrete, primed with Fibre Prime ®

- Concrete surfaces are saturated with water.
- Fibre Prime ® is applied in a thin coat over areas that will be repaired with Spray Con ®
- All repairs with Spray Con ® are realized.

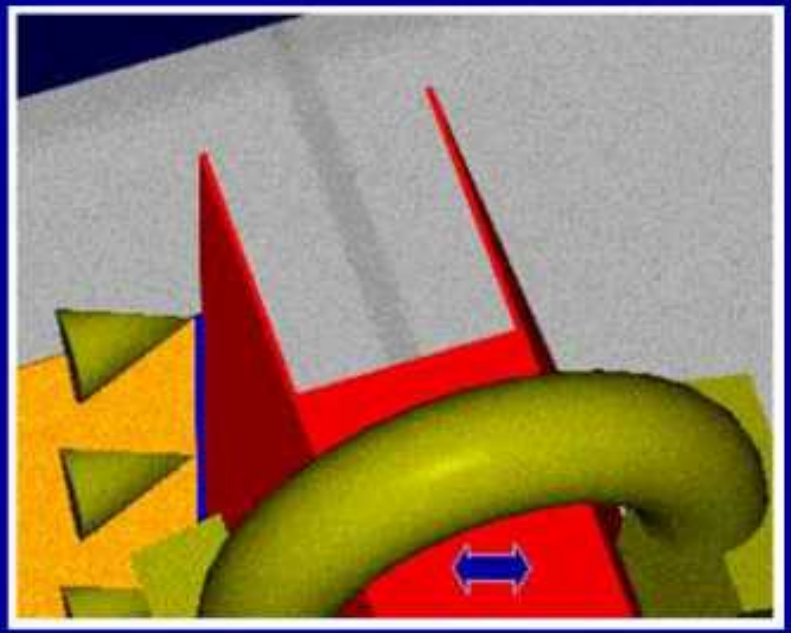
- **All repairs with Spray Con ® receive a surface profile.**

Plating the transversal faces with Gem Crete CRV ®

- On the border between two adjacent bunkers there are cut key-locks for strips.
  - Surface is saturated with water.
  - Entire surface is primed with Fibre Prime ®
- Gem Crete CRV ® is applied at a medium thickness of 15 mm, directly in the soft layer of Fibre-Prime ®.
- A special attention is given in filling with Gem-Crete ® the key-locks from edges

The Gem-Crete CRV ® strips.

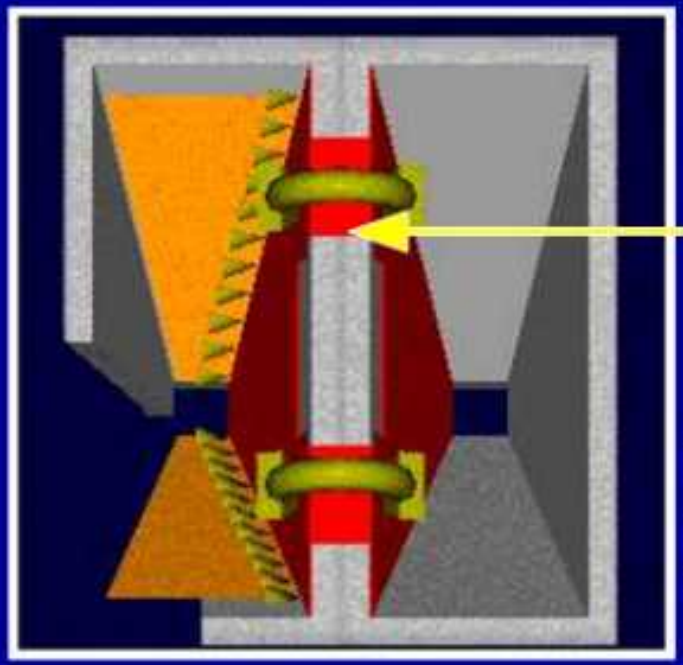
- Two adjacent faces are joined through the Gem-Crete strips.
- The strips are realized over and filling the key-locks from the bunker's border.



Plating the longitudinal faces with Gem Crete CRV ®

24 hours after plating the transversal faces with Gem Crete CRV ® :

- the longitudinal faces are saturated with water;



Fibre Prime is applied on all area;

Gem Crete CRV ® is applied at an 15 mm average thickness, directly in the soft layer of primer.

General aspect of the plated bunkers.

Concrete beams repairs

- Beams are re-shaped with Spray Con WAST ®, by filling wood pre-forms, after priming the old concrete with Fibre-Prime ®.
- The inferior part of the beams are repaired in minimum two layers, using the same technology.

Bringing the railroad concrete support to the same “0” level.

- Measures along the railroad bridge found waves with up to 12 cm amplitudes.

- Based on measures and control elements, a wood form is created around the top of the concrete beams.

- To obtain a straight level, control elements are fixed in the concrete beams, using Fibre Patch ST ®

Bringing the railroad concrete support to the same “0” level.

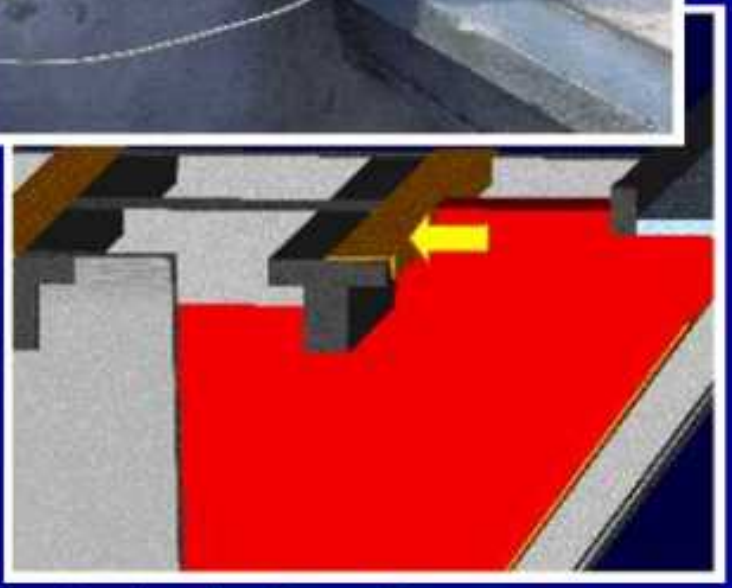
- All concrete beam surface is brushed and primed with pure Adi Con BAAC ®

Bringing the railroad concrete support to the same "0" level.

- Material used for leveling is a B 300 concrete, with 400 Kg of P42 cement / 1 cm of concrete, using aggregate up to 7 mm, and :
  - Adi Con CSF (R), 1 kit / 1 cm concrete
  - Adi Con BAAC, 80 litri / 1 cm concrete
- The concrete is poured in the wet Adi Con BAAC

Application of impact layer over the “0” level:

Three layers are applied simultaneously :



- First all surface is primed with Fibre Prime
- The exterior border is plated with Gem Crete
- The interior horizontal area is brought to the same level using Spray Con.

Details of application:

materials applied in wet or soft layers of primer.

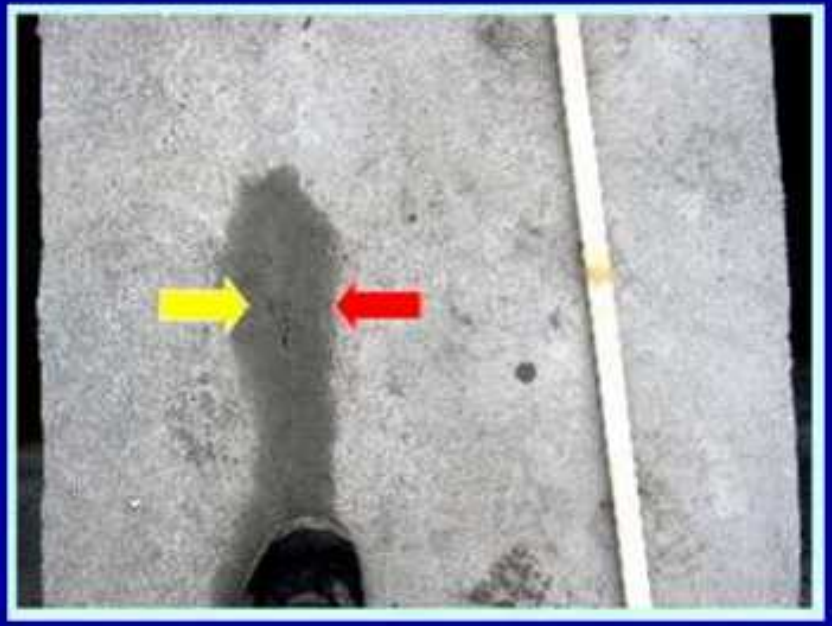
- Gem Crete applied over Spray Con
- Between the Gem Crete and Spray Con layers, the squished film of Fibre Prime may be observed.

- Adi Con BAAC as interface between the old concrete and B 300 modified concrete

Details of application:

a separation vertical plane appear between Gem Crete and Spray Con, the impact layers over the "0" level.

- The existing separation plane between the two different materials has to be sealed.
  - area with Spray Con WA ST
  - area with Gem Crete CR V



- Photo detail of the separation layer

Sealing the separation plane

by using Fibre Prime

- Concrete beam sealed

- Gem Crete CR

- Assembling back the railroad.

- Brushing the Fibre Prime over the gap.

General view over the repaired concrete beam structure

Sealing the dilatation joint:

using Cem Kote Flex ST reinforced with polypropylene fabric.

- The polypropylene fabric is squished in the fresh material and then sealed with Cem Kote Flex ST applied by brush.

Execution of working ways.

- Working ways: initial stage.

- Topping at 4 cm thickness from B300 concrete modified with:
  - Adi Con CSF (R), 1 kit / 1 mc
  - Adi Con BAAC, 80 litri / 1 mc
- B300 is poured over the repaired working ways, using pure Adi Con BAAC as primer.

- Repaired working ways: elements replaced.

Final view over the work.