HIDÁSZ NAPOK – 2017 – SIÓFOK

ÖSZVÉR GERENDAHIDAK AZ ÉPÍTÉSTECHNOLÓGIA TÜKRÉBEN

Teiter Zoltán

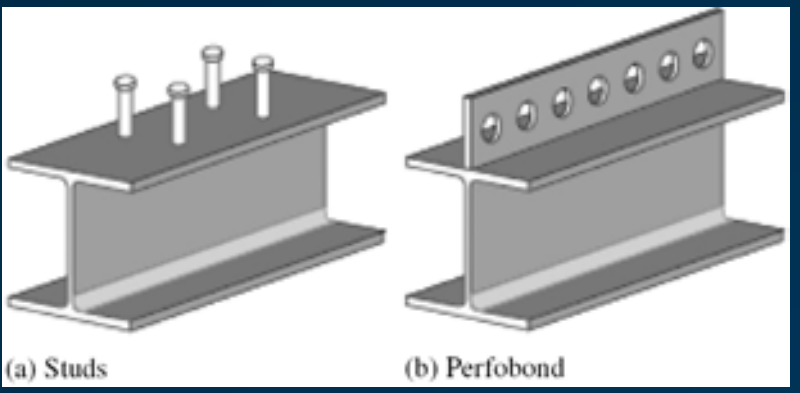
statikus főmérnök, UVATERV Zrt.
mérnöktanár, Széchenyi István Egyetem

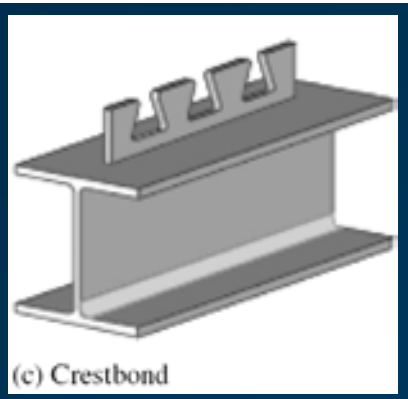
Tartalom:

- Kapcsolatok, csomópontok
- Keresztmetszeti kialakítások
- Csőfőtartós hidak
- Öszvérpallók
- PREFLEX tartók
- VTR® rendszer, „LEGO”
- Szabadon emelés
- Abaqus módszer
- egyéb

KAPCSOLATOK, CSOMÓPONTOK

Acél-beton kapcsolat





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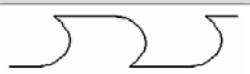
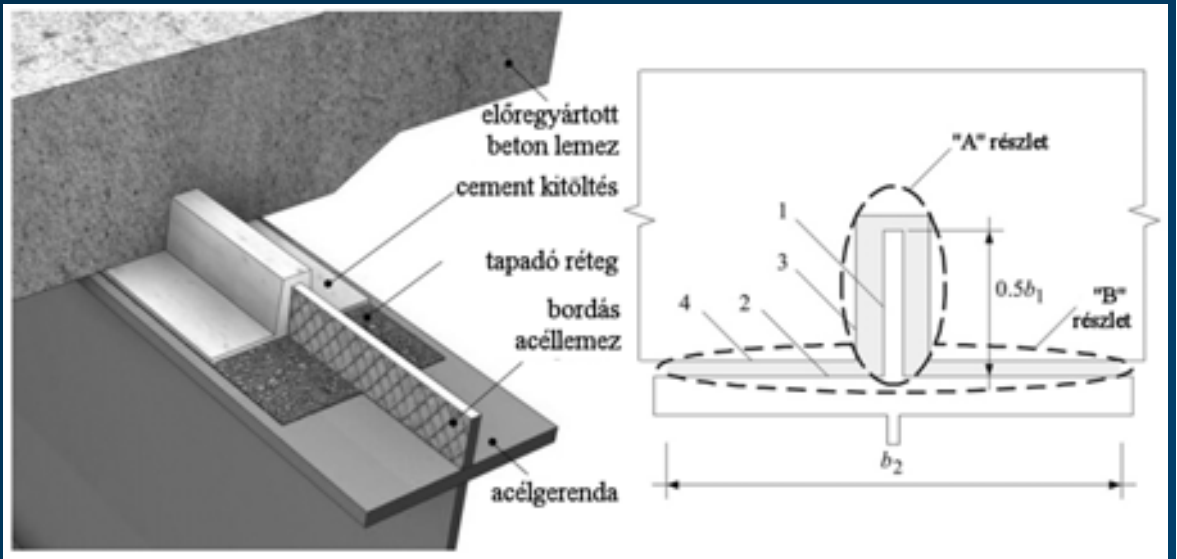
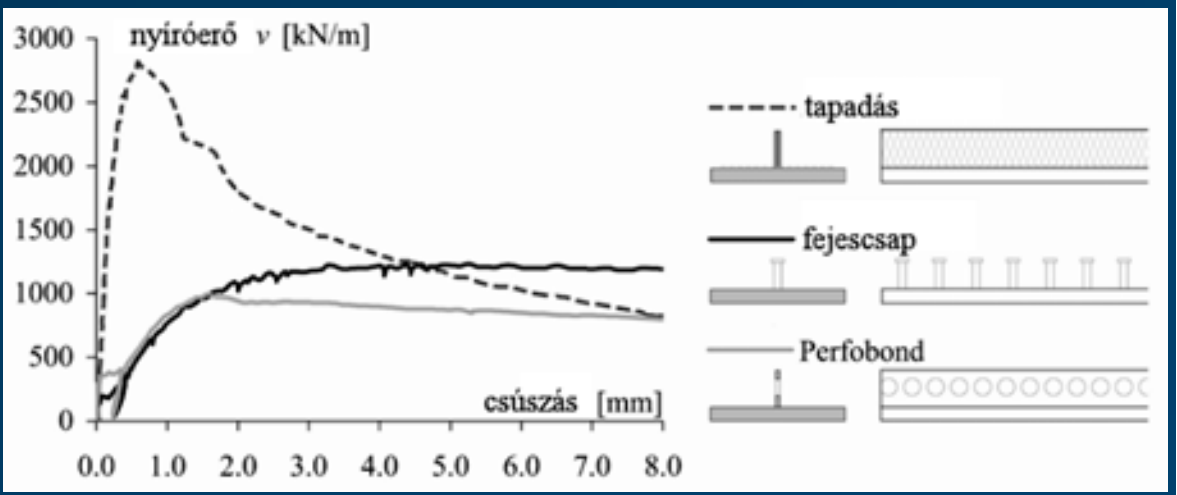
		

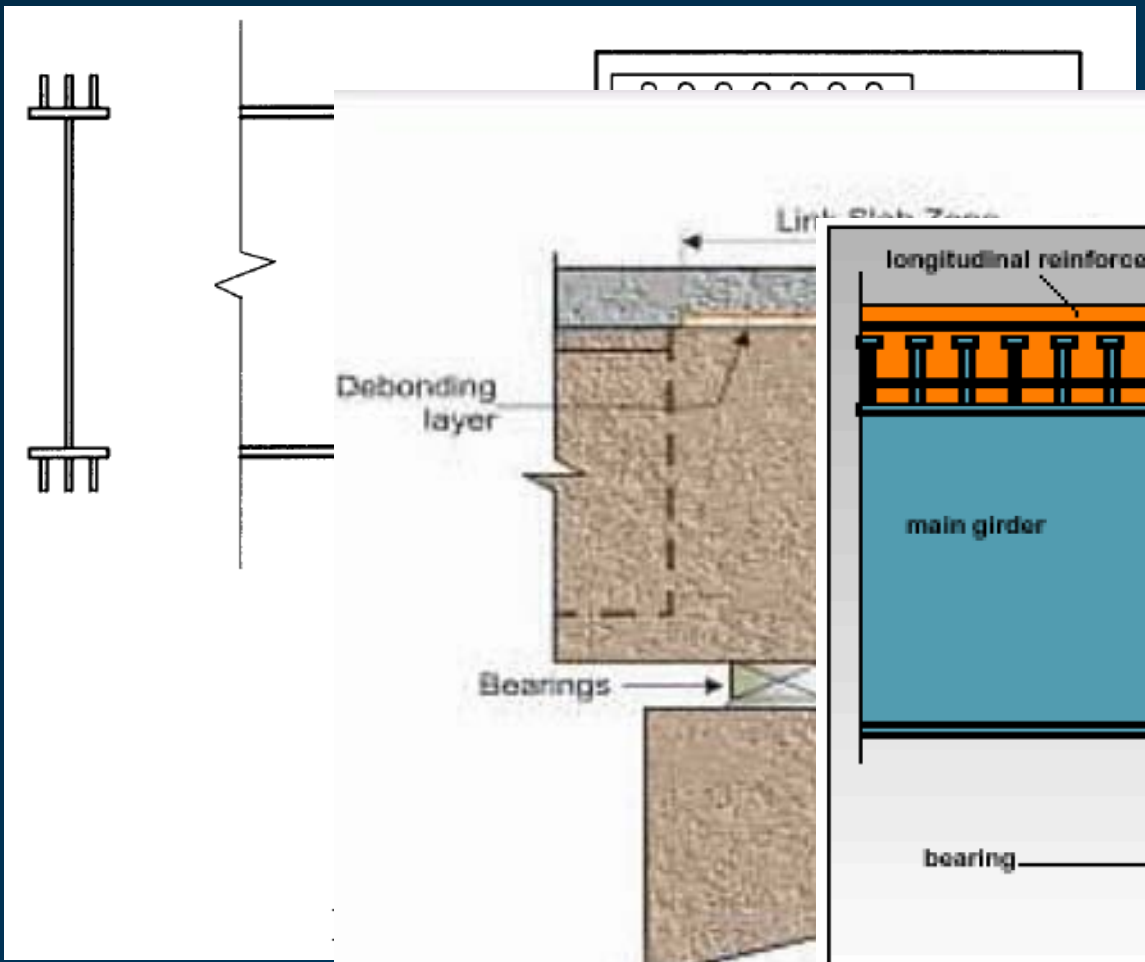




Vianna et al., 2009: Experimental assessment of Perfobond and T-Perfobond shear connectors' structural response
Skalska, 2009: VFT® - Prefabricated Composite Construction Method
Thomann, Lebet, 2008: A mechanical model for connections by adherence for steel–concrete composite beams

KAPCSOLATOK, CSOMÓPONTOK

Acéltartó befogása, többtámaszúsítása

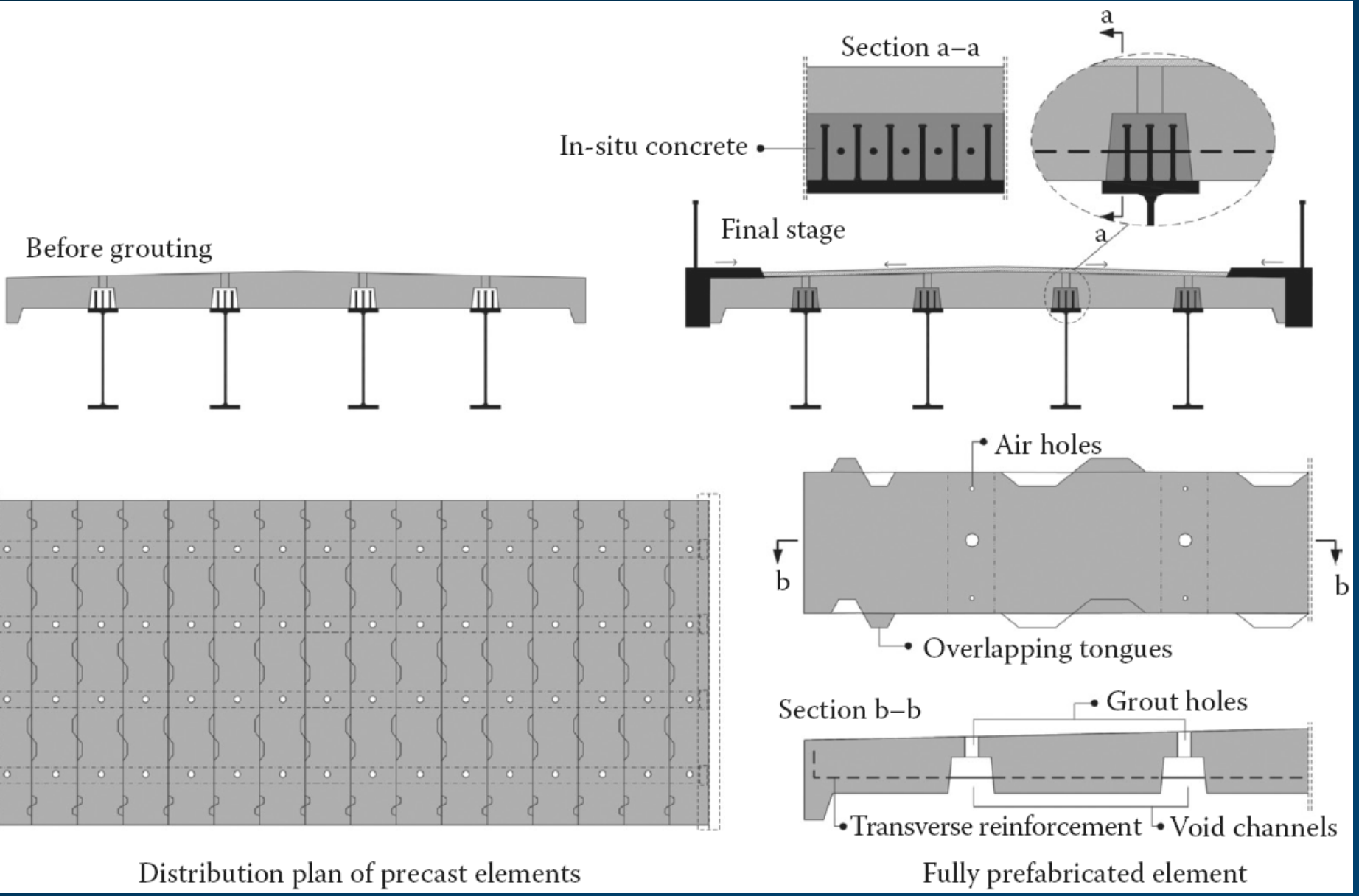


Link Slab Detail a

Concrete connection of main girders.
Cross section through bracing (schematic)

Nakamura et al., 2002: New technologies of steel/concrete composite bridges
Connal, 2004: Integral Abutment Bridges - Australian and US Practice
ECSC, 2002: Composite Bridge Design for Small and Medium Spans

Pályatáblák és utólagos, folytonos nyírókapcsolat

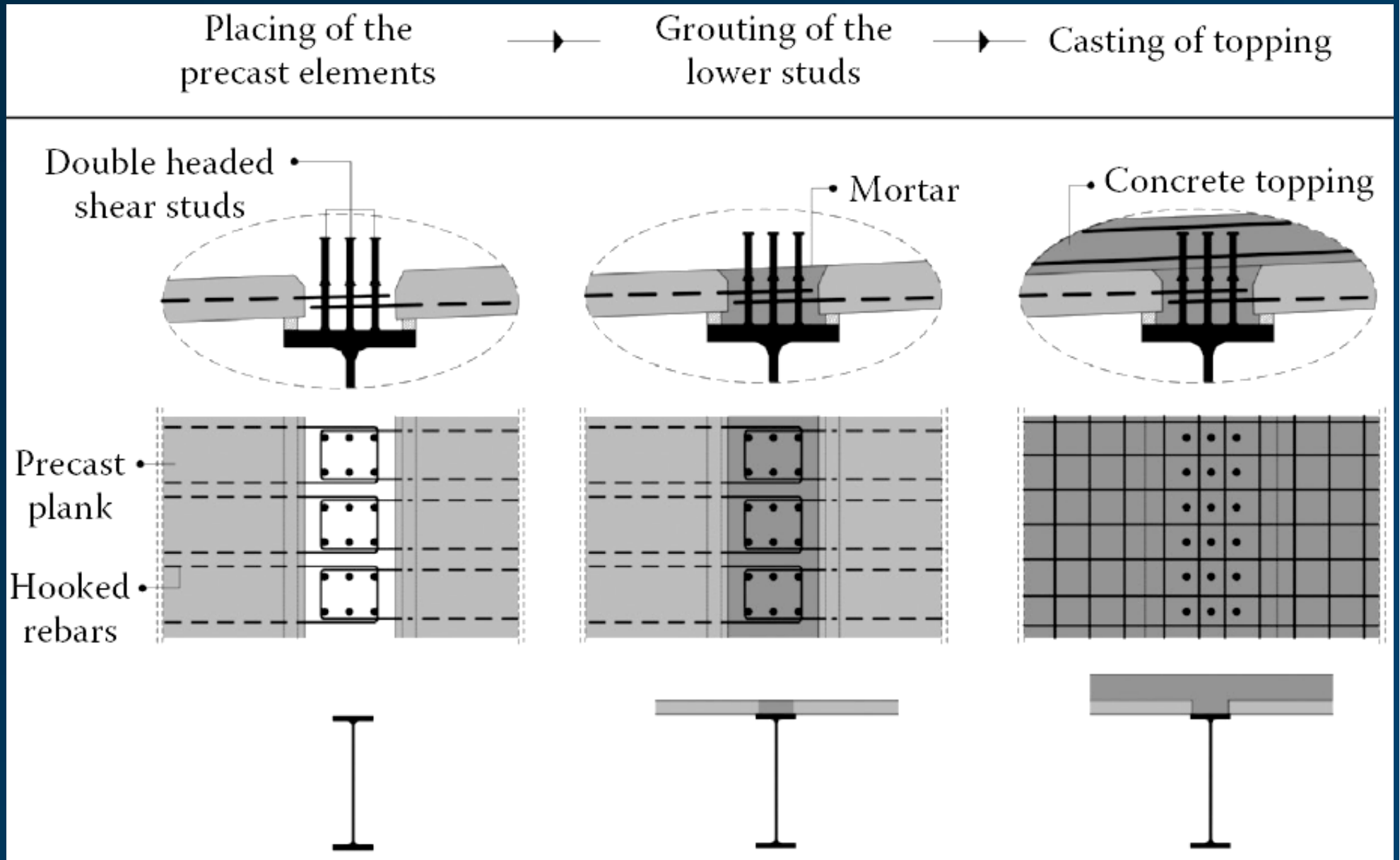


Distribution plan of precast elements

Fully prefabricated element

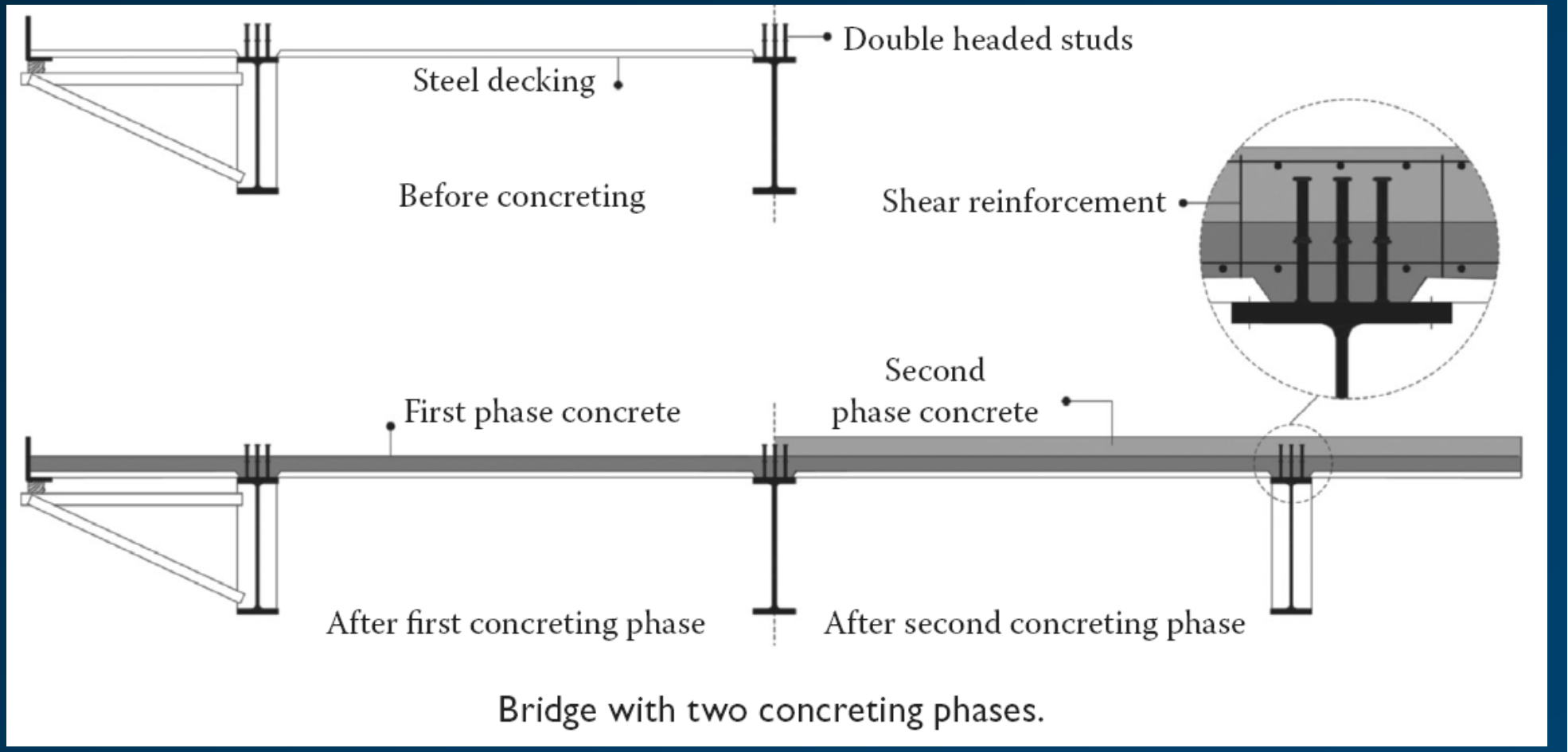
Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

Pályatáblák, folytatólagos kapcsolat és rábetonozás



Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

Pályatáblák, folytatólagos kapcsolat és rábetonozás

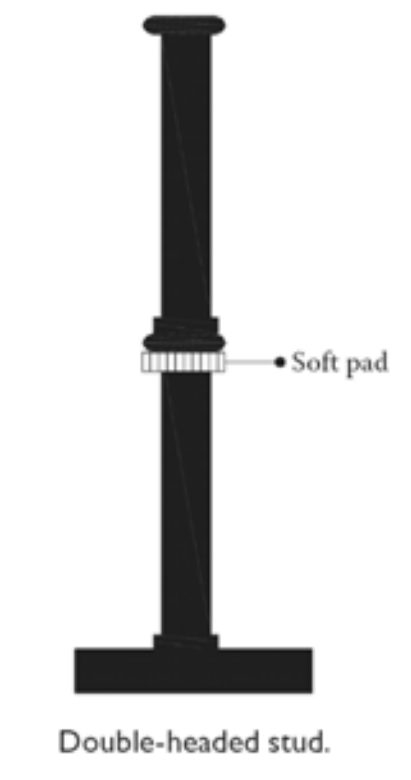


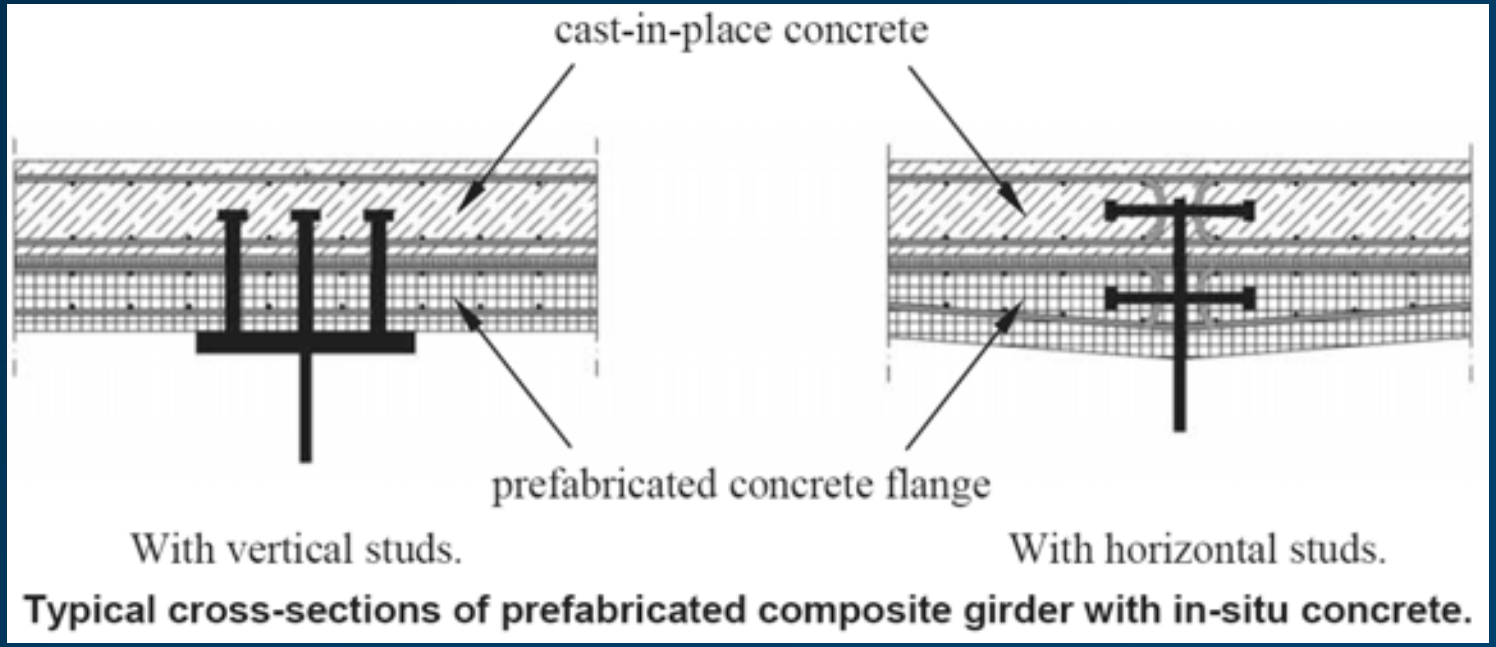
Bridge with two concreting phases.

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

KAPCSOLATOK, CSOMÓPONTOK

Pályatáblák, rábetonozás, acél felsőöv nélkül is

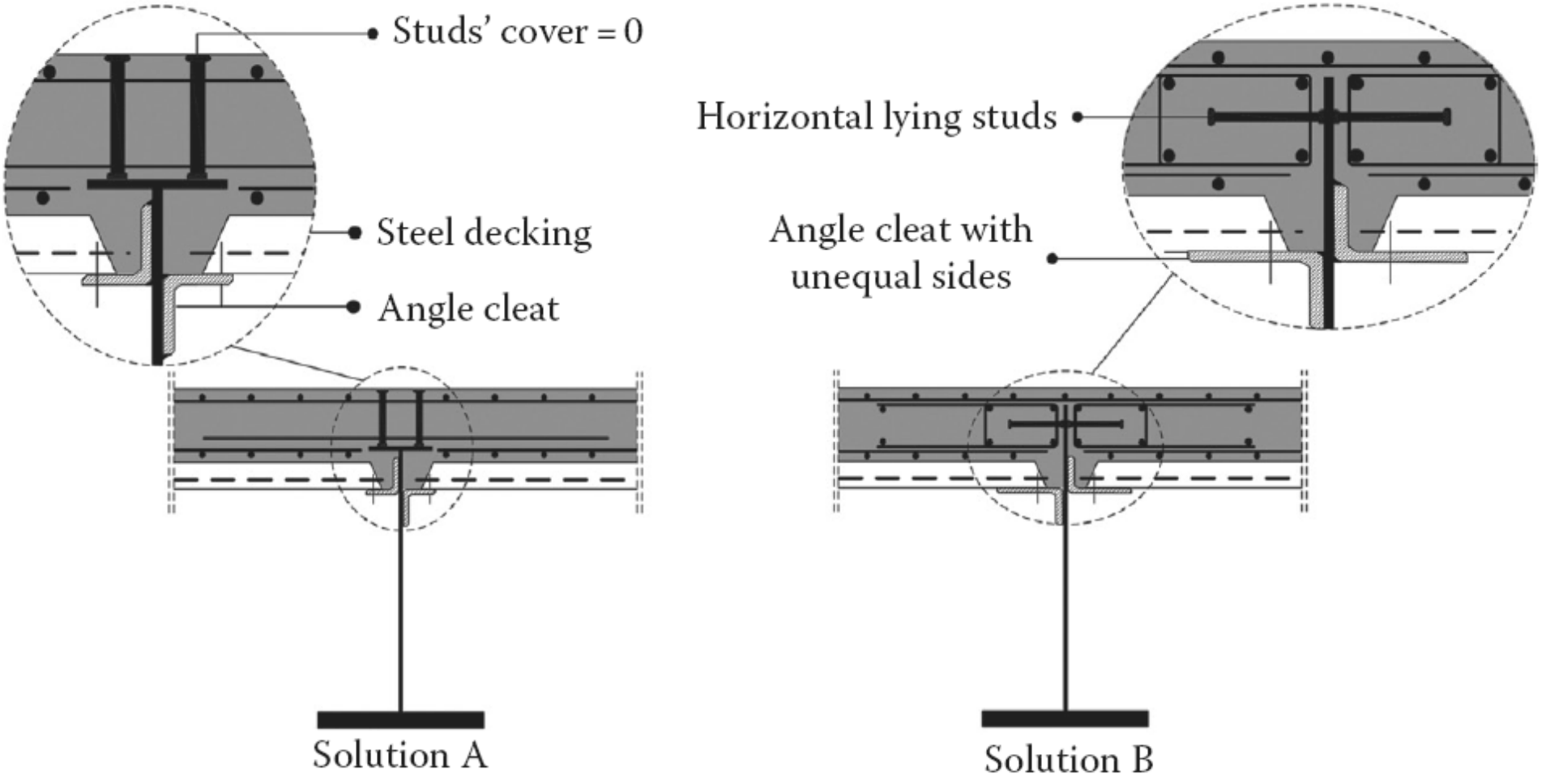




Typical cross-sections of prefabricated composite girder with in-situ concrete.

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes
Kuhlmann et al., 2008: COMBRI Design Manual II.

Pályatáblák, rábetonozás, acél felsőöv nélkül is



Shallow composite sections with angle cleats and steel decking.

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

KERESZTMETSZETI KIALAKÍTÁSOK

Gerinclemezes tartó

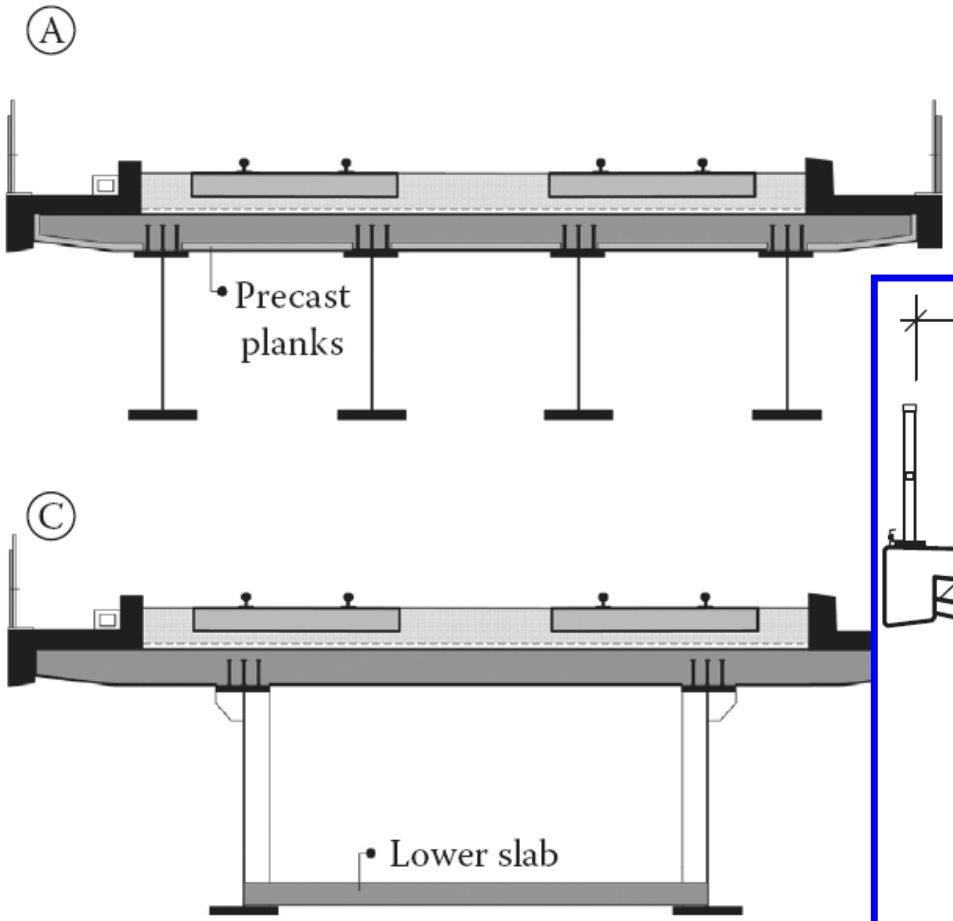
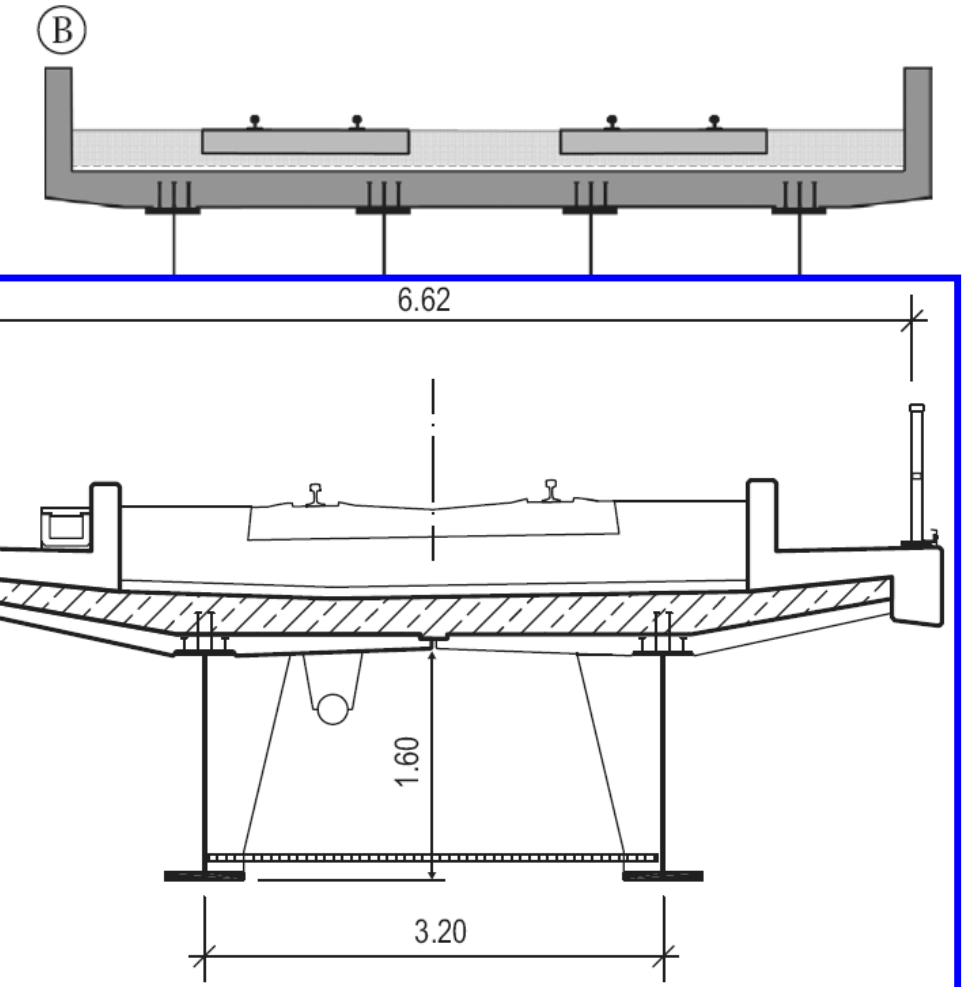


Plate-girder railway bridges. (A) Wit
lower reinforced concrete slab, and (

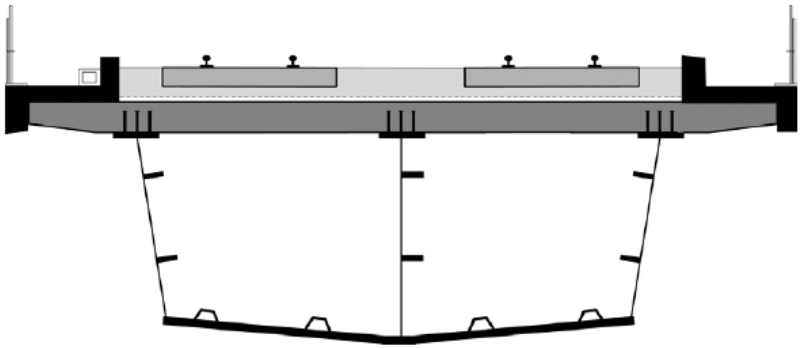


Cross-section of the bridge over the river Lech in Schongau, Germany

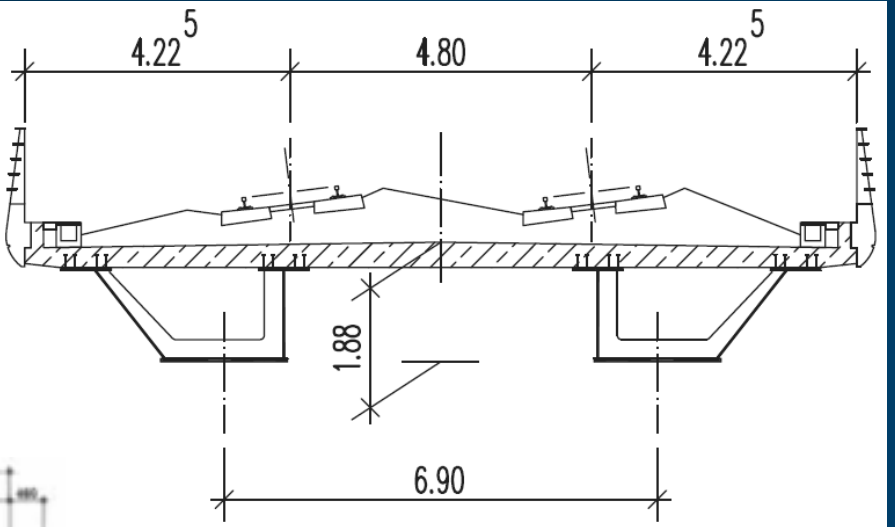
Schmitt, Seidl, 2010: Eisenbahnbrücken in Stahlverbundbauweise
Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

KERESZTMETSZETI KIALAKÍTÁSOK

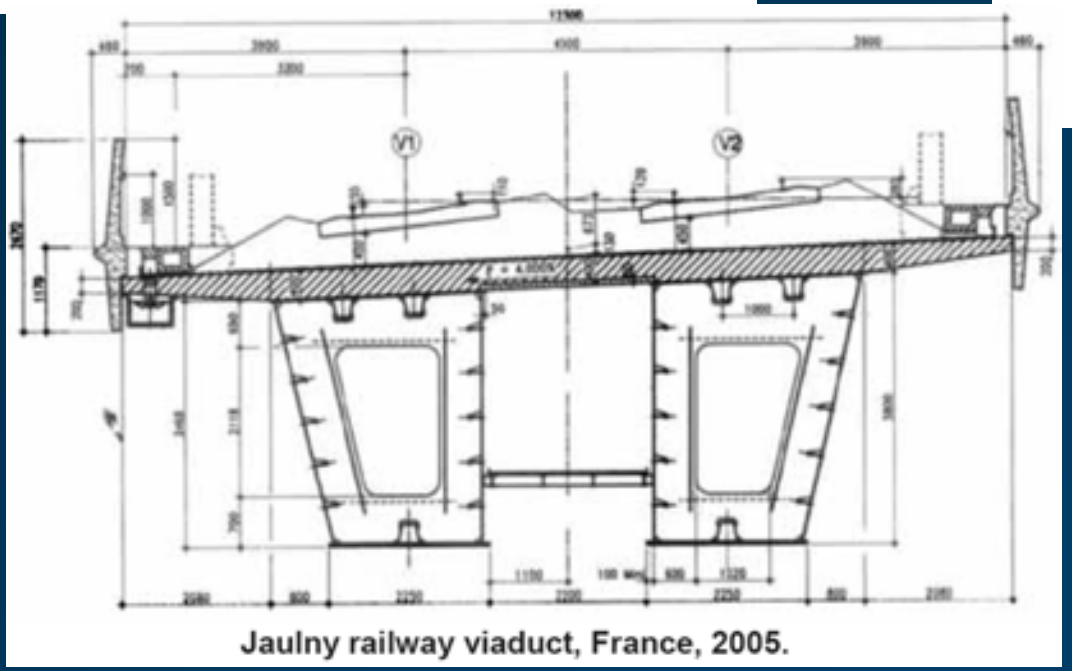
Szekrénytartó



Ship-bottom-shaped cross section.



Double-web T-beam for the SNCF with box girders

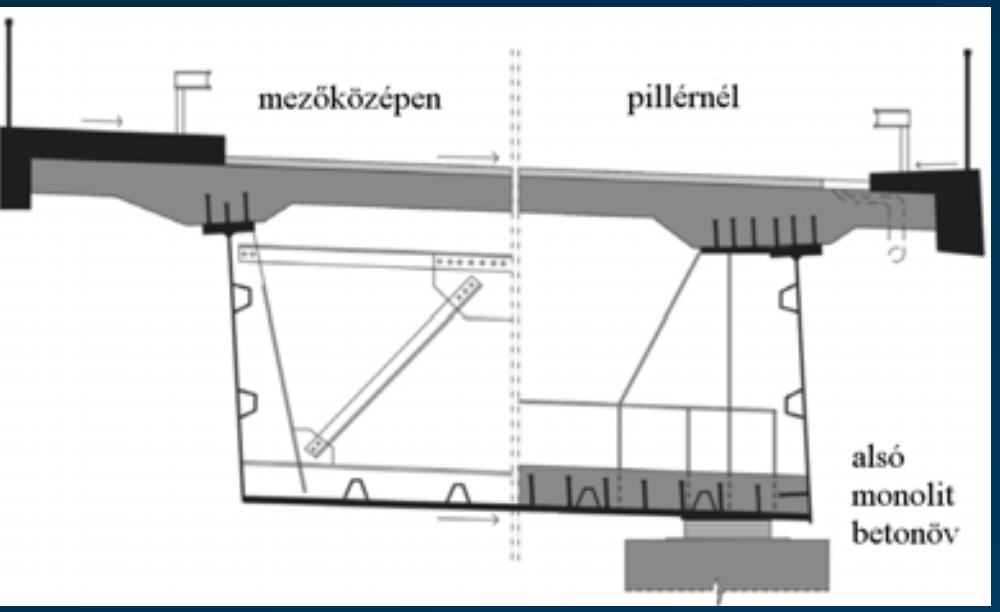


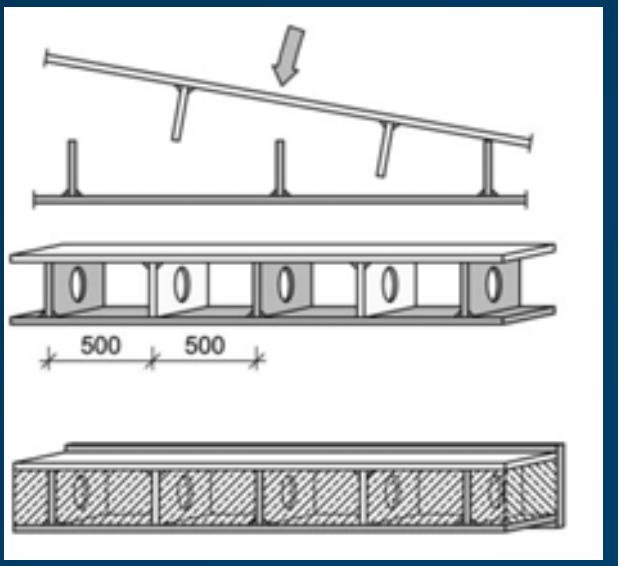
Jaulny railway viaduct, France, 2005.

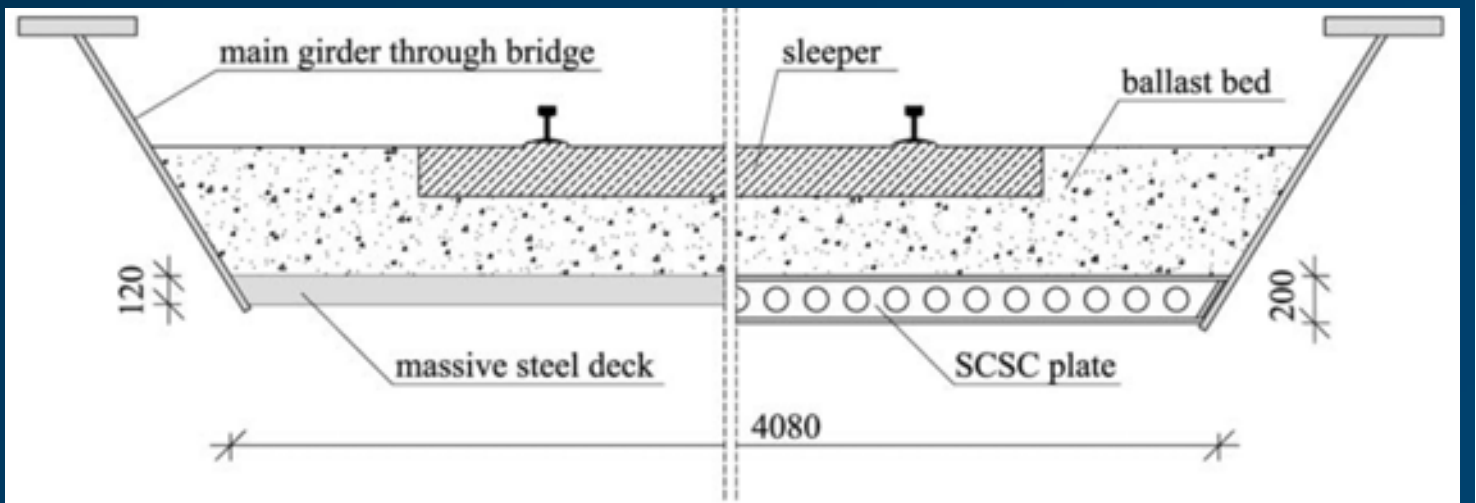
Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes
Schmitt, Seidl, 2010: Eisenbahnbrücken in Stahlverbundbauweise
Kuhlmann et al., 2008: COMBRI Design Manual II.

KERESZTMETSZETI KIALAKÍTÁSOK

Szekrénytartó, U tartó







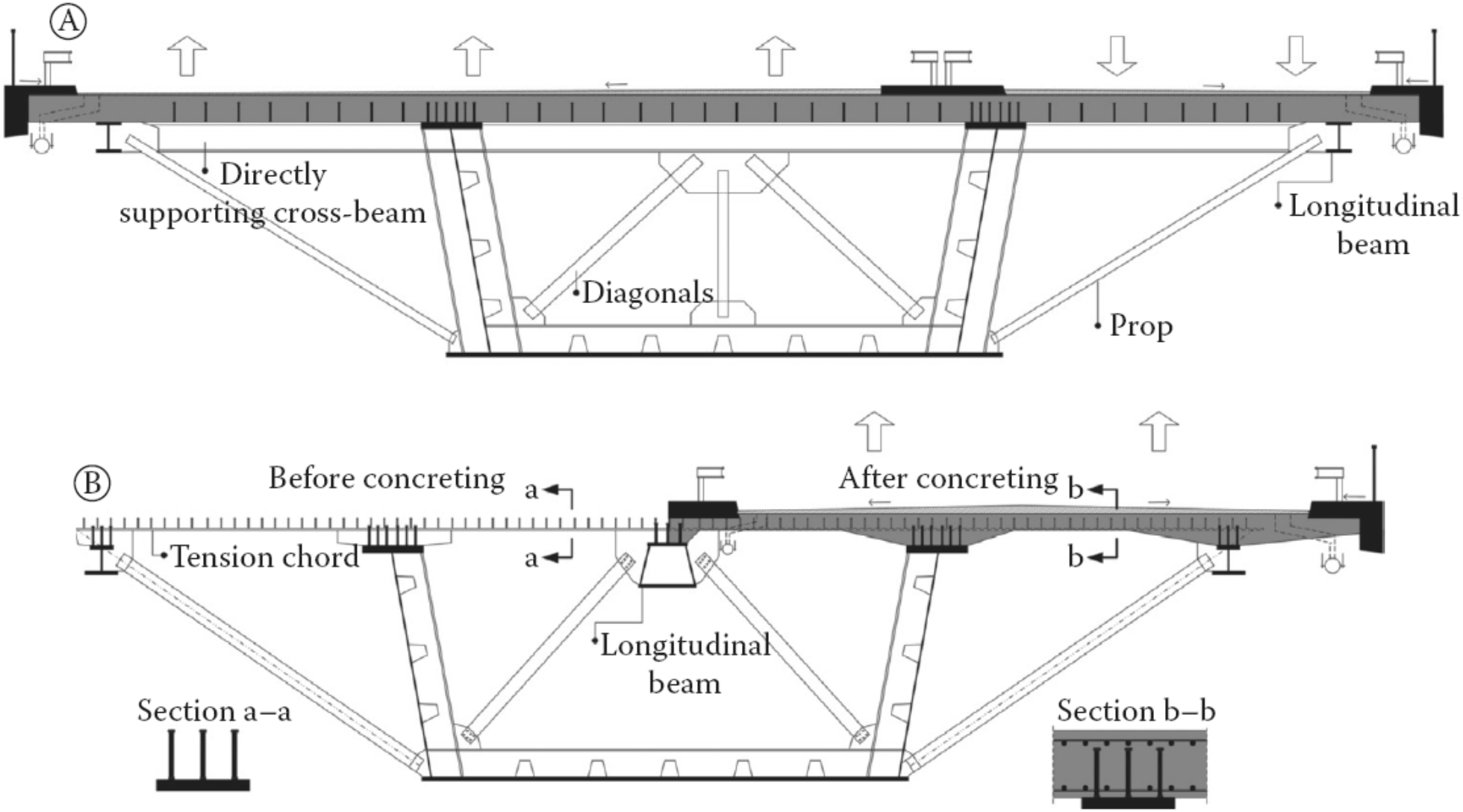
Regular through bridge section with a comparison of two deck slab systems. Dimensions in [mm]

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

Steurer, Fink, 2014: Innovative Composite Deck Slab for Railway Bridges

KERESZTMETSZETI KIALAKÍTÁSOK

Kikönyökölt konzol



Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

KERESZTMETSZETI KIALAKÍTÁSOK

Kikönyökölt konzol

Small stands as support for formwork carriages "running on top", valley bridge Reichenbach near Ilmenau, Germany, 2002.

Kuhlmann et al., 2008: COMBRI Design Manual II.

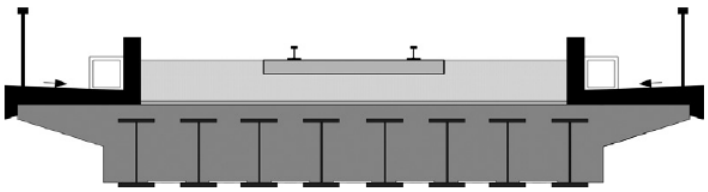
KERESZTMETSZETI KIALAKÍTÁSOK

Kikönyökölt konzol

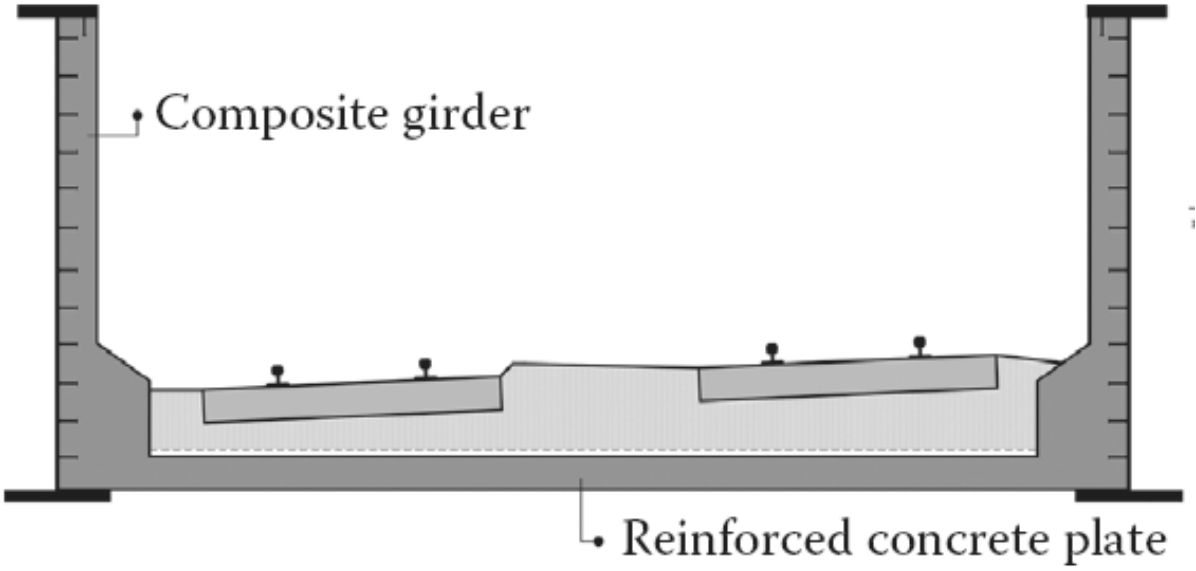
Kuhlmann et al., 2008: COMBRI Design Manual II.

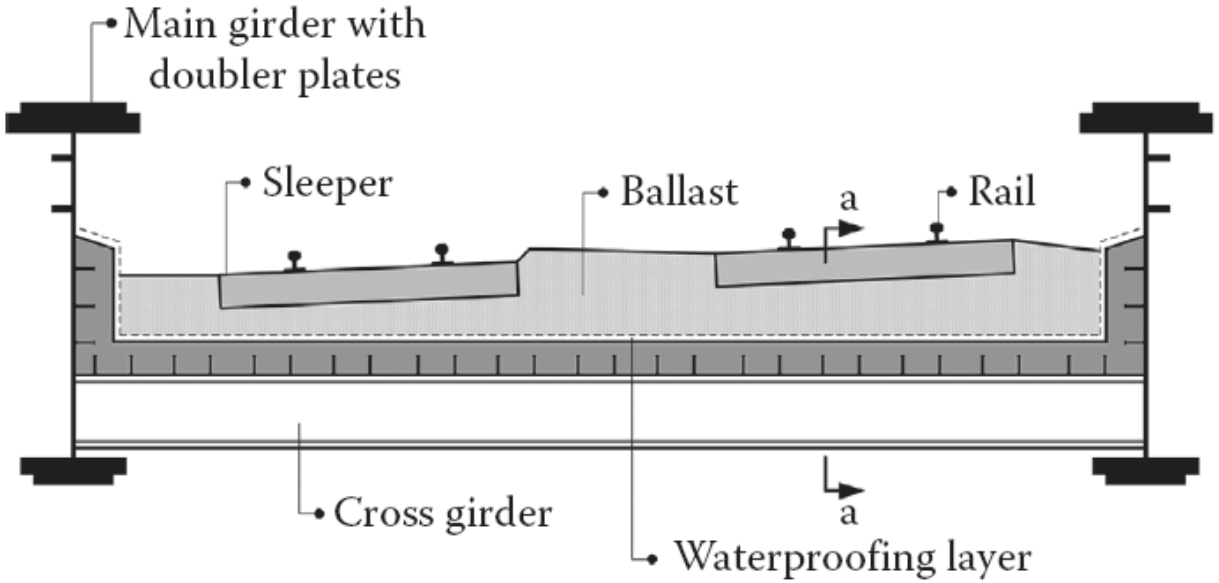
KERESZTMETSZETI KIALAKÍTÁSOK

Hagyomány és újszerűség



Filler-beam bridge.



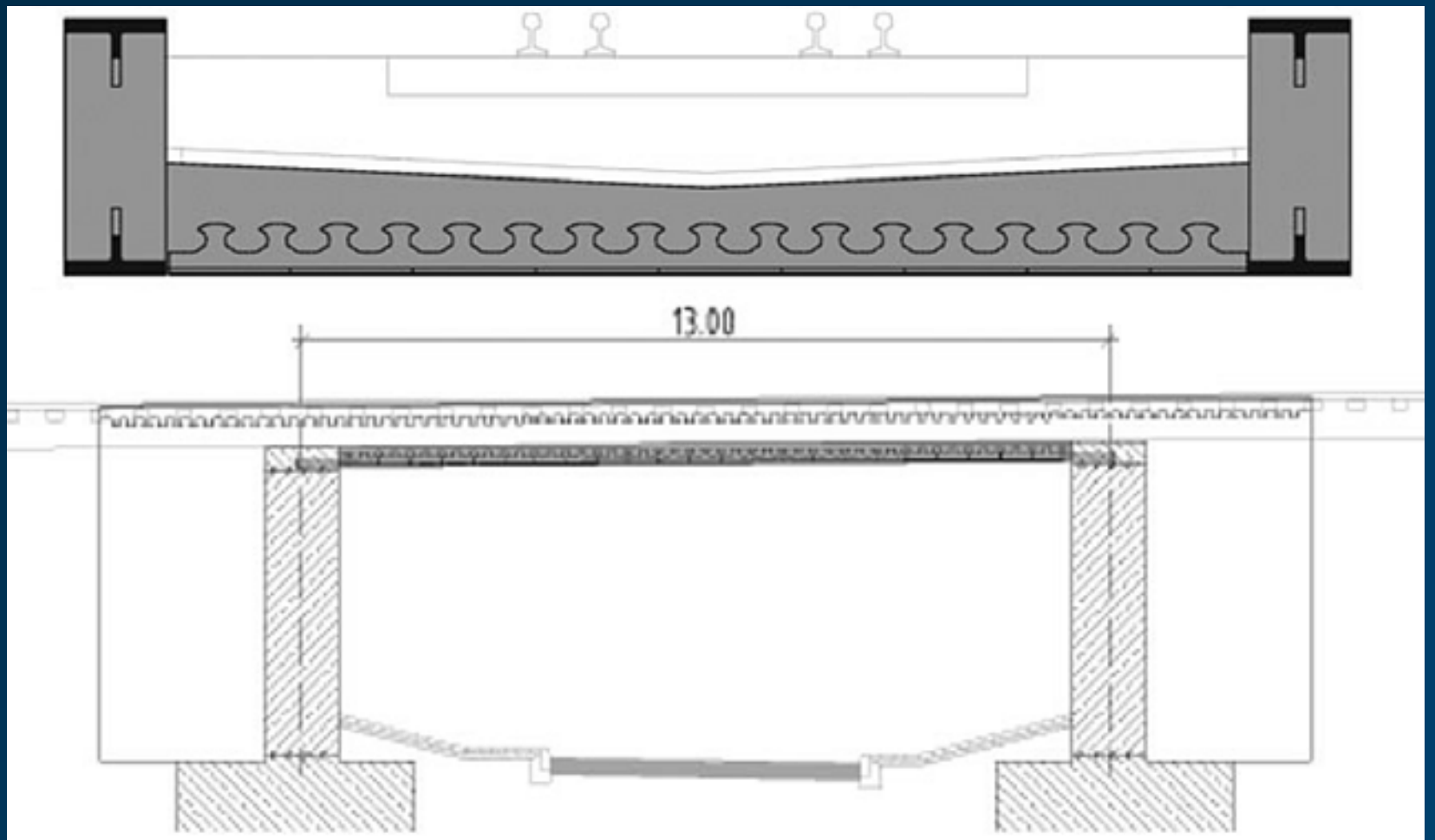


Half-through plate-girder bridge.

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

KERESZTMETSZETI KIALAKÍTÁSOK

Újszerűség

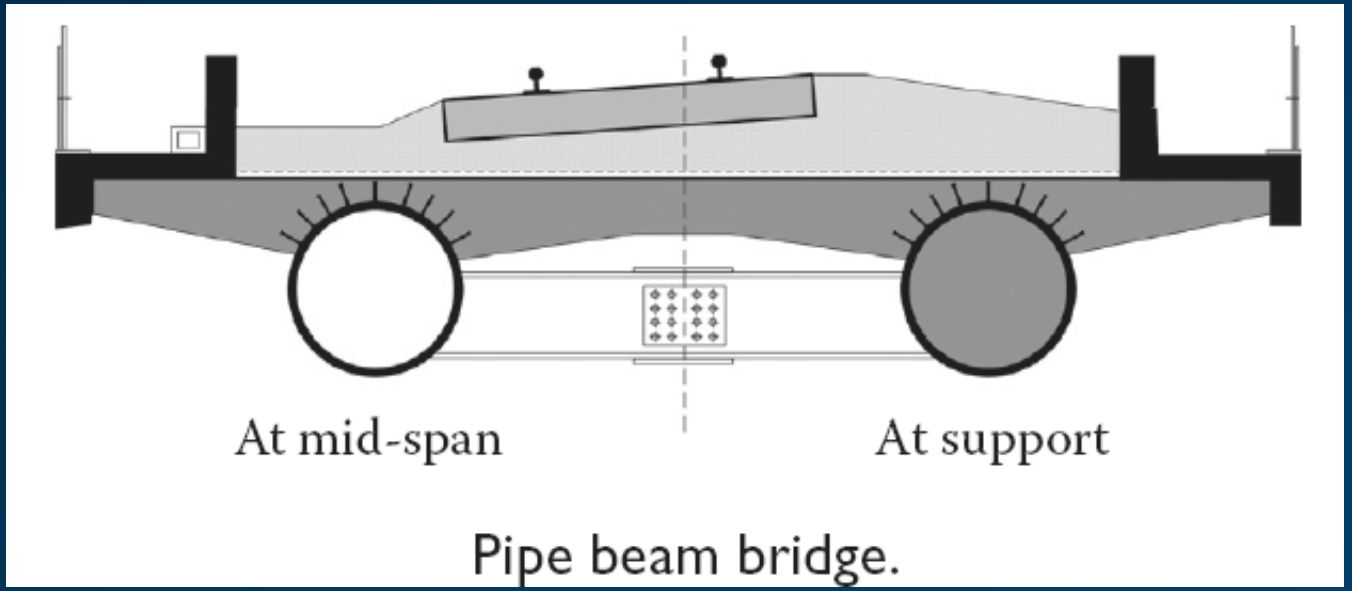


Cross-section and longitudinal section of the frame bridge located next to Spergau (GER) with external reinforcement applied in the trough girders and in the transversal direction of the slab

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

CSŐFŐTARTÓS HIDAK

Gerenda csőfőtartó

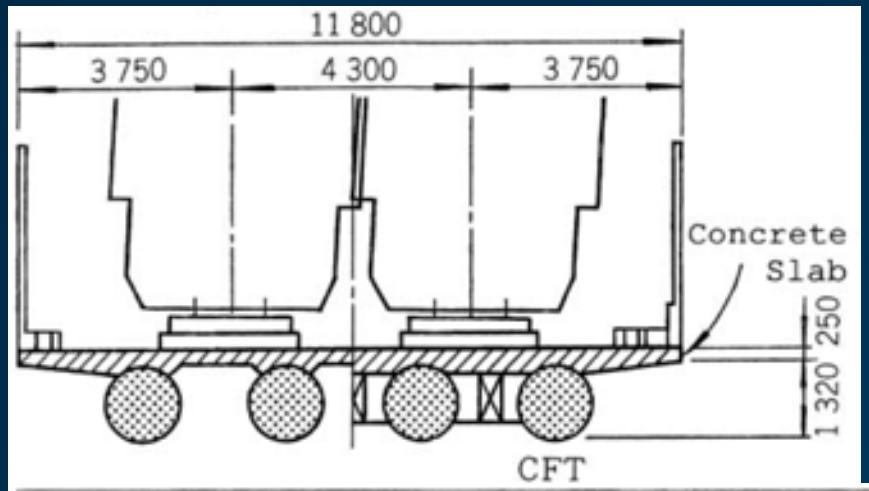


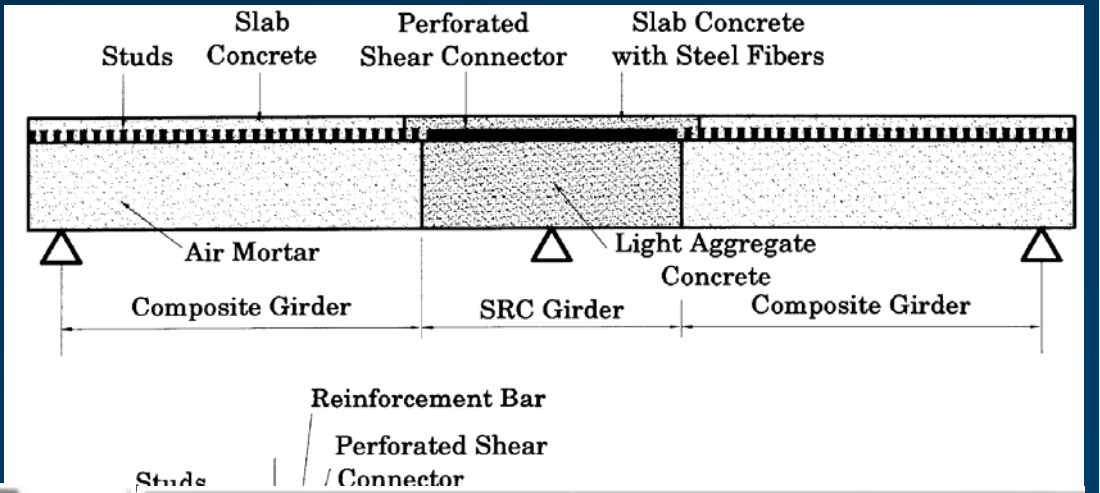
Pipe beam bridge.

Vayas, Iliopoulos, 2014: Design of Steel-Concrete Composite Bridges to Eurocodes

CSŐFŐTARTÓS HIDAK

Gerenda csőfőtartó





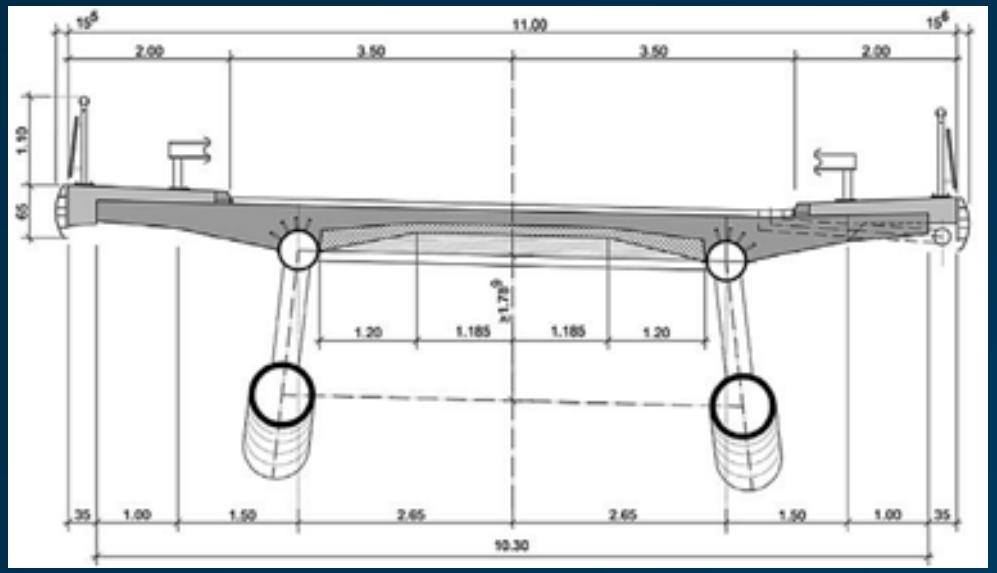
Upper side of the under construction pipe girder.

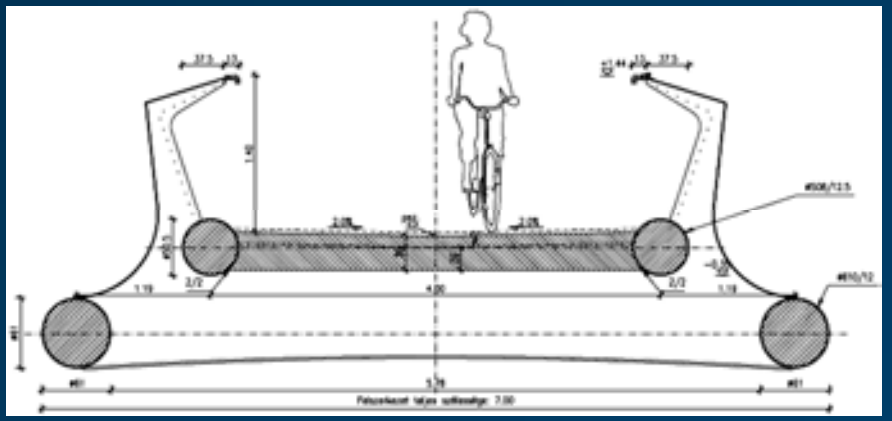
Completed pipe girder bridge.

Nakamura et al., 2002: New technologies of steel/concrete composite bridges

CSŐFŐTARTÓS HIDAK

Rács és Vierendel csőfőtartó



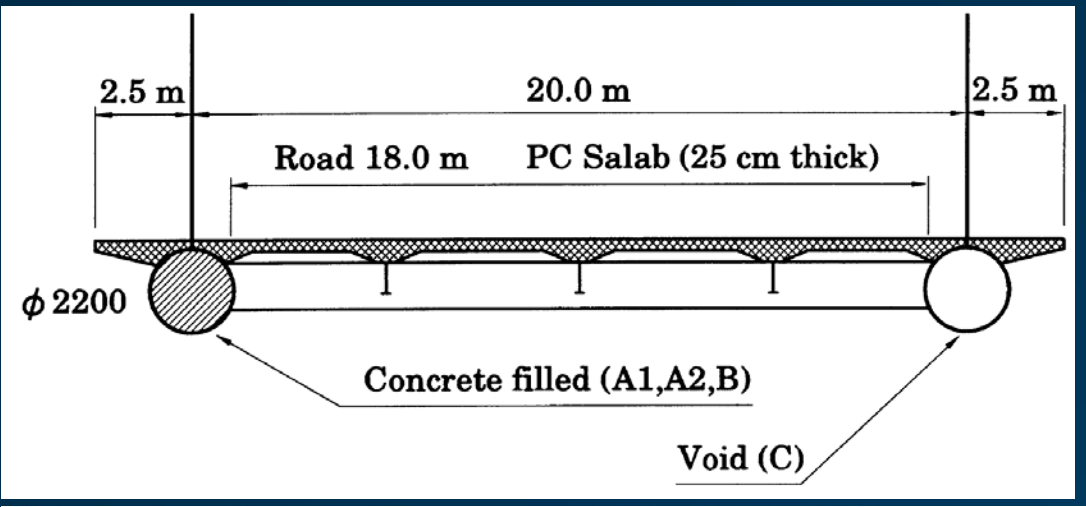


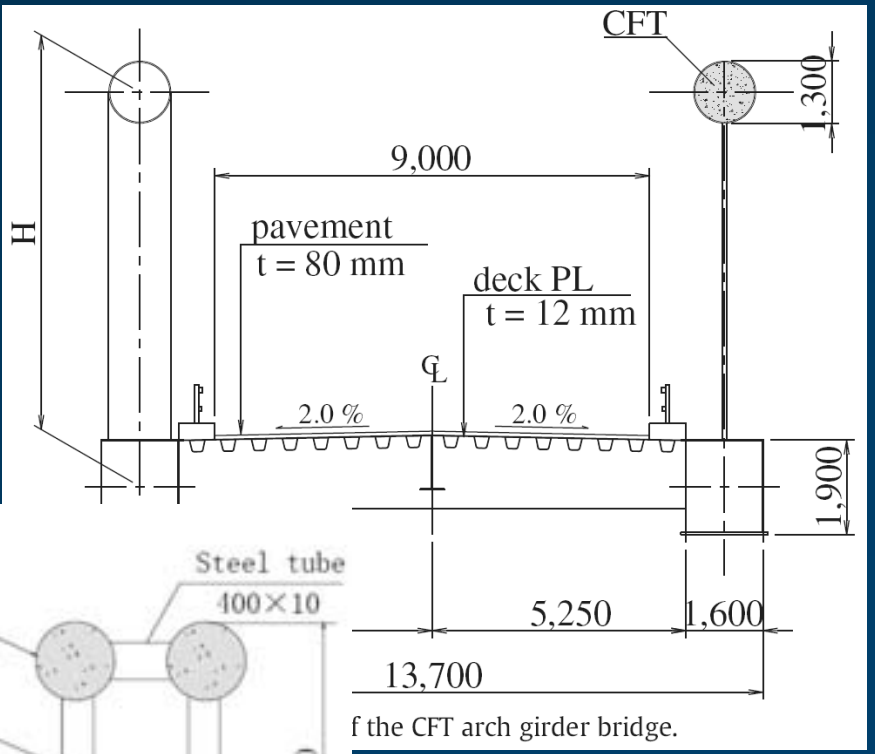
Casper, 2014: The First Fully Welded Integral Tube-Truss Bridge of Germany

Pál et al., 2015: Bajai kerékpáros híd tervezése a Petőfi- és a Pandúr-sziget közé 2.

CSŐFŐTARTÓS HIDAK

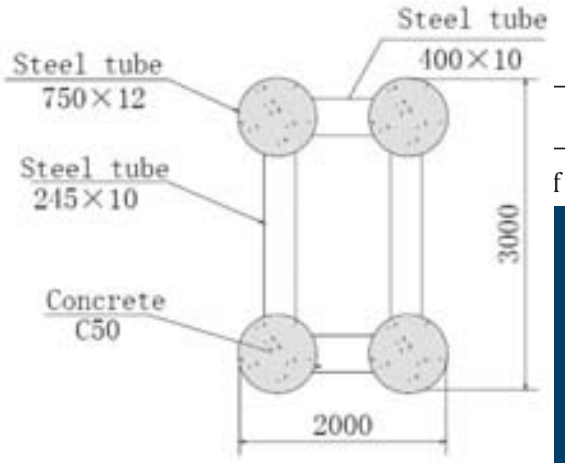
Hossztartó és ív csőfőtartó





f the CFT arch girder bridge.

Shenzhen Beizhan Bridge



Cross Section of Arch Rib (unit:mm)

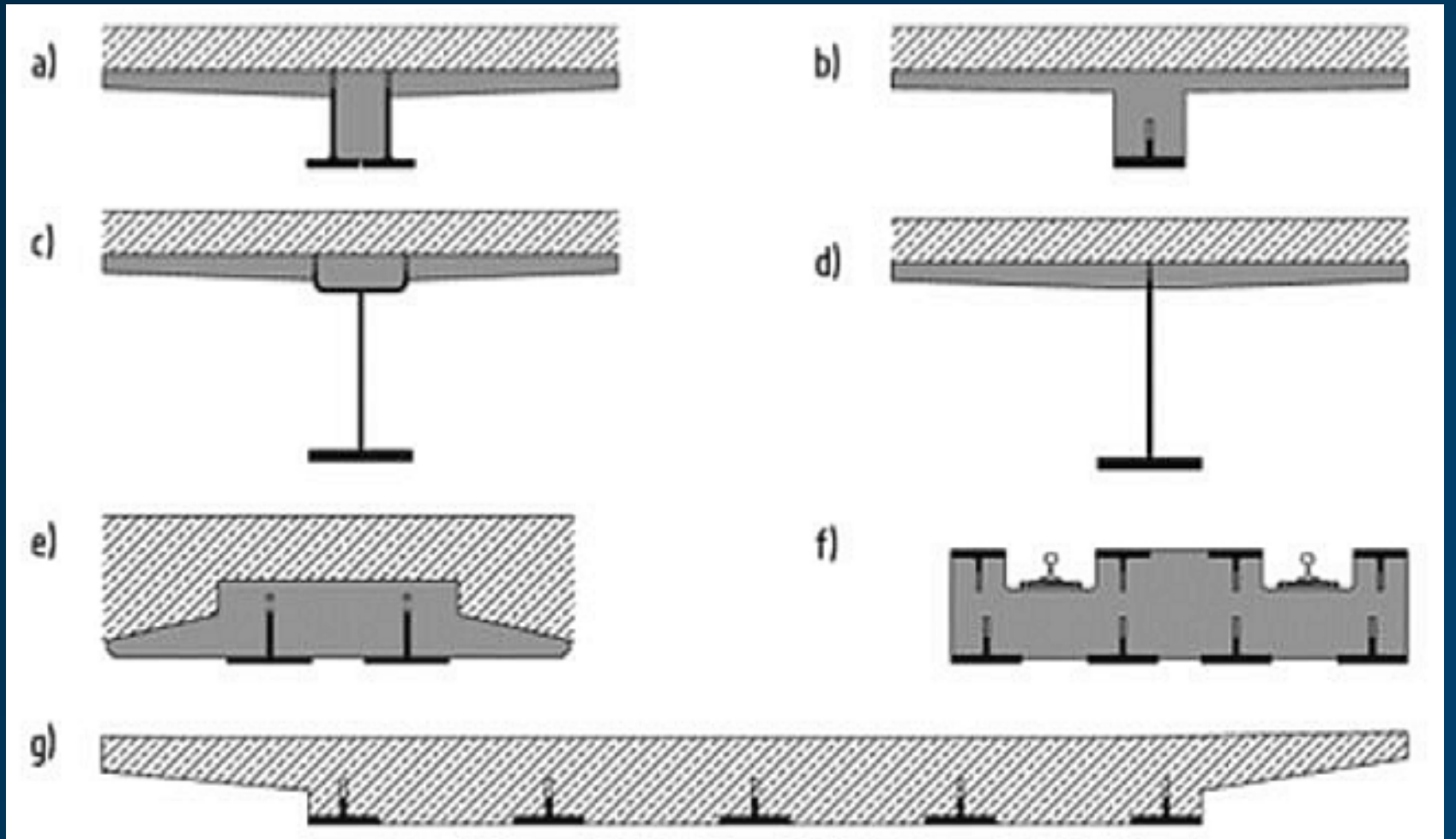
Nakamura et al., 2002: New technologies of steel/concrete composite bridges

Okamoto et al., 2012: Study on steel box girder bridges partly stiffened by CFT arch ribs

Chen et al., 2004: Application of Concrete Filled Steel Tubular Arch Bridges and Study on Ultimate Load-Carrying Capacity

ÖSZVÉRPALLÓK

Alapok

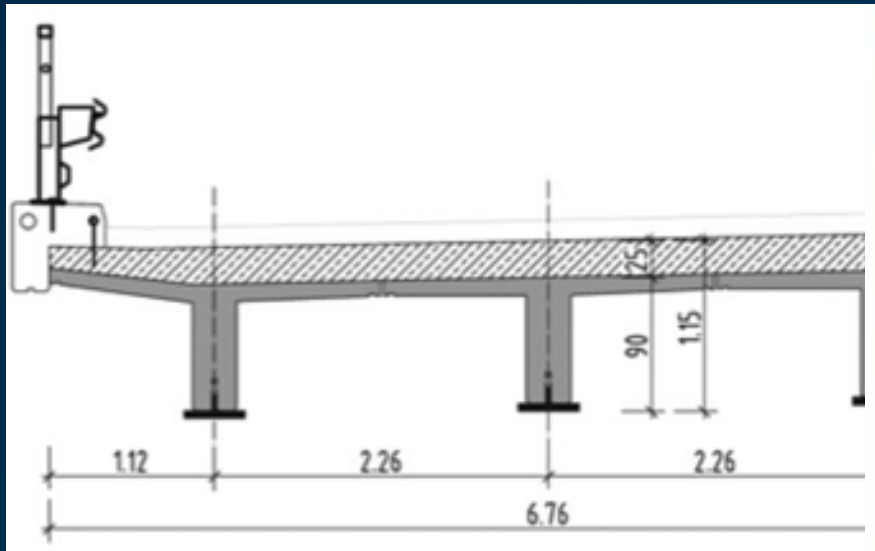


Typified cross-sections: VFT-WIB construction method called „duo-WIB“ (a) and „mono-WIB“(b) and using welded sections (c+d); special types VFR-Rail (f) and external reinforcement in in-situ plate cross-section

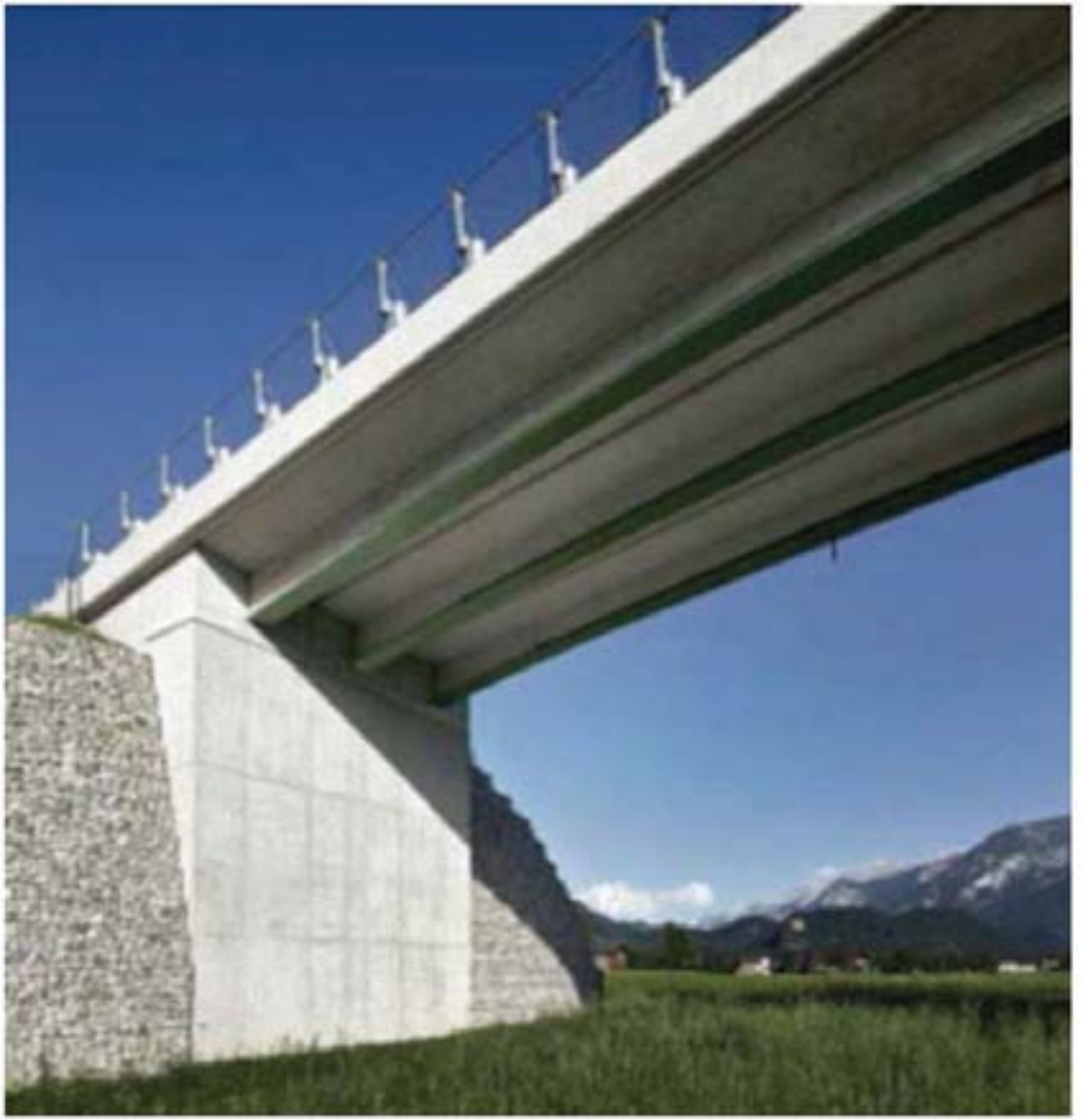
Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

ÖSZVÉRPALLÓK

Acél alsóöves előre gyártott tartó



Cross-sections of Kuchl (A) bridge at midspan and sup

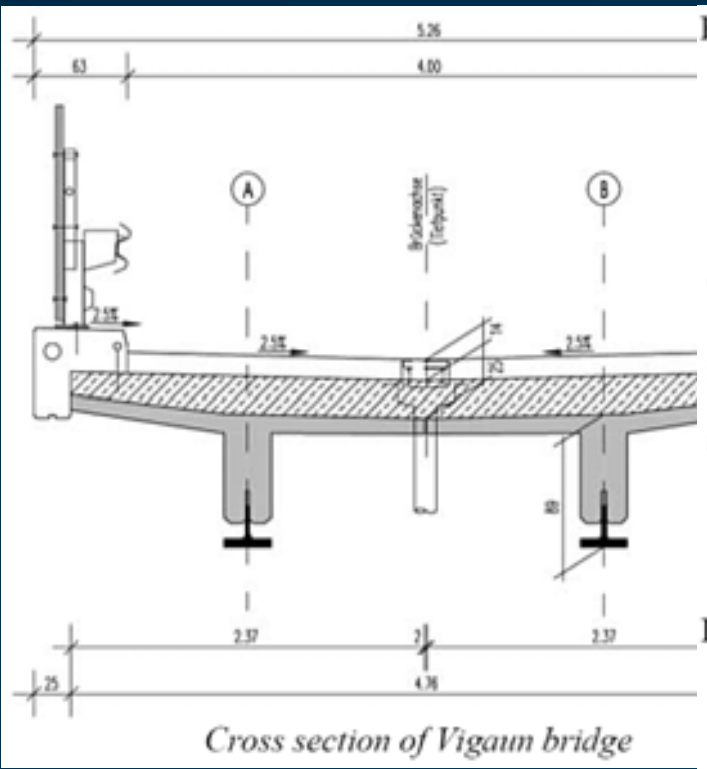


Bottom view on the VFT-WIB girders at Kuchl bridge (A)

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

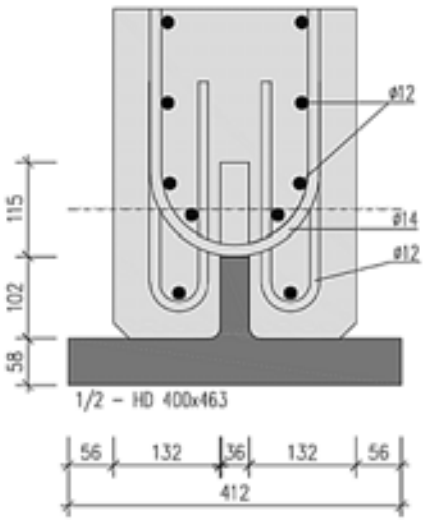
ÖSZVÉRPALLÓK

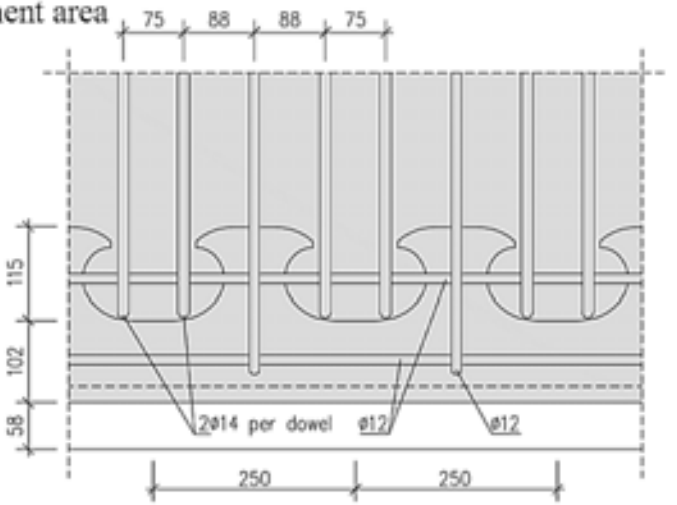
Acél alsóöves előre gyártott tartó



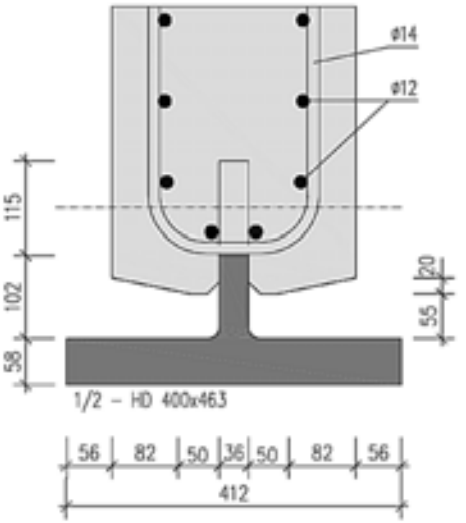
Cross section of Vigaun bridge

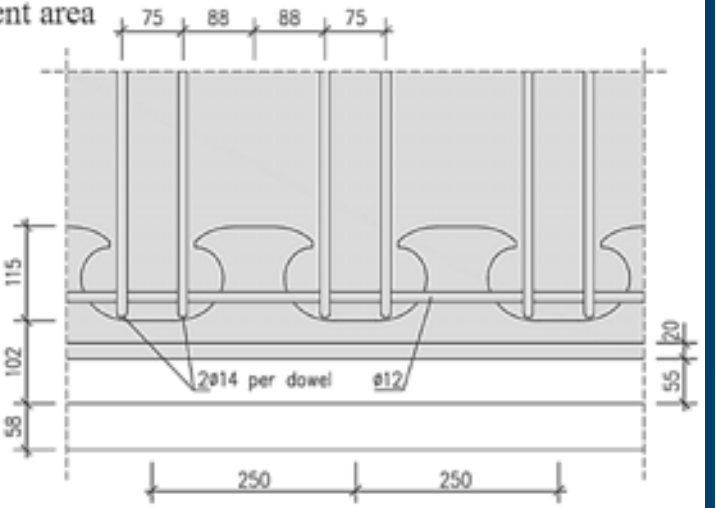
Reinforced Cross-section at hugging moment area





Reinforced cross-section at sagging moment area





RFCS, Seidl et al., 2013: Prefabricated enduring composite beams based on innovative shear transmission

ÖSZVÉRPALLÓK

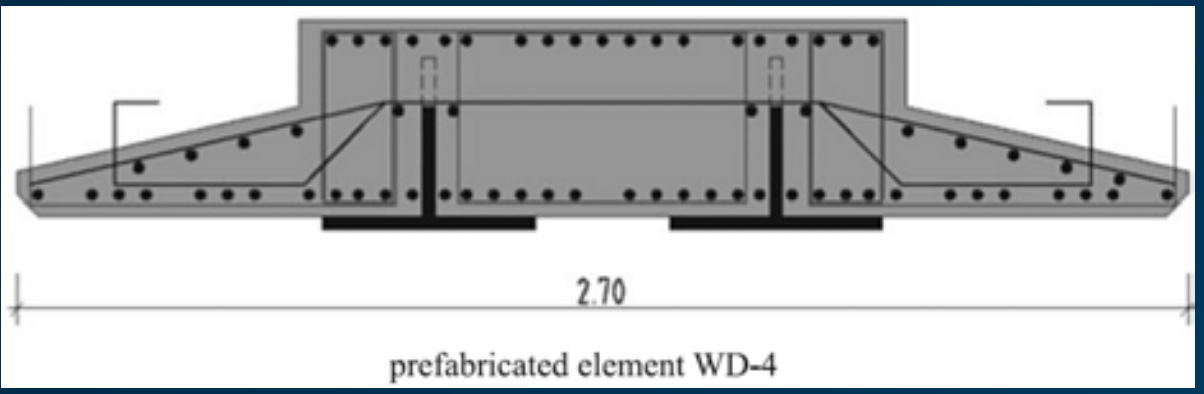
Acél alsóöves előre gyártott tartó

Bottom view of Vigaun bridge

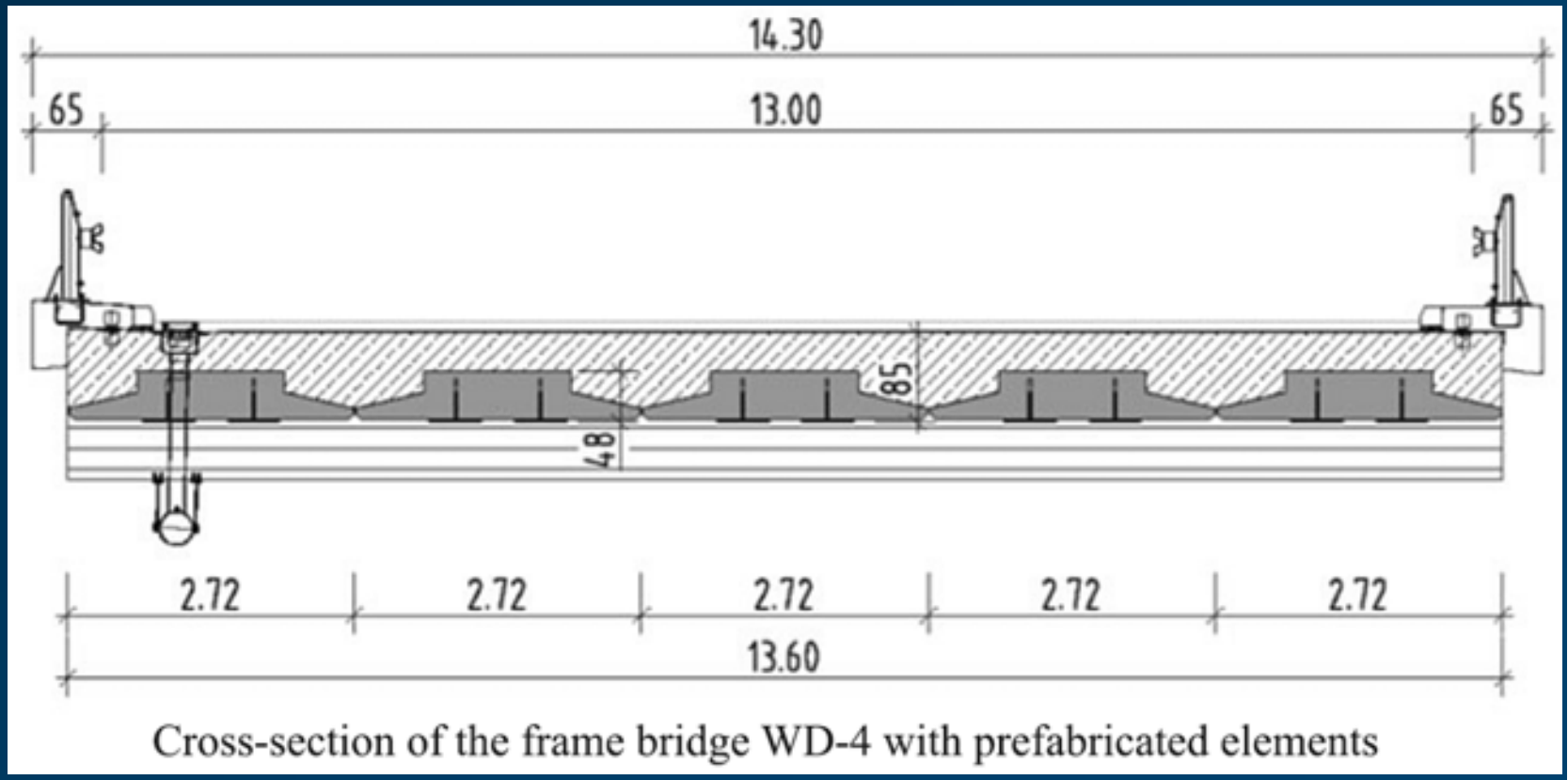
RFCS, Seidl et al., 2013: Prefabricated enduring composite beams based on innovative shear transmission

ÖSZVÉRPALLÓK

Két acél alsóöves előre gyártott palló



prefabricated element WD-4



Cross-section of the frame bridge WD-4 with prefabricated elements

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

ÖSZVÉRPALLÓK

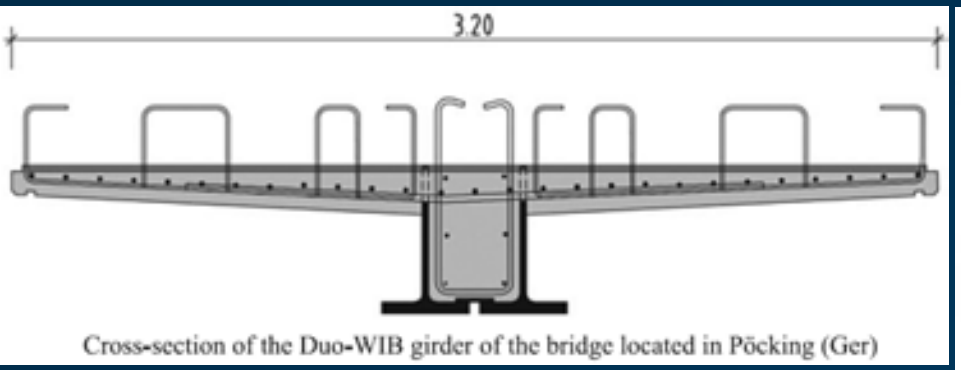
Két acél alsóöves előre gyártott palló

Cut (halved) rolled sections with PZ-geometry of the dowels and coating in the prefabrication plant

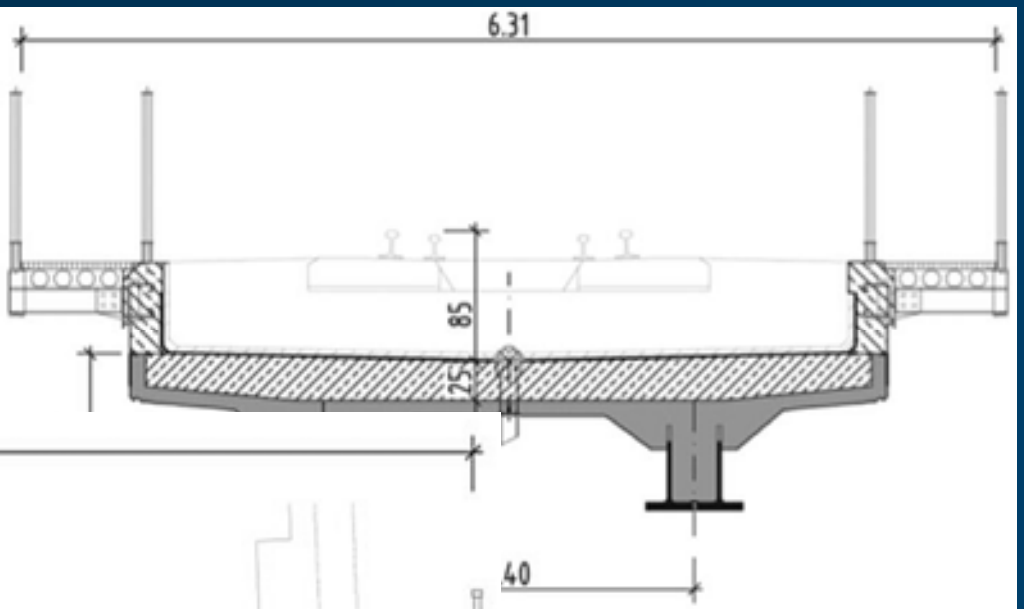
Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

ÖSZVÉRPALLÓK

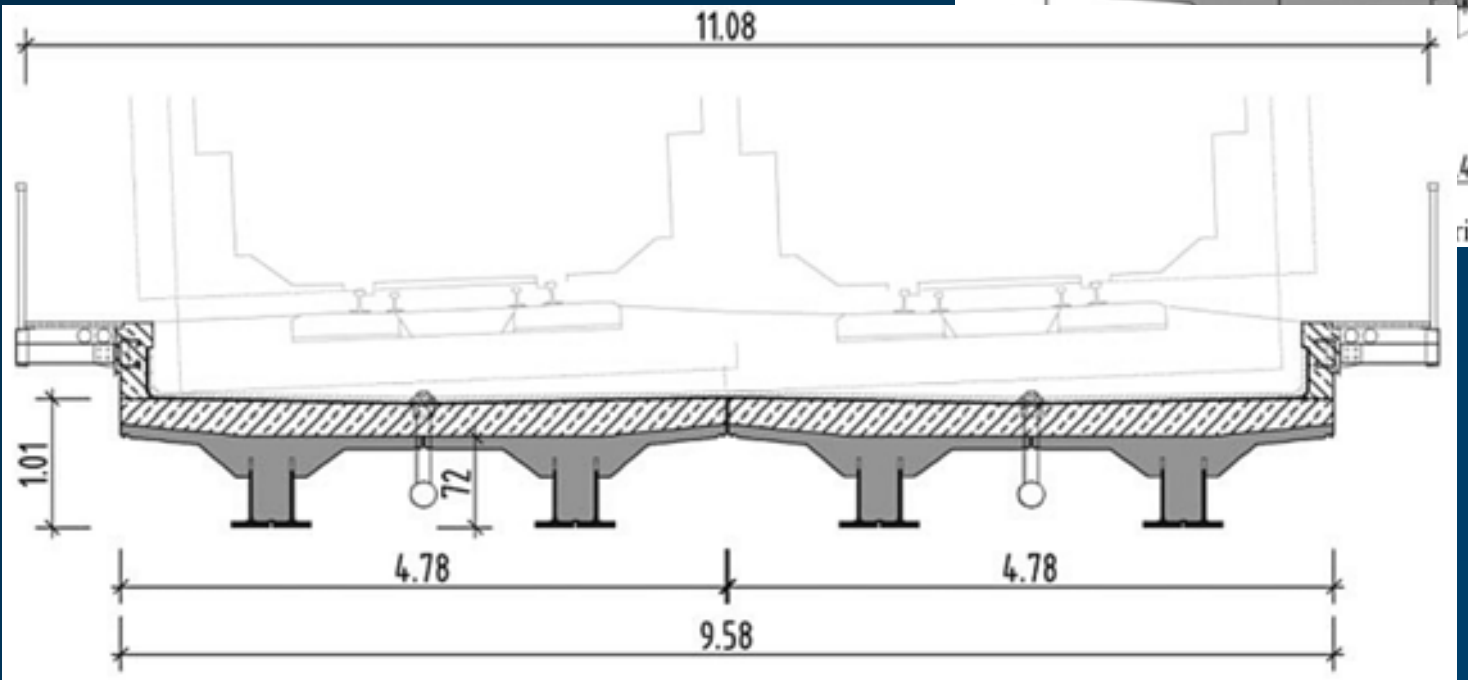
Két acél alsóöves előre gyártott tartó



Cross-section of the Duo-WIB girder of the bridge located in Pöcking (Ger)



ridge over the Łososina River (PL)

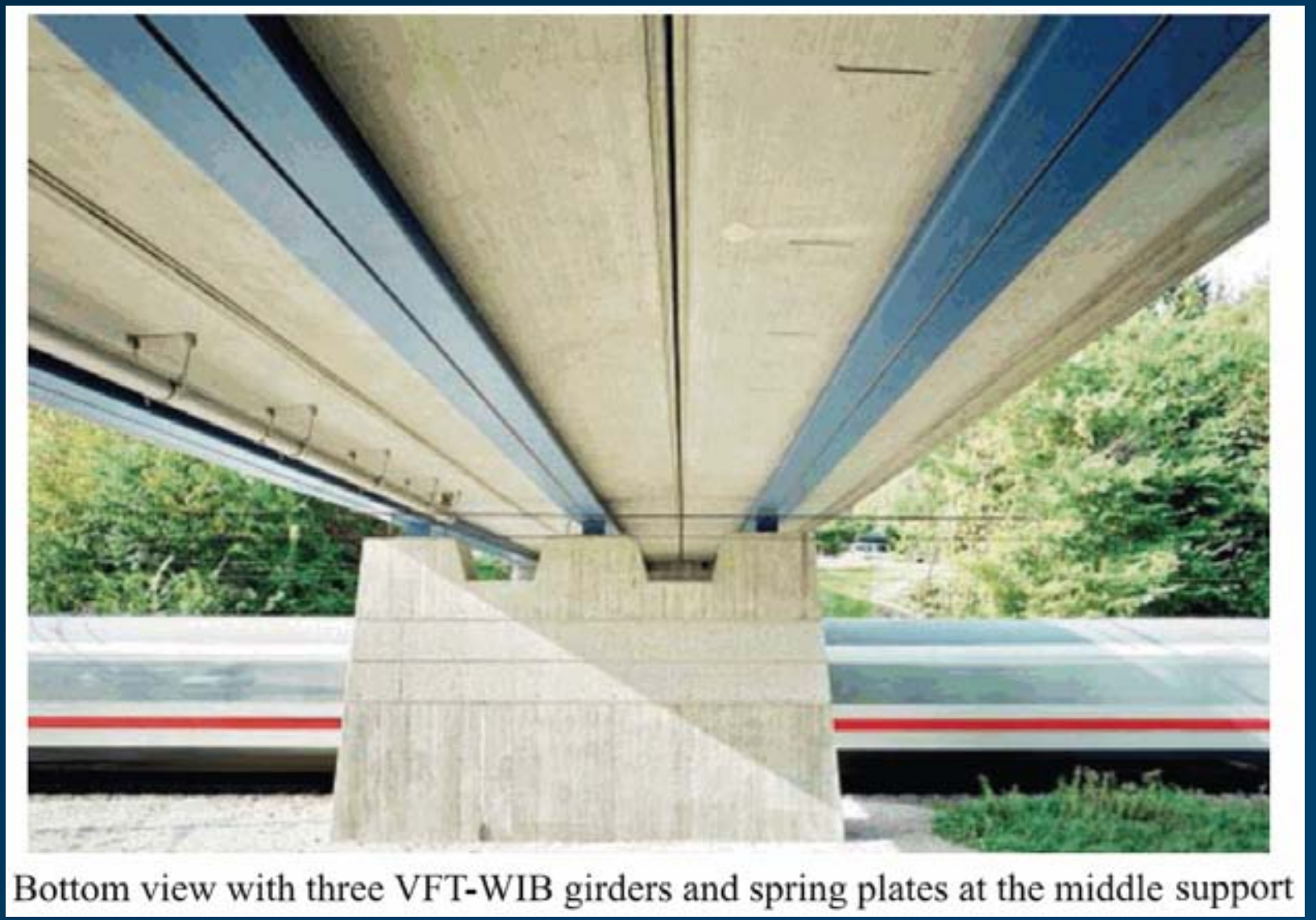


Longitudinal section and cross-section of the railway viaduct next to Tczew (PL) built as frame bridge implementing VFT-WIB girders

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

ÖSZVÉRPALLÓK

Két acél alsóöves előre gyártott tartó

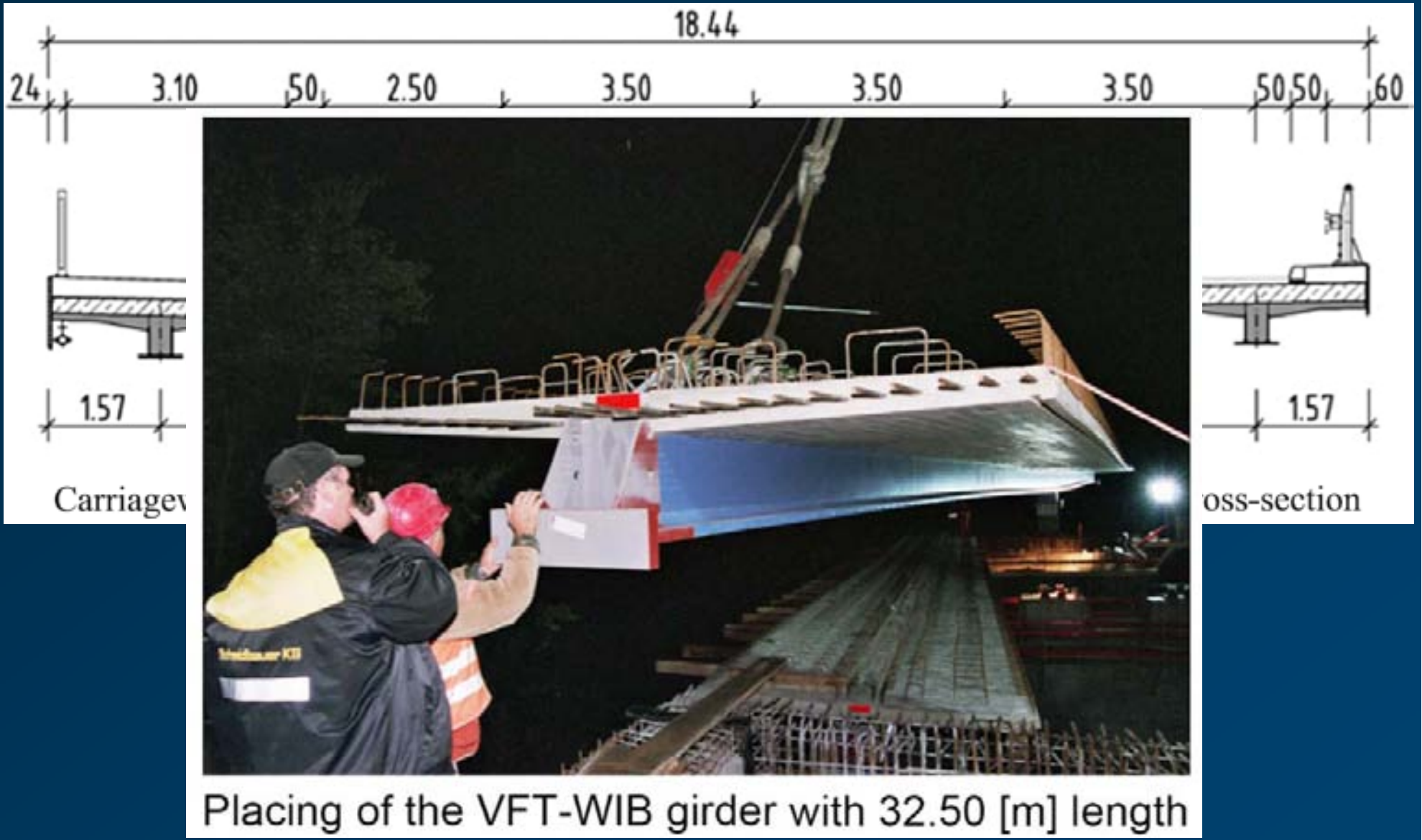


Bottom view with three VFT-WIB girders and spring plates at the middle support

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

ÖSZVÉRPALLÓK

Két acél alsóöves előre gyártott tartó



Placing of the VFT-WIB girder with 32.50 [m] length

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

Hechler et al., 2008: Continuous Shear Connectors in Bridge Construction

ÖSZVÉRPALLÓK

Beton felsőöves előre gyártott tartó

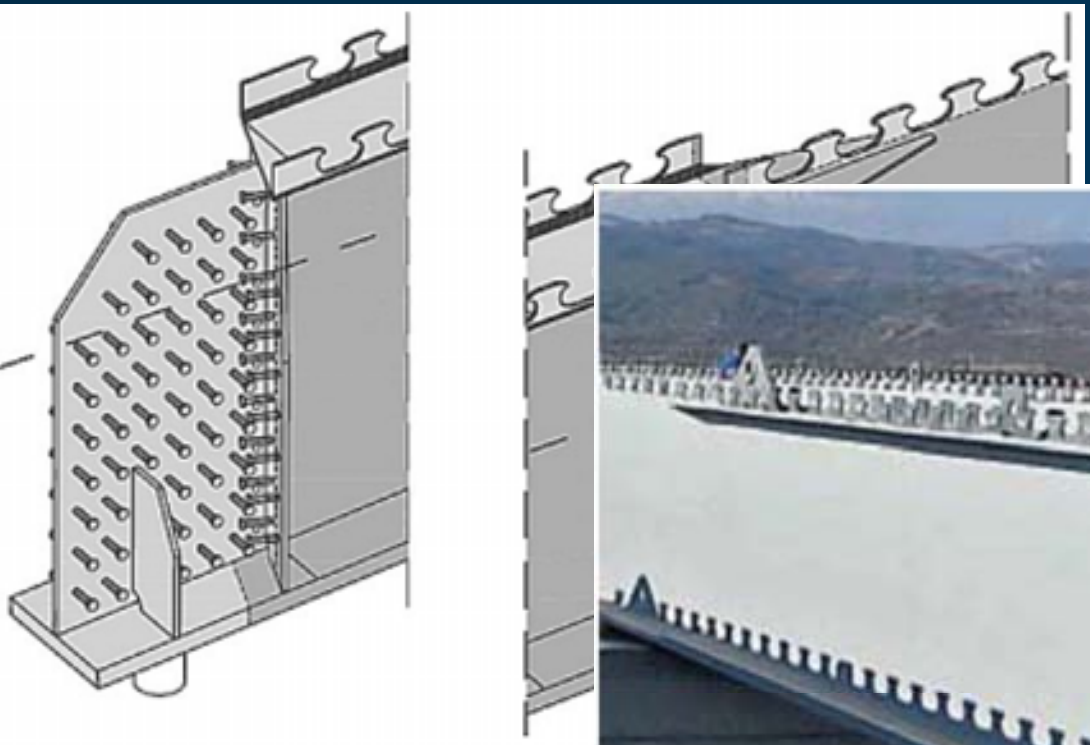
VFT®-so

"Ready to transportation" VFT girder in the factory.

Hechler et al., 2008: Continuous Shear Connectors in Bridge Construction
Skalska, 2009: VFT® - Prefabricated Composite Construction Method

ÖSZVÉRPALLÓK

Beton felsőöves előre gyártott tartó



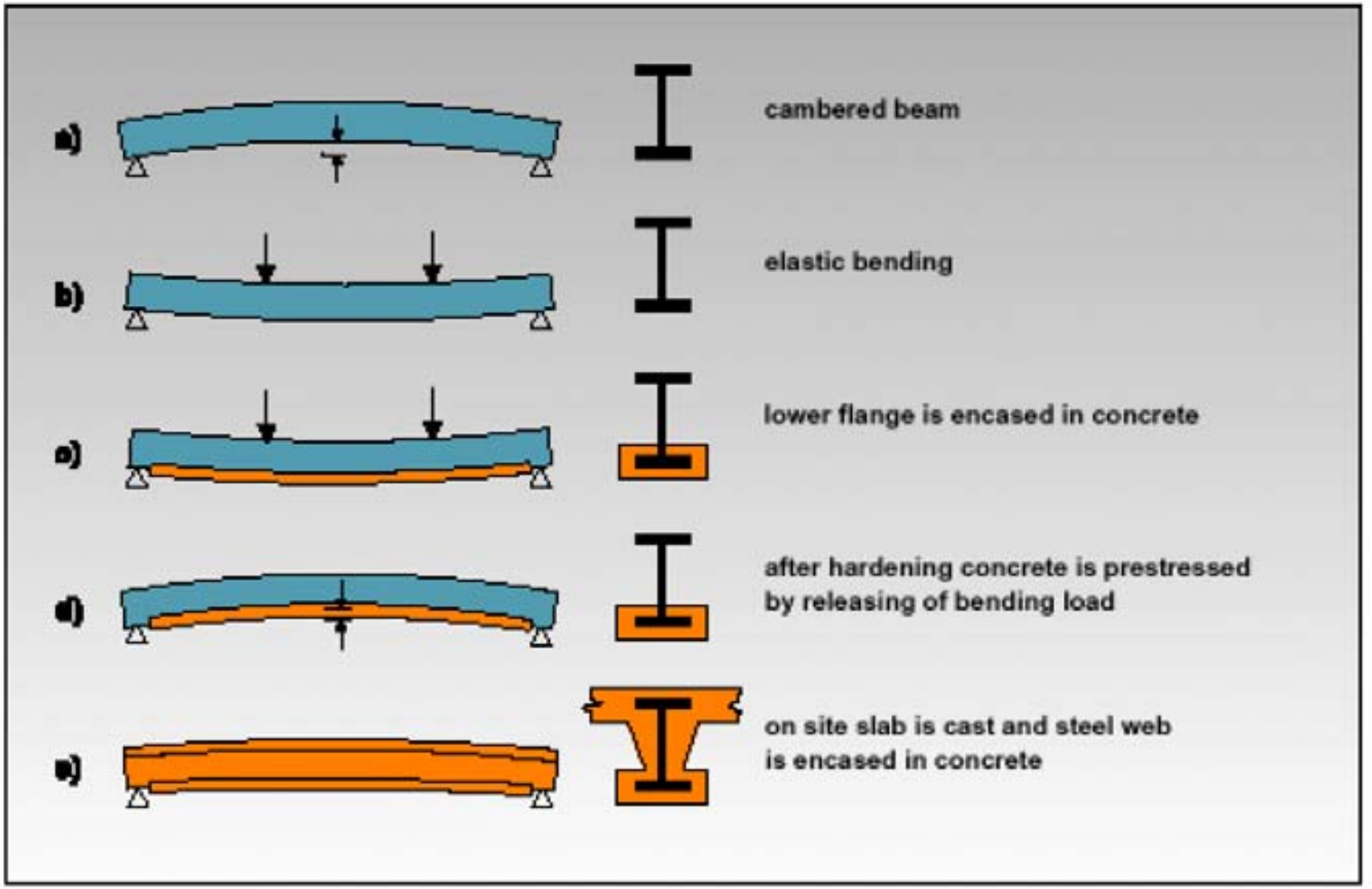
3-d sketch of the transition area of the
into two strips at the sup

Steel girders on site

Seidl et al., 2014: Economic Composite Construction for Birdges: Construction Methods Implementing Composite Dowel Strips

PREFLEX TARTÓK

Alapelv



Fabrication of prestressed composite girder

ECSC, 2002: Composite Bridge Design for Small and Medium Spans

PREFLEX TARTÓK

Szállítás

Transportation of a Preflex

Single span bridge in Kerpen Horrem, Germany. 41,25 m long HE 1000 A beams used for prestressed composite girders of " Preflex " type.

ECSC, 2002: Composite Bridge Design for Small and Medium Spans

PREFLEX TARTÓK

Hazai vizsgálat

Kővári Ákos okl. szerkezetépítő mérnök
Dr. Kovács Nauzika egyetemi docens

PREFLEX TARTÓK GYÁRTÁSI, ÉPÍTÉSTECHNOLÓGIAI ÉS STATIKAI KÉRDÉSEI

Ennek eredményeképpen megállapítható, hogy a szekrényes keresztmetszetű PREFLEX tartók statikai előnyei a következők:

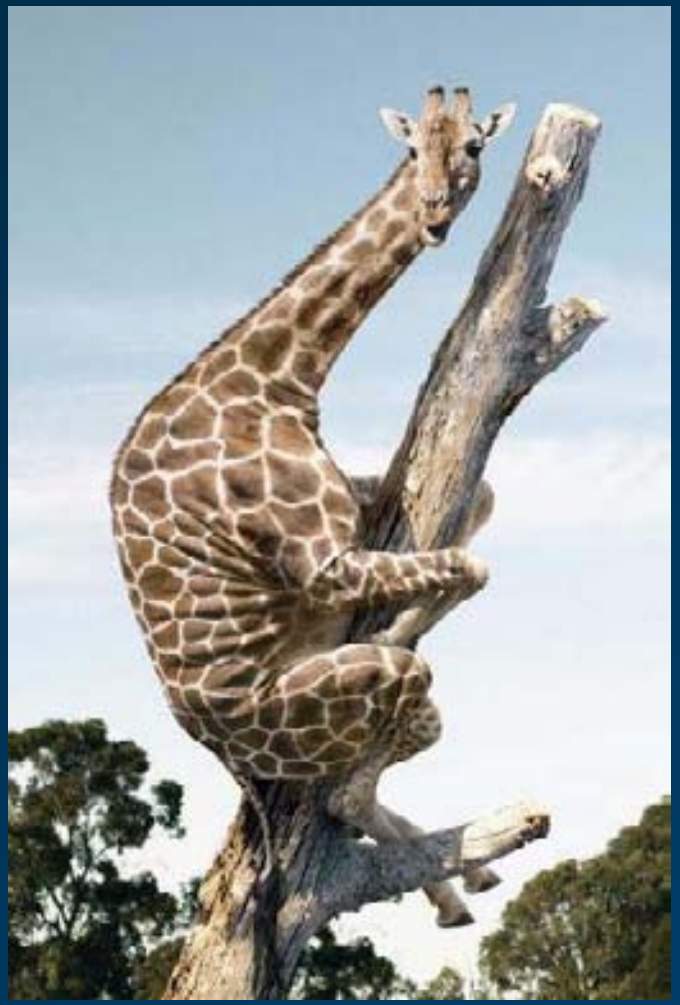
- A feszítéssel lehetőség van a tartómagasság csökkentésére, ezáltal a vasbeton hídgerendákkal azonos magasságú hidak építhetők.
- Számítása szoftveres és szabványi háttérrel ellátott, statikai viselkedése megbízhatóan követhető.

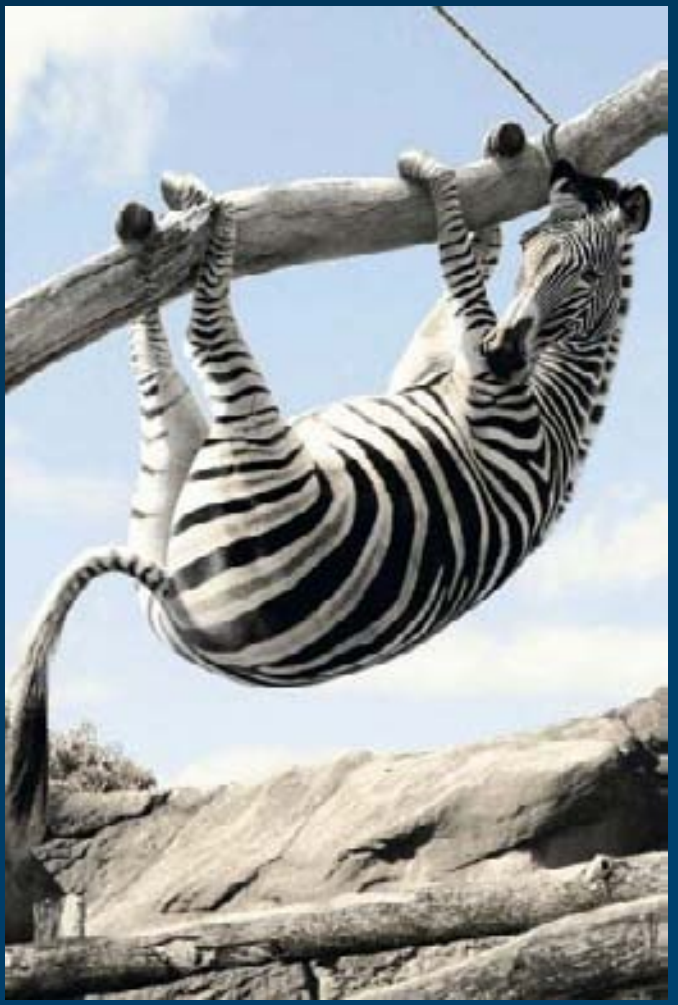
A PREFLEX gerendák hátrányaként megemlíthető, hogy a feszítőerő és a gerendamerevség egymásra hatása miatt számítása csak iteratív úton végezhető el.

Kővári, Kovács, 2012: Preflex tartók gyártási, építéstechnológiai és statikai kérdései

ÉRDEKES ÉPÍTÉSTECHNOLÓGIÁK

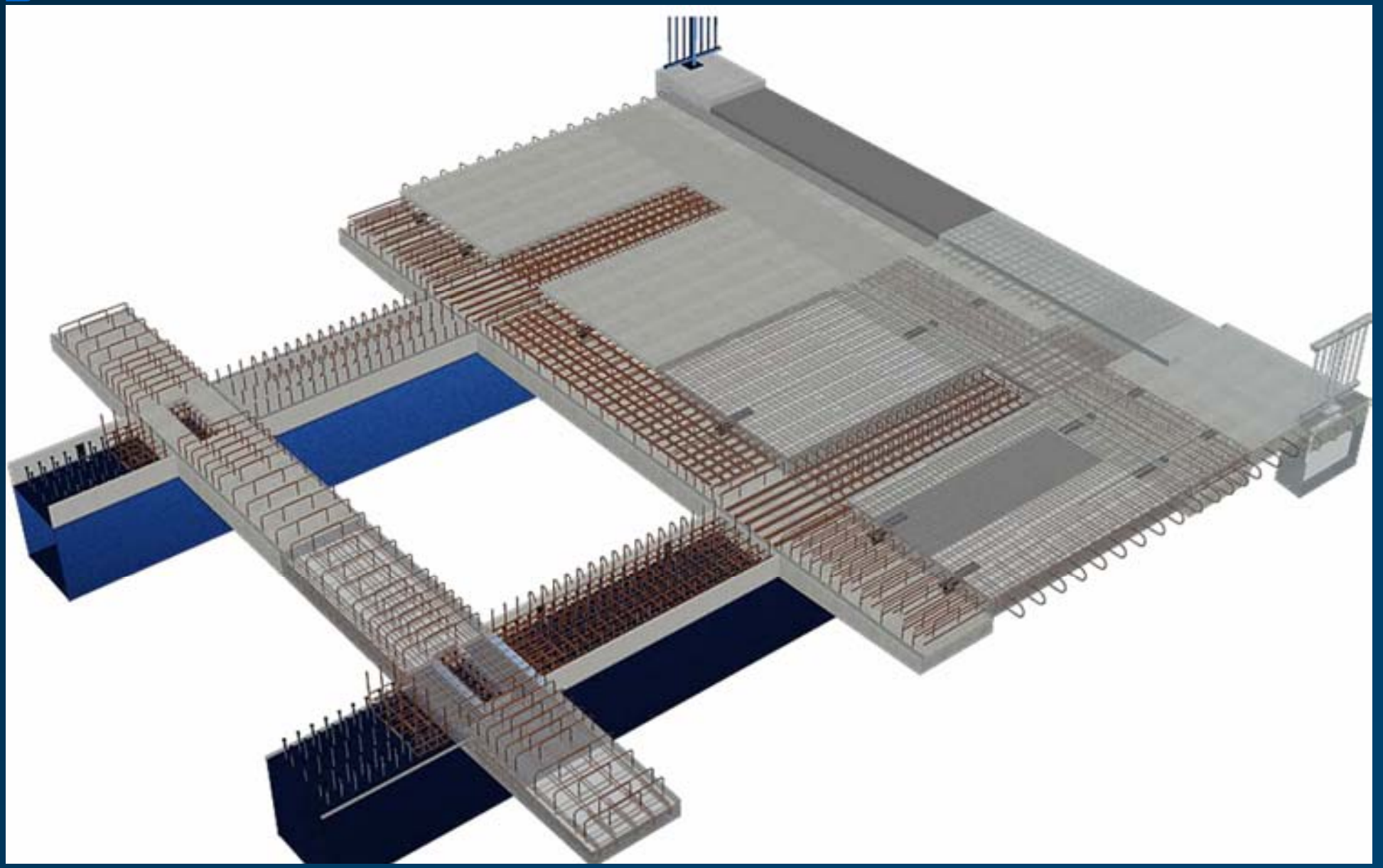
Ilyen állatok pedig nincsenek!





VTR® RENDSZER, „LEGO”

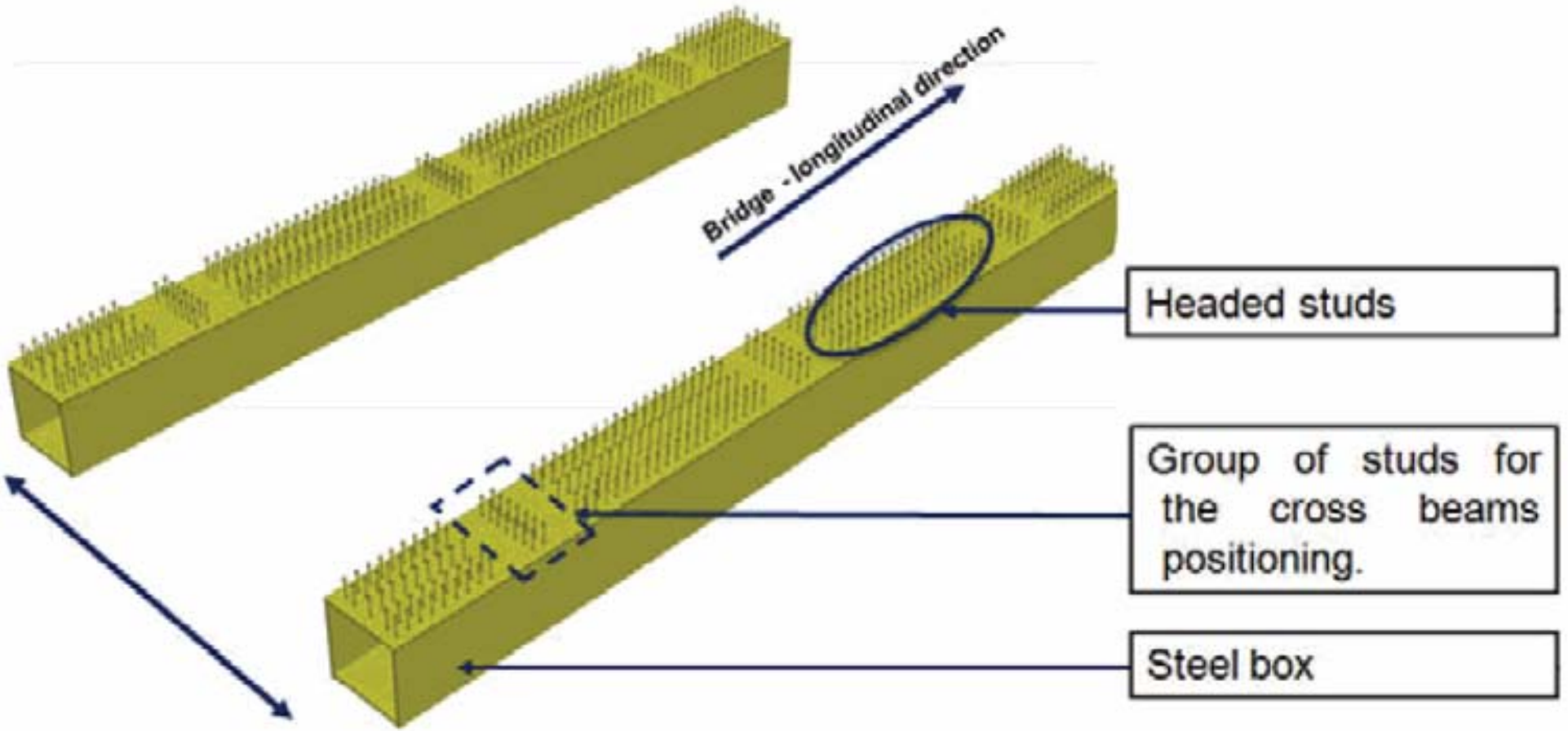
Alapelv



Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Építési fázisok

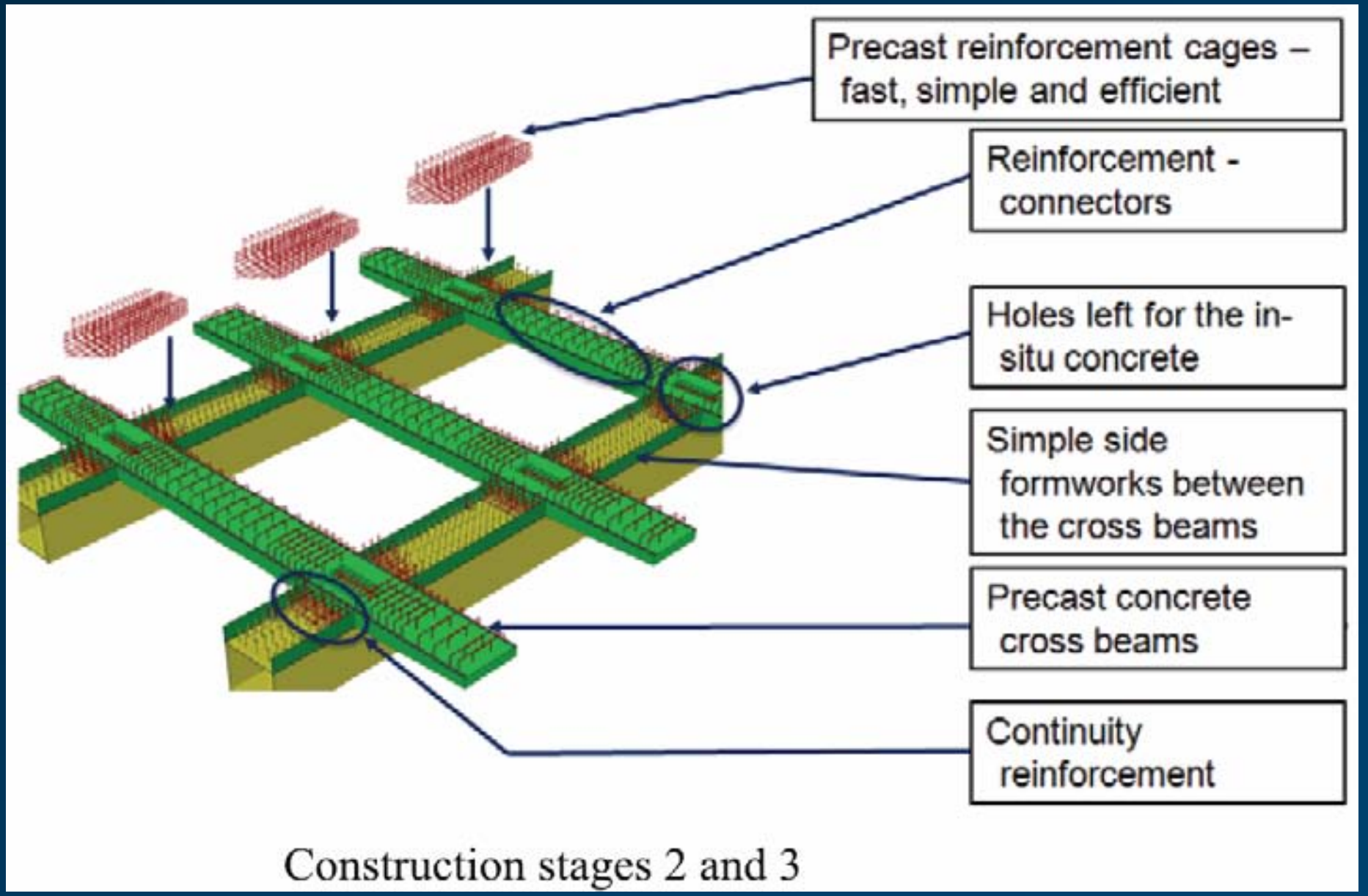


Construction stage 1

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Építési fázisok

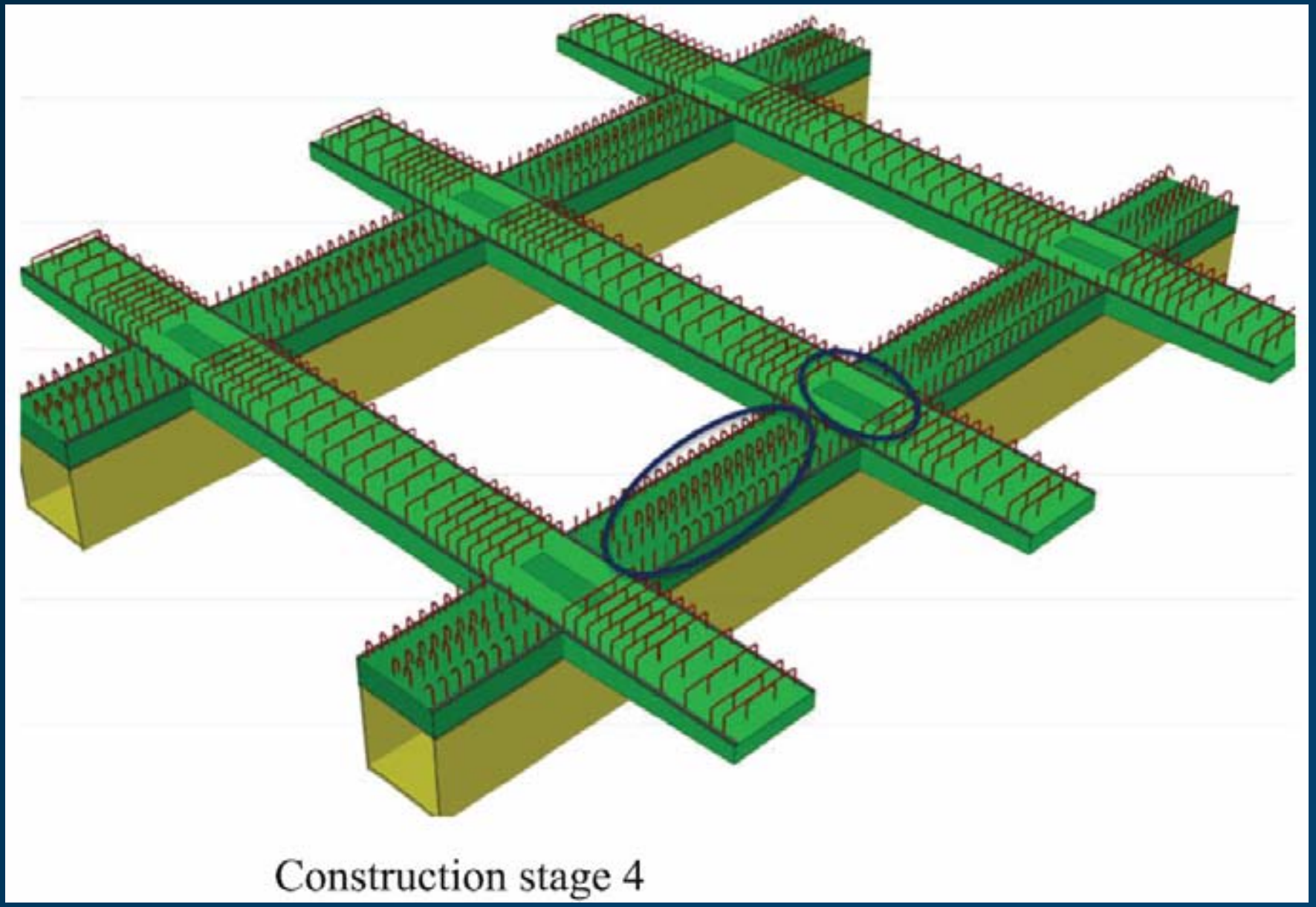


Construction stages 2 and 3

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

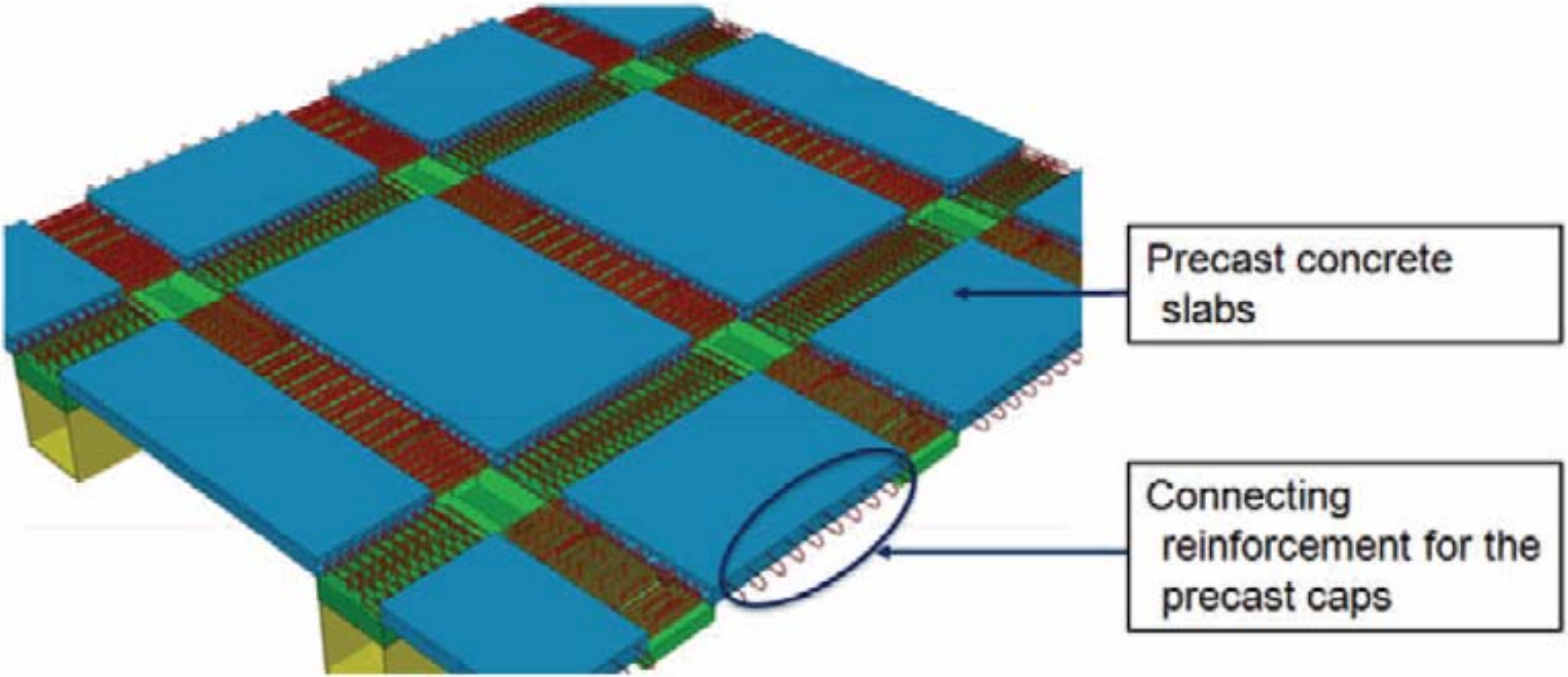
Építési fázisok



Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Építési fázisok

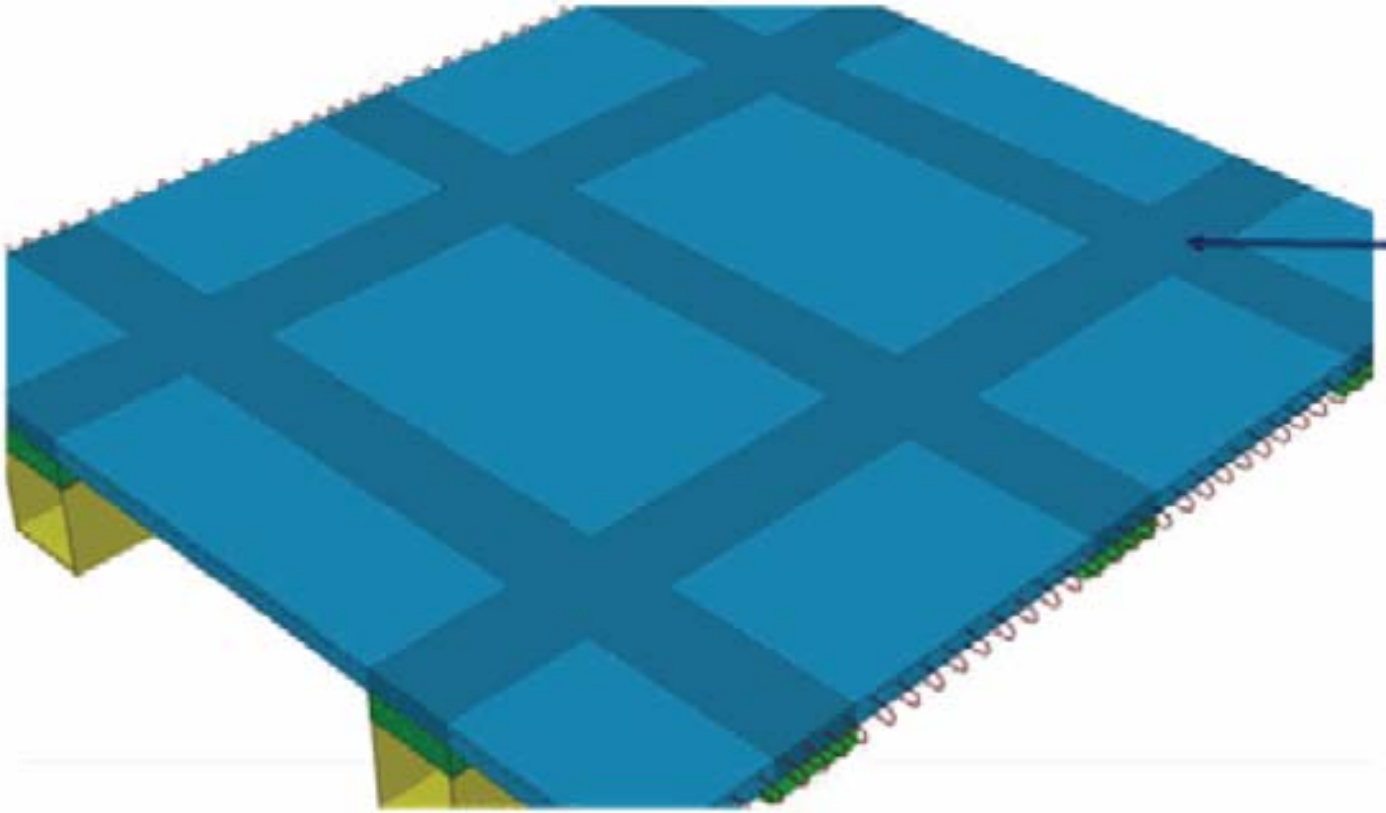


Construction stage 5 and 6

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Építési fázisok

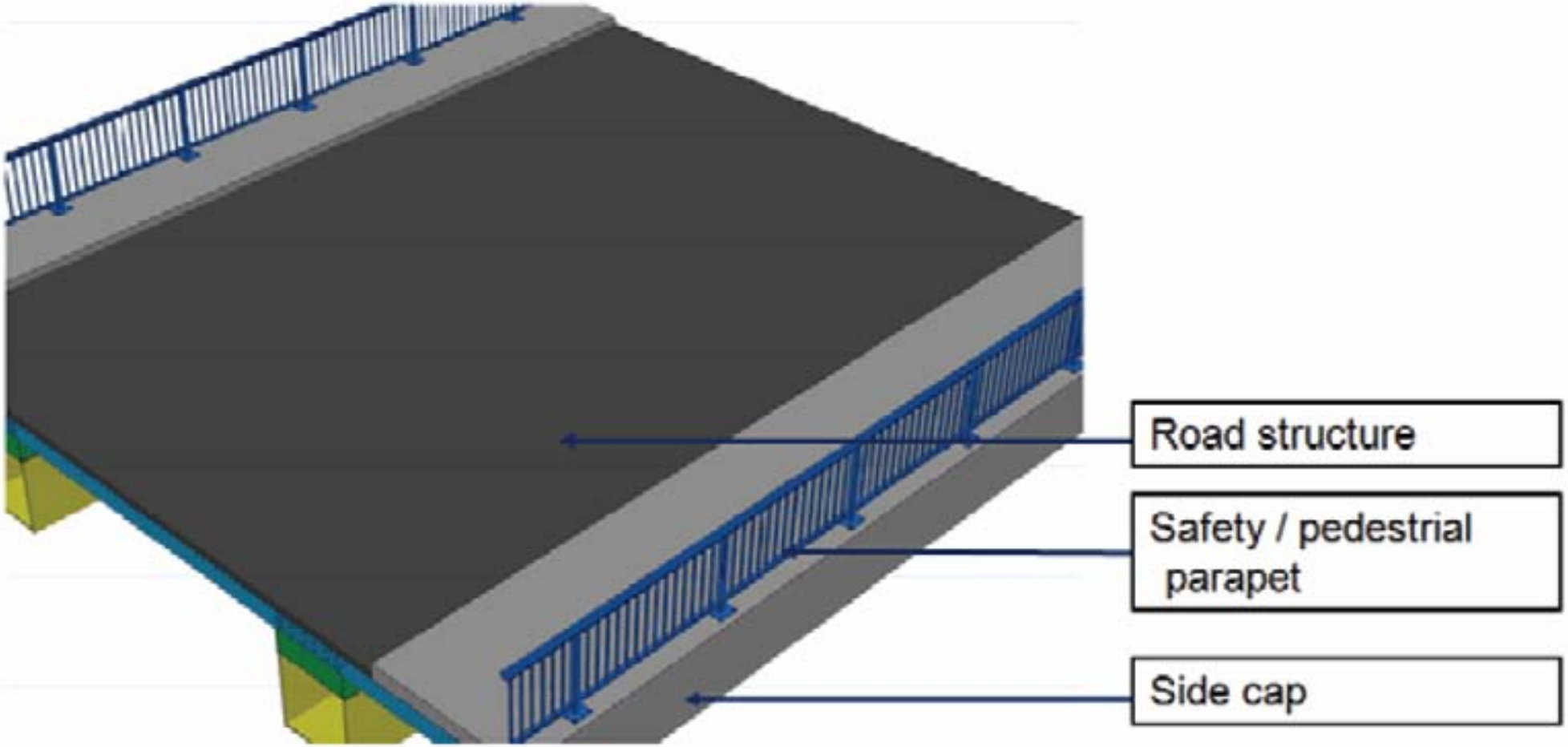


Construction stage 7

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

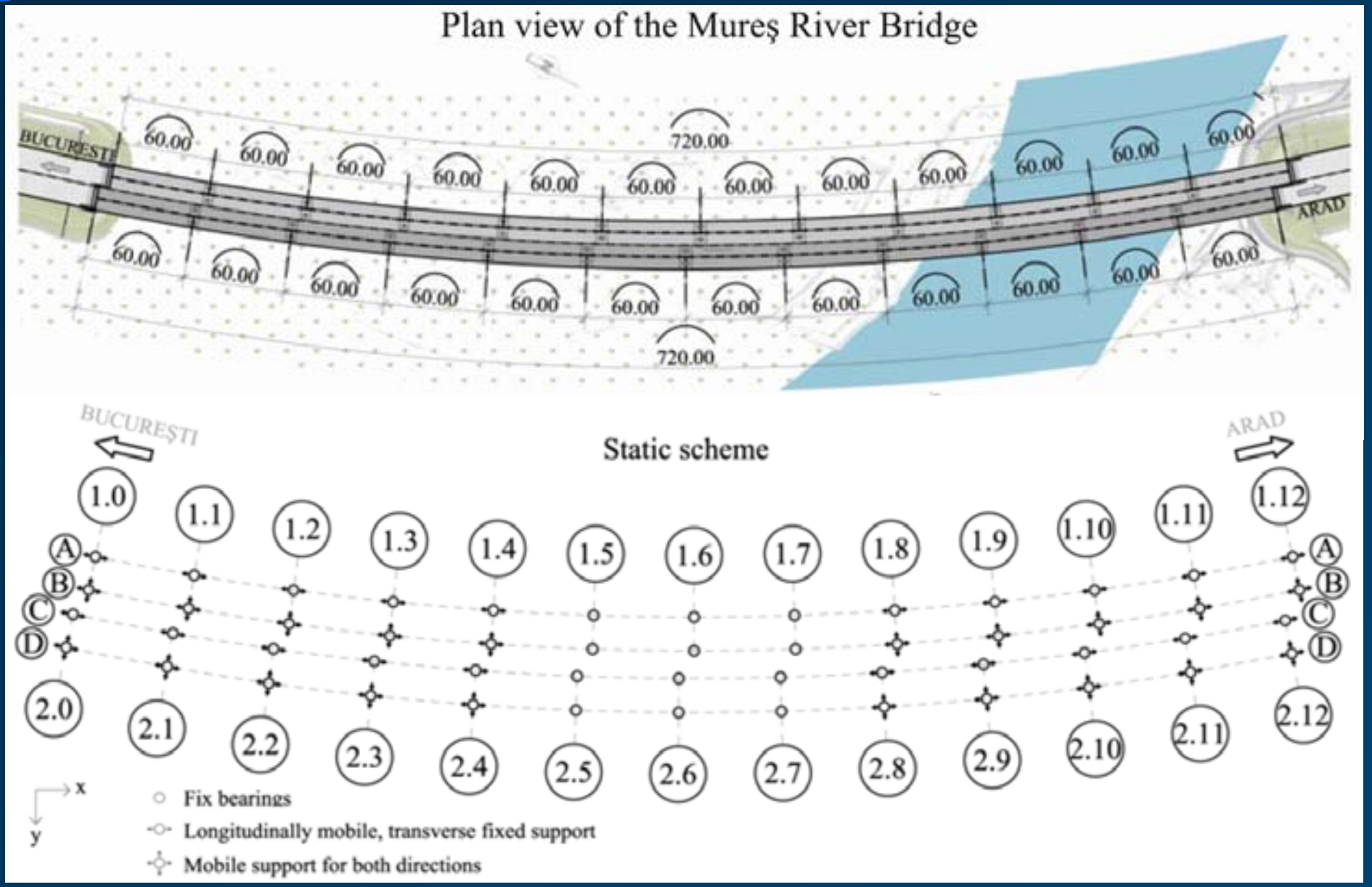
Építési fázisok



Construction stage 8

VTR® RENDSZER, „LEGO”

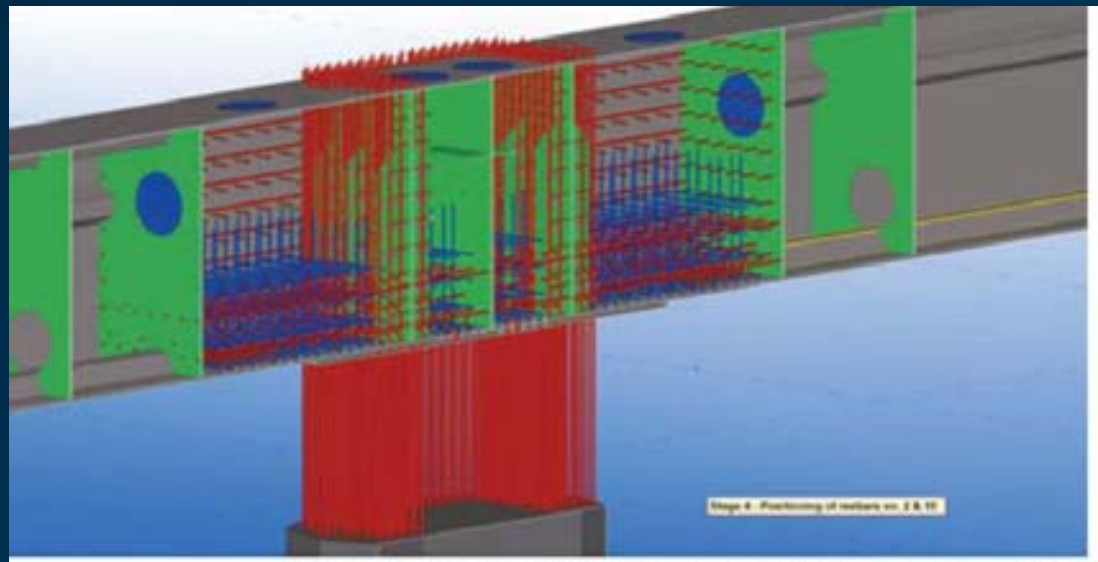
Alaprajzi elrendezés



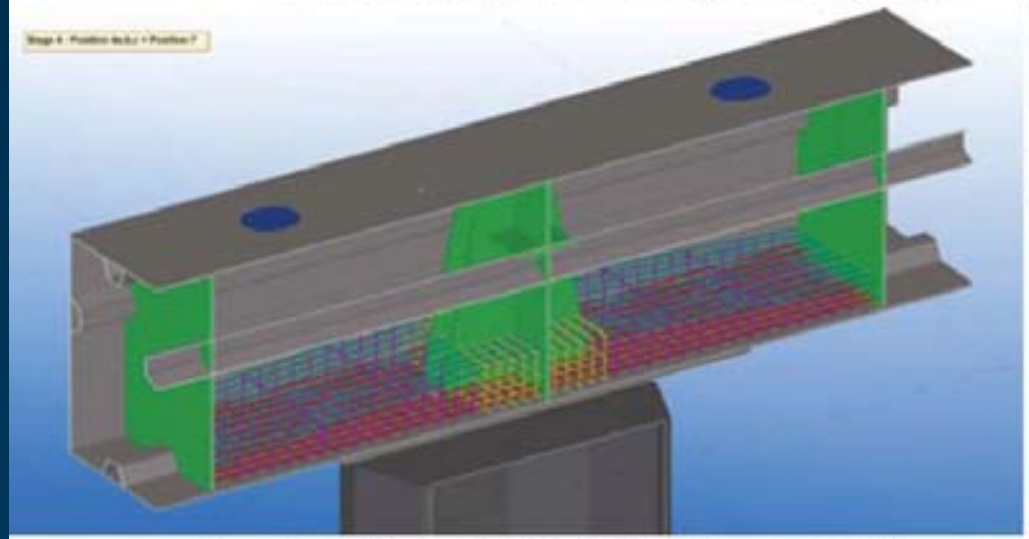
Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Pillér feletti csomópontok



Fixed node 3D view, axes 5, 6, 7 – double composite structure



Node with calotte bearings, axes 0 – 4, 8 – 12 – double composite structure

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Megvalósulás

Arrangement of the prefabricated cross girders at equal intervals on the steel boxes

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Megvalósulás

Intermediary composite girder system

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

Megvalósulás

Arrangement of the prefabricated slabs on top of the composite girder system

Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

VTR® RENDSZER, „LEGO”

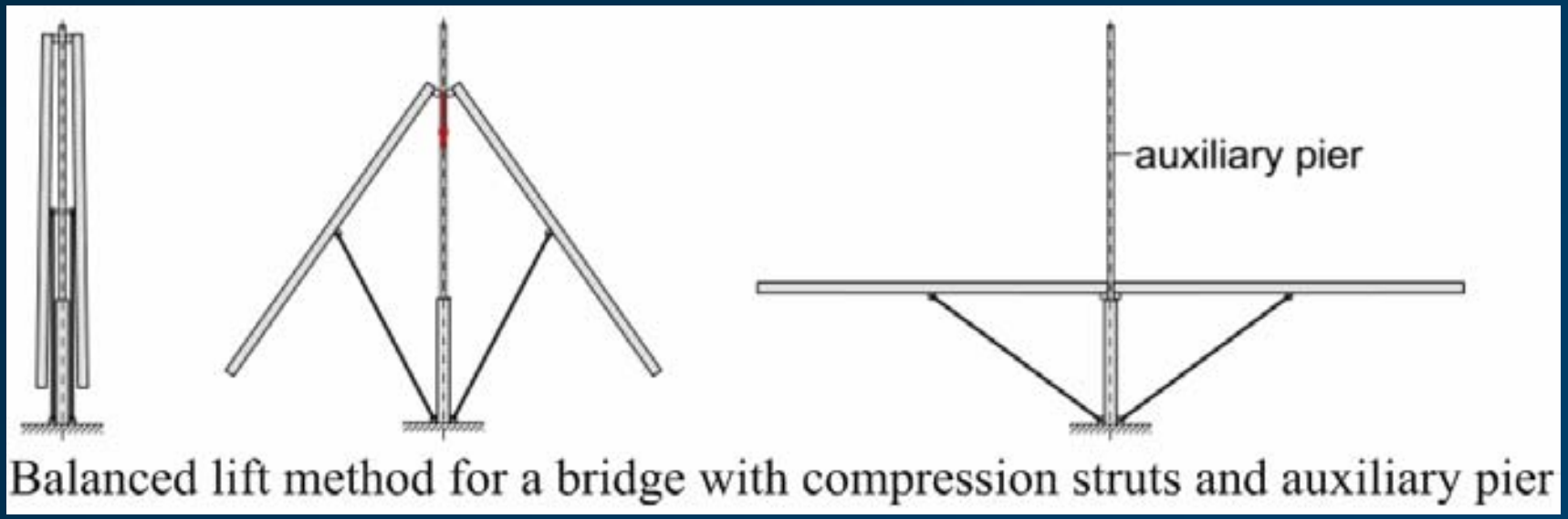
Megvalósulás

View of the final bridge

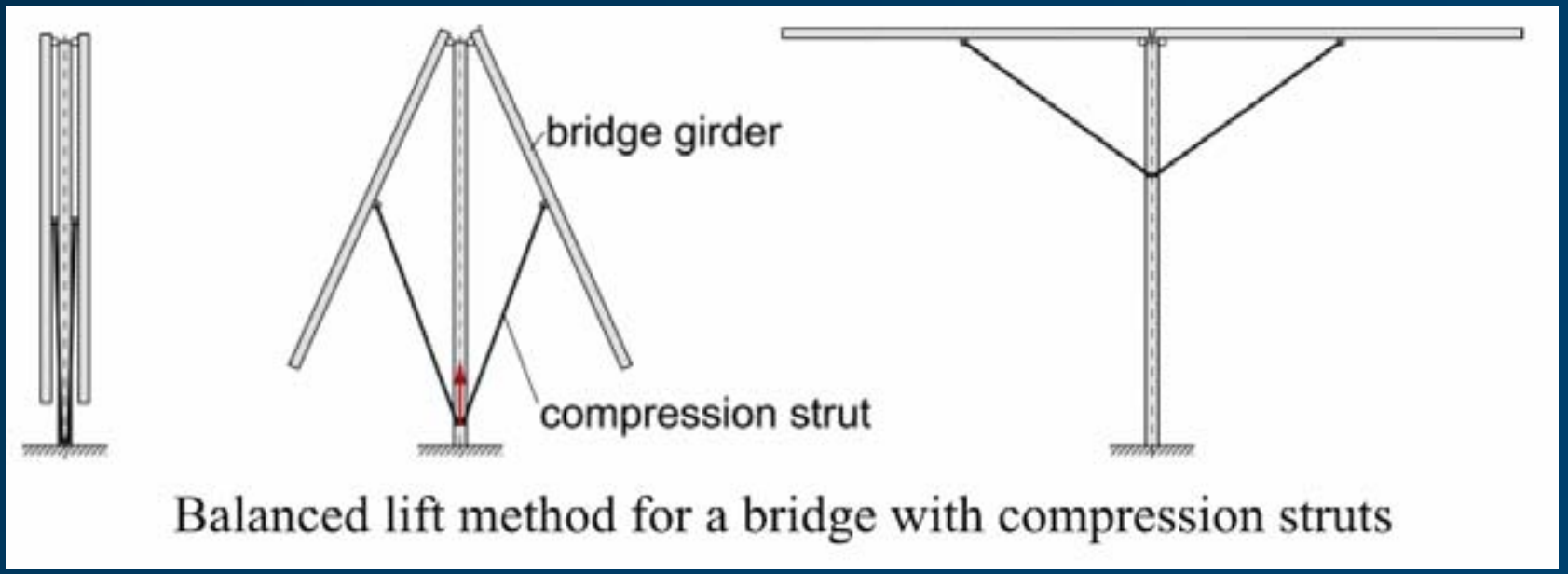
Petzek et al., 2014: VTR® - A Modern Composite Bridge Concept

SZABADON EMELÉS

Alapelv



Balanced lift method for a bridge with compression struts and auxiliary pier



Balanced lift method for a bridge with compression struts

Kolleger, Wimmer, 2014: Design of Bridges According to the Balanced Lift Method

SZABADON EMELÉS

Gyártás

Production of prefabricated elements at the Austrian precasting company Oberndorfer

Kolleger, Wimmer, 2014: Design of Bridges According to the Balanced Lift Method

SZABADON EMELÉS

Építés

Lowering of the top points of bridge girders with the aid of mobile cranes

Kolleger, Wimmer, 2014: Design of Bridges According to the Balanced Lift Method

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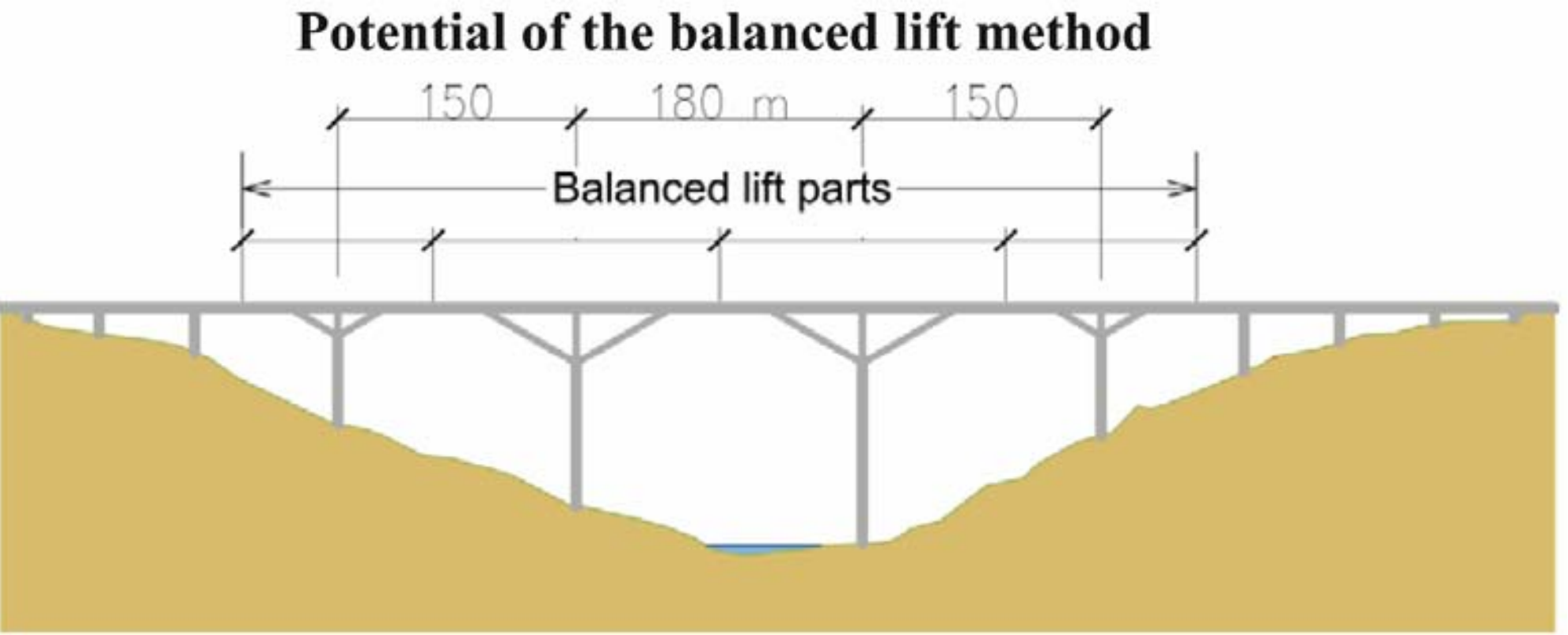
Az igazi lehetőség

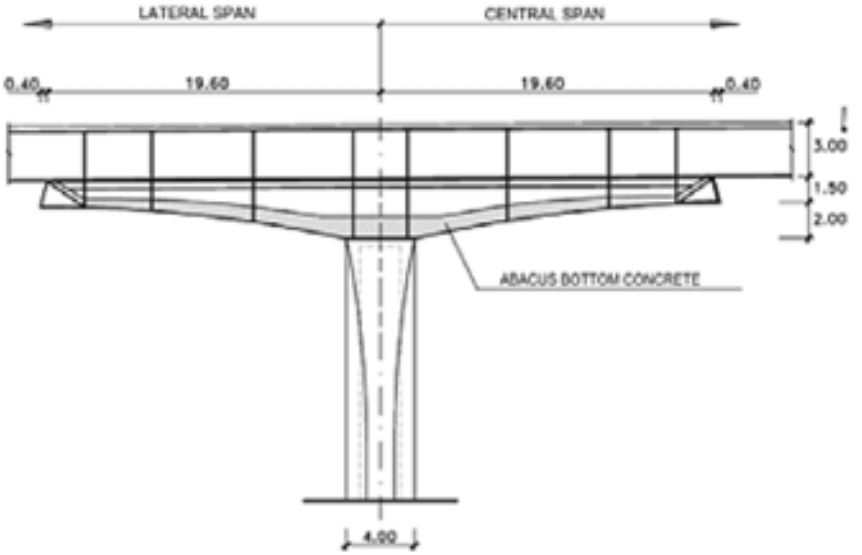


Design of a valley bridge according to the balanced lift method

Kolleger, Wimmer, 2014: Design of Bridges According to the Balanced Lift Method

ABAQUS MÓDSZER

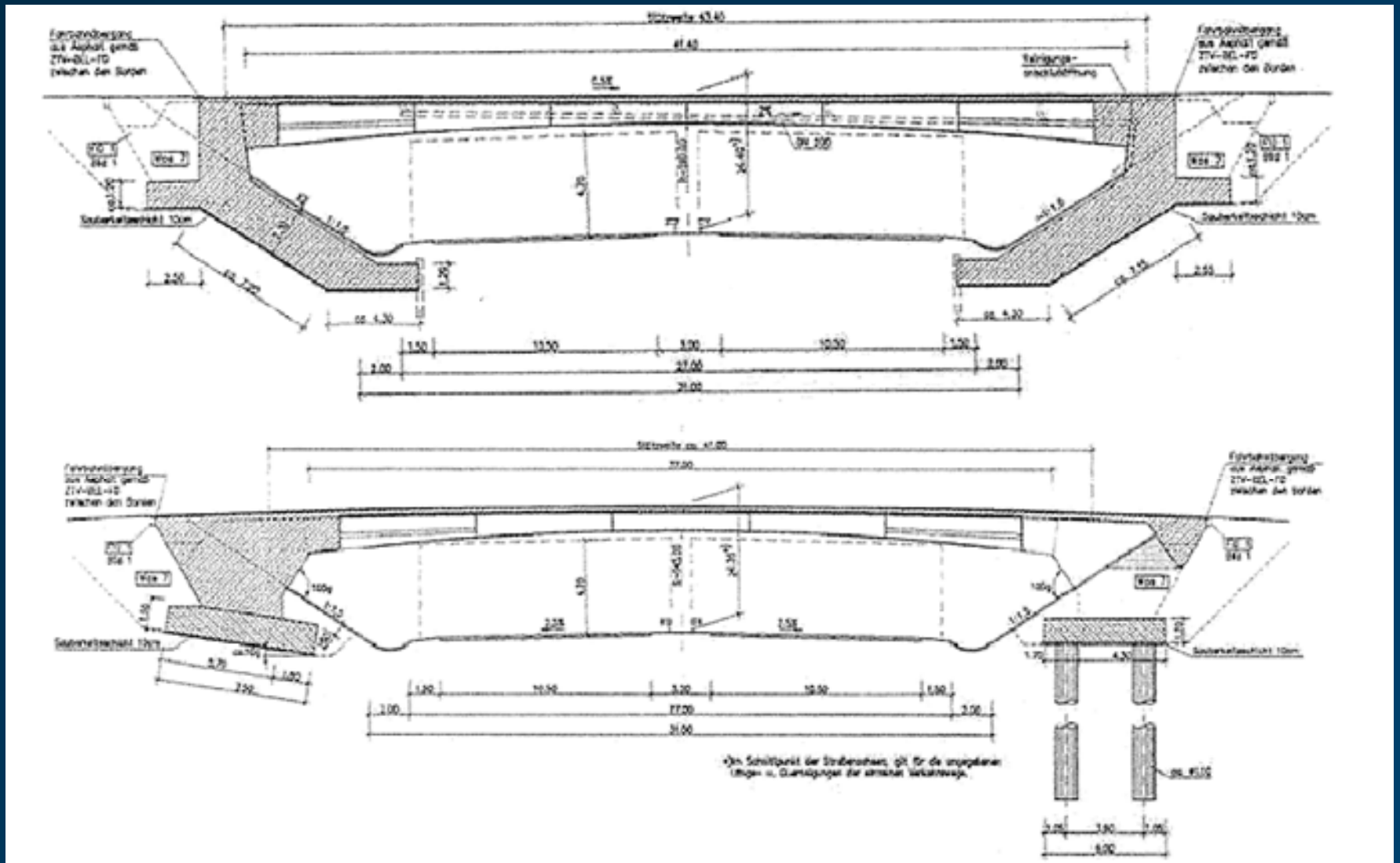
„Abaqus” módszerű betolás



Puente del Arenal, Cordoba, 1993, and scheme of the “Abaqus” system for the launching of bridges with variable depth

Kuhlmann et al., 2008: COMBRI Design Manual II.

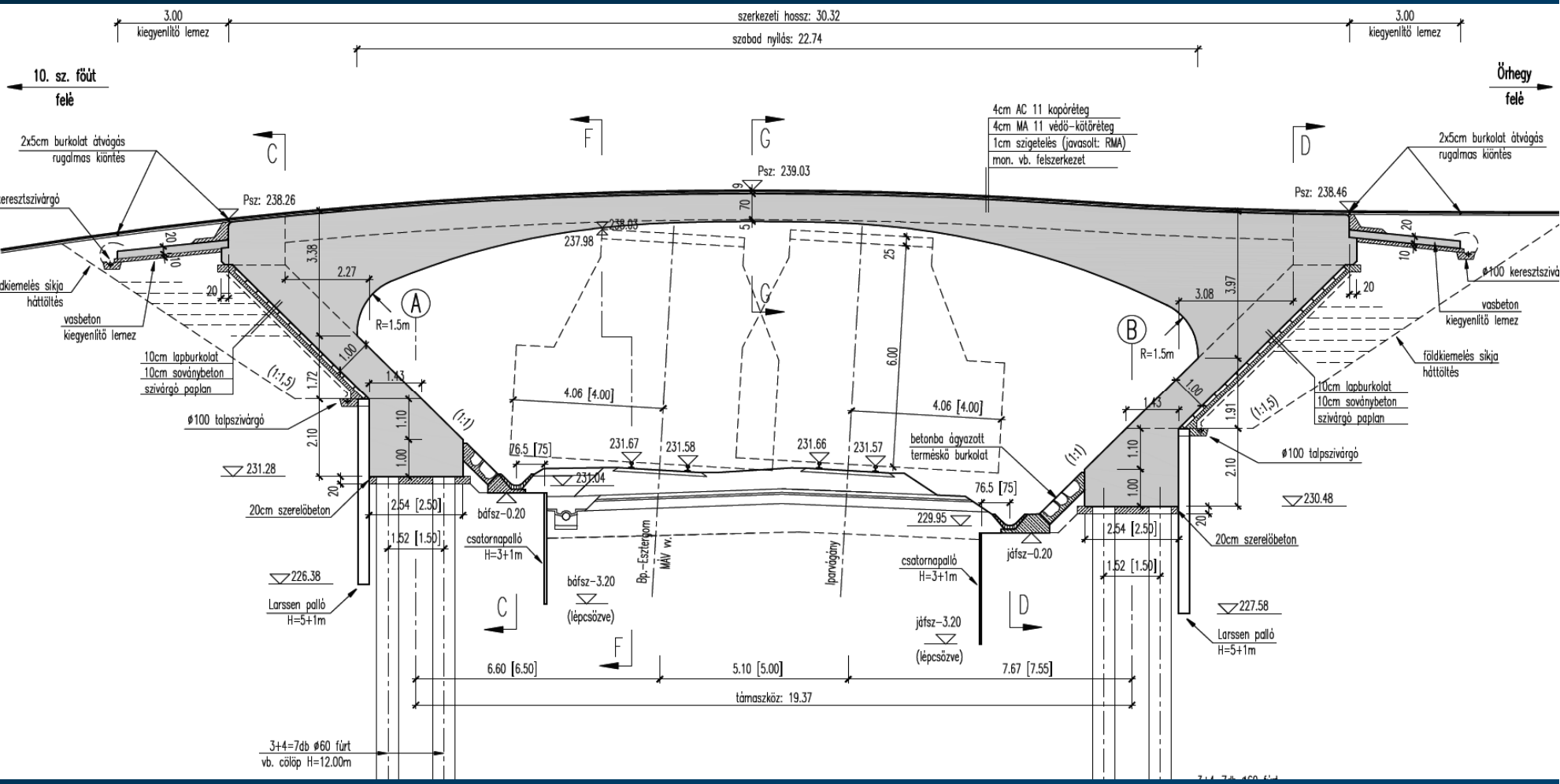
Befogott integrált híd



Two integral abutment frame prototype bridges from (Bundesministerium für Verkehr, Bau- und Wohnungswesen, 1999); Germany

RFCS, Feldmann et al., 2010: Economic and durable design of composite bridges with integral abutments

Budapest-Esztergom vv. Őrhegy utcai híd



Budapest-Esztergom vv. Őrhegy utcai híd

Köszönöm a figyelmet!