RURAL BRIDGE USE UHPC (ULTRA HIGH PERFORMANCE CONCRETE) GIRDERS BEAM AT VIET NAM

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Team of World Bank/
Vietnam Concrete Asspciation (VCA)
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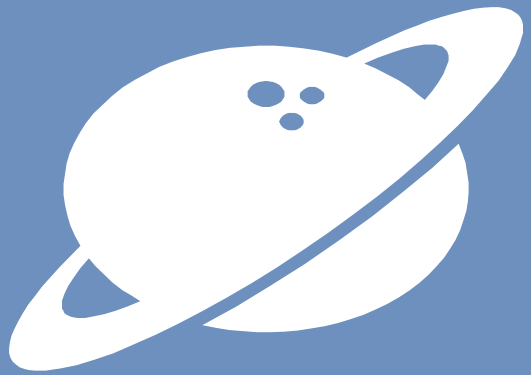
May, 2022

CONTENT:



BUILDING A SET OF STANDARDS UHPC VIETNAM

- NF P18-451:2018
- NF P18-470:2016
- NF P18-710:2016
- BS EN 13670:2009
- ACF 04:2020
- ACF 03:2021
- TCCS 02:2017/IBST

MINISTRY OF CONSTRUCTION

SPECIFICATION AND TEST METHODS

EXECUTION AND ACCEPTANCE

DESIGN OF CONCRETE STRUCTURES

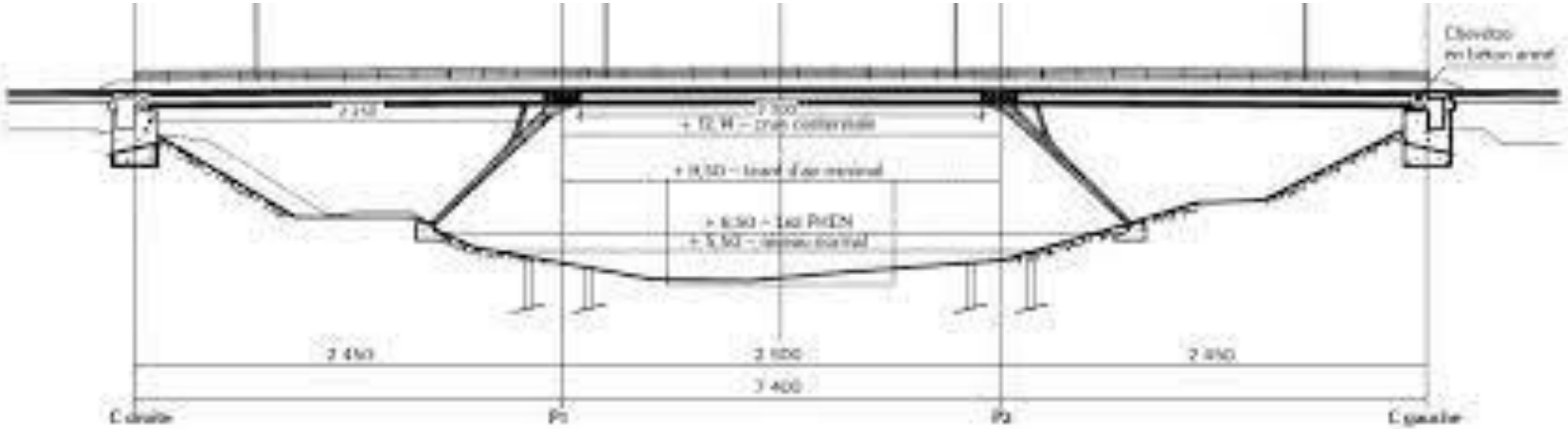
VCA presides over implementation

GLANCE OVER VIEW

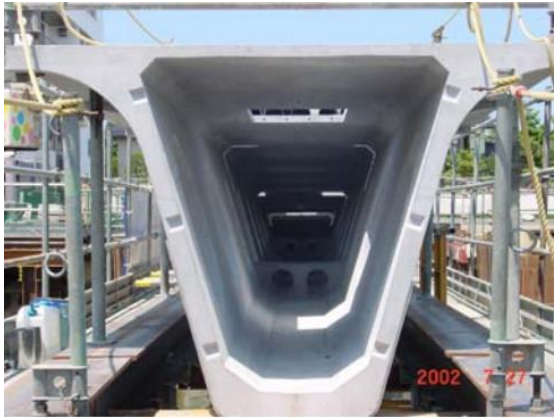

Batu 6 Bridge (1 span – 100m), 2015
Sustainable Construction
• Immediate Cost Saving > 25%
• Better functionality (wider navigation span)
• Minimal maintenance (no piers)
• Valuable asset (lower risk from destruction)
THE MALAYSIA BOOK of RECORDS
54

SUNGAI GUNTUNG BRIDGE

UHPC BRIDGE - FRANCE

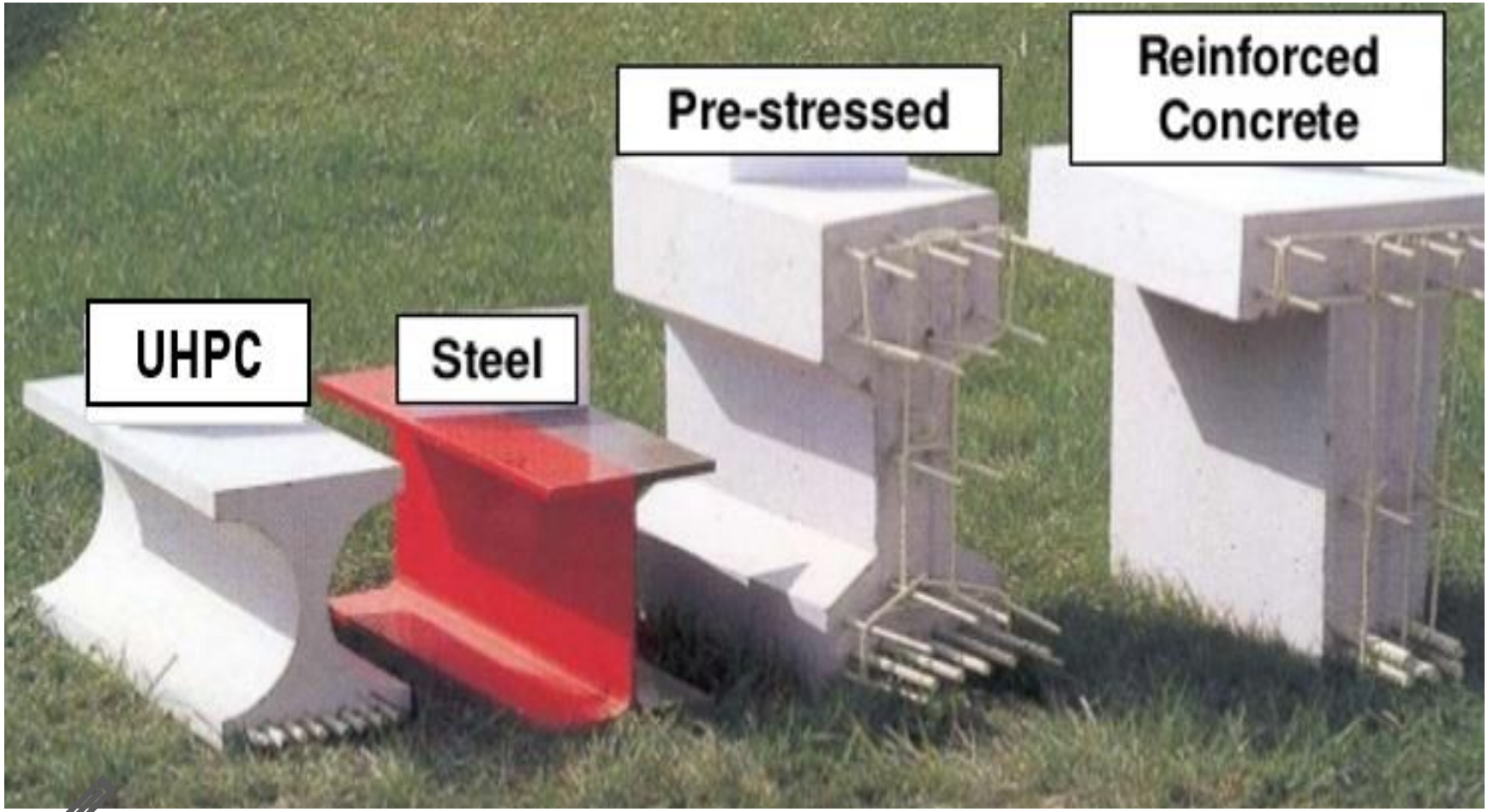


SATAKAMIRAI BRIDGE – JAPAN



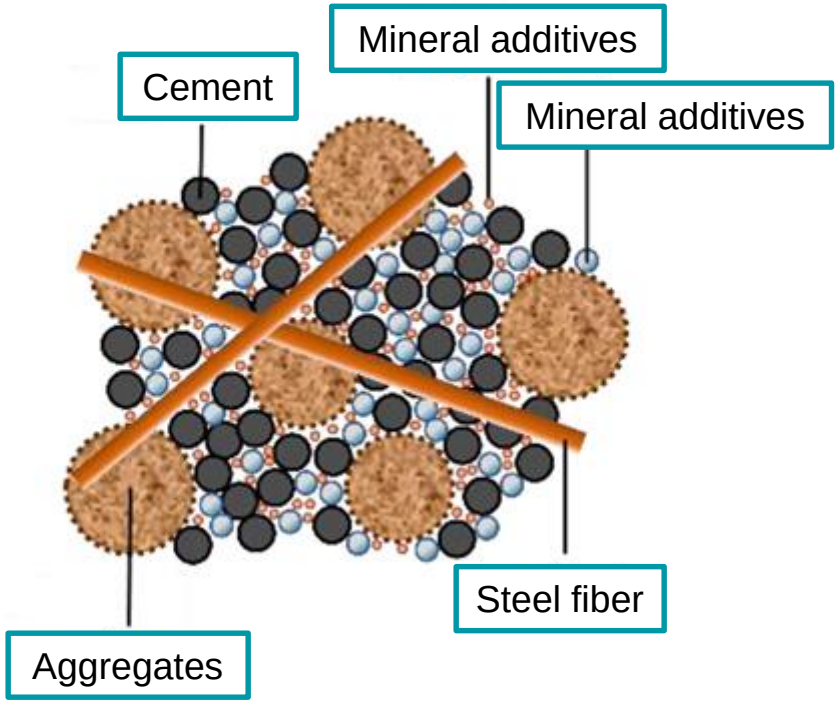
MARKKLEEBERG BRIDGE – GERMANY

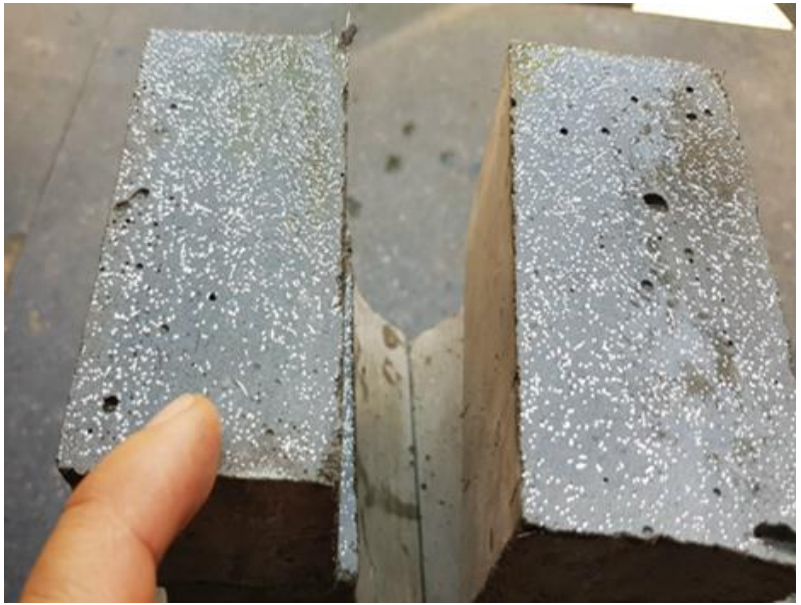
OVERPASS BRIDGE - CHINA


UHPC
Steel
Pre-stressed
Reinforced
Concrete

SCIENTIFIC SEMINAR – LONG AN

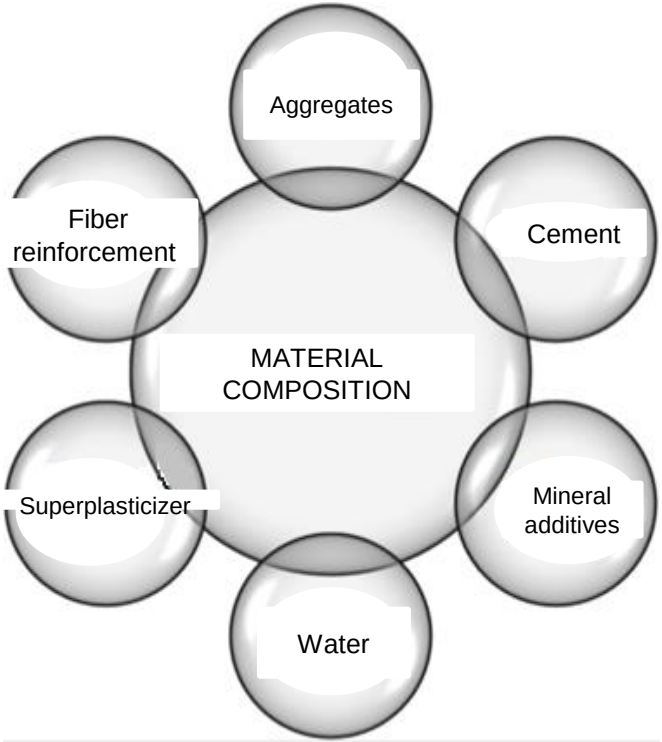
UHPC – ULTRA HIGH PERFORMANCE CONCRETE

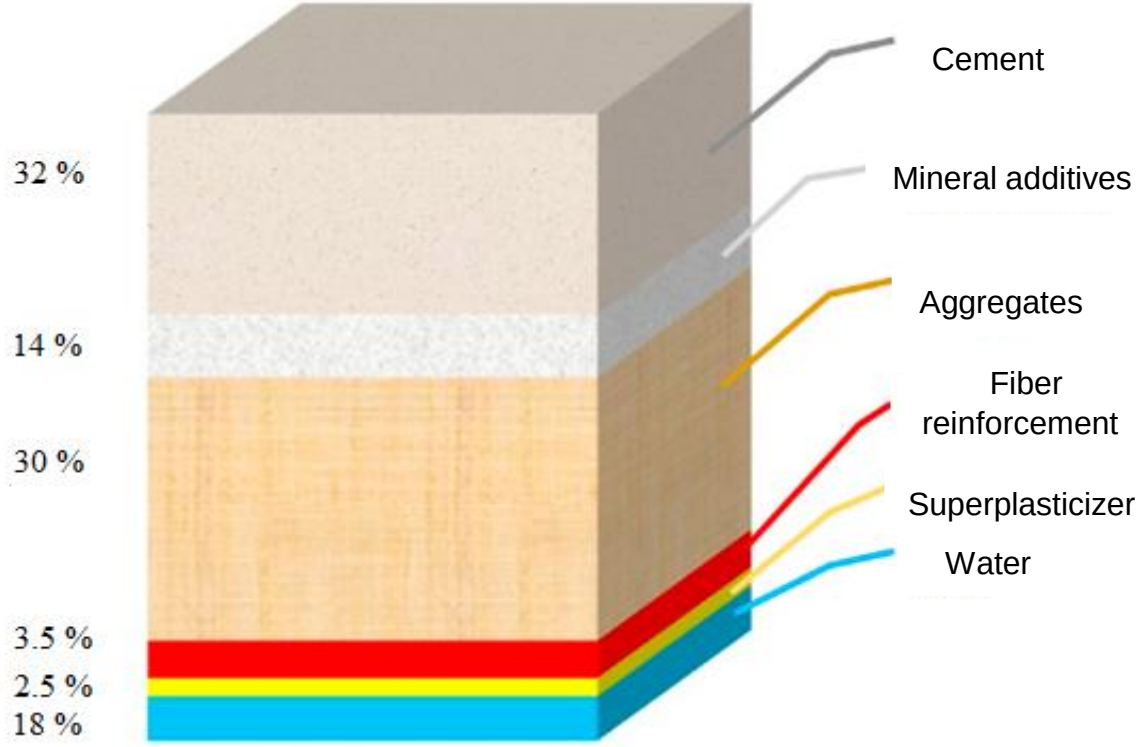




Rcompress: 120 ÷ 200 MPa; **Rtensile**: 7 ÷ 16 MPa

MATERIAL COMPOSITION





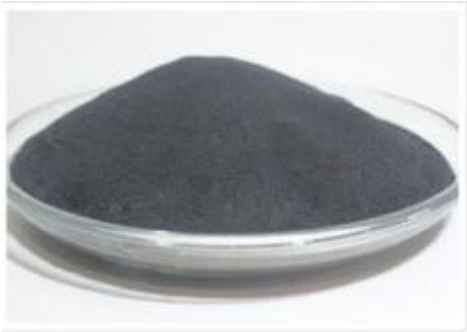
BINDER COMPOSITION

CEMENT

- PC 40
- PC 50

MINERAL ADDITIVES

- Silica fume
- Fly ash
- Blast furnace slag
- Meta kaolin
- Limestone powder
- Nano Silicat



CHEMICAL ADDITIVE GROUP

- **POWDER ADDITIVES**
- **WATER ADDITIVES**
- **STABILIZER ADDITIVE**

CHEMICAL ADDITIVE

SUPERPLASTICIZER

- SHORT MIXING TIME
- REDUCES N/CKD, INCREASE MECHANICAL DURABILITY UHPC
- INCREASED FLEXIBILITY, EFFECTIVE FIBER DISPERSAL

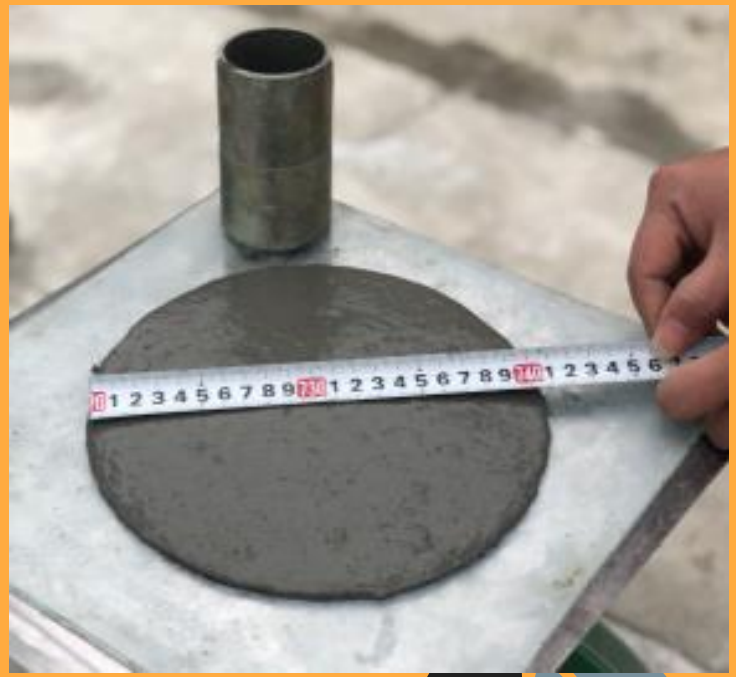
RHEOLOGICAL ADDITIVE

- FINAL TIME EXTENSION
- INCREASE MECHANICAL CAPABILITY UHPC

STABLE ADDITIVES

- FLEXIBLE STABILITY, THIOXOTROPY
- INCREASE MECHANICAL CAPABILITY UHPC

- REDUCES AIR BUBBLES, INCREASE POWER



AGGREGATES – WHITE SAND (QUARTZ)

- Sand crushed (selective)
- Quartz sand (selective)
- Other types of sand (selective)
- Quartz powder

FIBER REINFORCEMENT

- STEEL FIBER
- POLYME FIBER
- GLASS FIBER

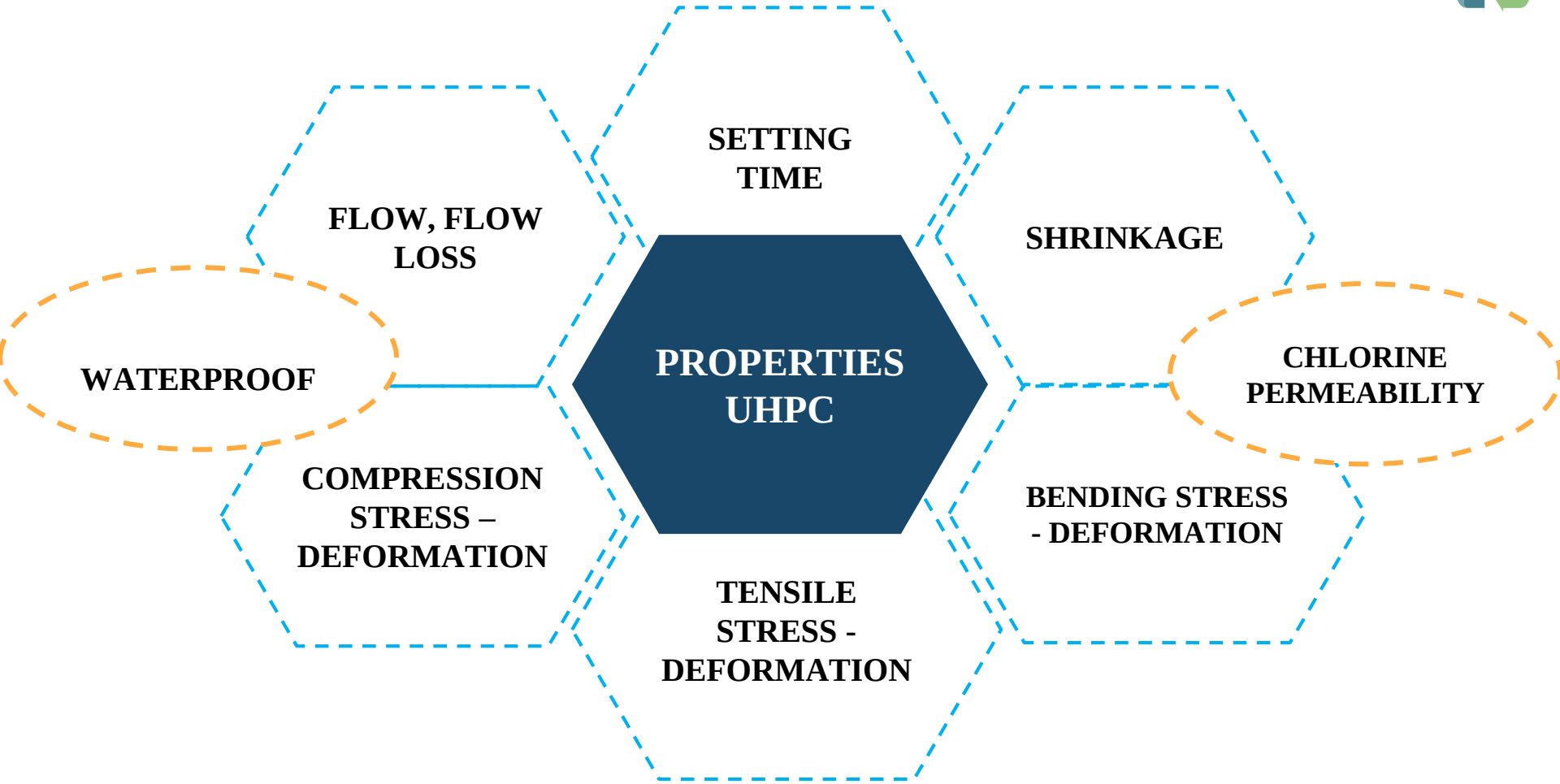
→ HYBRID

EFFECT OF MICRO STEEL FIBER

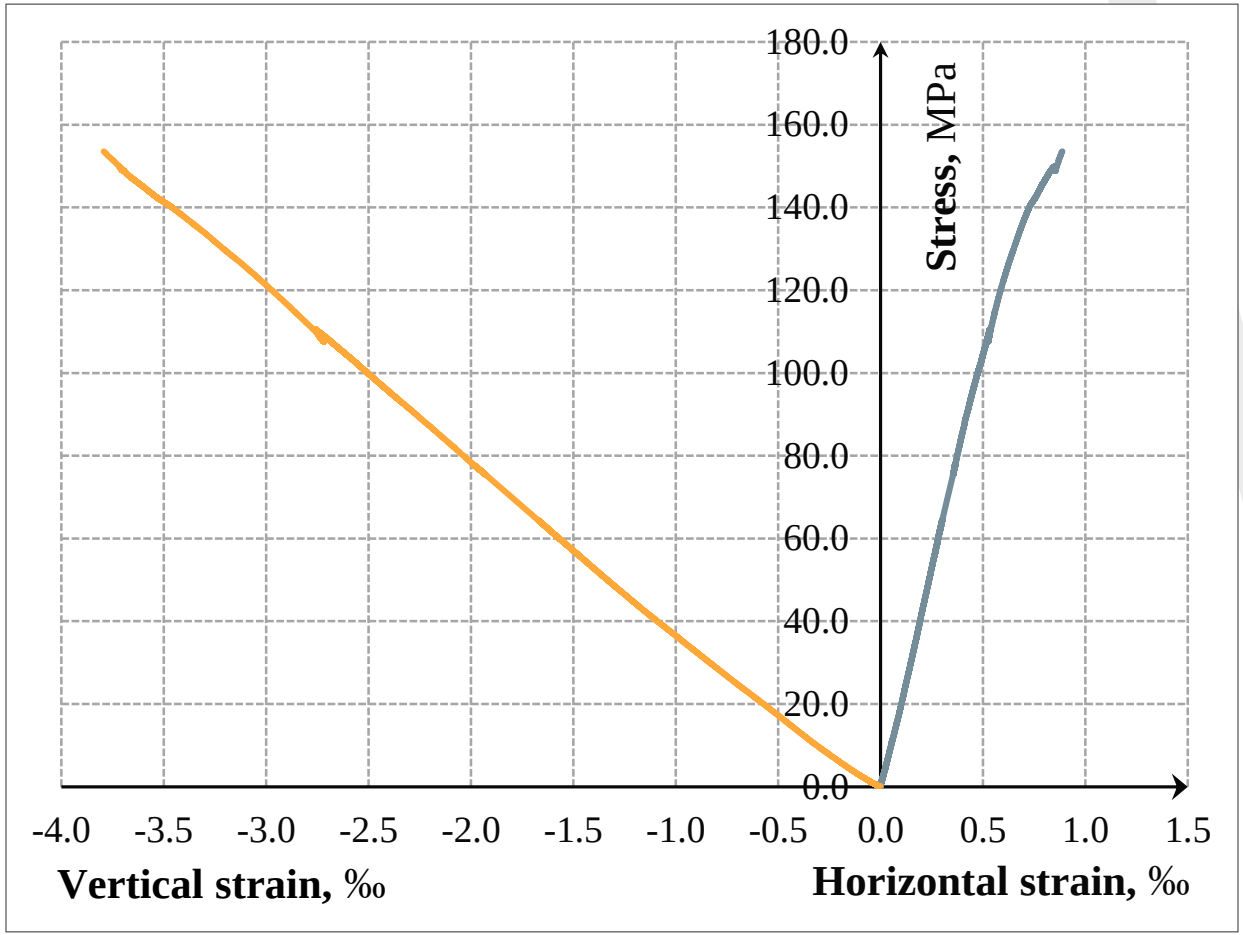
- **INCREASED FLEXIBILITY, WORKABILITY**
- **HIGH DENSITY**
- **ELASTICITY – THREE-DIMENSIONAL DISTORTION**
- **COMPRESSION STRENGTH – INCREASE 10 ÷ 25 %**
- **TENSILE STRENGTH, BENDING – INCREASE 200 ÷ 800 %**
- **ABRASTION, LONG LIFE**

- **USING MULTIPLE FIBER TYPES: WORKABILITY, OPTIMIZED FIBER DISTRIBUTION**

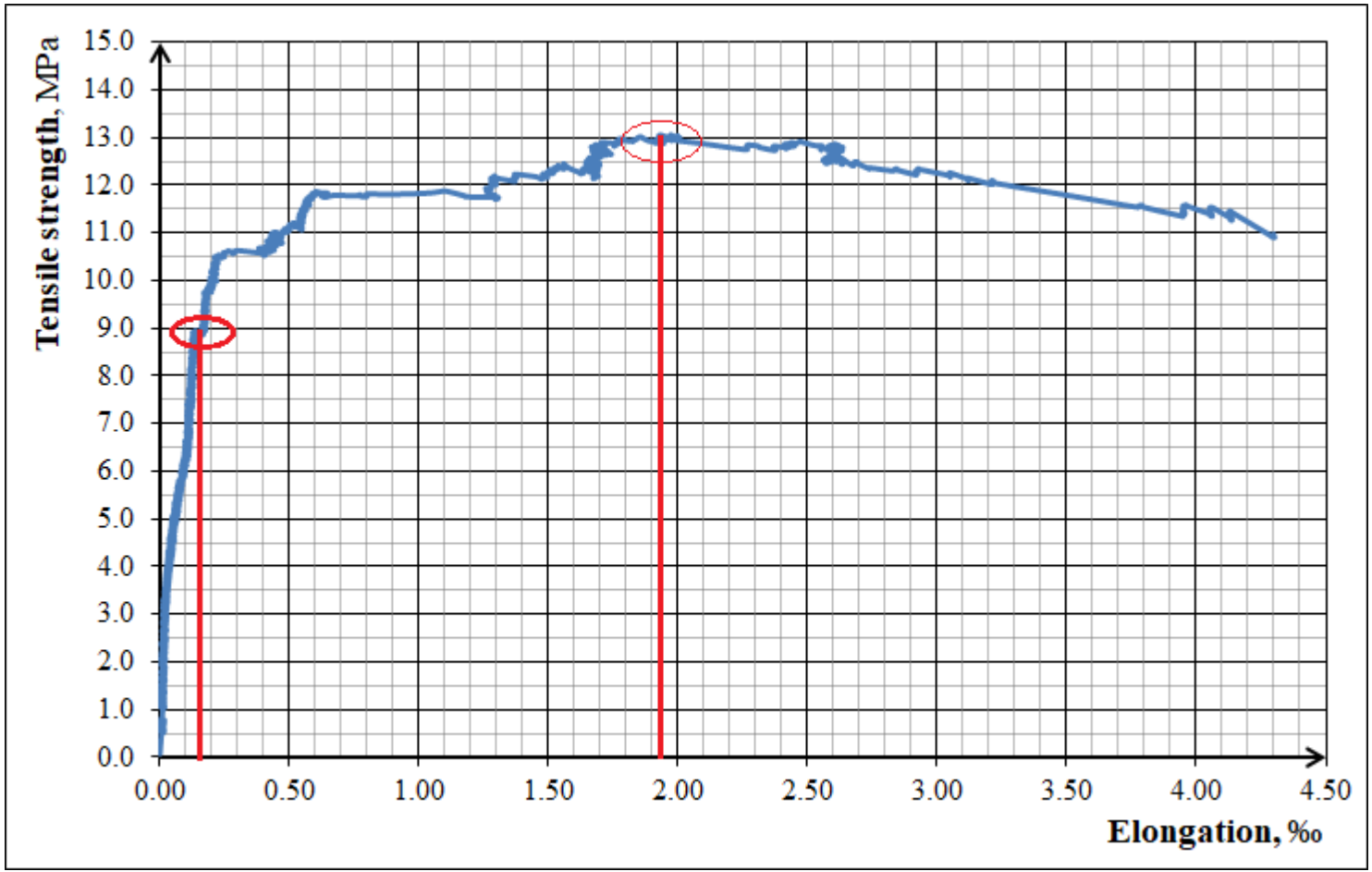
PROPERTIES OF UHPC



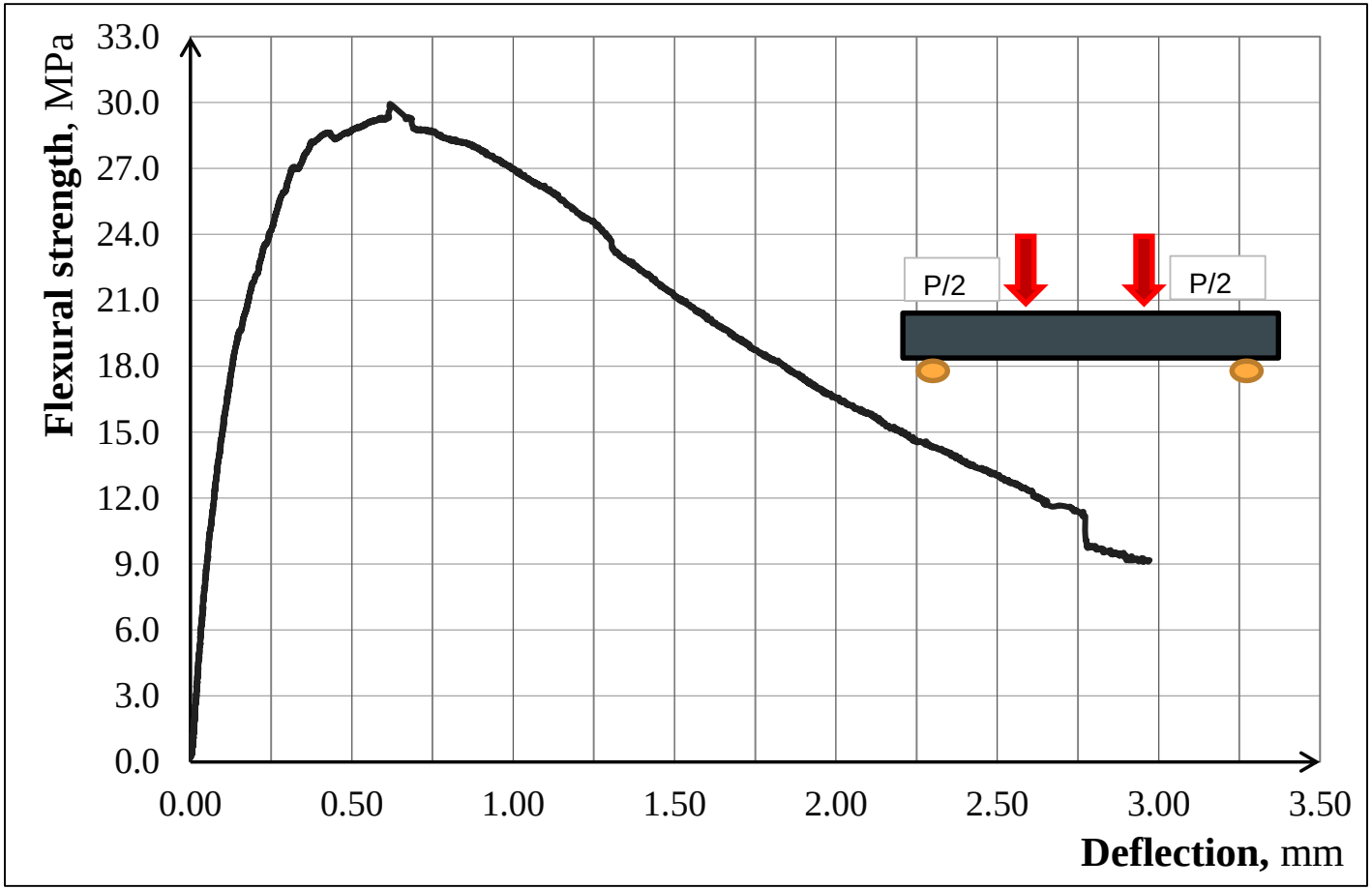
UHPC OF VIETNAM

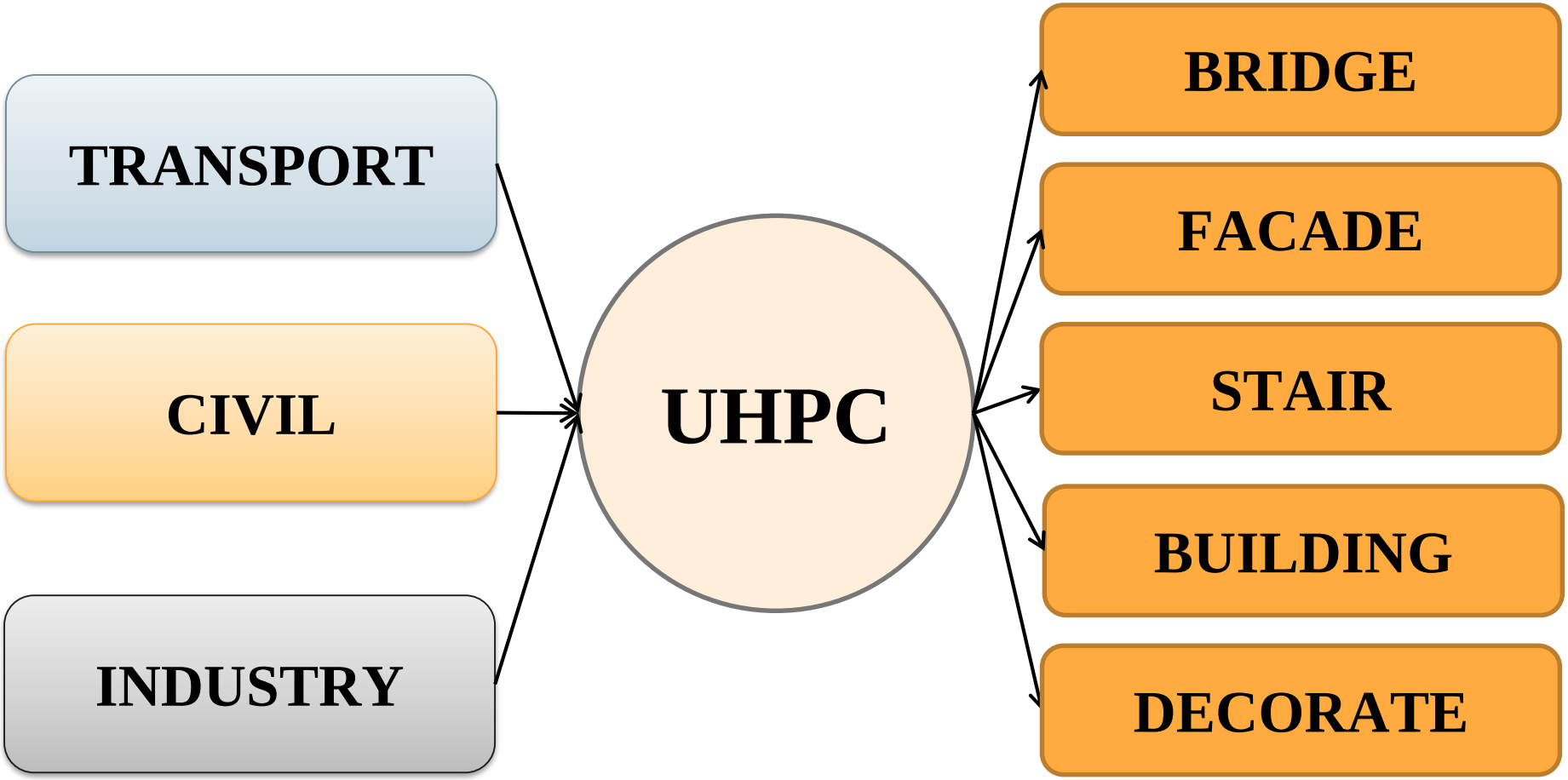


UHPC OF VIETNAM



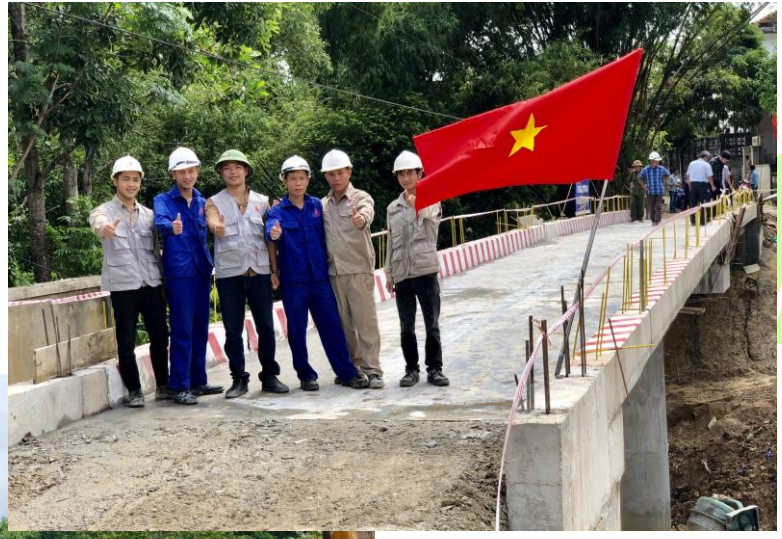
UHPC OF VIETNAM




TRANSPORT
CIVIL
INDUSTRY
UHPC
BRIDGE
FACADE
STAIR
BUILDING
DECORATE

LANG CO BRIDGE – LRAMP
FUNDED BY WB

KHE DON BRIDGE – LRAMP
FUNDED BY WB



TU O BRIDGE – LRAMP
FUNDED BY WB

CONTINUOUS UHPC BEAMS

- WITHOUTH BEARINGS

- NO NEED EXPANSION JOINT


Q = 10T
GRAND OPENING CEREMONY
THE FABRICATION PROCESS UHPC GIRDER FOR LANG CO, KHE DON AND TU O BRIDGES
LOCAL ROAD ASSET MANAGEMENT PROGRAM (LRAMP)
ITEM: UHPC GIRDER
DIRECTORATE FOR ROAD VIETNAM
WORLD BANK
Hanam - Vietnam, June 2019

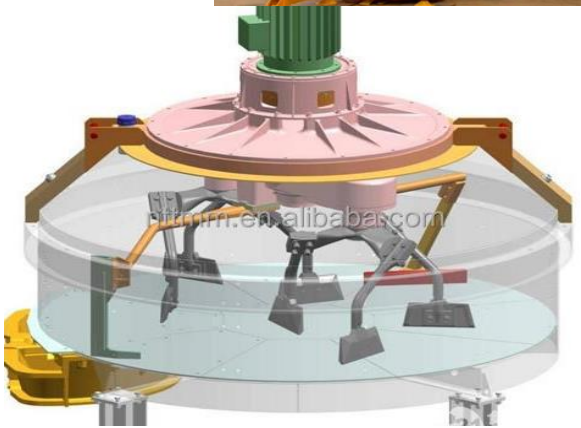
32 GOLF BRIDGES, SON TAY PROV.

ARCH BRIDGE, HAI PHONG CITY

ASIA CONCRETE FEDERATION VISIT GOLF BRIDGES

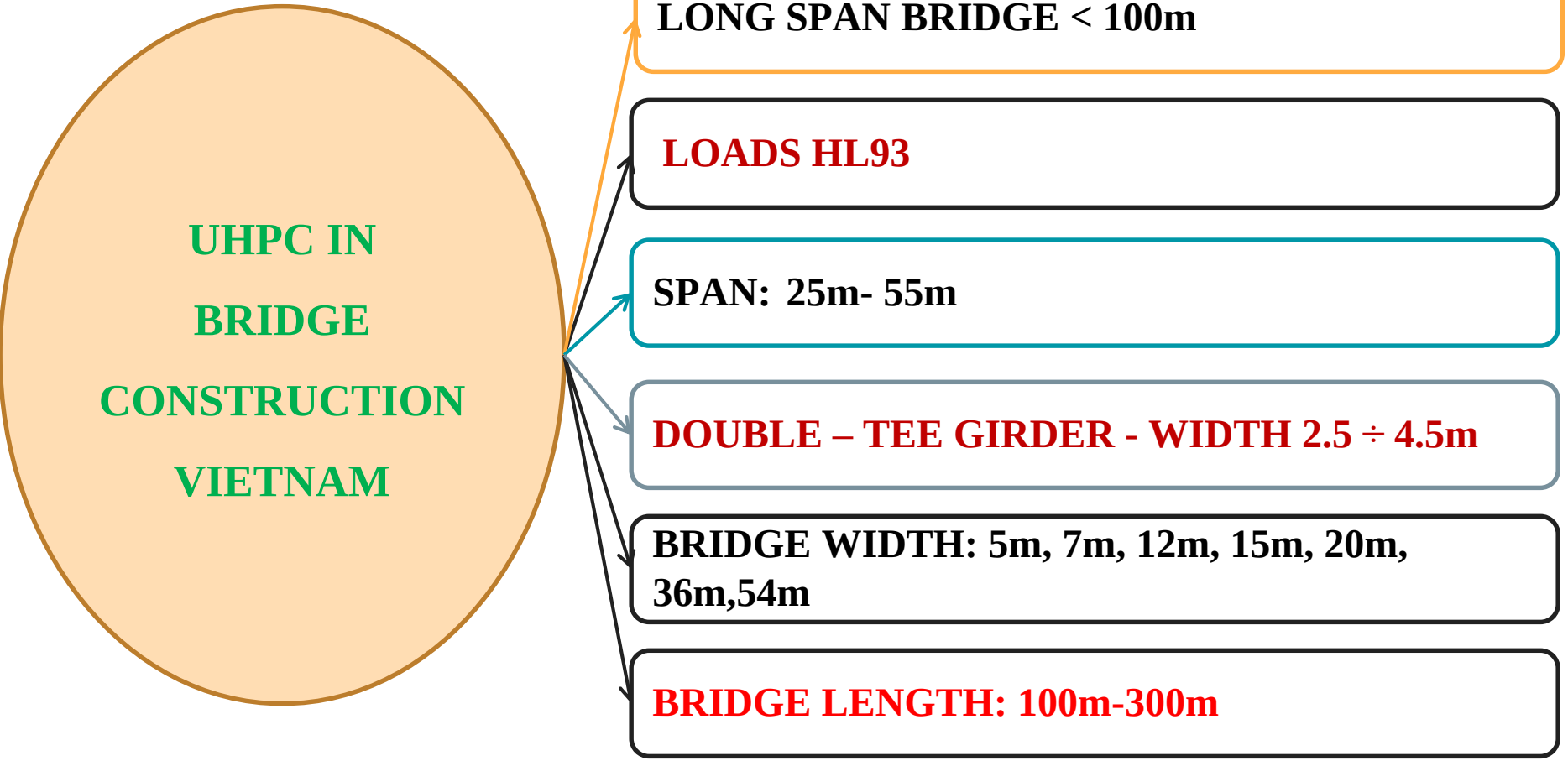
BRIDGE - VINH HUNG - LONG AN PROV.

CONCRETE MIXING PLANT



TRANSPORTATION EQUIPMENT UHPC- TRUCK

THANG LONG BRIDGE (UHPC COMPOSITE STEEL DECK)


UHPC IN BRIDGE CONSTRUCTION VIETNAM
LONG SPAN BRIDGE < 100m
LOADS HL93
SPAN: 25m- 55m
DOUBLE – TEE GIRDER - WIDTH 2.5 ÷ 4.5m
BRIDGE WIDTH: 5m, 7m, 12m, 15m, 20m, 36m,54m
BRIDGE LENGTH: 100m-300m

PRODUCTION – CONSTRUCTION CONTROL

- CONSTRUCTION DESIGN
- TECHNICAL INSTRUCTION
- MATERIAL / COMPOSITION MIX
- STRUCTURAL DESIGN/ SIMULATION MODEL
- PRODUCTION EQUIPMENT
- MIXING, PRECAST, MAINTENANCE
- CHECK QUALITY

- TRANSPORTATION – BEAM INSTALLATION LABOR
- CONSTRUCTION OF JOINT
- FINISHING
- CHECK/CONTROL QUALITY

STRUCTURAL DESIGN OF UHPC BRIDGE

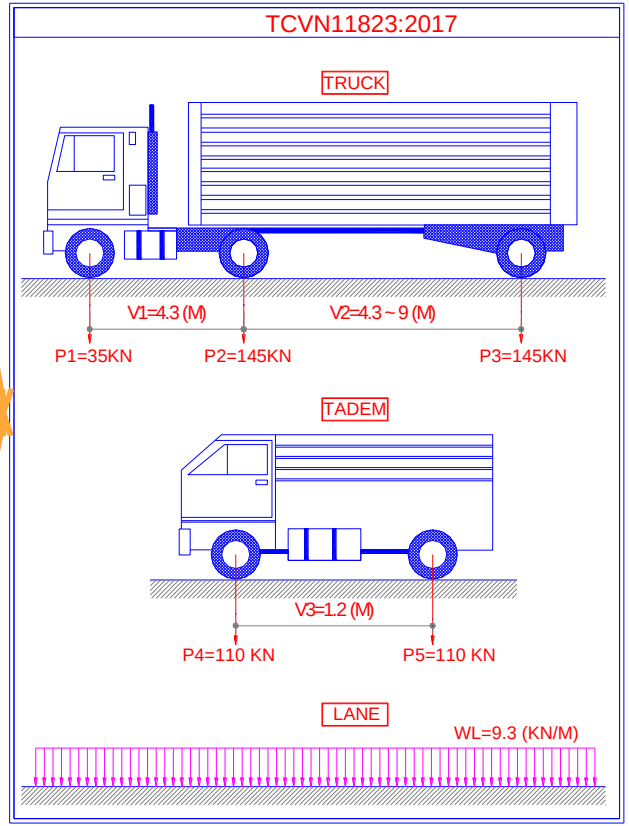
Design based on the AASHTO LRFD bridge design philosophy and current standards and worldwide UHPC research papers:

- American Society of Testing and Materials (ASTM, USA)
- Federal Highway of Administration (FHWA, USA)
- French Society of Civil Engineering (AFCG, France)
- Japanese Society of Civil Engineers (JSCE, Japan)
- Korea Concrete Institute (KCI, Korea)

STANDARDS AND LOAD

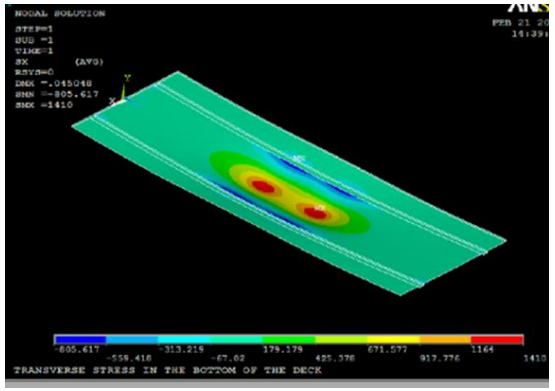
- TCVN 11823:2017
- NF P18-470:2016
- NF P18-710:2016
- NF P18-451:2018
- TCVN 01-03:2022 (DRAFT)
- K-UHPC:2014
- FHWA-HRT 13-060:2013

LOADING ACTIVITIES



- 0.45 HL93: RURAL BRIDGES – 10T
- 0.65 HL93: RURAL BRIDGES – 16T
- HL93: HIGHWAY

ANALYSIS – STRUCTURAL CALCULATION



ATENA/ ABAQUS

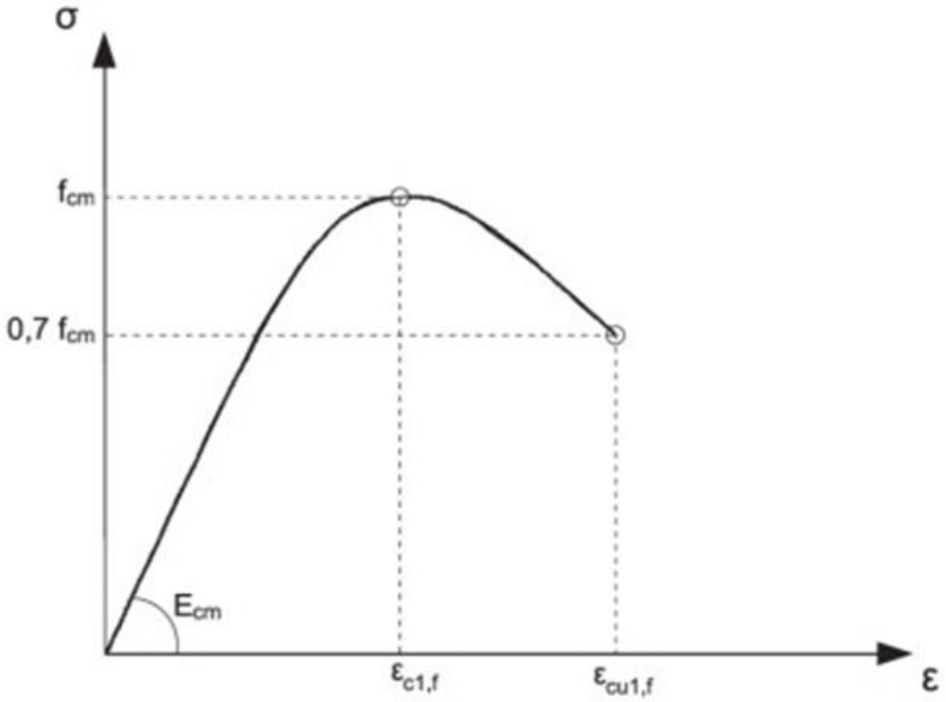
MIDAS

FINITE ANALYSIS

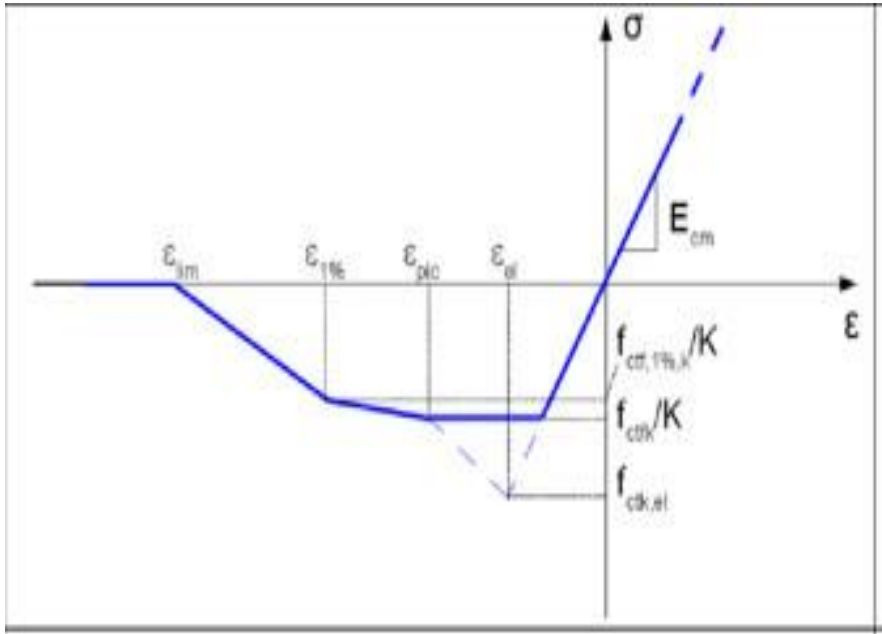
STRENGTH LIMIT STATE

STATUS LIMITED USE

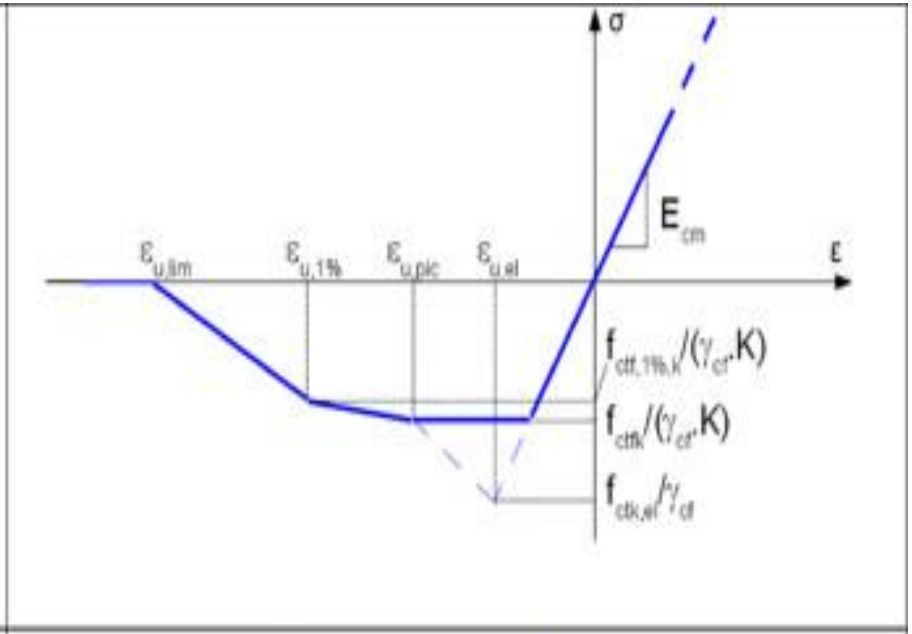
Representation of the stress-strain relation of UHPFRC in compression for non-linear structural analysis



Designing thick sections is as follows

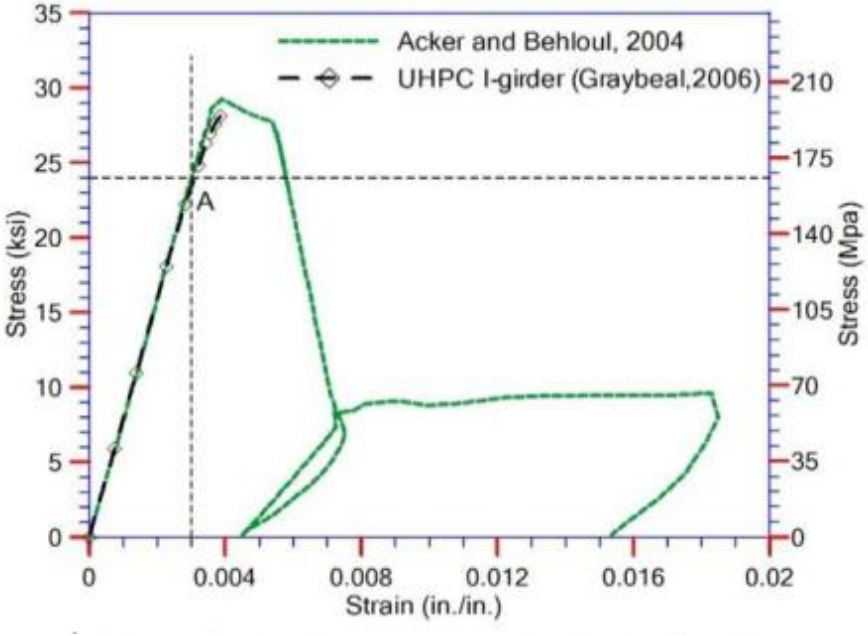


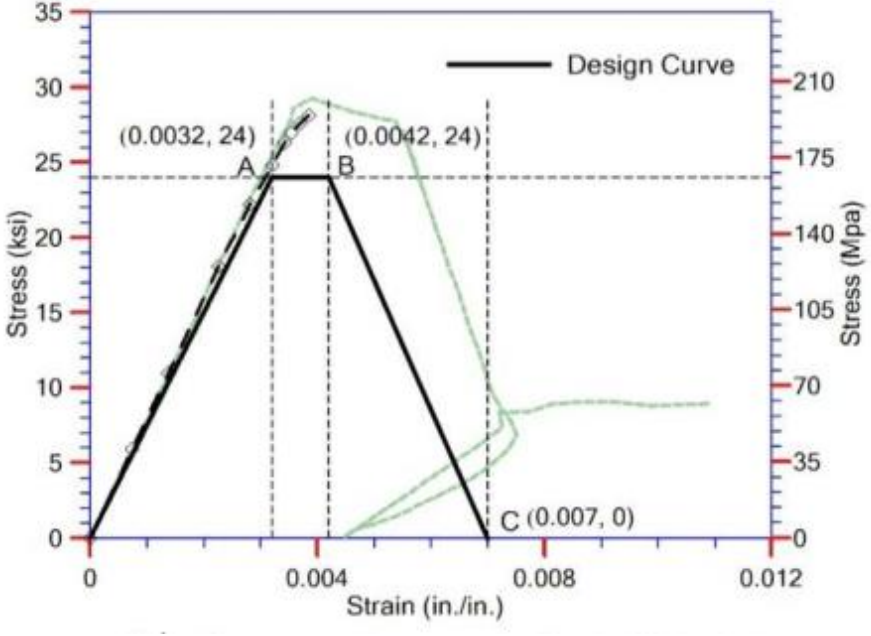
Design law at SLS



Design law at ULS

STRESS – DEFORMATION IN COMPRESSION

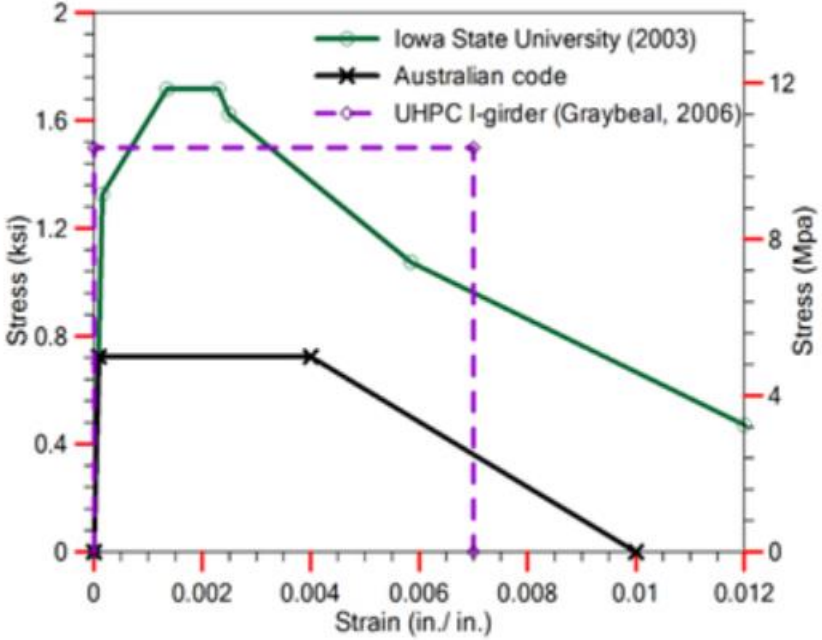




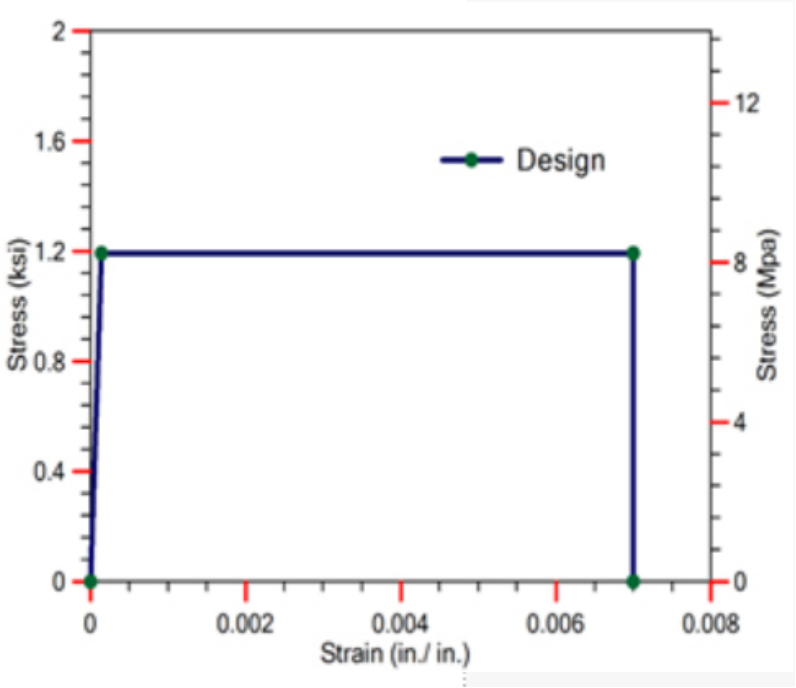
EXPERIMENT

DESIGN

TESILE STRENGTH – DEFORMATION

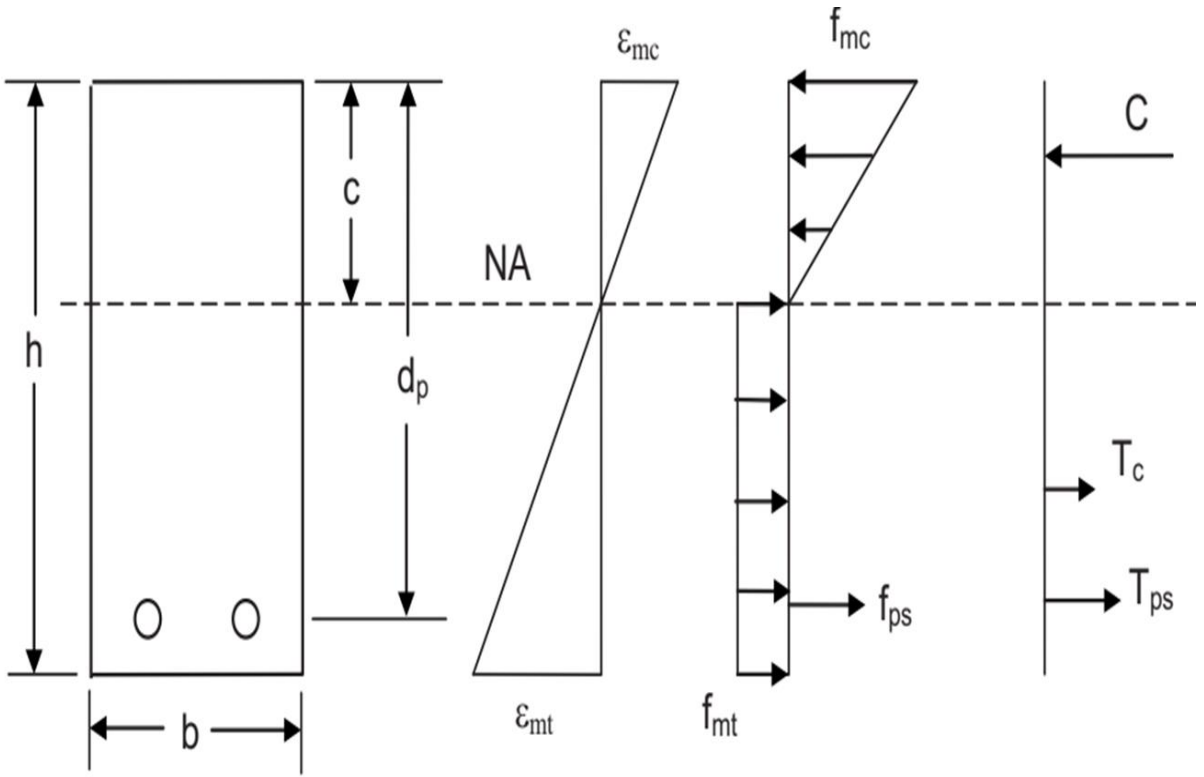


EXPERIMENT



DESIGN

FLEXURAL RESISTANCE & SHEAR RESISTANCE



$$V_{yd} = V_{rpcd} + V_{fd} + V_{ped}$$

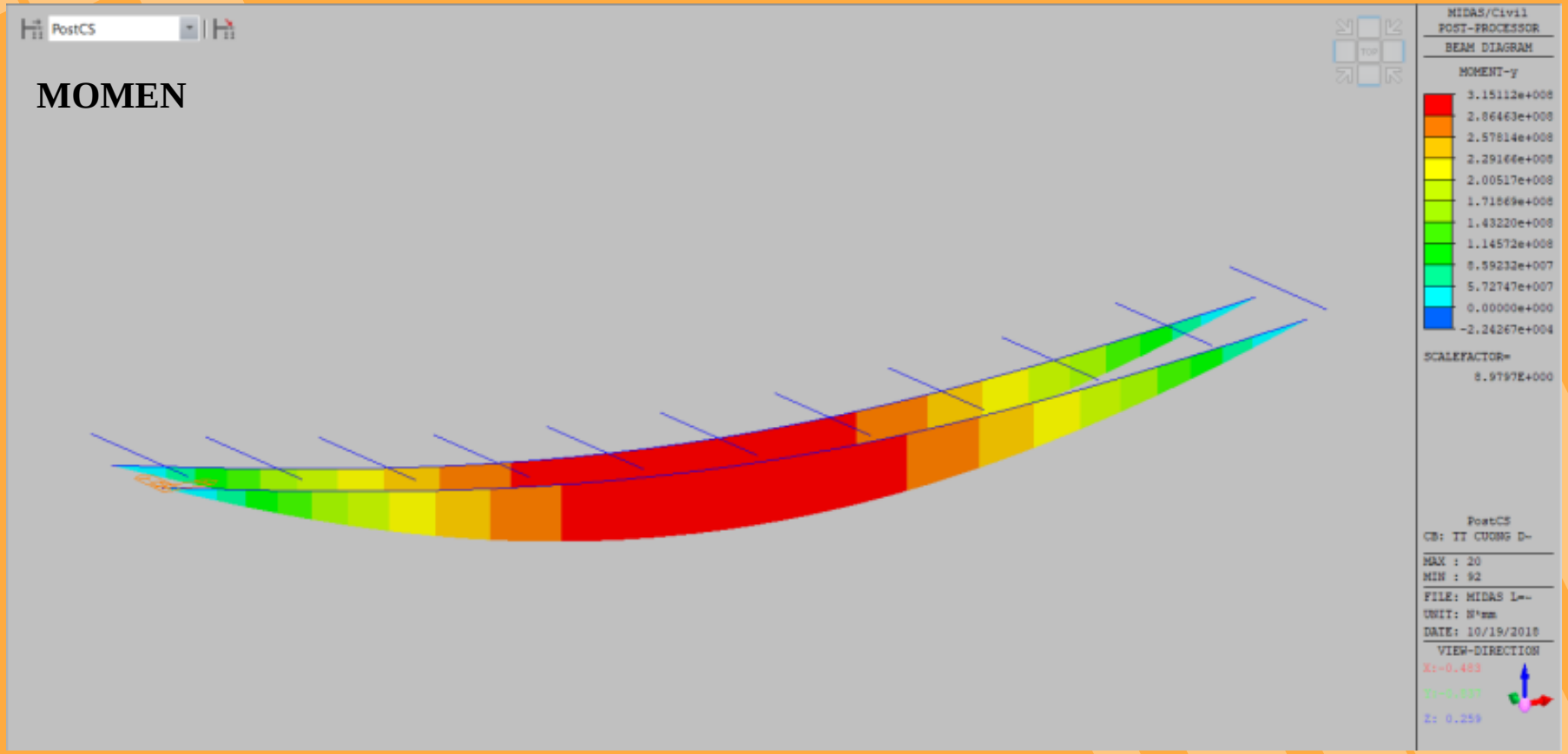
$$V_{rpcd} = \frac{0.18\sqrt{f'_{cd}}\, b_w d}{\gamma_b}$$

$$V_{fd} = \left(\frac{(f_{vd} / \tan \beta_u) b_w z}{\gamma_b} \right)$$

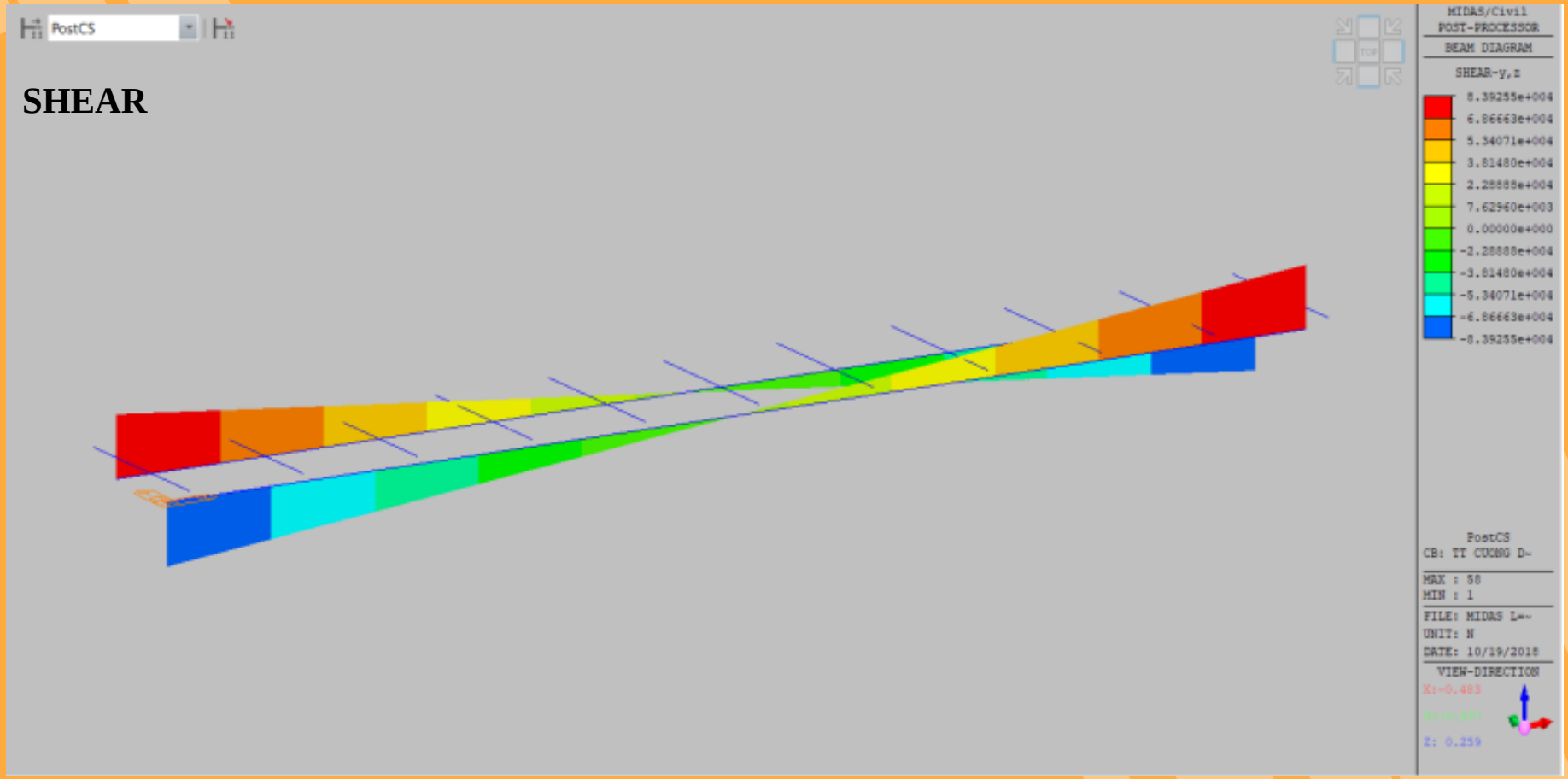
$$\beta_u = \frac{1}{2} \tan^{-1}\left(\frac{2\tau}{\sigma_{xu} - \sigma_{yu}} \right) - \beta_o$$

$$V_{Rd} = V_{yd}$$

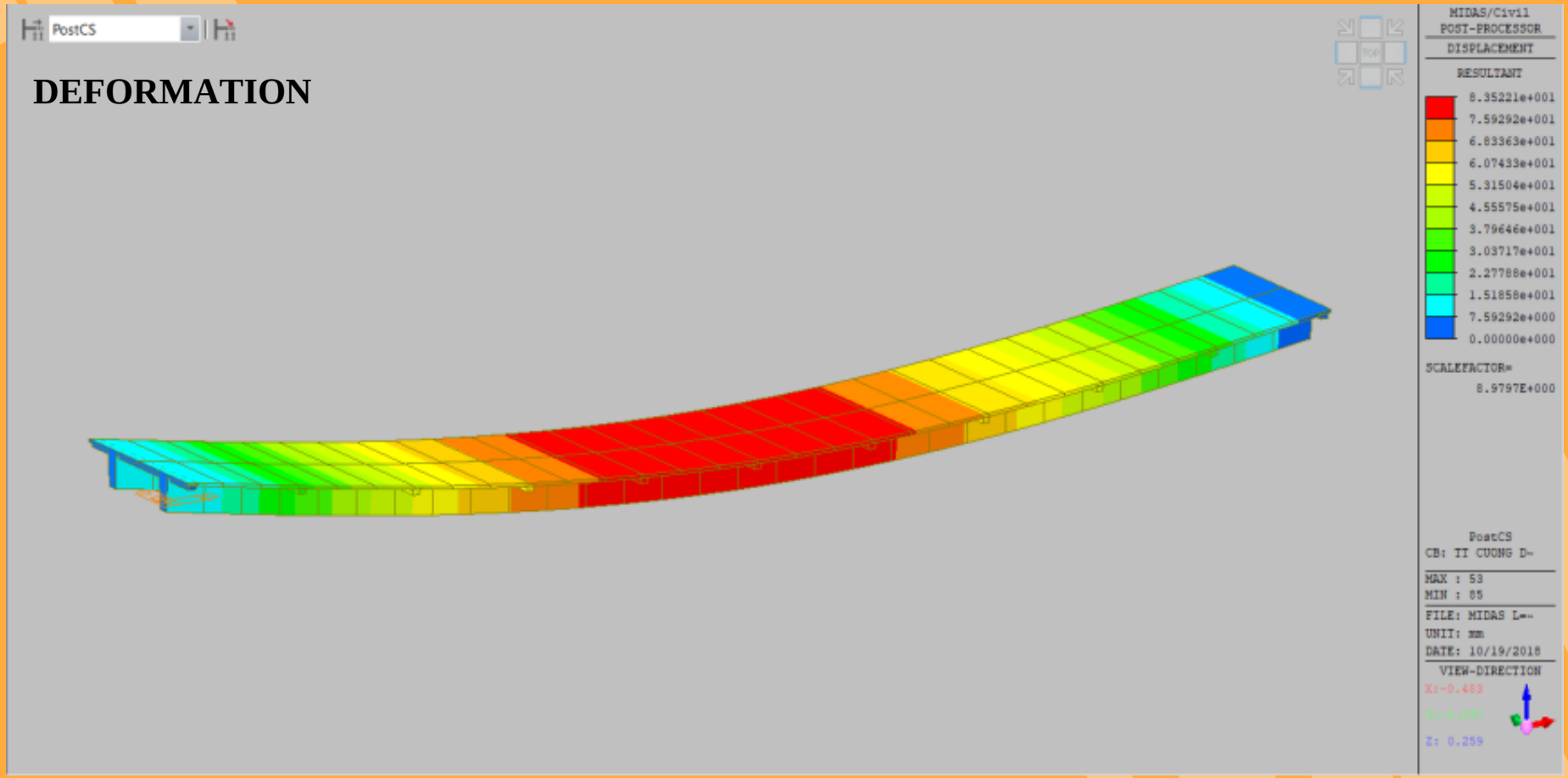
MOMENT MODEL



SHEAR MODEL


PostCS
SHEAR
MIDAS/Civil
POST-PROCESSOR
BEAM DIAGRAM
SHEAR-y,z
8.39255e+004
6.86663e+004
5.34071e+004
3.81480e+004
2.28888e+004
7.62960e+003
0.00000e+000
-2.28888e+004
-3.81480e+004
-5.34071e+004
-6.86663e+004
-8.39255e+004
PostCS
CB: TT CD089 D~
MAX : 50
MIN : 1
FILE: MIDAS L~
UNIT: N
DATE: 10/19/2018
VIEW-DIRECTION
Z: 0.259

DEFORMATION MODEL



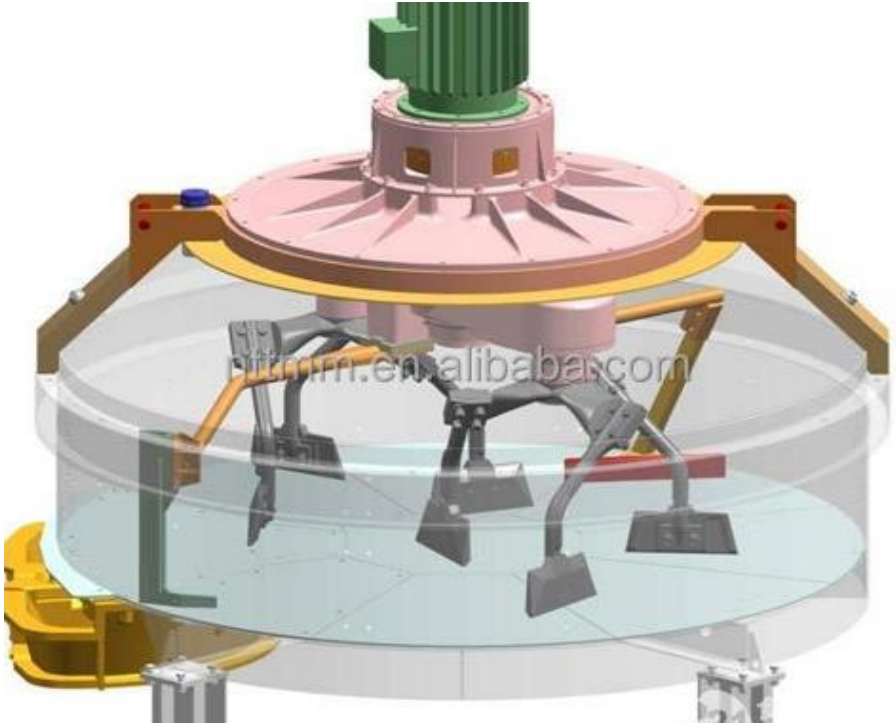
BRIDGE GIRDER

I GIRDER

T GIRDER

U GIRDER

EQUIPMENT OF PRODUCTION



INTENSIVE MIXER

INTENSIVE MIX PLANT FOR UHPC AT VIETNAM

CAST & CURING OF BRIDGE UHPC BEAMS

TEST/CONTROL QUALITY

TESTING BEAMS

UHPC BEAM UHPC BEAM IN VIETNAM

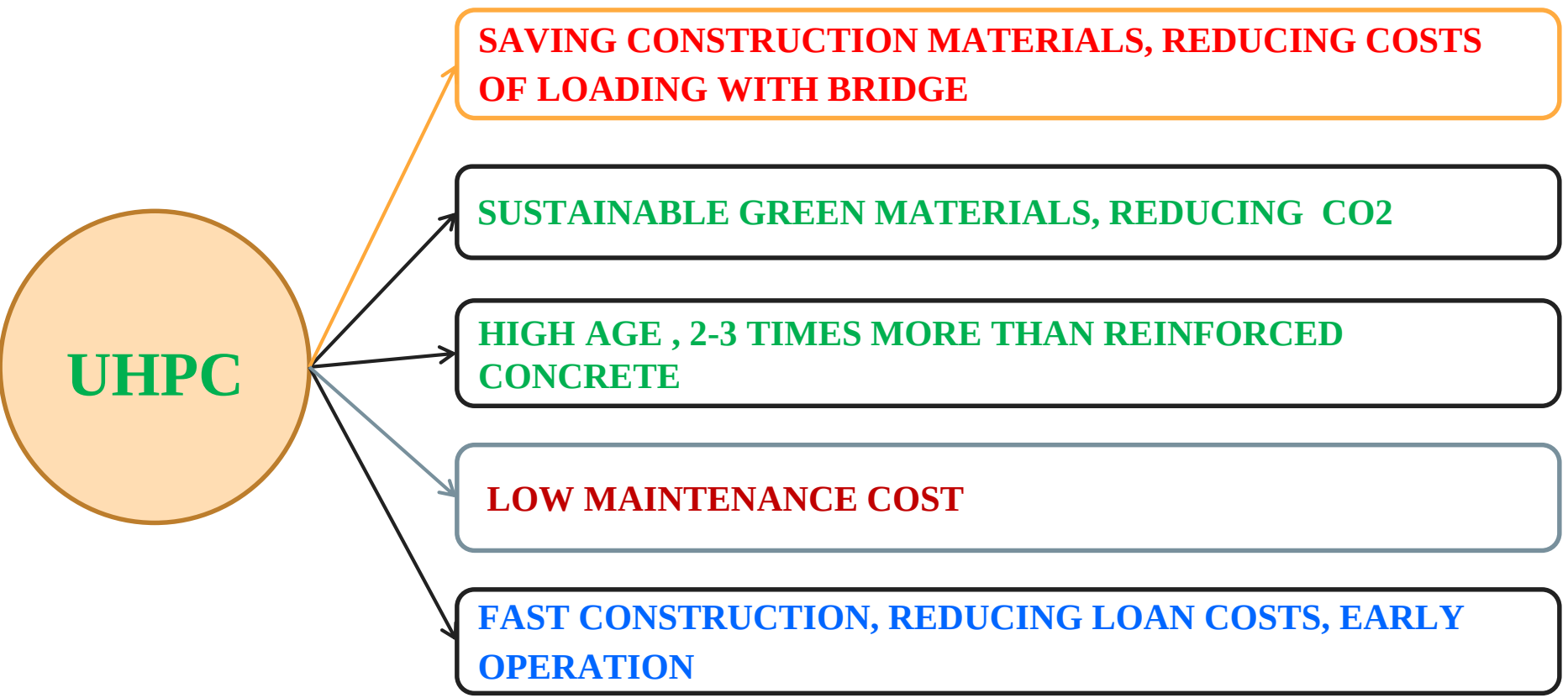
(GOLDEN BRIDGE, PHU THO)


ASIAGROUP


KATO
KARGO


29C-769.35

UHPC - NEW TECHNOLOGY APPLICATION



CONCLUSION

1. BUILDING A SET OF 3 TCVN STANDARDS, TECHNICAL INSTRUCTIONS

2. RESEARCH ON MATERIAL SELECTION OF VN

3. RESEARCH FOR SELECTION OF EQUIPMENT AND TECHNOLOGY IMPORTED+ PRODUCTION VN

4. DESIGN AND MANUFACTURING UHPC, VN OWNERS

5. APPLICATIONS FOR NON-STRUCTURAL

6. APPLICATIONS FOR STRUCTURAL/ BEAMS

7. GREEN, SUSTAINABLE BUILDING/ BRIDGES

CONCLUSION

8. LONG LIFE (over 100 years), 2 -3 times higher than ordinary concrete

9. VERY LOW MAINTENANCE COST, NEARLY ZERO

10. MATERIAL COMPOSITION WEGHT 30% OF CVC

11. CO2 emissions equal to 80% of conventional concrete

12. FAST CONSTRUCTION TIME, 3 TIMES TIMES OF CVC

14. EXWORK PRICE UHPC BEAMS EQU CVC BEAMS; LLC OF UHPC BEAMS=80% CVC BEAMS.

LRAMP PROJECT FUNDED BY WORLD BANK

TU -O
BRIDGE
LRAMP

FUNDED BY
WB

TU O BRIDGE LRAMP

FUNDED BY WB

TU O BRIDGE LRAMP

FUNDED BY WB

LANG CO BRIDGE LRAMP

FUNDED BY WB

AFTER 40 MONTHS

LANG CO BRIDGE LRAMP

FUNDED BY WB

AFTER 40 MONTHS

LANG CO BRIDGE LRAMP

FUNDED BY WB

AFTER 40 MONTHS

LANG CO BRIDGE LRAMP

FUNDED BY WB

AFTER 40 MONTHS

UHPC BRIDGE

UHPC BRIDGE. 2021

UHPC BRIDGE FEB, 2022

GOLDEN BRIDGE, PHU THO 4SPAN x30M, W6.5m. Span = 10 Segments x3m

GOLDEN BRIDGE, PHU THO, JUN/2022

GOLDEN BRIDGE, PHU THO

GOLDEN BRIDGE, PHU THO

GOLDEN BRIDGE, PHU THO, JUN/2022

BỘ XÂY DỰNG
Ministry of Construction
VIỆN KHOA HỌC CÔNG NGHỆ XÂY DỰNG
Vietnam Institute for Building Science and Technology

GIẤY CHỨNG NHẬN HỢP CHUẨN

CERTIFICATE OF CONFORMITY

No: 021/2021VKH

Chứng nhận sản phẩm/ *This is to certify that:*

Bê tông bột trộn sẵn UHPC

mã hiệu: UHPC(C)-125/7,5; UHPC(C)-135/8; UHPC(C)-145/9; UHPC(C)-155/10; UHPC(C)-165/10,5; UHPC(C)-175/11; UHPC(P)-125/3,5 và UHPC(P)-135/4.

Đơn vị sản xuất/ *Manufactured by:*

CÔNG TY CỔ PHẦN SÁNG TẠO VÀ CHUYỂN GIAO CÔNG NGHỆ VIỆT NAM.

Địa chỉ/ *Address:*

- Trụ sở: Số 44 đường Nguyễn Văn Huyên, Tổ 37, P. Nghĩa Đô, Q. Cầu Giấy, Hà Nội.
- Nhà máy: Thôn Cây khế phường Đội Cấn, thành phố Tuyên Quang, tỉnh Tuyên Quang.

Phù hợp với/ *Conforms to:* **NF-P18-470:2016**

Bê tông - Bê tông cốt sợi tính năng siêu cao - Chỉ dẫn kỹ thuật, tính năng, sản xuất và sự tuân thủ.

Phương thức đánh giá sự phù hợp/ *Certification method:*

Phương thức 5

Giấy chứng nhận có giá trị/ *This certificate is valid:*

từ ngày 03 tháng 3 năm 2021 đến ngày 02 tháng 3 năm 2022.

Giấy chứng nhận này sẽ được gia hạn tiếp 12 tháng/ lần sau các lần đánh giá giám sát vào tháng 3/2022 và 3/2023.

Được phép sử dụng dấu hợp chuẩn

Hà Nội, ngày 03 tháng 3 năm 2021

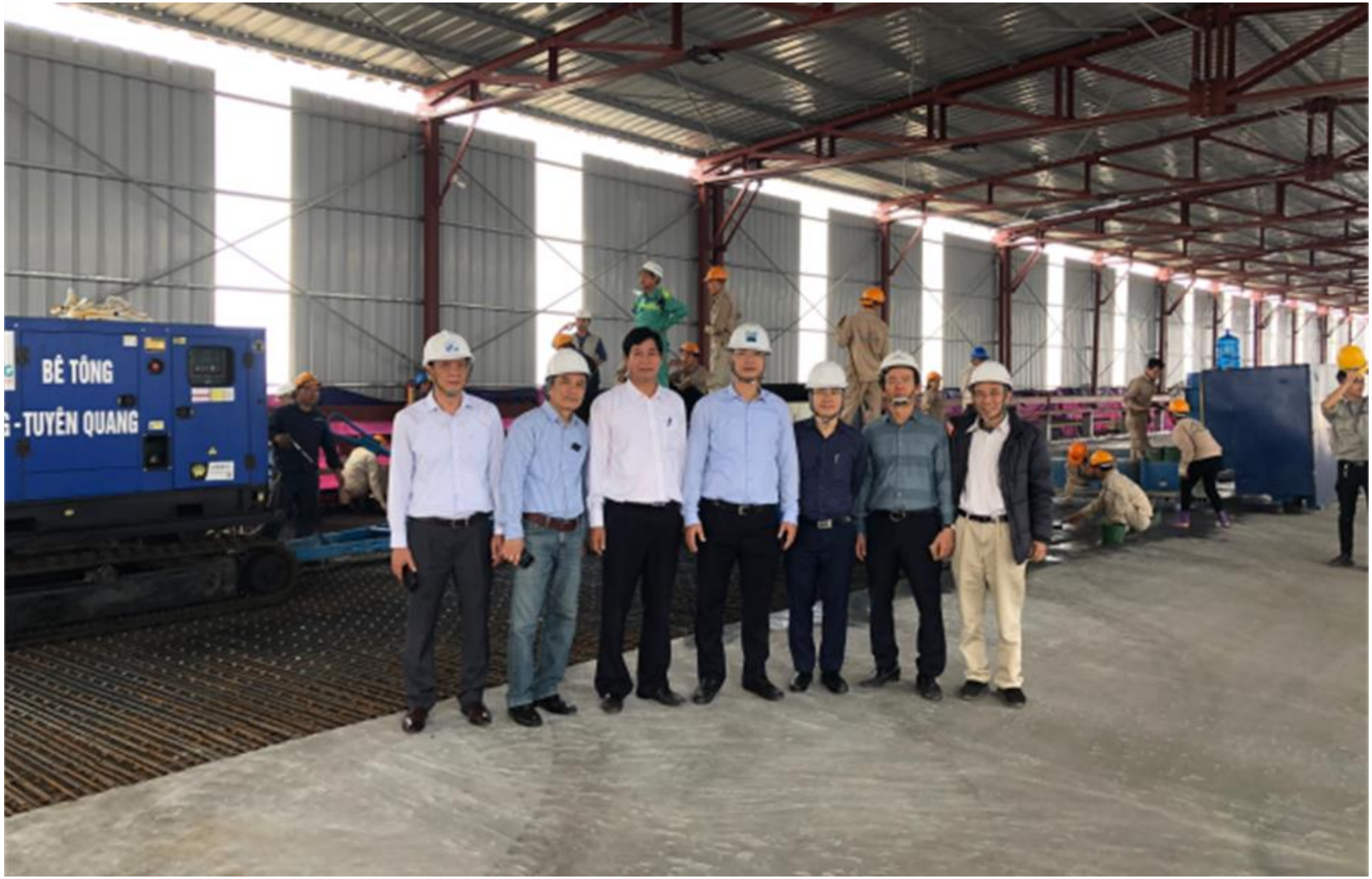
KT. VIỆN TRƯỞNG
PHÓ VIỆN TRƯỞNG

Đinh Quốc Dân

PHẠM DUY HÒA (Chủ biên)
KHÚC ĐĂNG TÙNG - CÙ VIỆT HƯNG - NGUYỄN BÌNH HÀ
NGUYỄN VĂN TUẤN - TRẦN VĂN TẤN
NGUYỄN NGỌC TUYẾN - LÊ BÁ DANH - NGUYỄN THỊ NHƯ MAI

THIẾT KẾ VÀ THI CÔNG CẦU BÊ TÔNG CHẤT LƯỢNG SIÊU CAO UHPC

NHÀ XUẤT BẢN XÂY DỰNG


BÊ TÔNG
-TUYÊN QUANG


AN TO
ẤT LƯỢNG HIỆU QUẢ


ĐẢNG CỘNG SẢN VIỆT NAM QUANG VINH MUÔN NĂM
DỰ ÁN SỬA CHỮA CẦU THĂNG LONG
HỘI NGHỊ TỔNG KẾT, ĐÁNH GIÁ
01 NĂM NGÀY HOÀN THÀNH
07/01/2021-07/01/2022

Thank For Your Attention!