PREFABRICATED CONCRETE STRUCTURES

INTRODUCTION FROM A MANUFACTURER

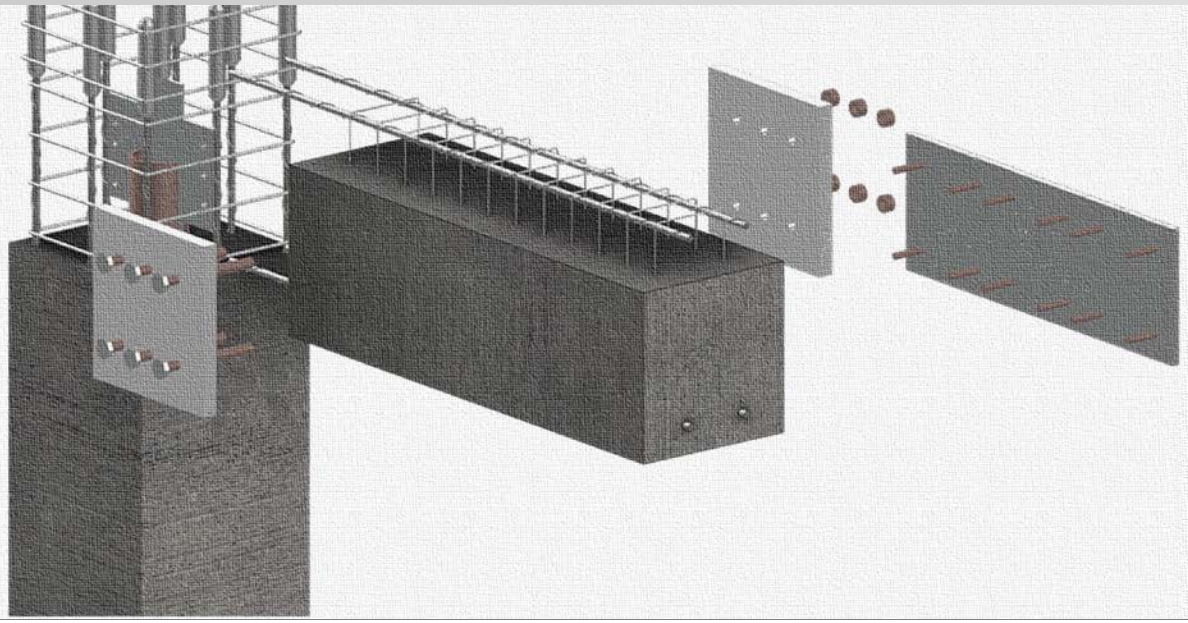
Elément SA

I . Structural connections between prefabricated elements

II. Prefabricated structures : an answer to today's challenges

III. Discussion

I. Structural connections between prefabricated elements

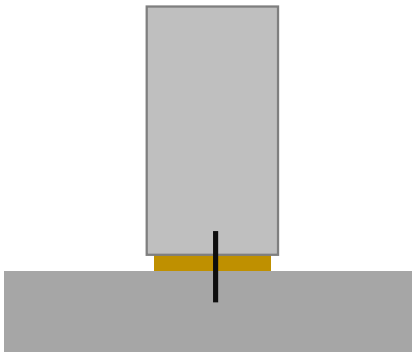


Overview of structural connections

Columns

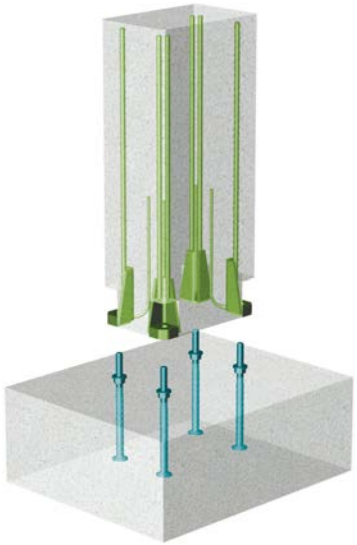
Pinned connection

Mortar + Dowel

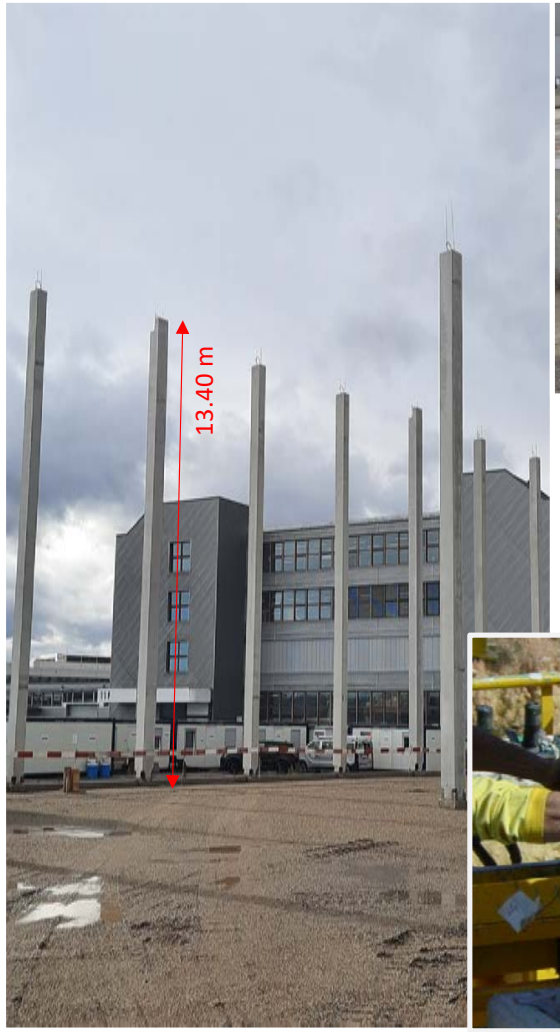


Columns

Moment resisting connection

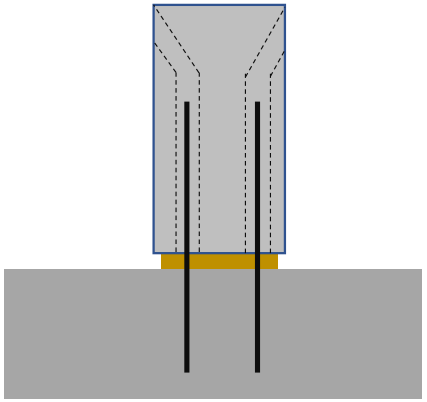


Peikko
Column shoe system

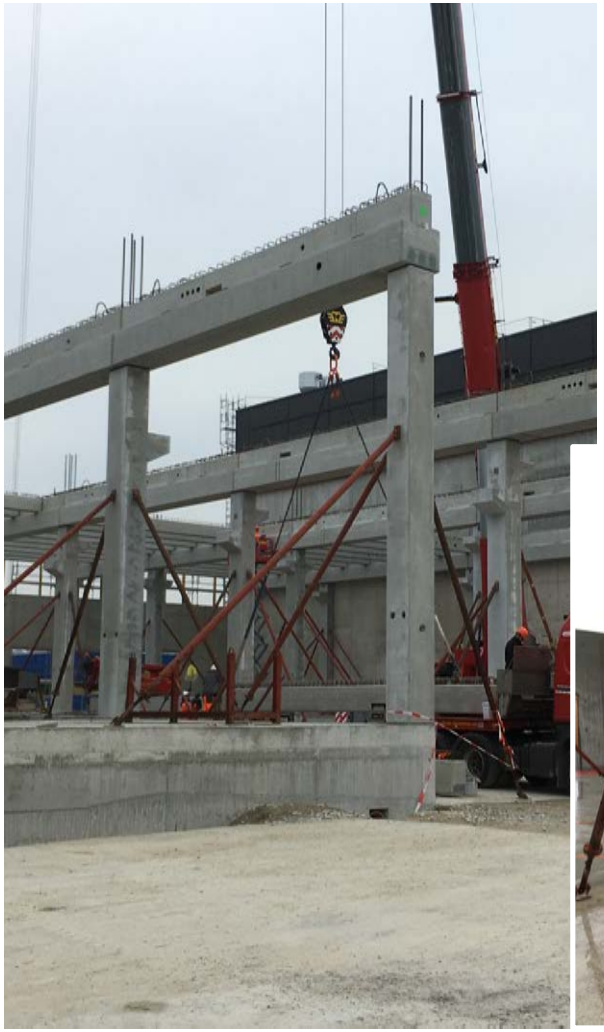


Columns

Moment resisting connection



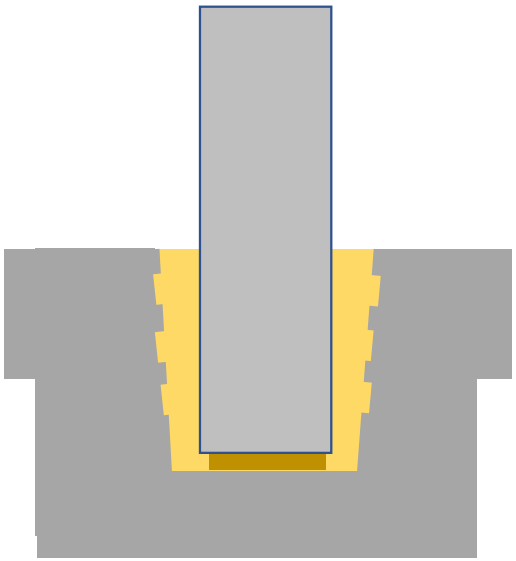
Mortar
+
Steel bars grouted



Overview of structural connections

Columns

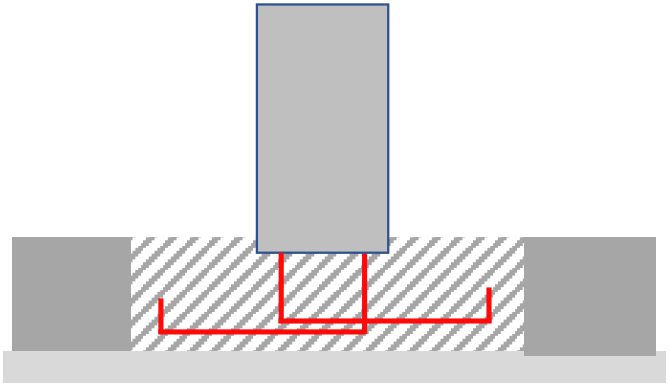
Embedded connection



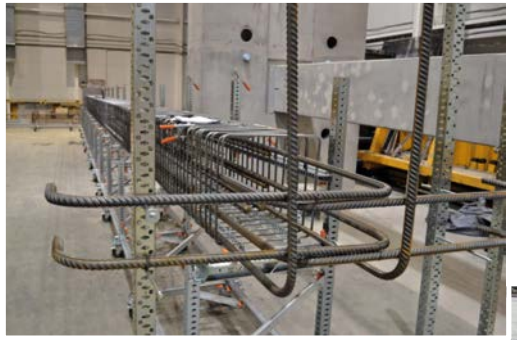
Socket / Pocket connection

Columns

Embedded connection

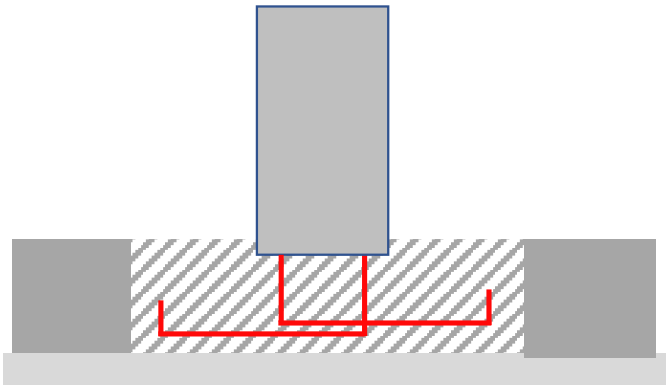


Rebars concreted in the slab



Walls

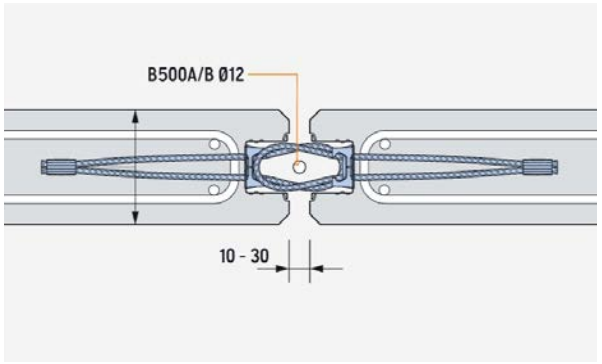
Embedded connection

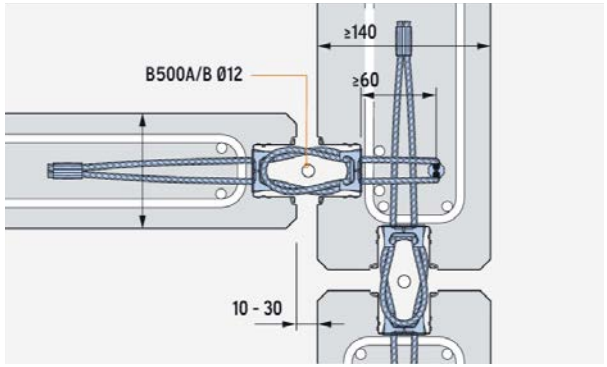


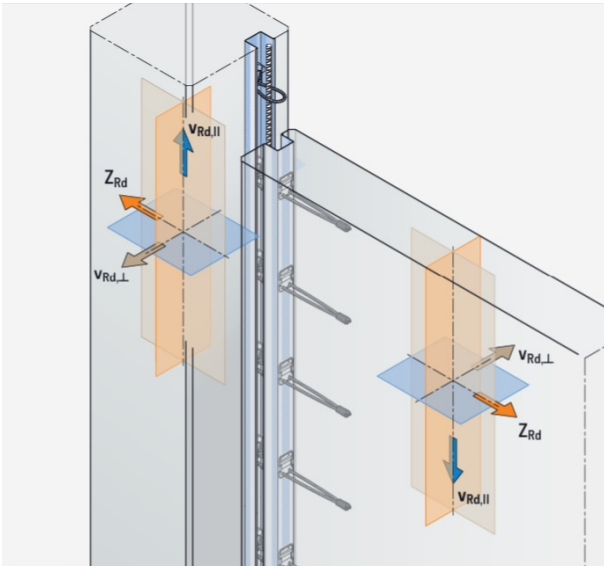
Rebars concreted in the slab

Walls

Vertical Connection (Wire loop)

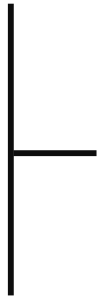


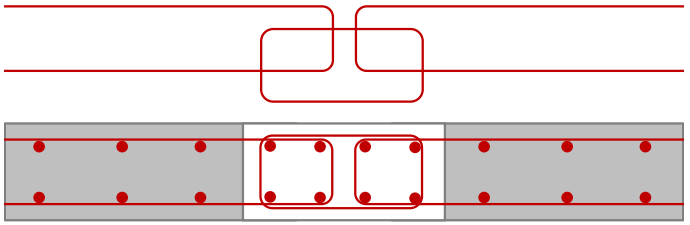


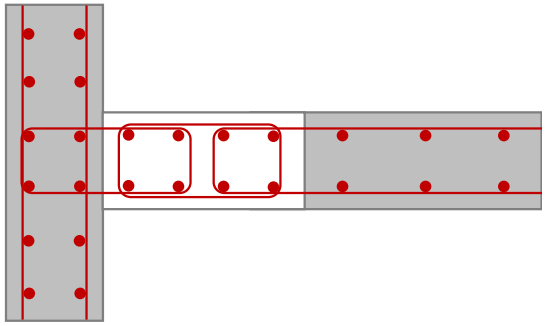


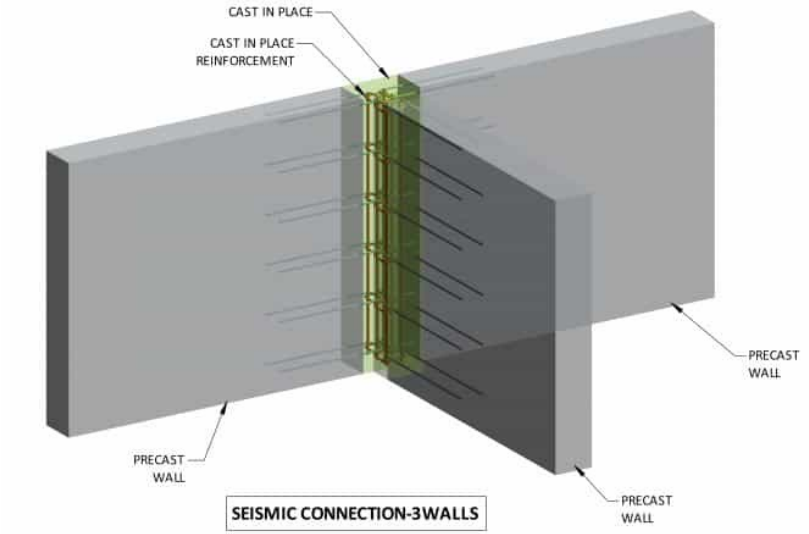
Walls

Vertical Connection (Seismic)



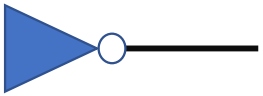


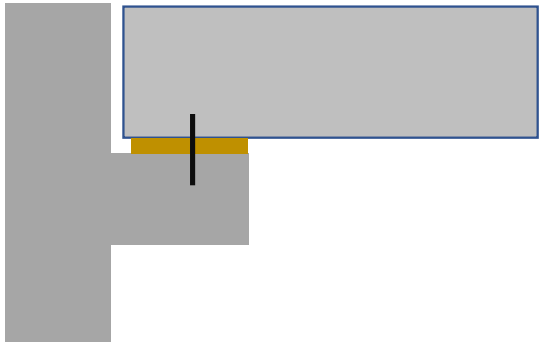




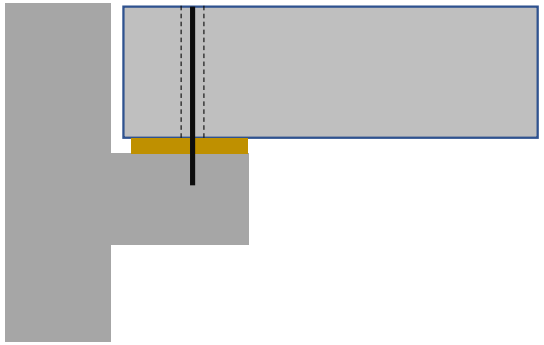
Beams

Pinned connection



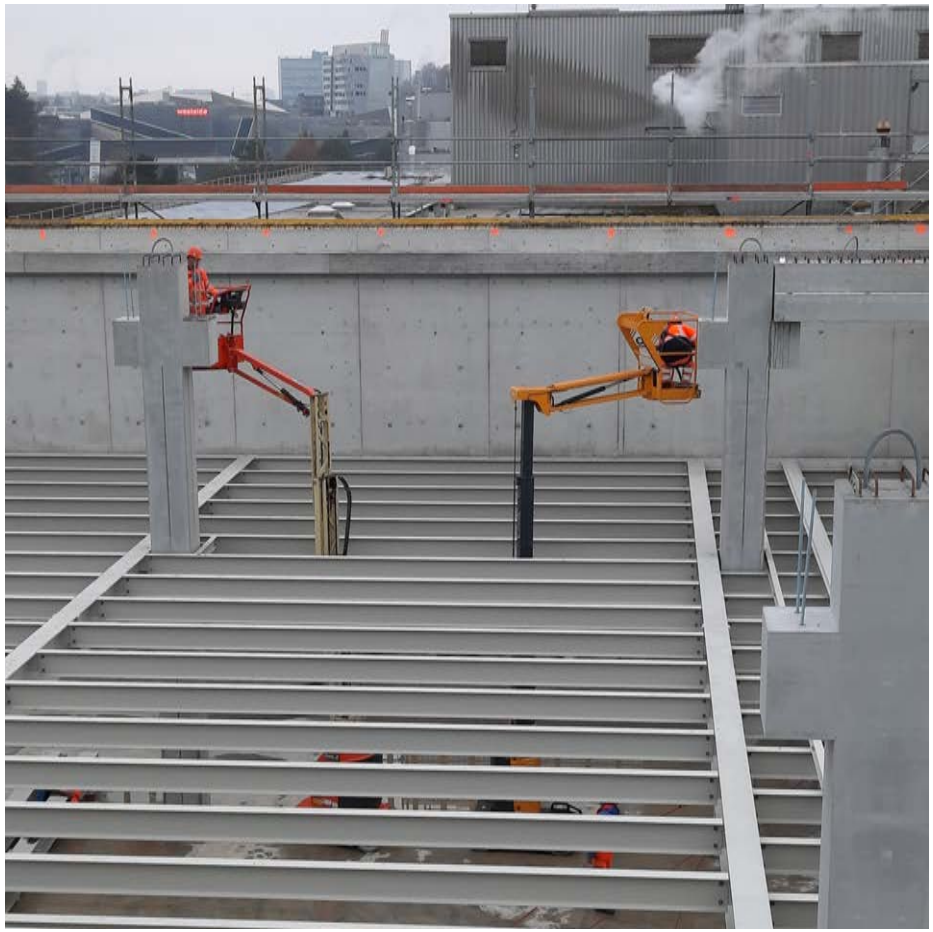


Mortar + Dowel



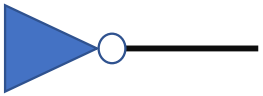
Mortar
+
Steel bars grouted

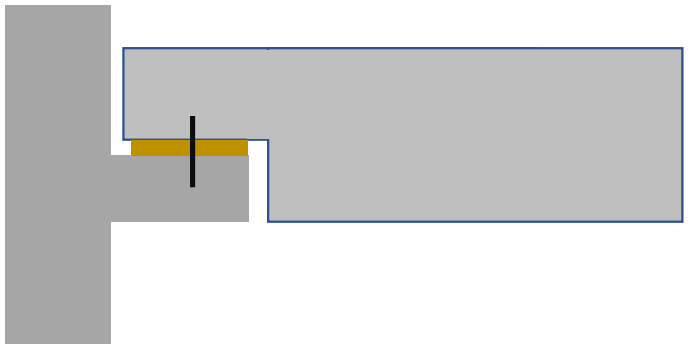
Beams



Beams

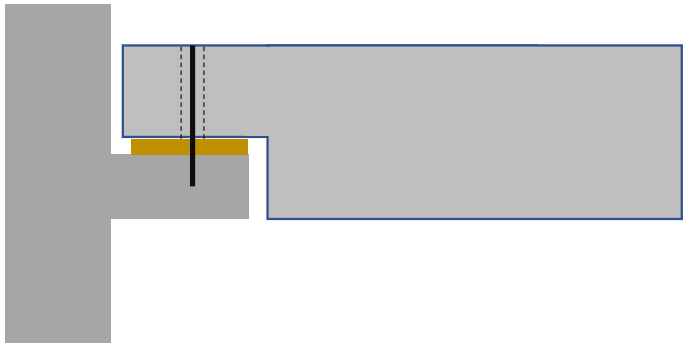
Pinned connection





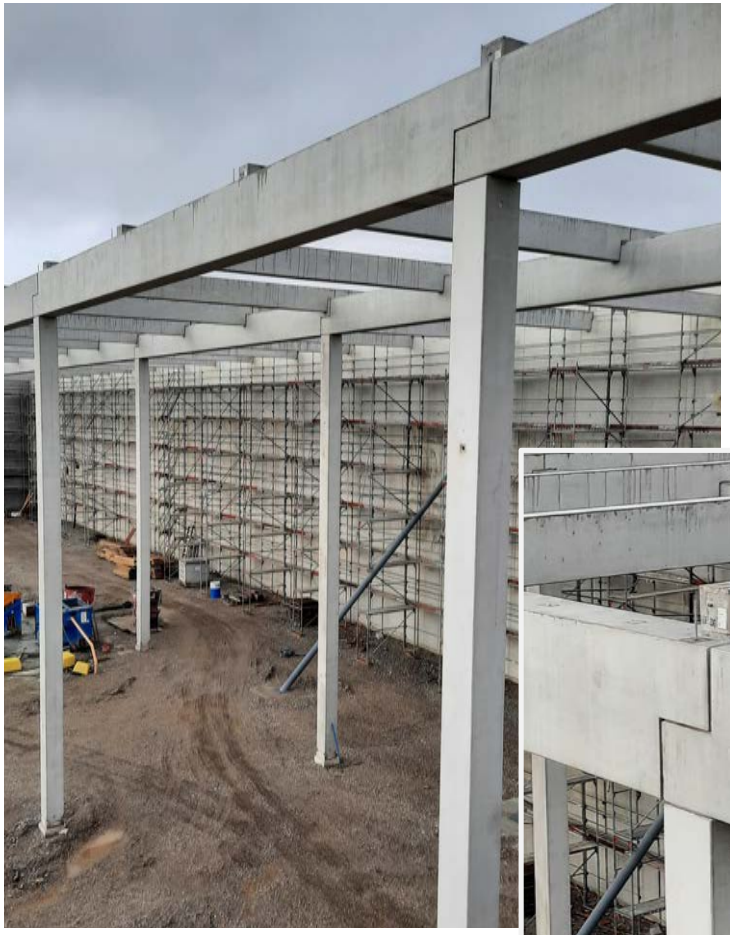
Mortar + Dowel

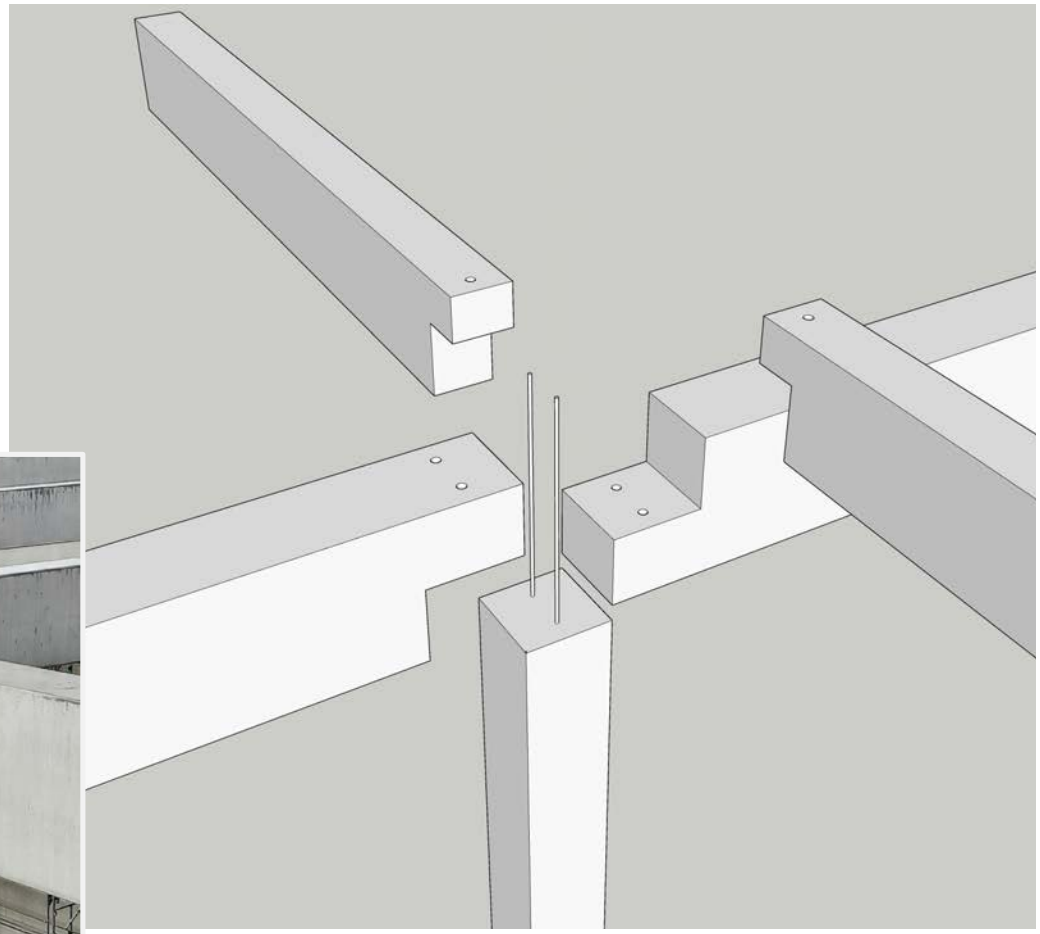
With half-joint



Mortar
+
Steel bars grouted

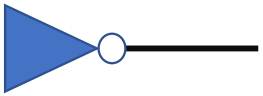
Beams

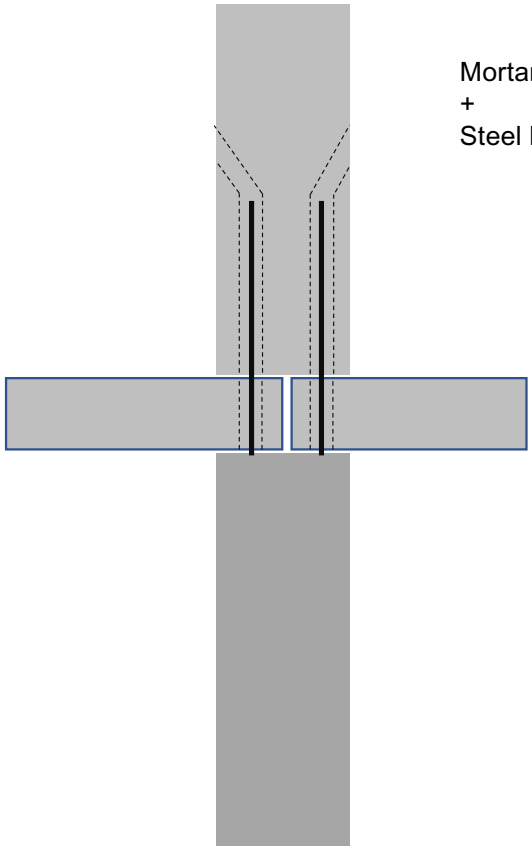




Beams

Pinned connection



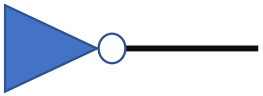


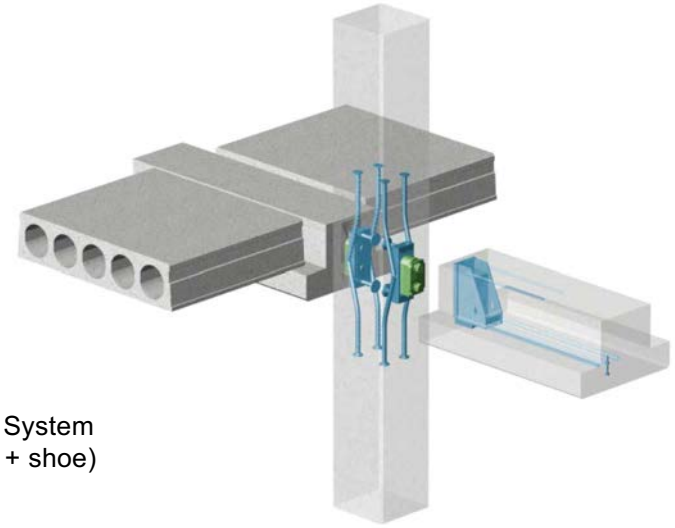
Mortar
+
Steel bars grouted

Overview of structural connections

Beams

Pinned connection



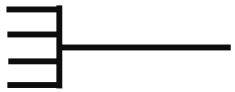


Peikko System
(corbel + shoe)

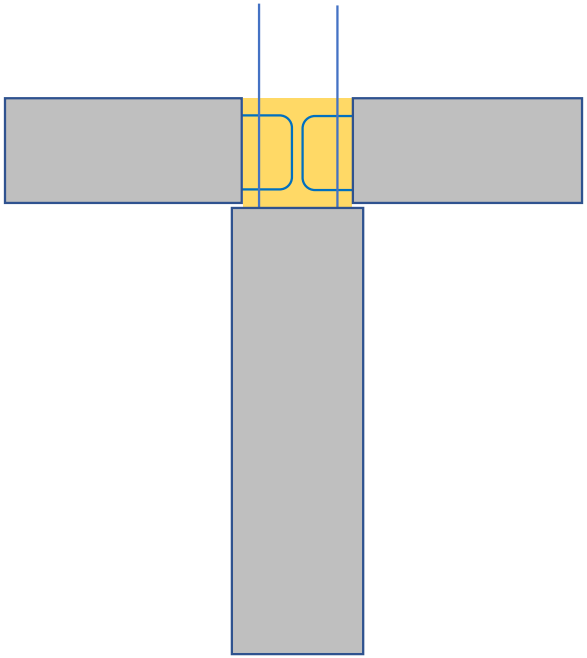
Steel insert

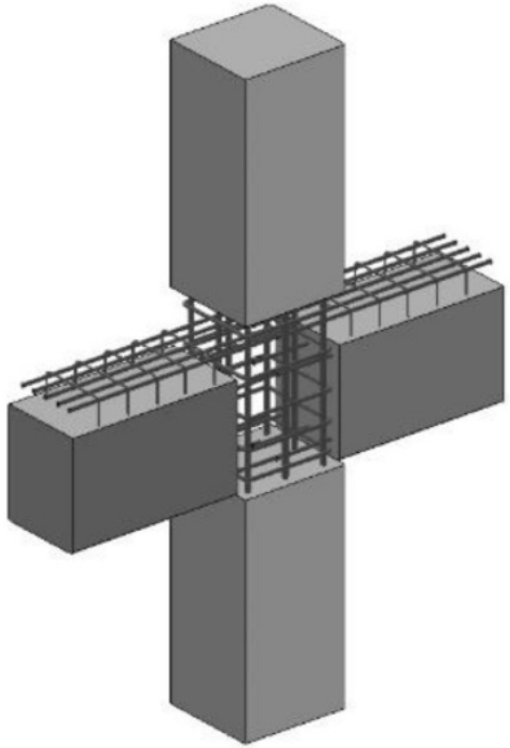
Beams

Moment resisting connection



Cast in-situ connection

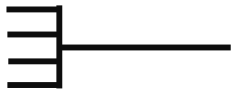


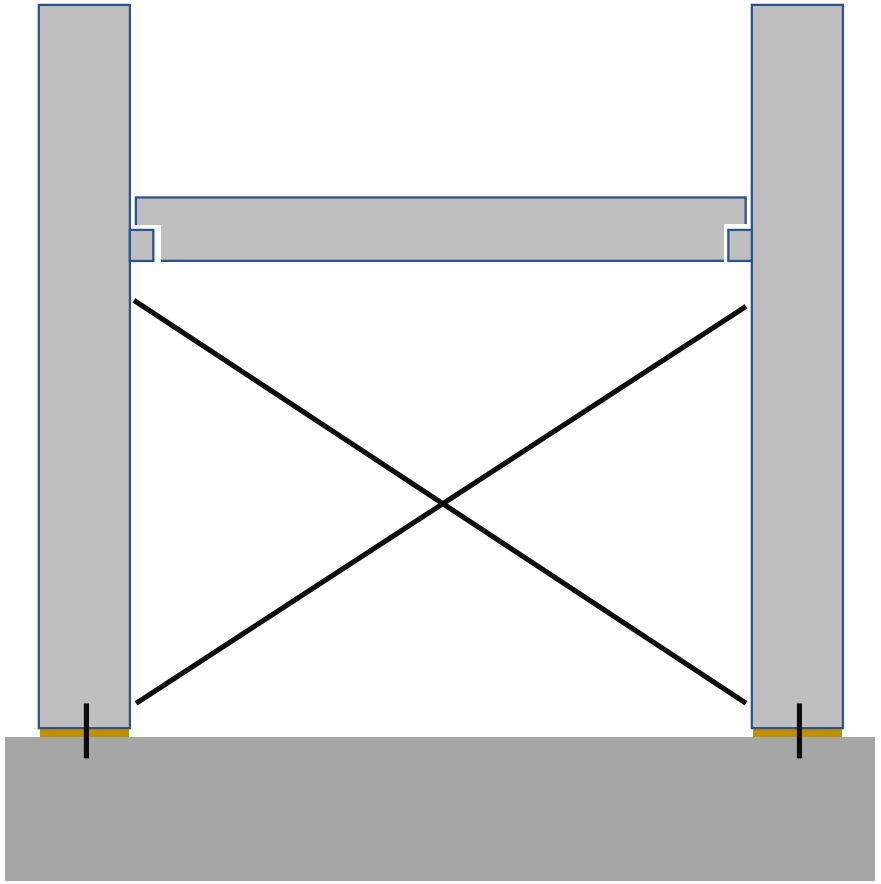


Beams

Beams

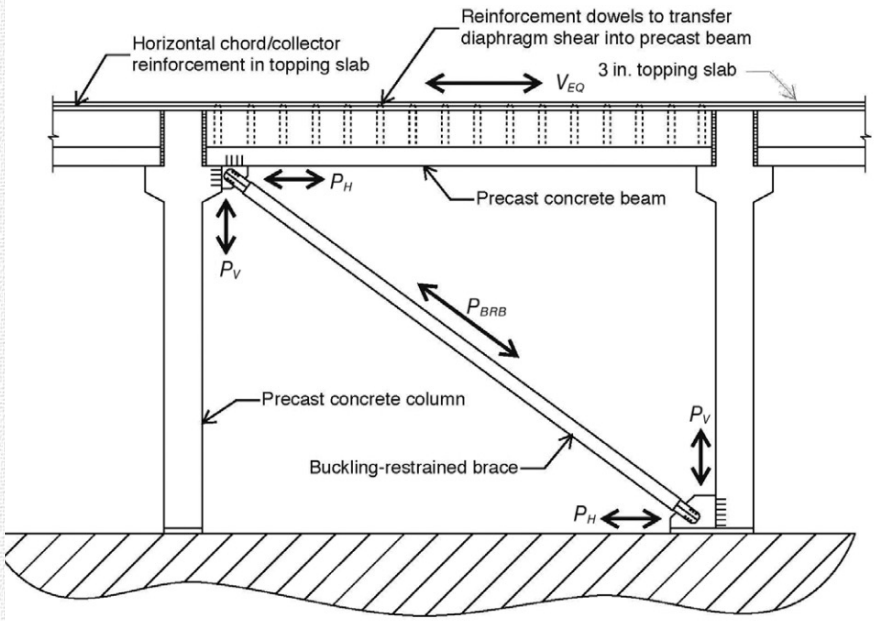
Moment resisting connection





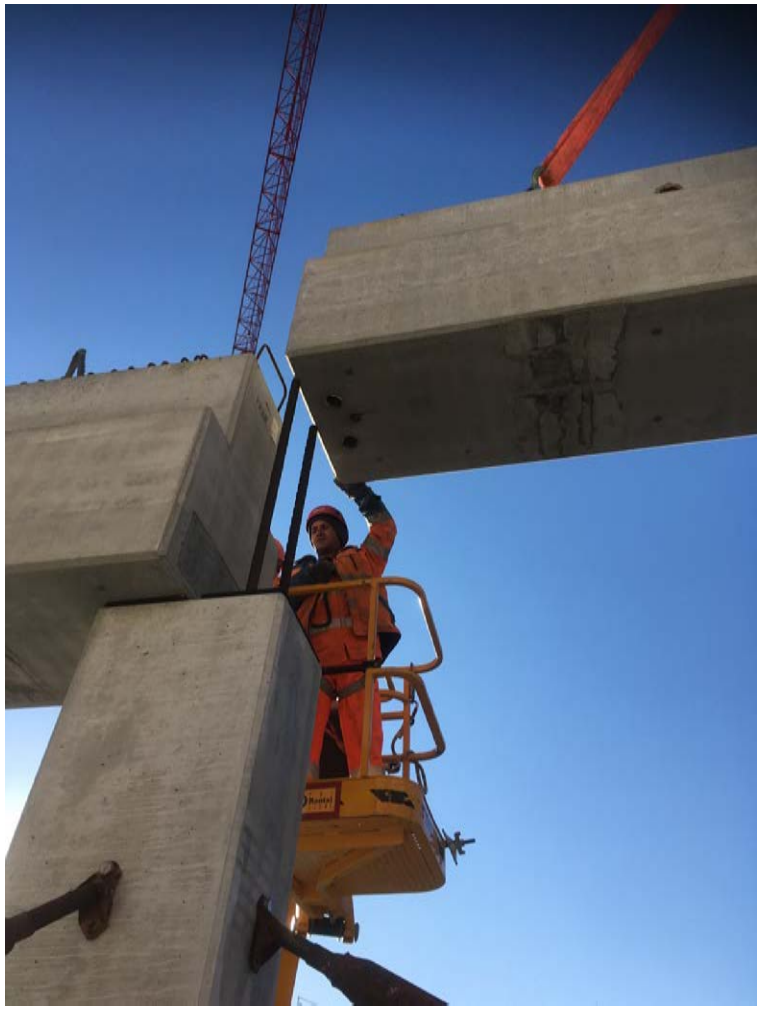
Use bracing

Beams


Horizontal chord/collector reinforcement in topping slab
Reinforcement dowels to transfer diaphragm shear into precast beam
V_{EQ}
3 in. topping slab
P_H
Precast concreate beam
P_V
P_{BRB}
Precast concrete column
P_V
Buckling-restrained brace
P_H

Overview of structural connections

Overview of structural connections



Post-tensioning with bars

Post-tensioning with strands

Post-tensioning with strands

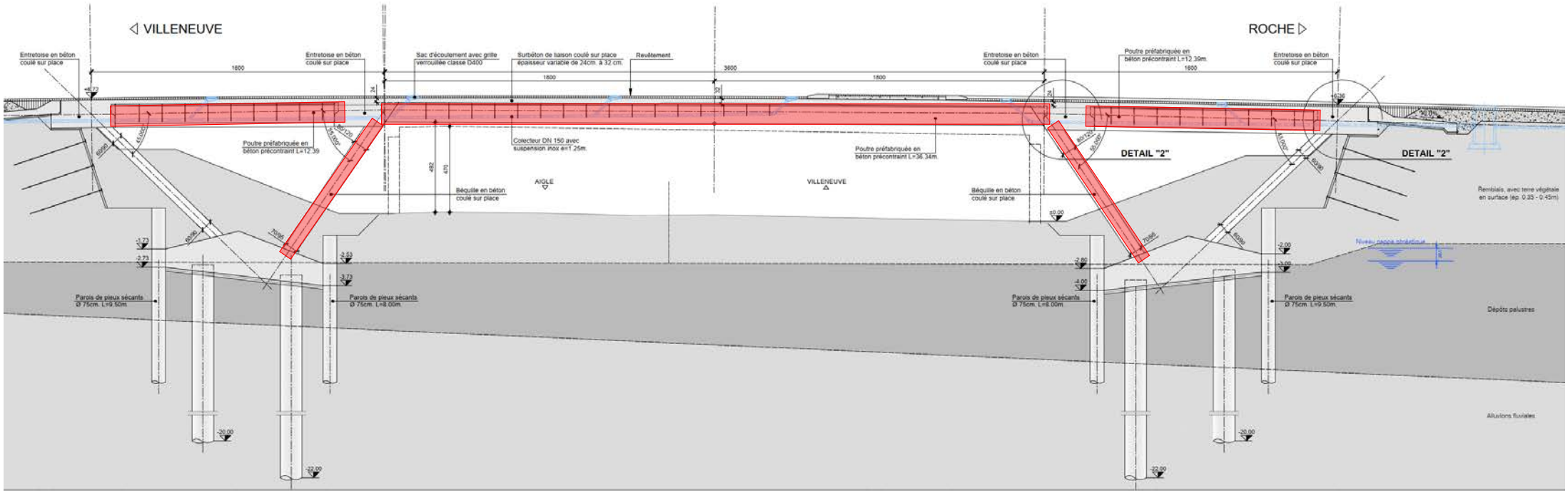
Post-tensioning with strands


II. Precast elements : An answer to today's challenges


Reduce service disruption to a minimum

- Reduce site duration
- Reduce or eliminate service disruption
- Allow to concentrate very disturbing works on a very short time : lightning raid
- Maximize off-site activities and preparatory works

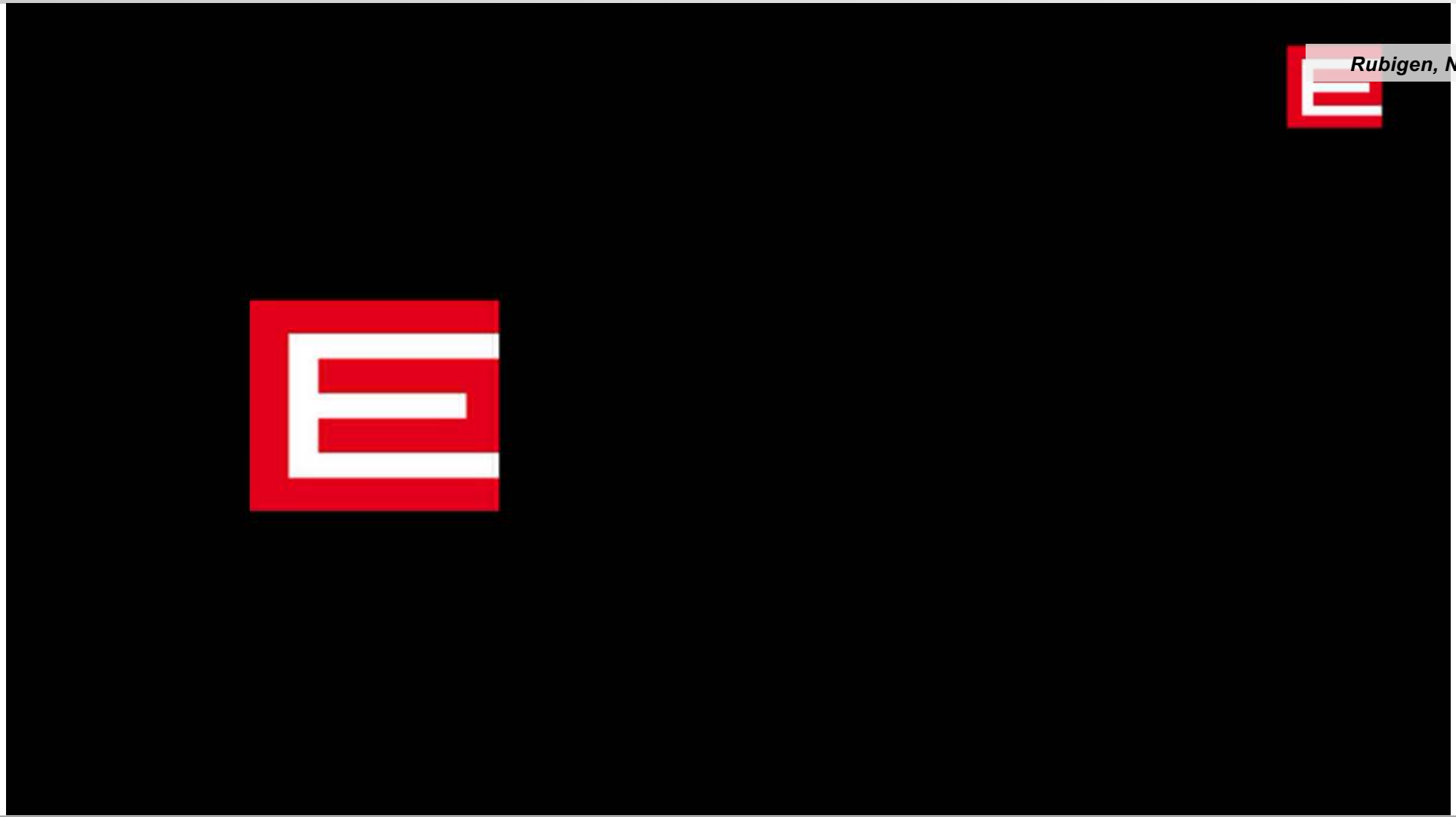
Saint-Prex, N9 Bridge


◁ VILLENEUVE
ROCHE ▷
Entretoise en béton coulé sur place
Entretoise en béton coulé sur place
Sac d'écoulement avec grille verrouillée classe D400
Surbéton de liaison coulé sur place épaisseur variable de 24cm. à 32 cm.
Revêtement
Entretoise en béton coulé sur place
Poutre préfabriquée en béton précontraint L=12.39m.
Entretoise en béton coulé sur place
1800
3600
1800
1800
1800
Poutre préfabriquée en béton précontraint L=12.39
Corecteur DN 150 avec suspension inox e=1.25m.
Poutre préfabriquée en béton précontraint L=36.34m.
DETAIL "2"
DETAIL "2"
AIGLE
VILLENEUVE
Béquille en béton coulé sur place
Béquille en béton coulé sur place
Remblais, avec terre végétale en surface (ép. 0.33 - 0.45m)
Niveau nappe phréatique
Parois de pieux sécants Ø 75cm. L=9.50m.
Parois de pieux sécants Ø 75cm. L=8.00m.
Parois de pieux sécants Ø 75cm. L=8.00m.
Parois de pieux sécants Ø 75cm. L=9.50m.
Dépôts palustres
Alluvions fluviales

Reduce service disruption and impact on users

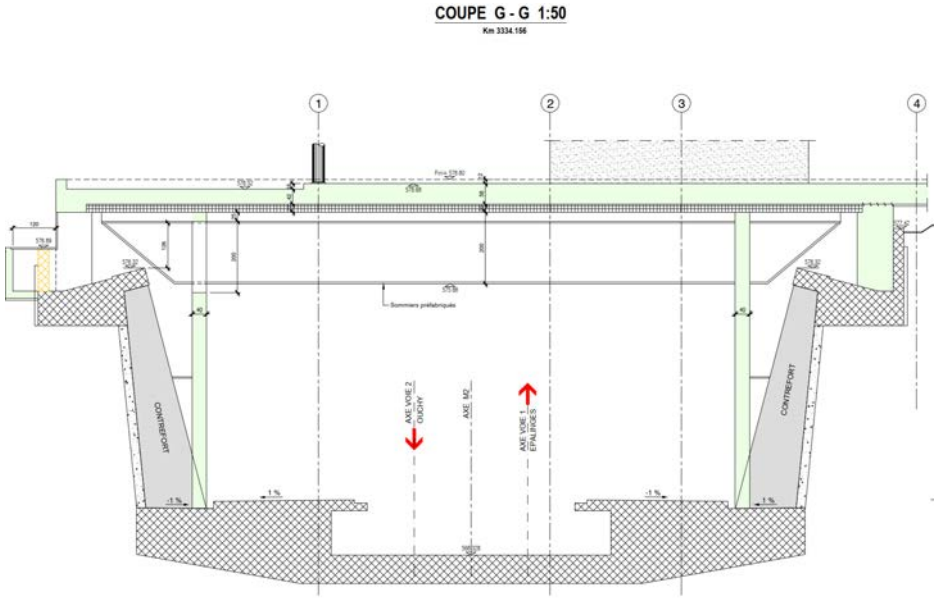
Villeneuve, N9 Bridge

Reduce service disruption and impact on users



Rubigen, N6 Bridge

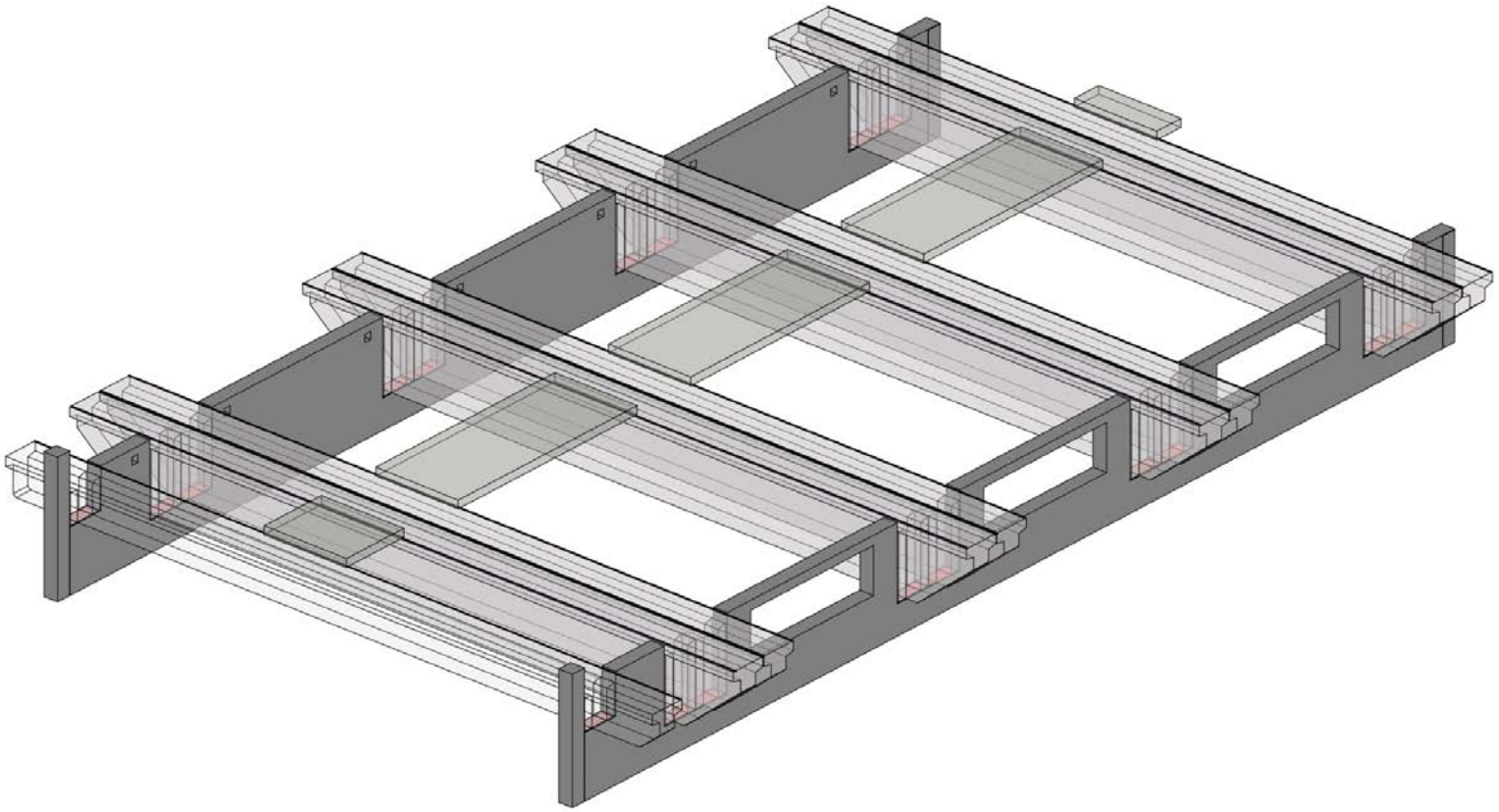
Lausanne, Hôpital des enfants



8 x Beams 200cm
40 x slabs 22 cm

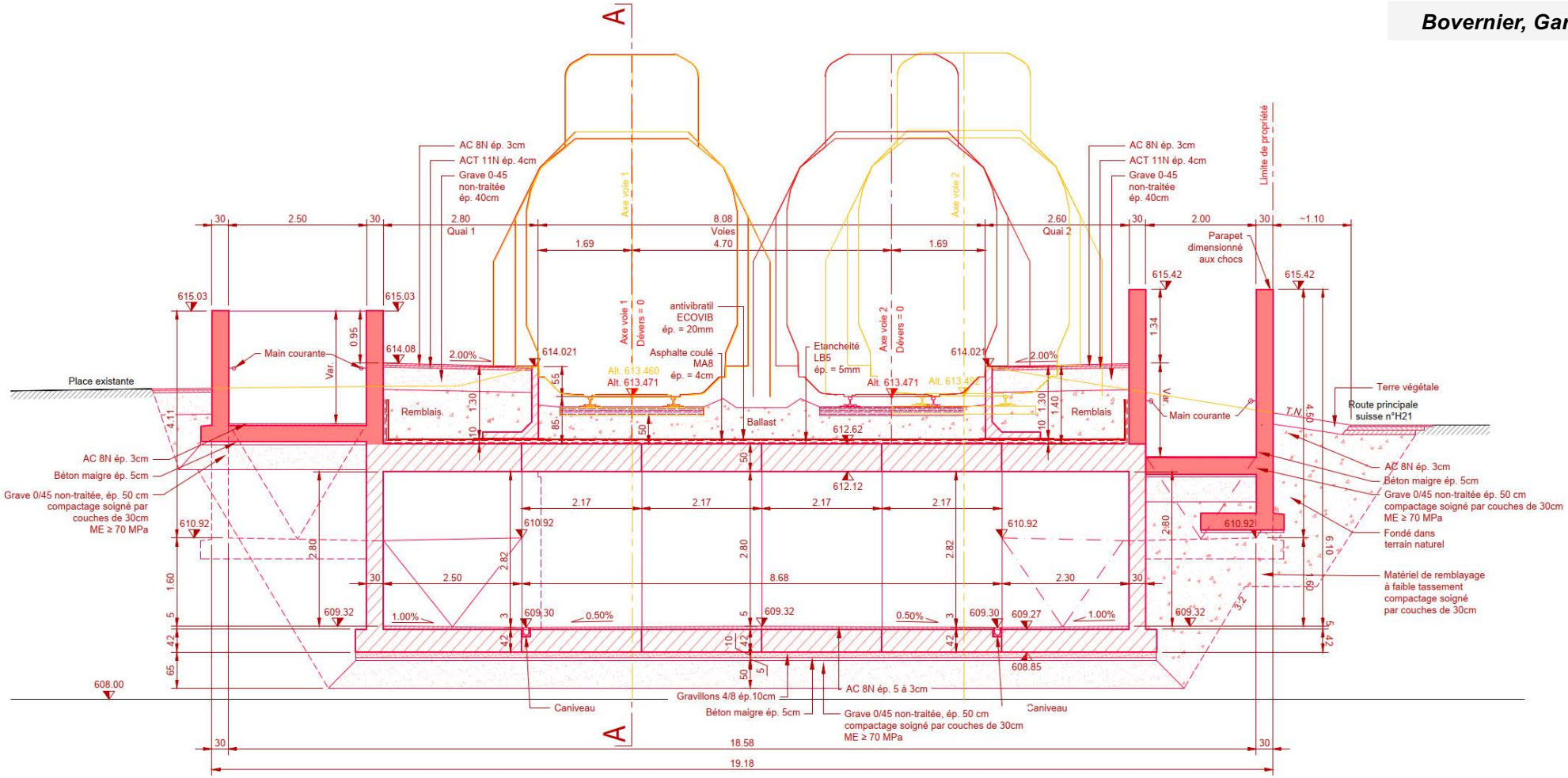
19.5 m – 57.6 To

Lausanne, Hôpital des enfants



Lausanne, Hôpital des enfants

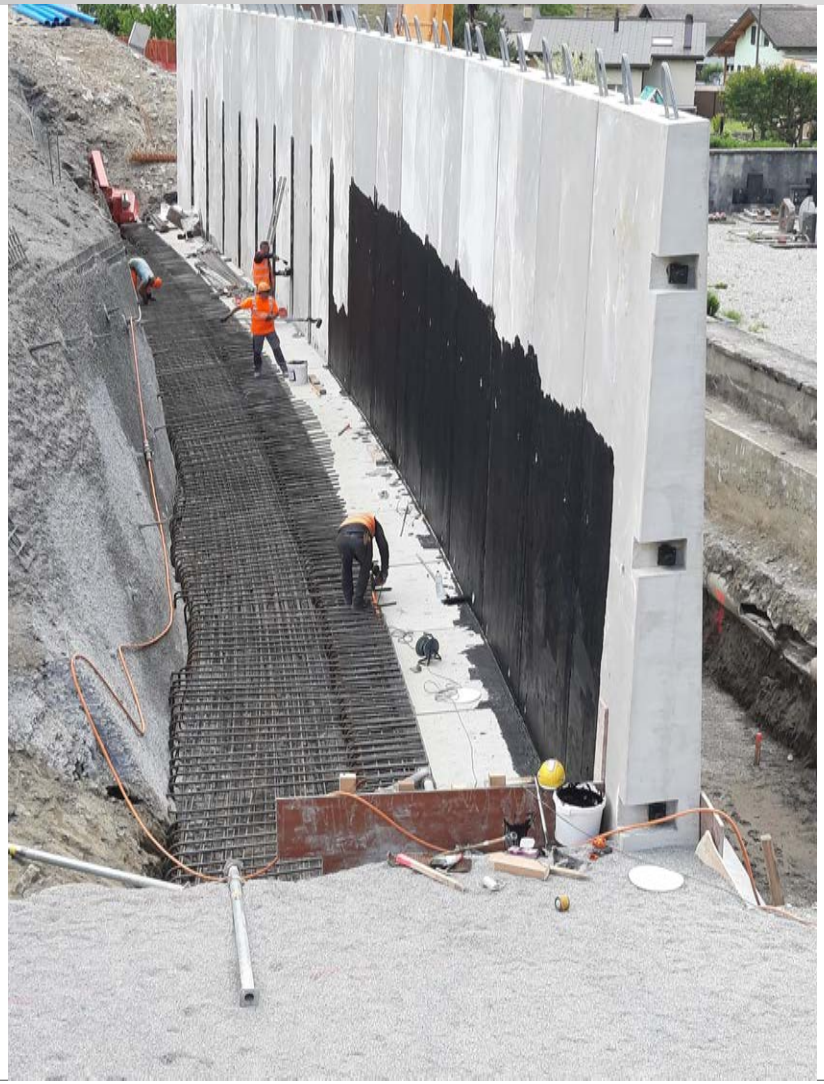
Bovernier, Gare TMR



Reduce service disruption and impact on users

Bovernier, Gare TMR

Reduce service disruption and impact on users



Bovernier, Gare TMR

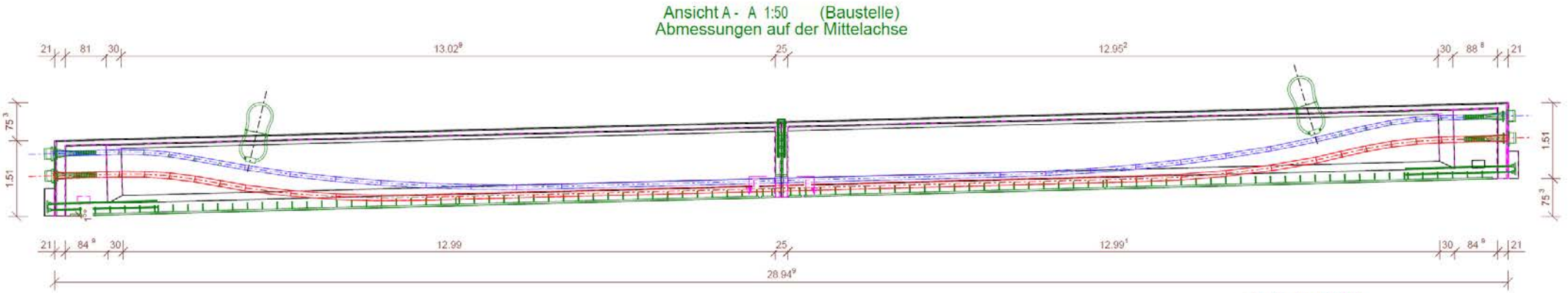
Reduce service disruption and impact on users

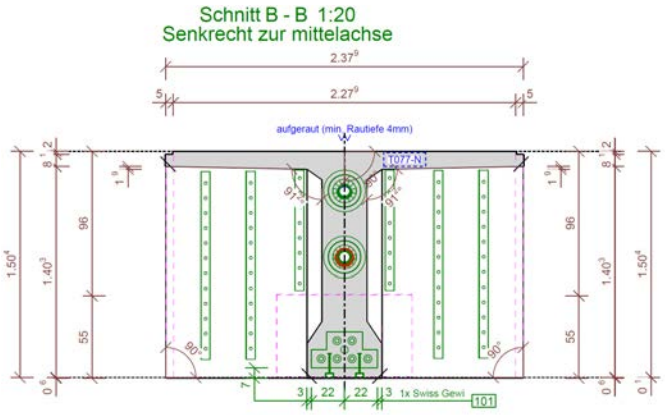
Zurich, Schwamendingen N1

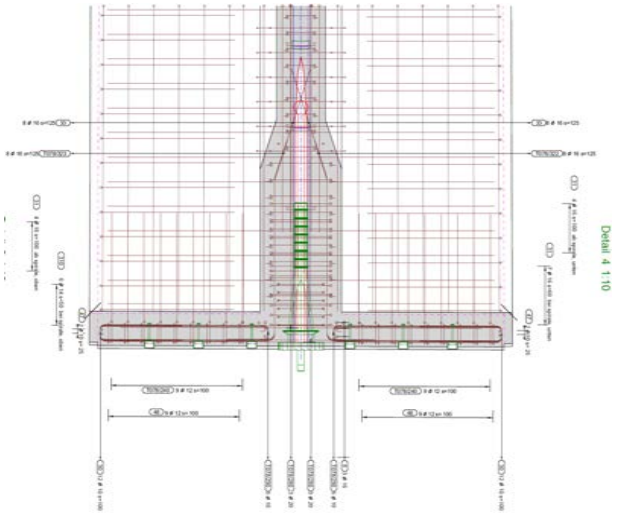
Reduce service disruption and impact on users

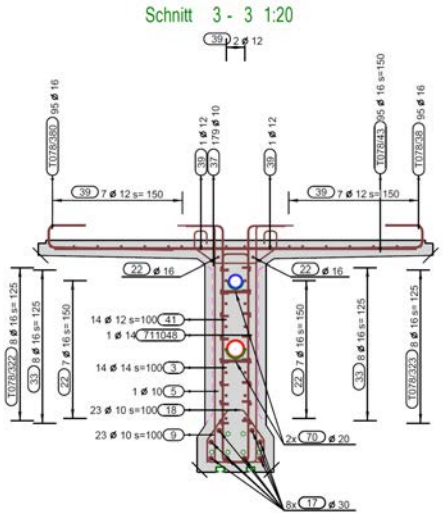
Zurich, Schwamendingen N1

Zurich, Schwamendingen N1









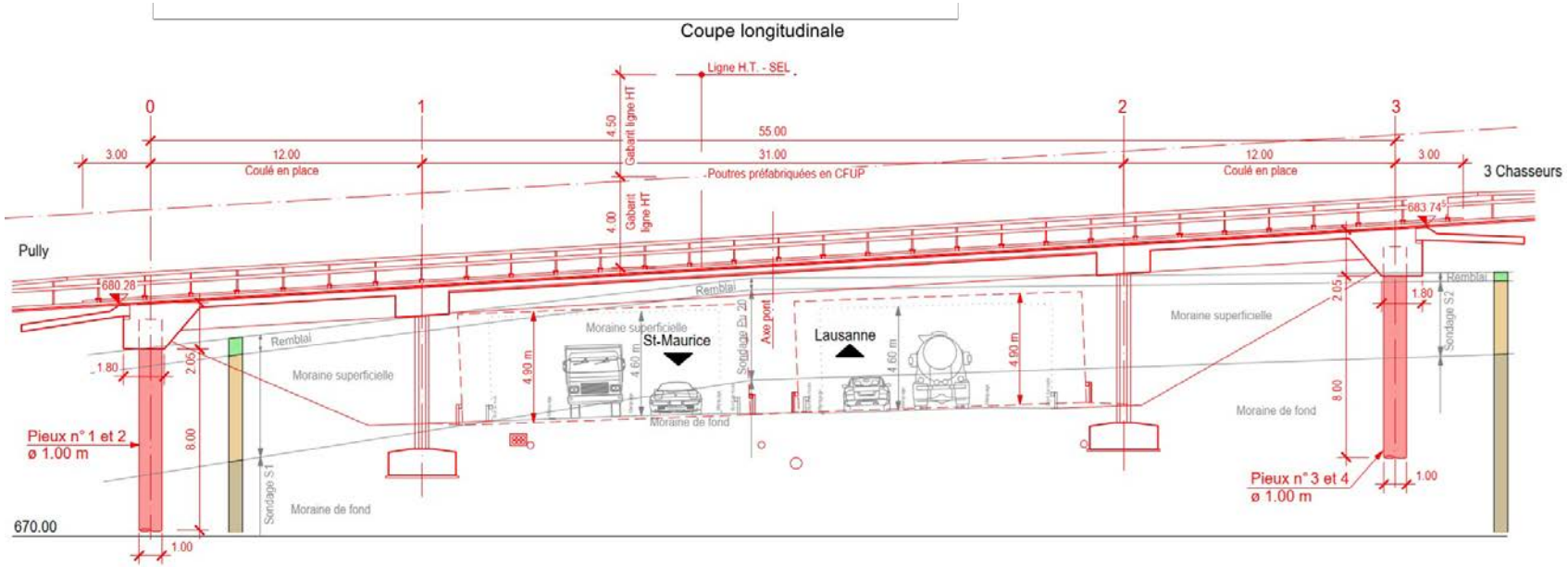
Reduce service disruption and impact on users

Zurich, Schwamendingen N1

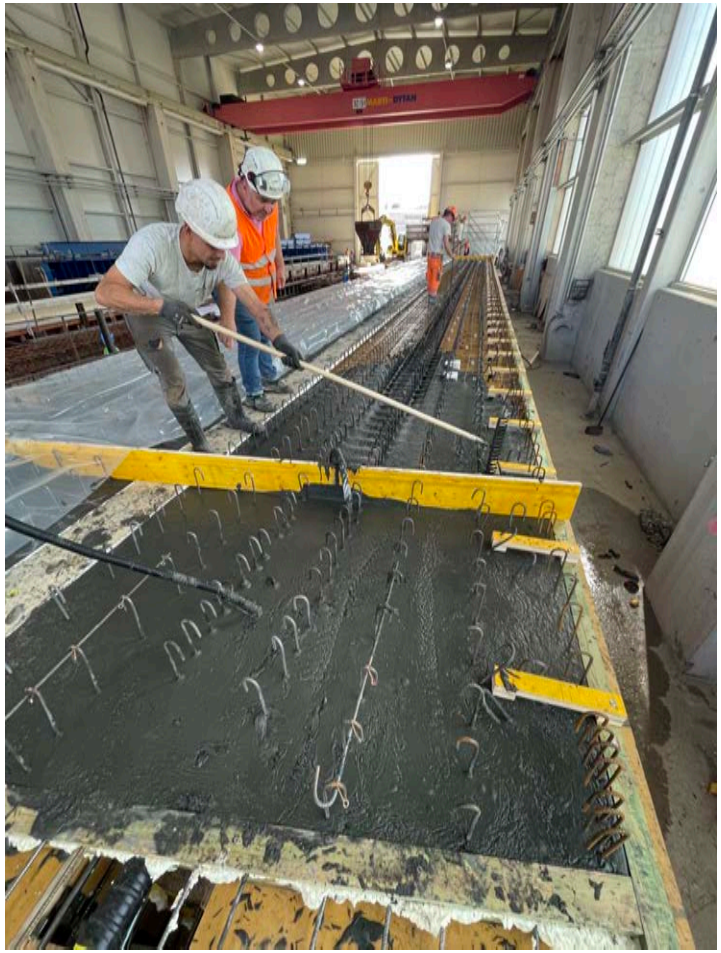
Reduce service disruption and impact on users

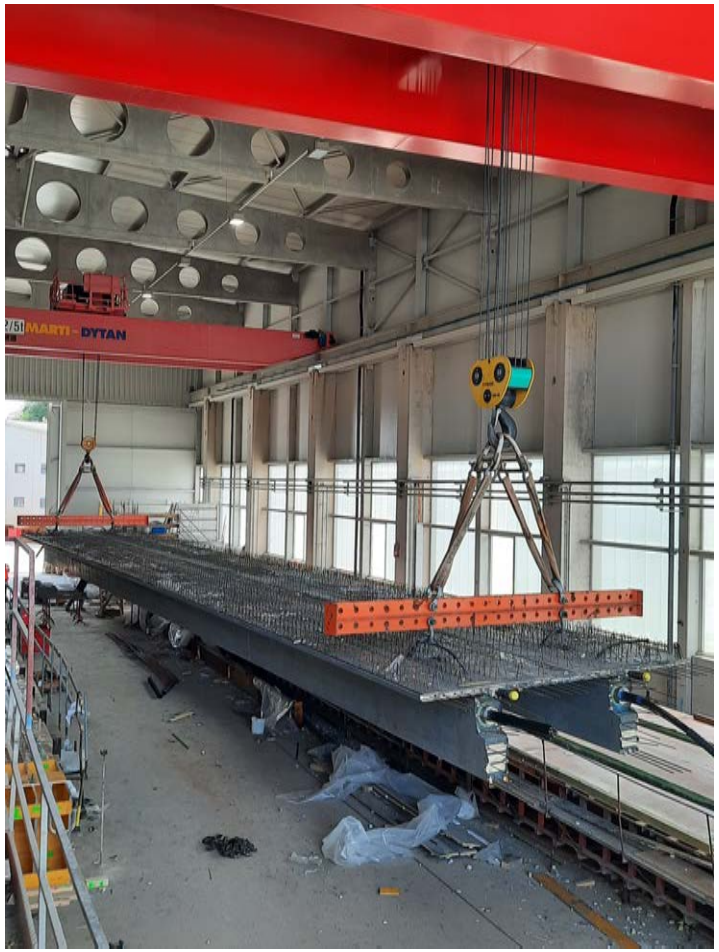
Zurich, Schwamendingen N1

Pully, N9 UHPC Bridge



Pully, N9 UHPC Bridge



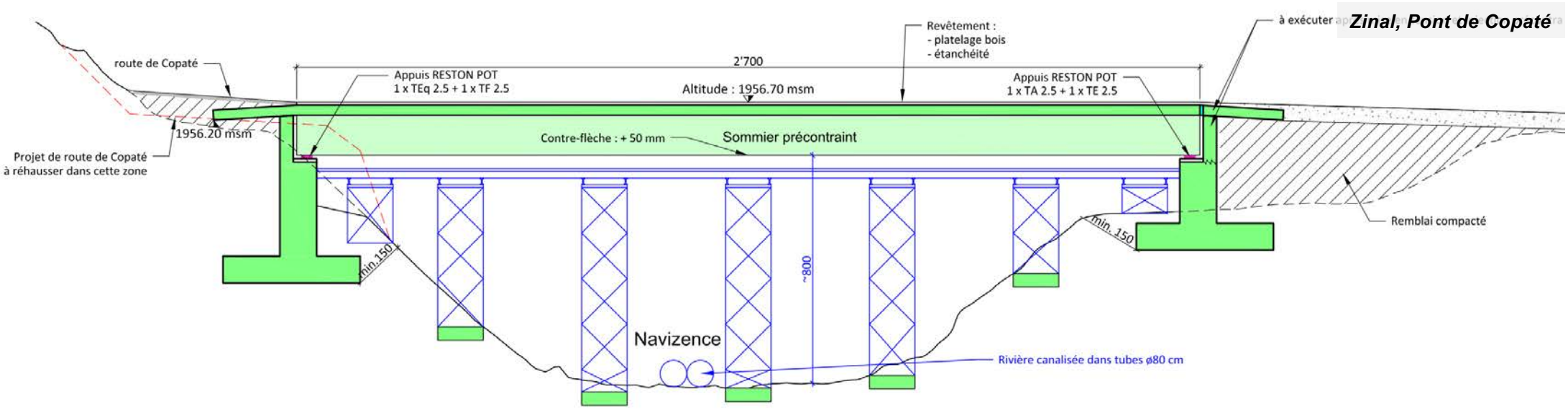


Reduce service disruption and impact on users

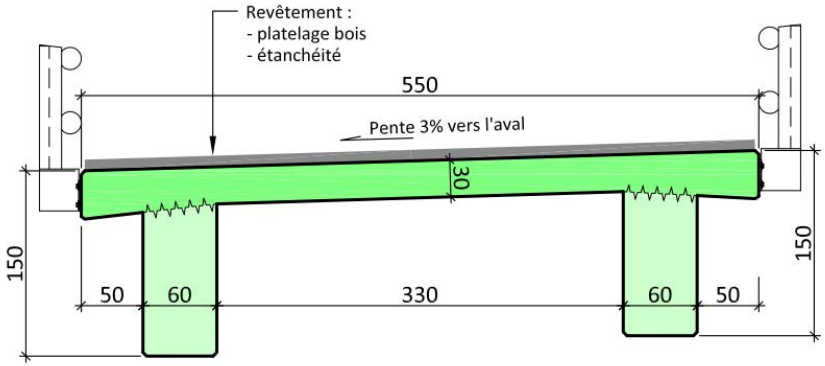
Pully, N9 UHPC Bridge

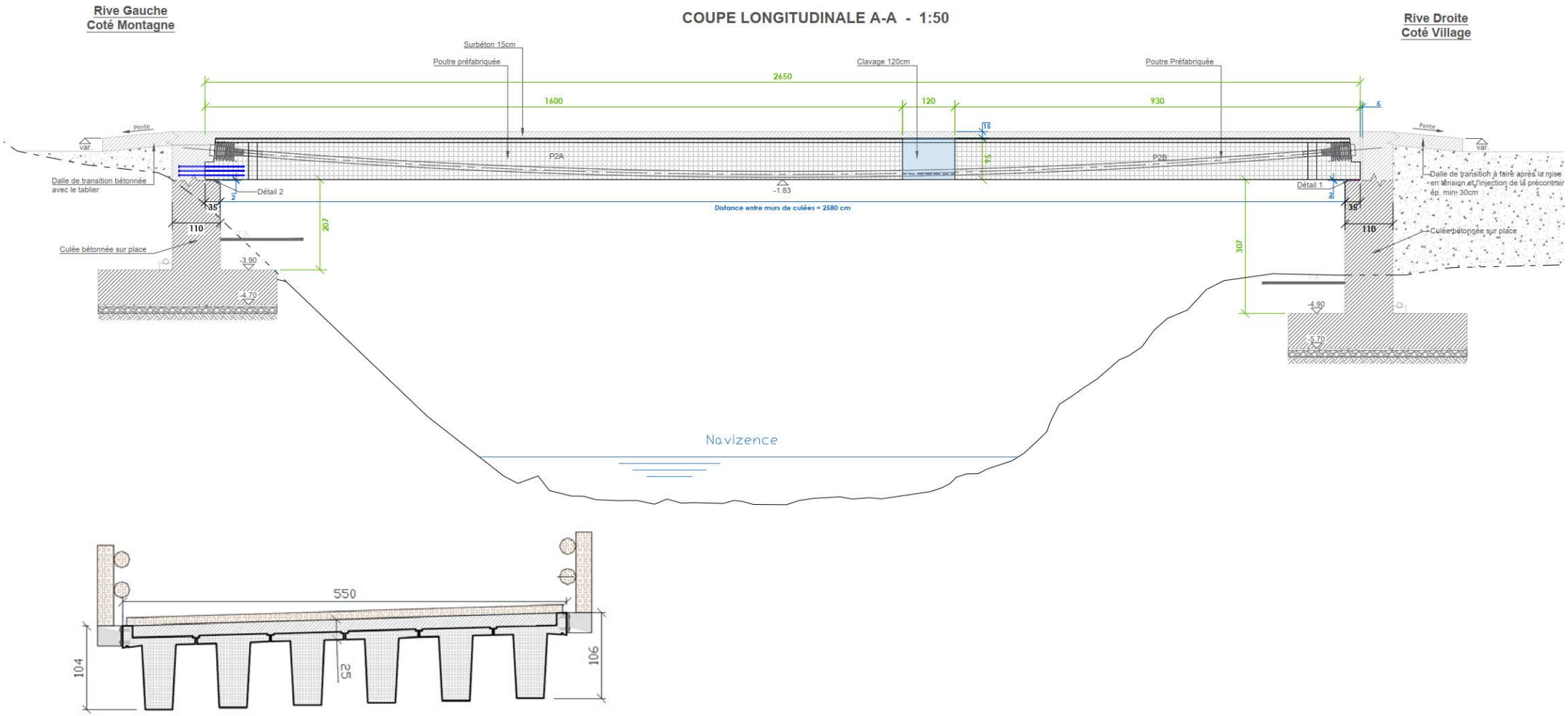
Reduce site allowance and duration

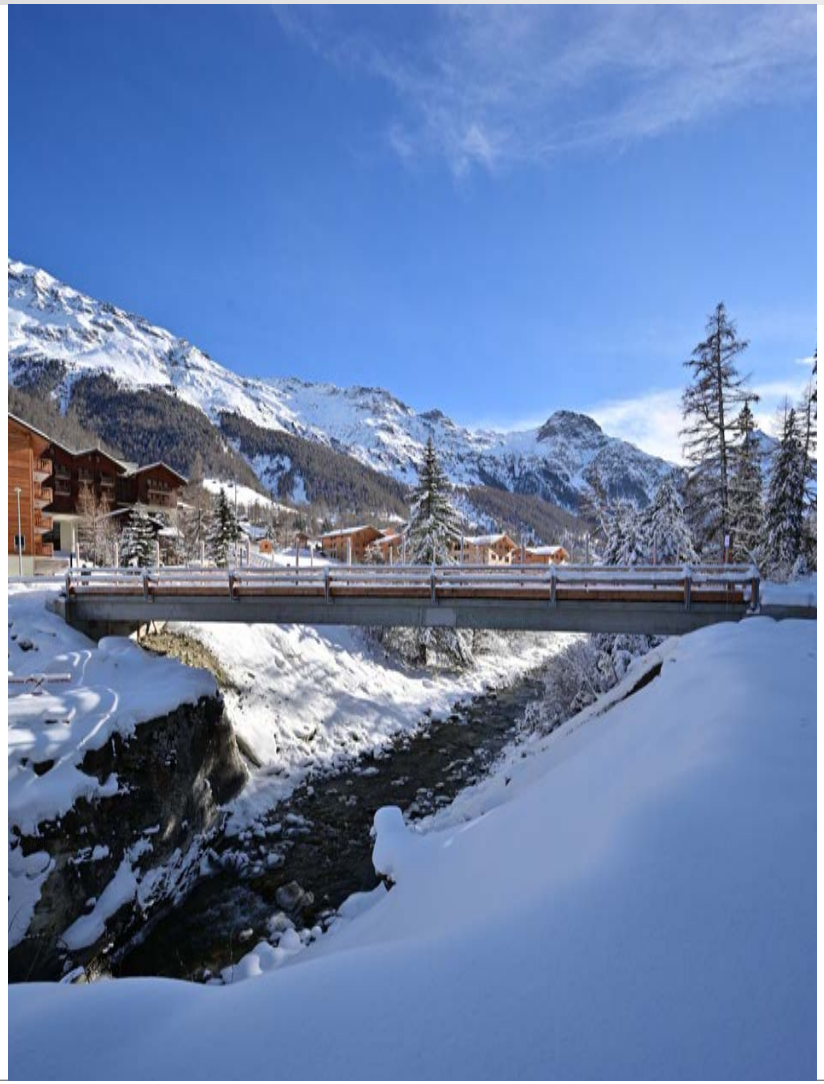
- Reduce site duration
- Reduce site allowance
- Reduce equipment and personal on site
- Reduce environmental impact
- Optimize production process



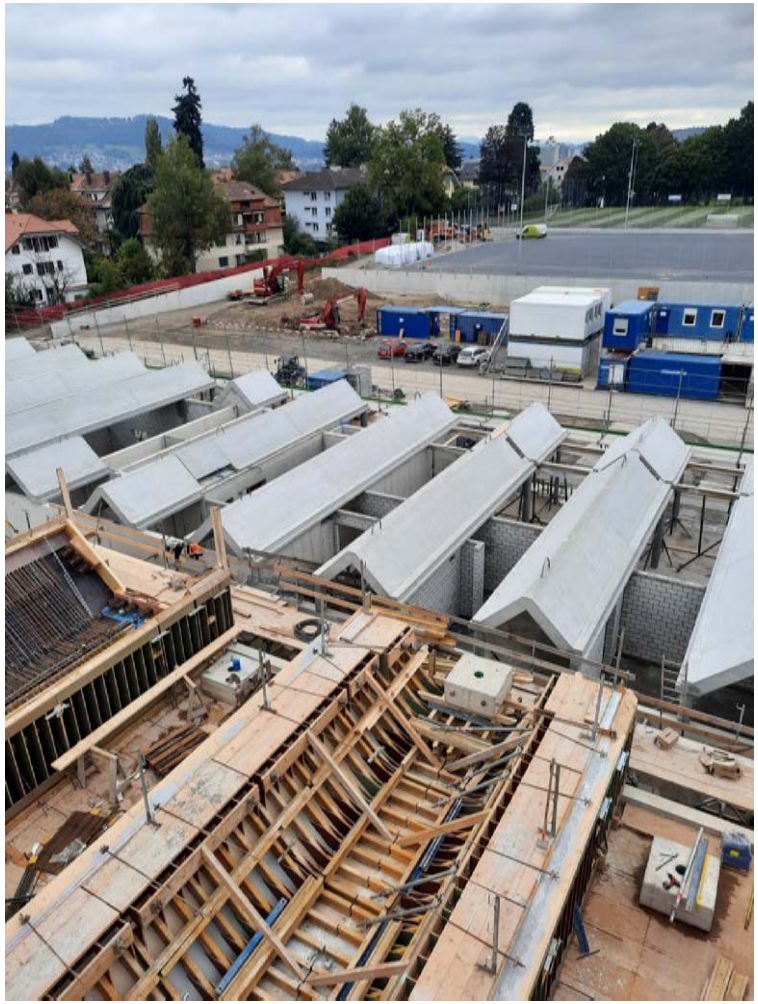
Zinal, Pont de Copaté

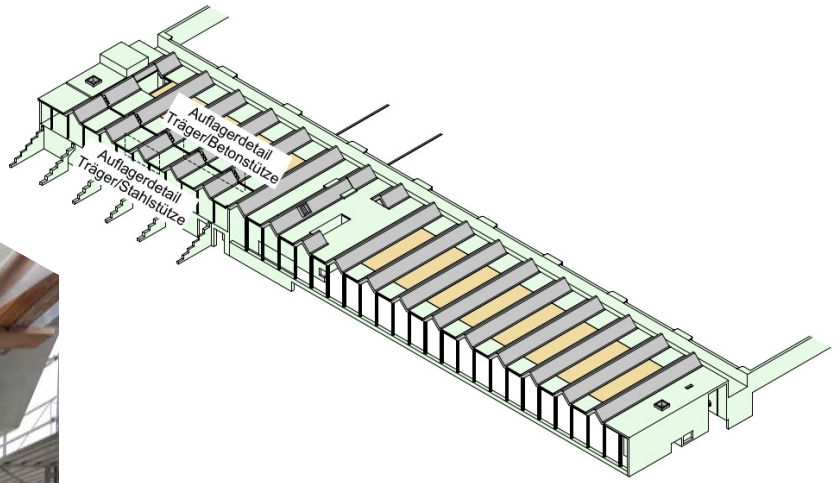


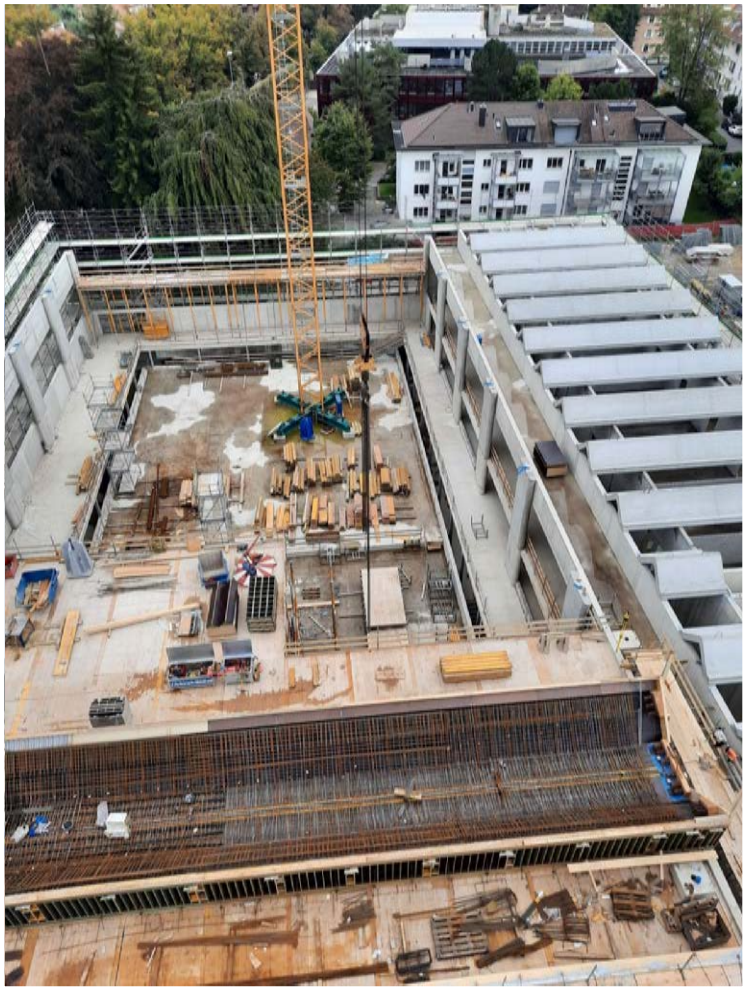

Rive Gauche
Coté Montagne
COUPE LONGITUDINALE A-A - 1:50
Rive Droite
Coté Village
Surbéton 15cm
Poutre préfabriquée
Clavage 120cm
Poutre Préfabriquée
2650
1600
120
930
P2A
P2B
-1.83
Distance entre murs de culées = 2580 cm
Dalle de transition bétonnée avec le tablier
Détail 2
Détail 1
Culée bétonnée sur place
Dalle de transition à faire après la mise en tension et l'injection de la précontrair ép. min: 30cm
Culée bétonnée sur place
-3.90
-4.70
-4.90
-5.70
207
307
110
35
Navizence
550
104
25
106

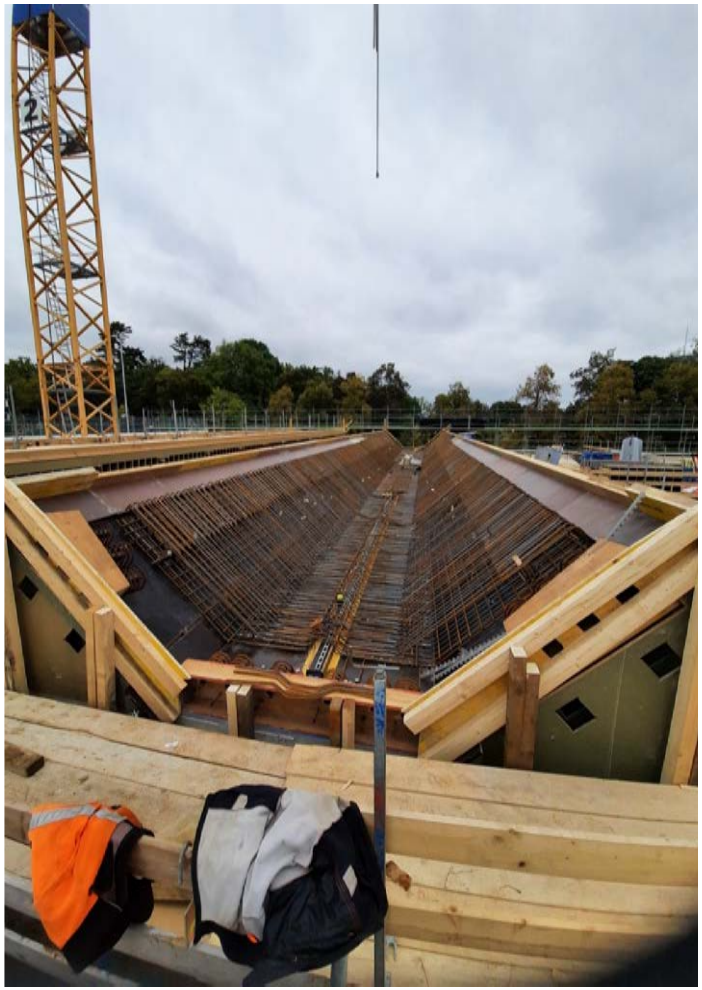


Reduce site allowance and duration




Auflagerdetail
Träger/Betonstütze
Auflagerdetail
Träger/Stahlstütze





Epalinges, Complexe de Bois murat


GYGER

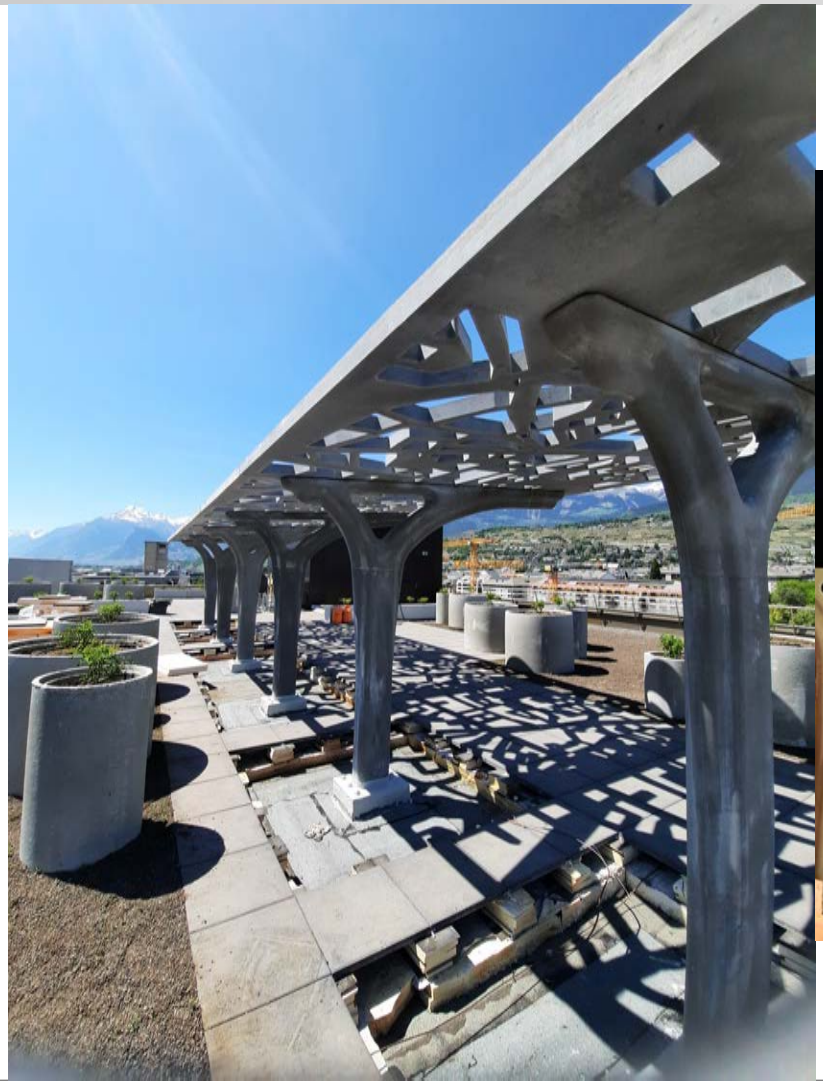
Lausanne, Ecole Belvédère

Answer to new architectural challenges

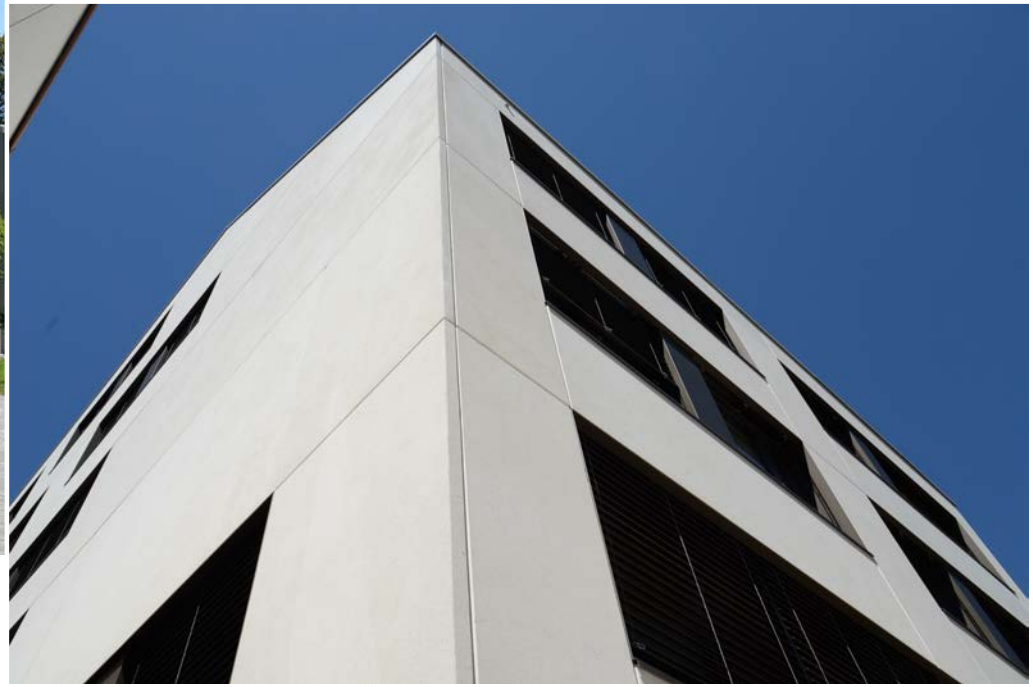
- Accommodate mechanical characteristics and durability of concrete with high aesthetic demands
- Concrete structures are not just grey, massive and cubic

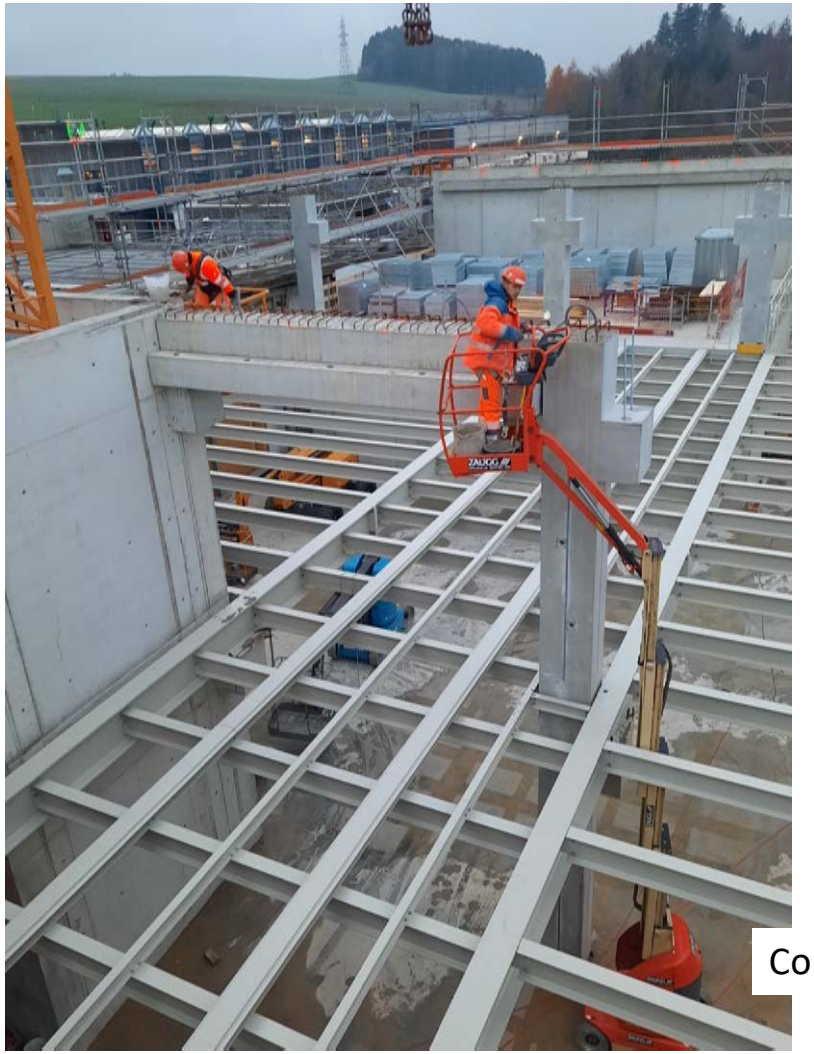
- Production in a indoor environment
- Use of high performance concrete
- Use of fiber reinforced concrete
- Use of specific agregates
- Use of complex formworks CNC milled
- Mix concrete and steel
- Mix of concrete and wood

Answer to new architectural challenges

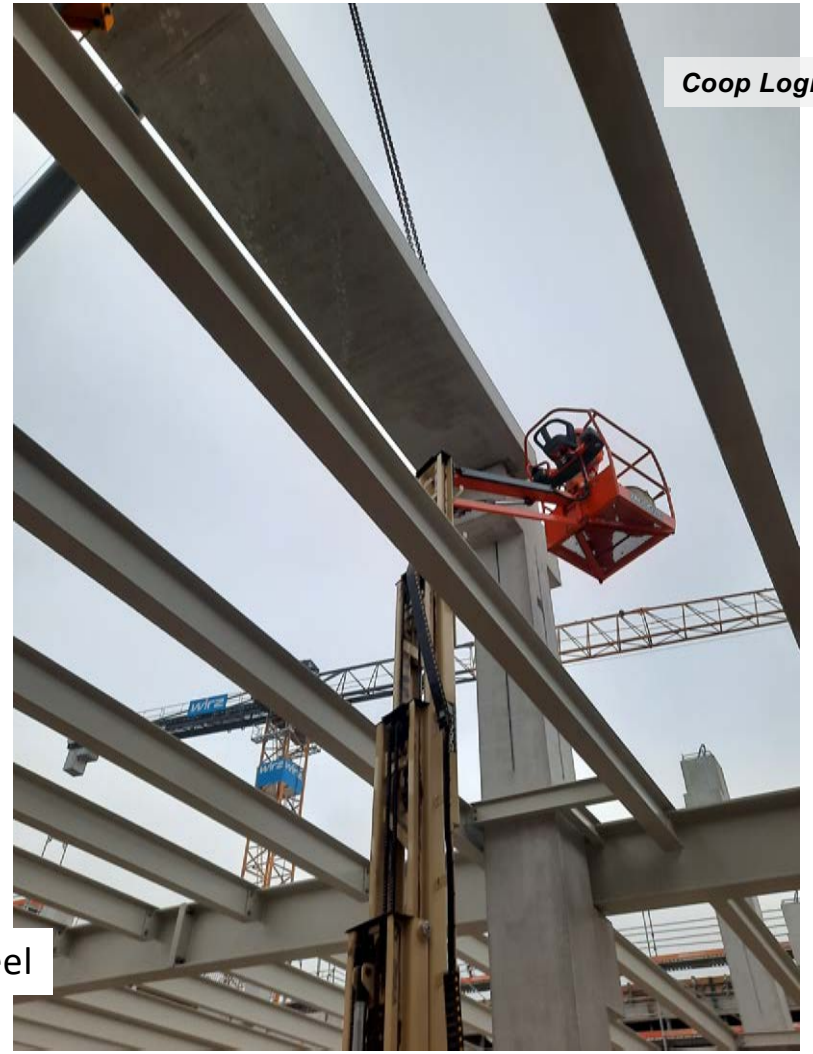


Answer to new architectural challenges





Concrete and steel



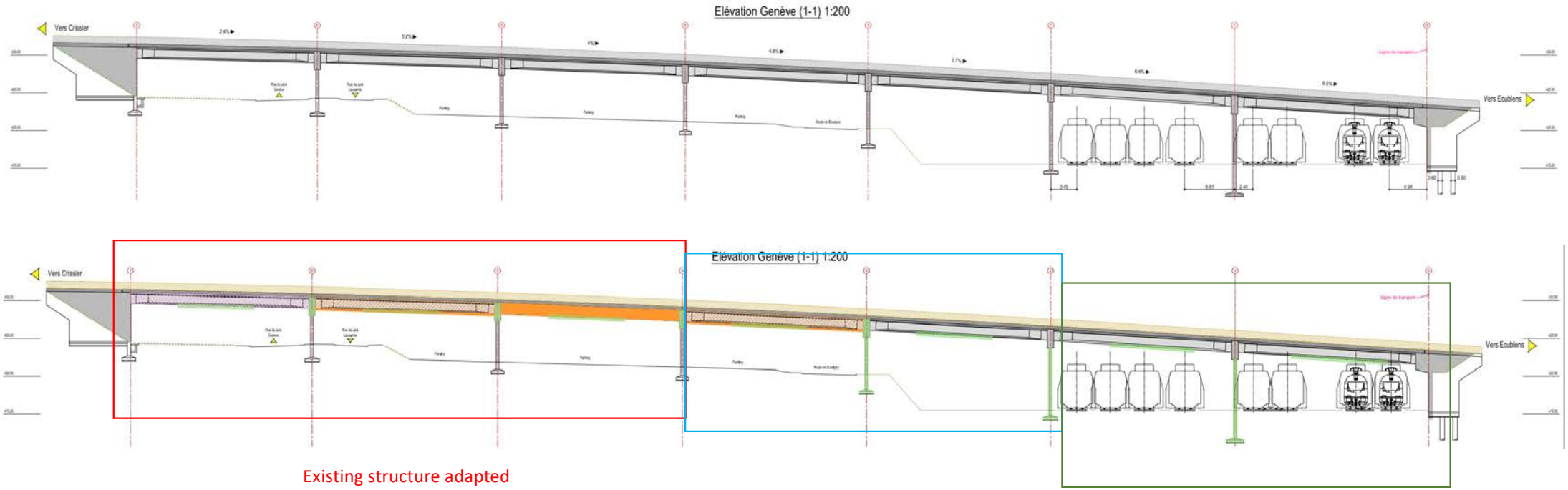
Coop Logistic center

Concrete and wood

Flexibility and ability to evolve

- Over time infrastructures need to evolve and accommodate new needs (traffic, activities,…)
- Maintenance should now be taken into consideration from the very beginning of planing

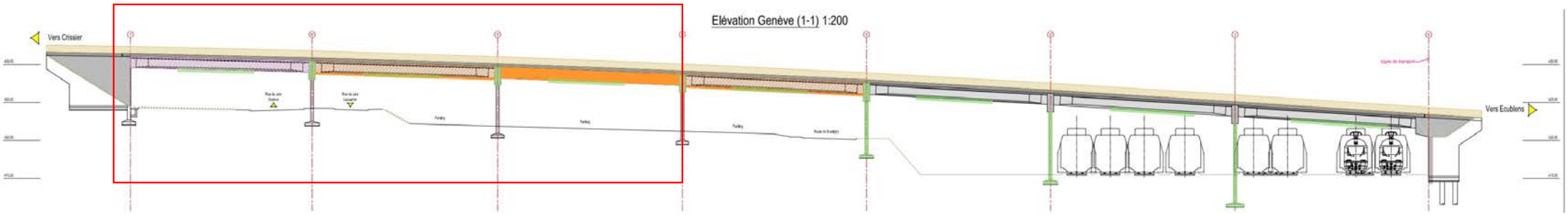
- Precast structures are modular and flexible
- Precast structures can more easily evolve over time than cast-in situ structures
- Precast structures allow easier maintenance



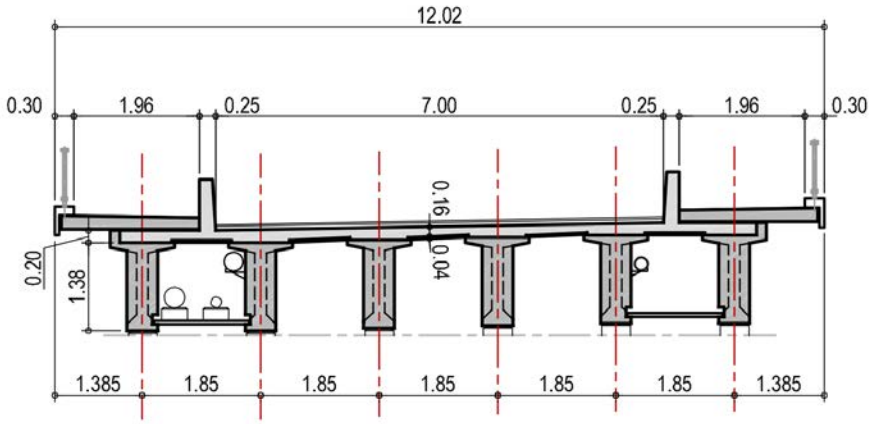
Existing structure adapted

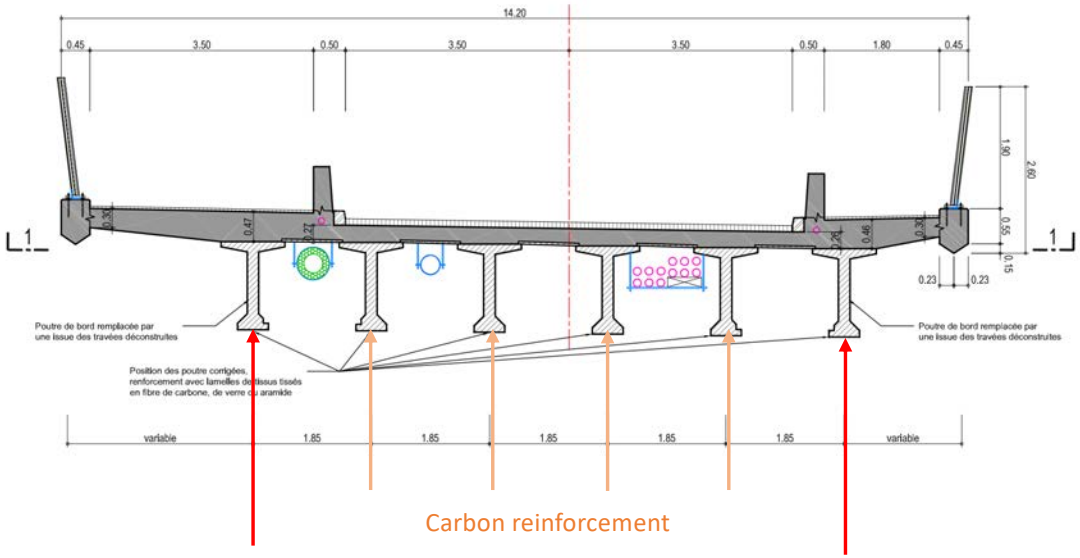
New concrete structure

New steel structure



Existing structure adapted



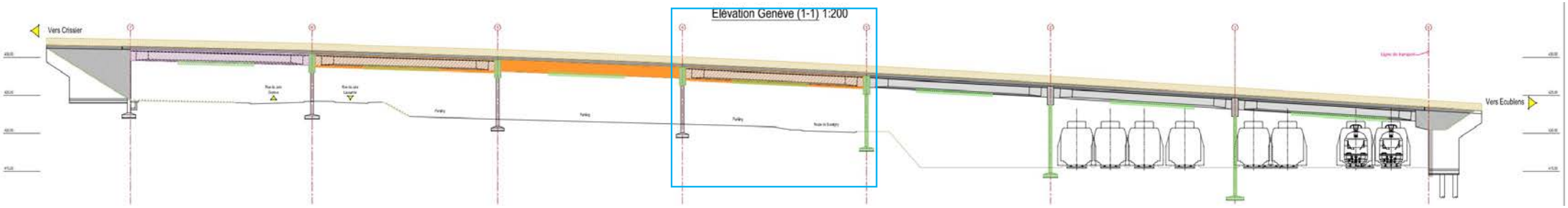


Carbon reinforcement

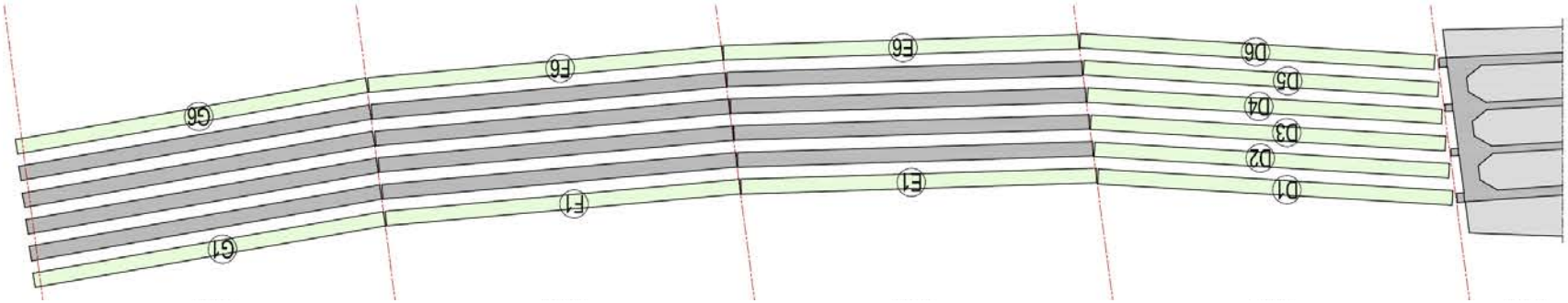
Replacement

Replacement

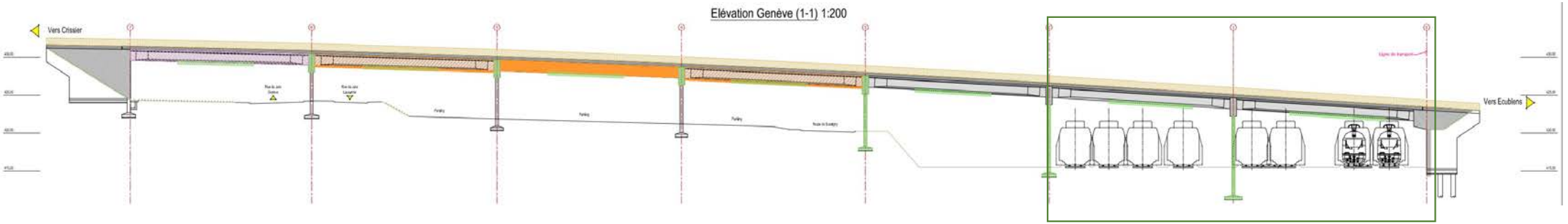

ZM



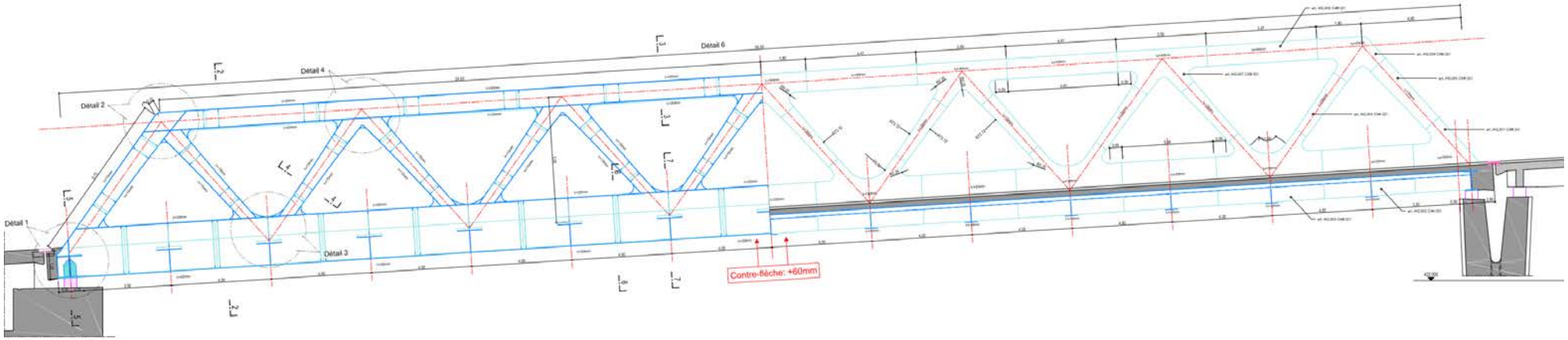
New Precast beams




ZM
synaxis
ZM



Steel structure



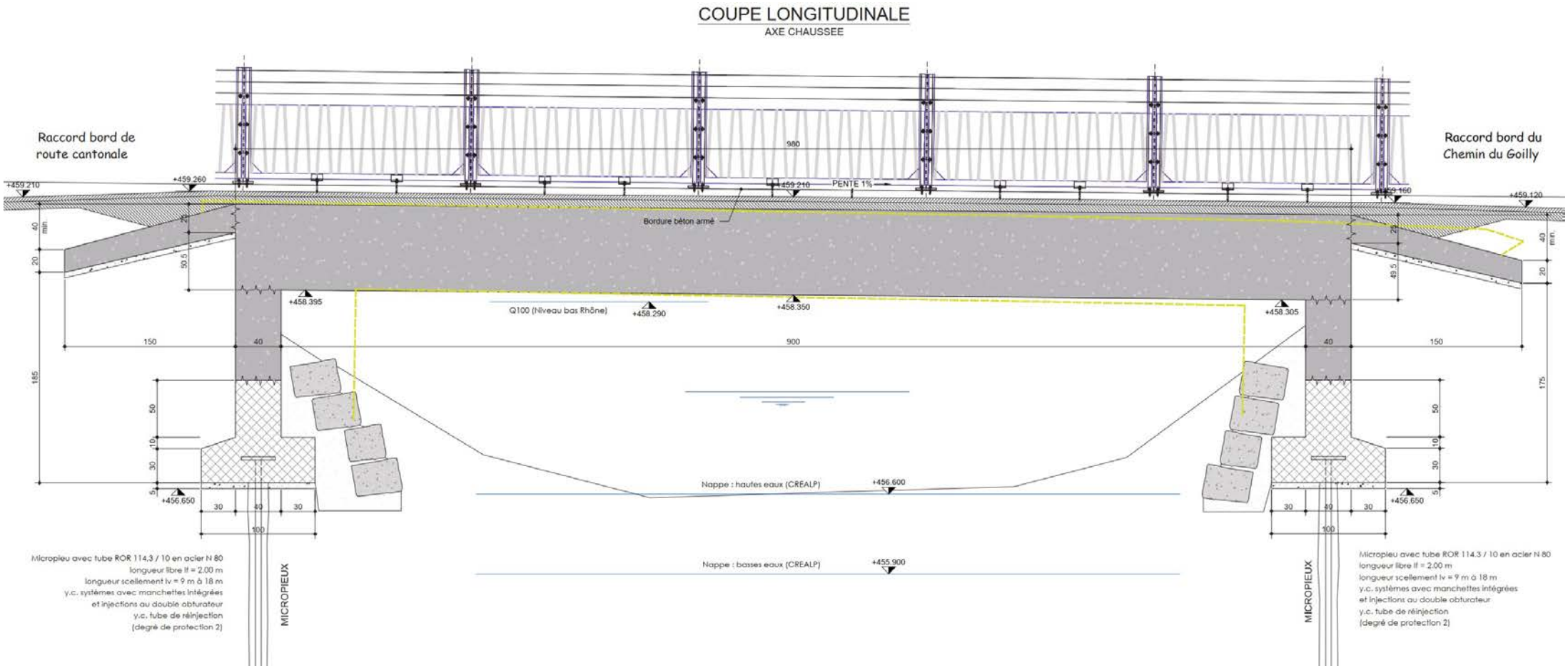
Müelelen, Bridge

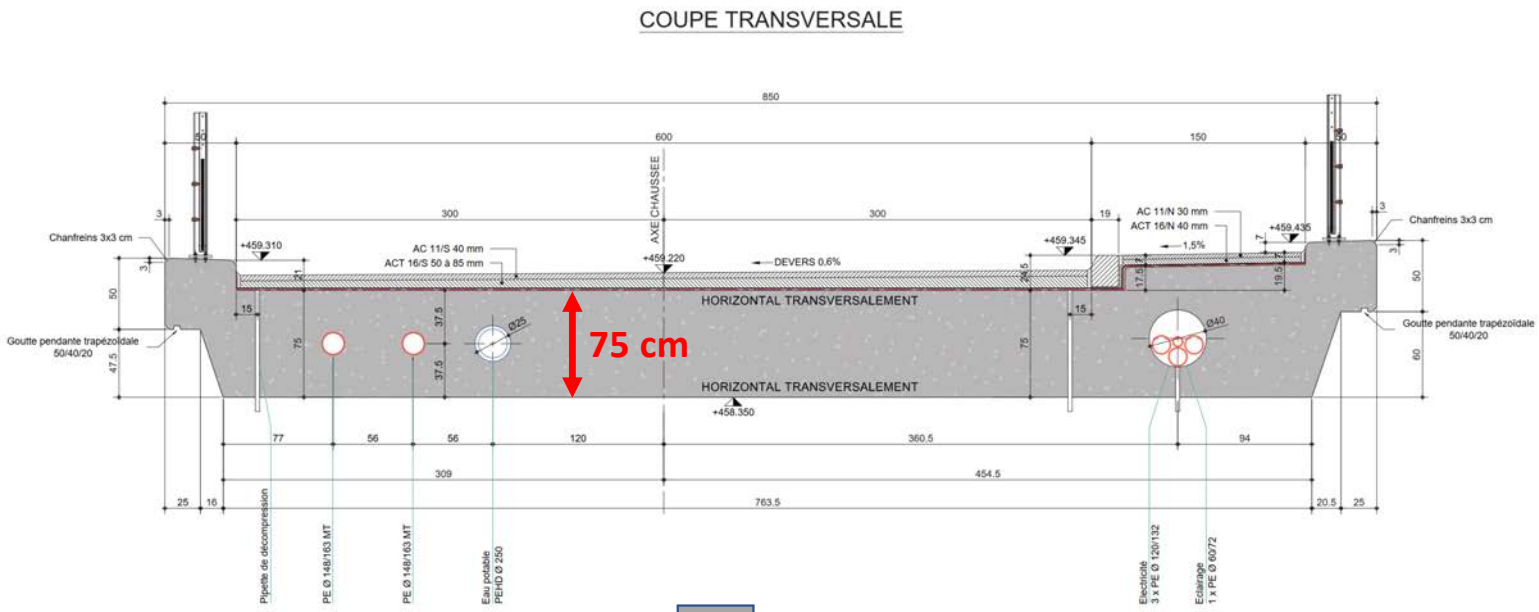
Reduce environmental impact

- Environmental impact of construction is now a major concern
- Use of precast element can have a significant impact on the ecological footprint of the project

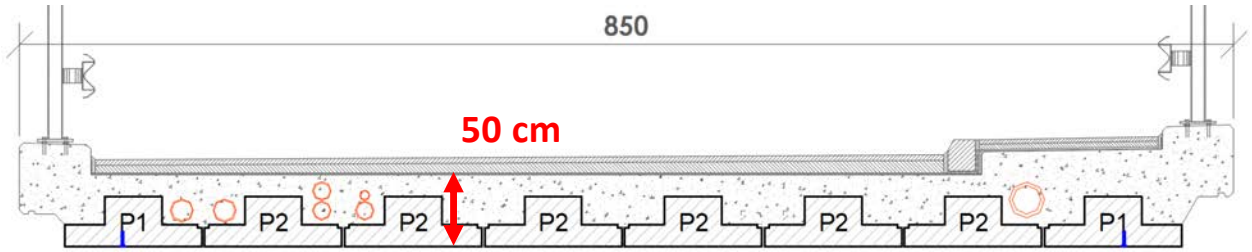
- Structure optimization
- Eco-Ciment and recycled aggregates

Fully, Mottier bridge



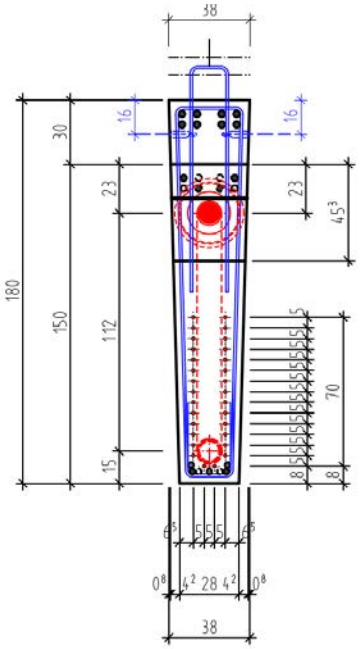


56 m3

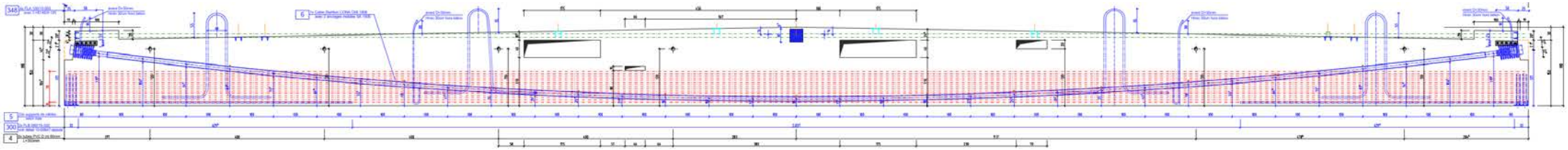


41 m3

Save -27 %



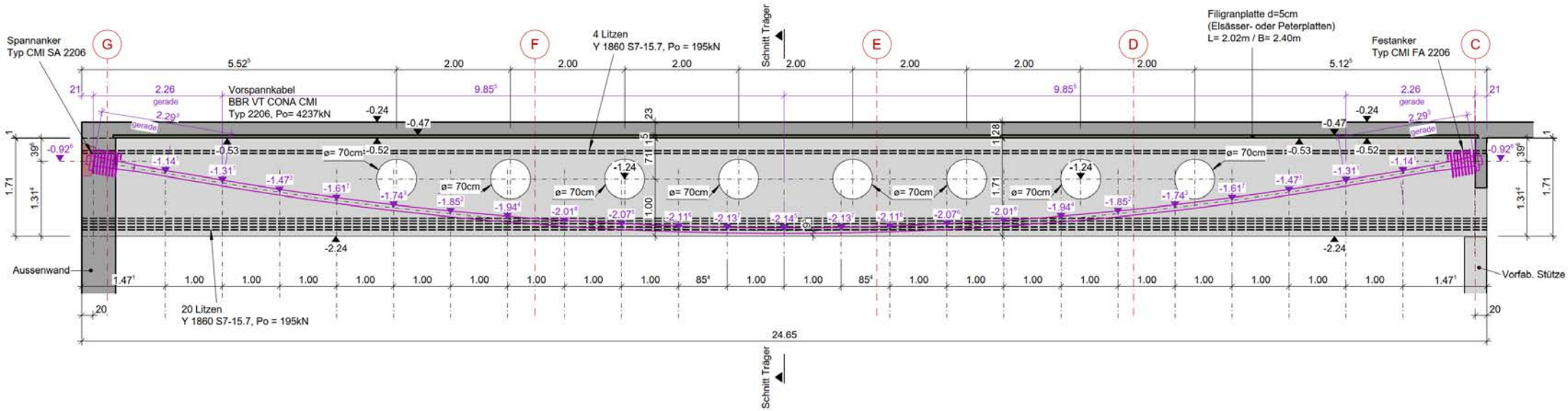
Avenches, Gymnasium



Zürich, Depot Hard

CEM II éco
+
recycled aggregates

Zürich, Schulanlage Guggach III



CEM III
+
recycled aggregates

III. Discussion