Steel Product Development of Hot Rolled Coil Specification JIS G3106 SM520B Application in Steel Box Girder Elevated Toll Road MBZ, Jakarta-Cikampek

Malaysia, November 2022

SEAISI
South East Asia Iron and Steel Institute
Company No: 993483-M

BUMN UNTUK INDONESIA

KRAKATAU STEEL

Outline

Elevated toll road MBZ

Steel for construction sector

Production of high strength steel

Analysis & Result

Conclusion

Traffic Jam

Jakarta

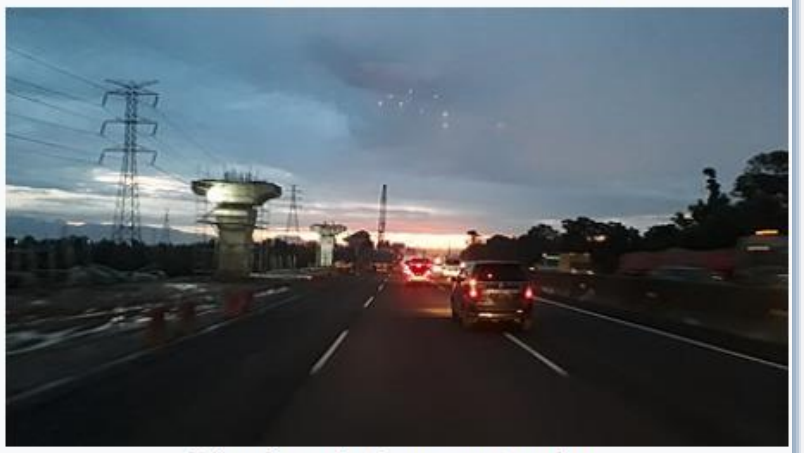
The Risk Will Increase.

Holiday Season

Rush Hour

Sheikh Mohammed bin Zayed Skyway
Jakarta–Cikampek Elevated Toll Road

Jalan Layang Sheikh Mohammed bin Zayed
Jalan Tol Layang Jakarta-Cikampek



Situation during construction

Route information

Part of AH2 AH2

Maintained by PT Jasamarga Jalanlayang Cikampek (PT Jasa Marga Tbk, Nusantara Infrastructure, PT Ranggi Sugiron Perkasa)

Length	36.4 km (22.6 mi)
Existed	2019–present

Major junctions

West end	Cikunir
	Jakarta–Cikampek Toll Road
	Jakarta Outer Ring Road
East end	Karawang

ELEVATED TOLL ROAD

1. Small vehicles.
2. Operation since 2019
3. Separate Short/long-distance travel route
4. The longest elevated toll road in Indonesia

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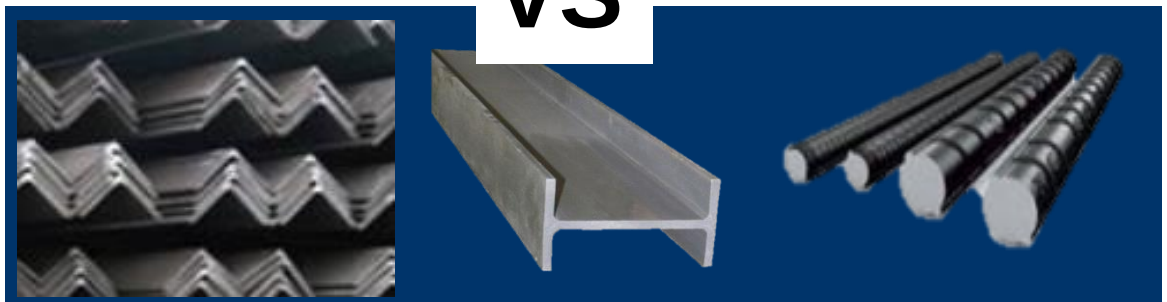
VS



Comparison between RCC and Steel Structure

Steel Structure has been chosen due to longer span, reduce pillars and faster

RCC	Steel
Large cross section	Small cross section
Lower tensile strength	Higher tensile strength
Lower resistant to earthquake and wind	Higher resistant to earthquake and wind
Speed of construction is slow	Speed of construction is fast
High corrosion resistance	Low corrosion resistance
Cost of repair is more	Cost of repair is less
fire resistant	Not fire resistant
Quality control is difficult	Better quality control.
Skilled as well as non-skilled workers	Only Skilled workers
No Costly form of construction	Costly form of construction
Brittle, sudden failure	Ductile, failure is not sudden.
Not recyclable.	recyclable

Comparative steel segment

Construction, Oil & gas, Automotive

Oil & Gas

American Petroleum Institute

Project Based

- **Rifers to API Standard**, several project is using high strength (X65).
- The **requirements** for any project is **differents** due to project own request.
- Pipe maker has **additional requirement** to get more competitiveness pipe.

Construction

JIS
ASTM
BS EN

As Per Standards

- As per **standard** Requirements.
- The **popular** requirements is tensile **400 Mpa class**. Only few demand which use High strength steel to build an infrastructure

Automotive

Their Own Standard.

Strict

- Provide **approval material** to supply in specific part.
- Using international standard (JIS) with **more strict requirement.**
- Market trend is going to **higher mechanical** properties (620 Class) with **lower thickness** of steel

- Steel manufacture is **capable** to produce material with **stricter product** compare to standard

Ex : 400 Mpa Class → 410 minimum

History of steel development PT KS

1985

Low-Medium Strength (Mild Steel)

Application

- ❖ General Construction
- ❖ Rerolling

1990

HSLA Steel

- High Strength
- Good Toughness
- Good Weldability
- Good Ductility/Formability
- Good Corrosion Resistance

Application

- ❖ General and Welded Construction up to 490 Mpa Class
- ❖ Boiler and pressure vessel
- ❖ Oil & Gas line pipe up to 65 Class
- ❖ Weathering Steel
- ❖ Interstitial free steel

2000

HSLA Steel with Thermo-mechanical controlled, Quenched & Tempered Steel

- Improved Mechanical Properties
- Improved Toughness
- Improved Wear Reasistance
- Special purposes

Application

- ❖ **General and Welded Construction up to 590 Mpa Class**
- ❖ Oil & Gas line pipe up to 80 Class
- ❖ Oil & gas line pipe X60 for sour condition
- ❖ Wear plate with stregth up to 1000 MPa

2010

TMCP, Accelerated cooling, microstructural monitoring system

- Reduced alloyed elements
- Improved Mechanical Properties
- Improved Toughness
- Improved Wear Reasistance
- Special purposes

Application

- ❖ Fire resistant steel
- ❖ **General and Welded Construction up to 590 Mpa Class**
- ❖ Oil & Gas line pipe up to 80 Class
- ❖ Oil & gas line pipe X65 for sour condition
- ❖ Wear plate with stregth up to 1000 MPa

2021-Now

HSLA Steel , TMCP, acc cooling, microstructural monitoring system, Dual Phase

- Reduced alloyed elements
- Improved Mechanical Properties
- Improved Toughness
- Improved Wear Reasistance
- Special purposes
- DP Steel

Application

- ❖ Fire resistant steel
- ❖ **General and Welded Construction up to 590 Mpa Class**
- ❖ Oil & Gas line pipe up to 80 Class
- ❖ Oil & gas line pipe X65 for sour condition
- ❖ Wear plate with stregth up to 1000 Mpa
- ❖ Automotive up to 650 Class
- ❖ Dual Phase 600

HRC Steel Grade

SEGMEN	SPESIFIKASI
Automotive	JIS G 3113 SAPH310-540, JIS G 3134 SPFH490-540, JIS G 3131 SPHC, SPHD, SPHE HSAPH540, KSAPH540, HSAPH620
Boiler, Pressure Vessel & Gas Cylinder	ASTM A53 Grade B, ASTM A252 Grade 1-3, ASTM A283 Grade A-D, ASTM A285 Grade A-C, ASTM A515 Grade 70, ASTM A516 Grade 70, JIS G 3116 SG255, SG295
Oil & Gas Pipe	API 5CT H40, J55, K55, API 5L Grade A, Grade BM, Grade BN, API 5L X42-X80 (PSL1 and PSL2), ASTM A139, DNV 485, DNV OS F101 Grade 450
Pipe & Tube	JIS G 3232 SPHT1-4, SPHK1, SPHK2, KSA29H, KSA37H, KSA39H, MPW1, MPW2, MP38
General & Welded Structure	AS/NZ 1594 HA250, HA350, ASTM A36, A242 Grade 2, A284 Grade C-D, A570 Grade 30-50, A572 Grade 42-55, A573 Grade 70, BSEN S235-355 (J0, JR, J2), MS ENS235-355, DIN 17100 ST37-ST52,JIS G 3101 SS330-540, JIS G 3106 SM400-SM570 (A,B,C), JIS G 3136 SN400B, SN490B, SNI 07 0601 BJPC, BJPS,
Shipbuilding	ABS (A, AH32, AH36), BKI (Grade A, B, A32, A36), BV (Grade A & B), DNV (Grade A), GL (Grade A & B), LR (Grade A), NKK (Grade A, A32, A36)
Reroll	SAE 1006-1026, BSEN 10111 DD11, ASTM A1006-1012
Container & Weathering Corrosion	CORTEN A-C, JIS G 3125 SPAH, BTKC Grade A, Grade B, Grade C
Floor Plate	Checker Plate

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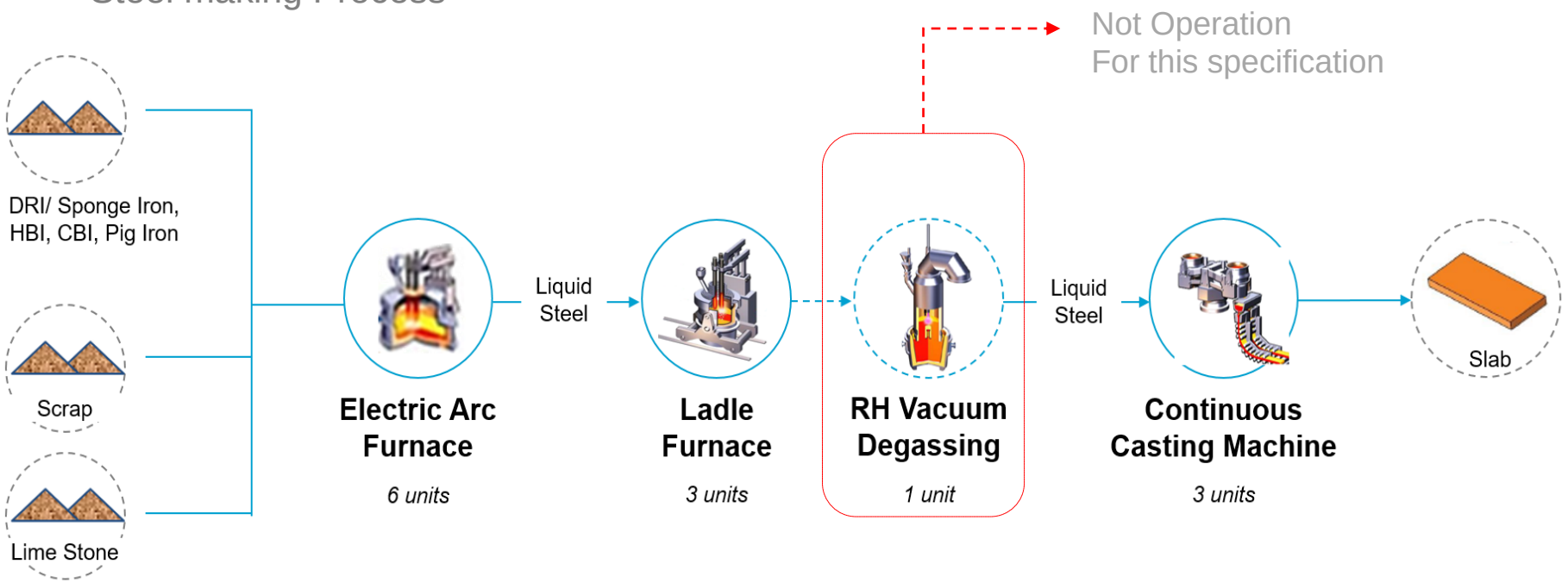
Production Process

Steel making Process



EAF

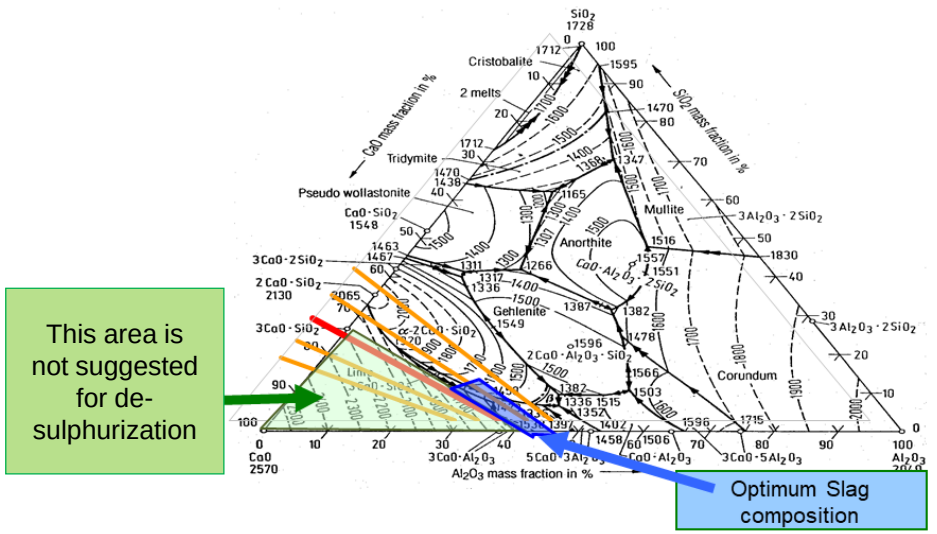
- Number of EAF : 6 units
- Tapping capacity : 130 ton/heat
- Transformer capacity : 60 MVA (4)
  93 MVA (2)

Ladle Furnace

- Number of LF : 3 units
- Ladle capacity : 130 ton/heat
- Transformer capacity : 25 MVA (2)
  22 MVA (1)

Continuous Casting Machine

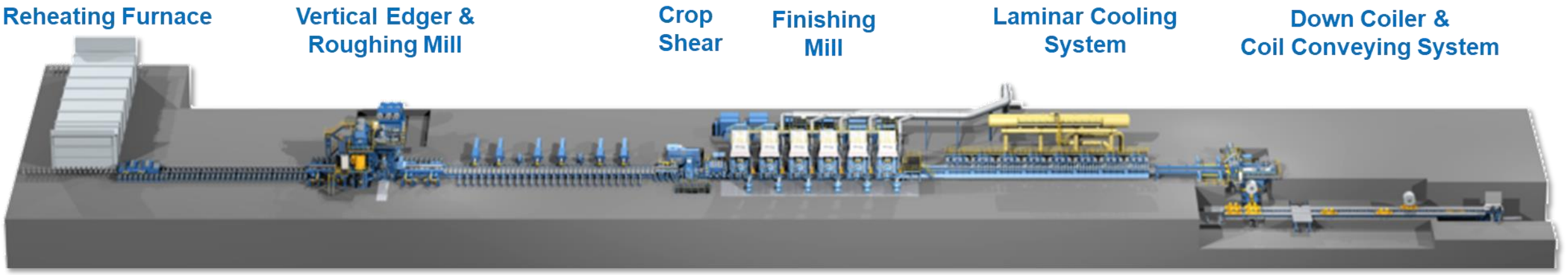
- Number of CCM : 3 units @ 1 strand
- Tundish capacity : 16 ton



OBJECTIVE

- Production slab using raw material DRI & Scrap.
- High quality slab.
  - Internal defect
  - Surface defect
- Chemical Composition in accordance quality design
- Operating Excellence
  - Yield Production
  - Energy Consumtion
  - Material Consumable
  - Etc.

Production Process



HOT STRIP MILL

Thermomechanical Control Process is applied.

During rolling practice, controlling parameter process is the key to get excellence product especially on mechanical properties (SM520B)

Niobium
Grain refinement

Producing high quality coil in accordance both JIS standard & Customer requirement.

Objective

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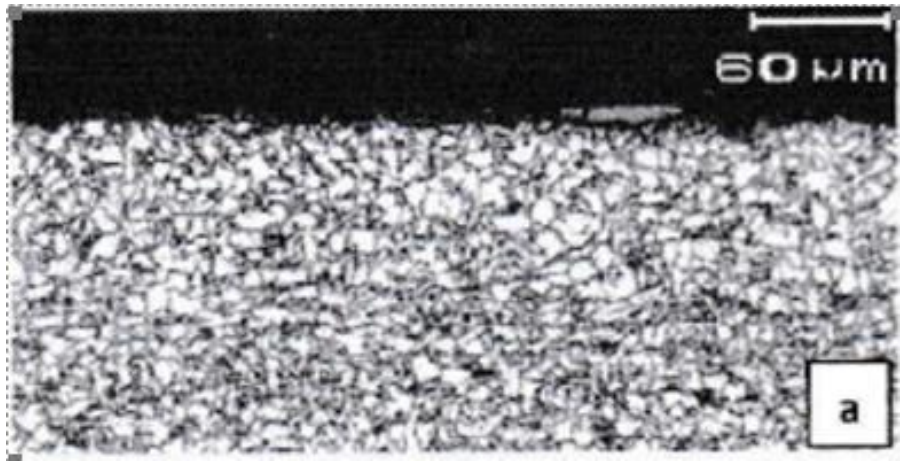
Analysis & Result

Elements	SM 520B (%wt, max)	Typical PTKS Design	Trial Result
C	0,20	0,16 - 0,18	OK
Mn	1,60	1,2 - 1,40	OK
Si	0,55	0,03 max	OK
P	0,035	0,025 max	OK
S	~~0,035~~/0,010	0,010 max	OK
Nb	-	± 0,025	OK
Al Total	-	0,02-0,06	OK
N	-	-	OK
CE (IIW)	0,40 max	0,39 max	OK
PCM	0,26 max	0,24 max	OK



Microstructure Ferrite & Pearlite

Chemical Composition → Mechanical Properties → Microstructure → QUALITY PRODUCT

Material	Charphy Absorbed Energy (Joule)			
	+20°C	0 °C	-20 °C	-40 °C
HRC	156 - 244	135 - 237	83 – 225	54 - 216
Cust Req			(-12°C) 41 Min	

Mechanical properties	Unit	Standard Specification [7]	Head	Midle	Tail
Ys	MPa	365 Min	± 474	± 504	± 484
Ts	MPa	520 – 640	± 572	± 617	± 614
El	%	19 min	Min 23	Min 20	Min 19

Quality Product HRC is Comply to standard & Customer Requirement

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01

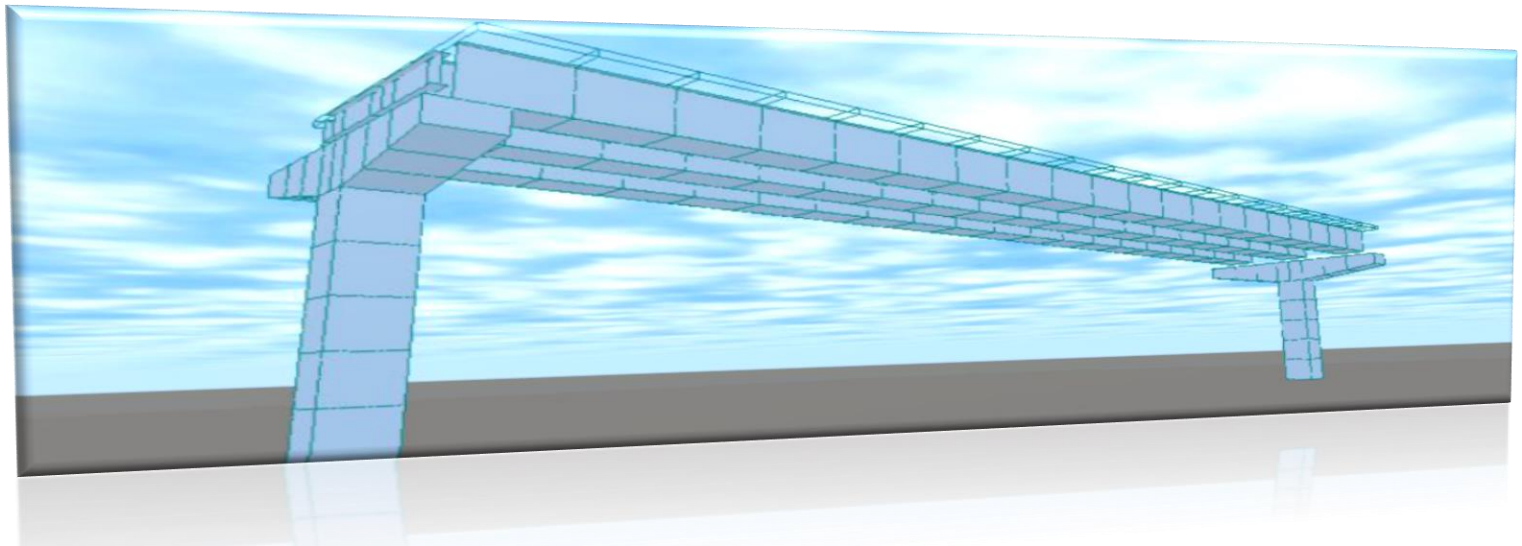
Steel and concrete materials have **advantages and disadvantages. Good calculations** for material selection will get **better results.**

02

The **Development of HRC** Spec JIS G3106 SM 520B by PT KS is **Successful** since **Mechanical properties and Chemical properties** is **comply to standard.**

03

PT KS is able to fulfill the order for MBZ elevated toll road girder box with **good toughness** even in very low temperatures (-40).



KRAKATAU STEEL

THANK YOU