BRIDGES IN INDONESIA: PRESENT AND FUTURE

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OUTLINE

- Introduction
- Database of Bridges in Indonesia
- Standards, Norms, Manuals and Guidelines
- Current Inspection and Maintenance Strategies
- Future Developments
- Closure

INTRODUCTION

INTRODUCTION

- Indonesia is an archipelago country, consisting of 17,508 islands. The total area of Indonesia is 1,904,569 square meter, of which 80% is water. A wide and long rivers characterize some of the islands in Indonesia.
- Because of those characteristics, the need for bridges is high in Indonesia in order to achieve connectivity between centers of economy
- This need is relevant with MP3EI program (with an objective to improve connectivity among centers of economy in Indonesia)

DATABASE OF BRIDGES IN INDONESIA

Bridges in Indonesia

Total 93.000 bridges (1138 km) in Indonesia, comprising of:

- 72.000 bridges (734 km) → a part of provincial roads & regency/city roads
- 21.000 bridges (404 km) → a part of national roads

1. **Bridge Span/Length (National roads)**

Span (m)	Length (m)	%	Number	%
6 - 20	125,376	31	15,759	73.7
20 - 40	87,391	21	3,366	15.7
40 – 60	48,234	12	1,041	4.9
60 – 100	47,051	12	658	3.1
> 100	96,783	24	547	2.6

2. **Superstructure Types (National roads)**

Types	Length (m)	%
Culvert	21 km	7 %
Girder	164 km	51 %
Truss	100 km	32 %
Others	31 km	10 %

→
- Concrete girder (123 km, 75 %)
- Steel girder (41 km, 25 %)

Special Bridges

A. Continous Concrete Box Girder

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Rantau Berangin, Riau	200	121	1972-1974
2	Rajamandala, Jabar	222	132	1972-1979
3	Serayu Kesugihan, Jateng	274	128	1978-1985
4	Mojokerto, Jatim	230	62	1975-1977
5	Arakundo, Aceh	210	95	1987-1990
6	Tonton-Nipah, Batam	420	160	1995-1998
7	Setoko-Rempang, Batam	365	145	1994 -1997
8	Siti Nurbaya, Sumbar	156	76	1995-2002
9	Tukat Bangkung, Bali	240	120	2006
10	Air Teluk II, Sumsel	208	104	2006
11	Perawang,Riau	1473	180	2007

Continuous Concrete Box Girder

Rajamandala Bridge

West Java, 1979
Main span 132 meter dan side span (simetry) 45 meter (Total span 222 meter).

Continuous Concrete Box Girder

Teluk Efil Bridge

Sekayu, Sumatera Selatan,
Concrete Box Girder, Balanced Cantilever
Total Span 52 + 104 + 52 meter

Special Bridges

B. Continuous Steel Bridges

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Ampera, Sumsel	354	75	1962-1965
2	Danau Bingkuang, Riau	200	120	1968-1970
3	Siak I , Riau	350	52	1975-1977
4	Kapuas Timpah	255	105	2010

C. Concrete Arch Bridges

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Rempang-Galang, Batam	385	245	1995-1998
2	Serayu Cindaga, Jateng	150	90	1996
3	Besok Koboan Jatim	125	89	2000.
4	Bajulmati, Jatim	90	60	2007
5	Karebbe	60	60	1996
6	Pangkep	84	60	2006

Continuous Steel Bridge

Ampera

Palembang, South Sumatra, 1962-1965
Main Span 75 m (Classical Continuous Steel Girder Bridge)
Total Span = 354 meter

Concrete Arch Bridge

Besok Koboan Bridge

Lumajang, Jawa Timur, 2000
Main Span 80 meter, Total Span 125 meter,

Concrete Arch Bridge

Bajulmati Bridge

Malang, Jawa Timur
Single Plane Concrete Arch
Span 15 + 60 + 15 meter

Serayu Cindaga Bridge

Jawa Tengah, 1979
Double Plane Concrete Arch Bridge,
Main Span 90 meter.

Concrete Arch Bridge

Kelok 9 Bridge

Bukit Tinggi, Sumatera Barat,
Concrete Arch Bridge,
Main Span 80 meter

Special Bridges

D. Steel Arch Bridge

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Kahayan, Kalteng	150	150	1995-2000
2	Martadipura, Kaltim	560	200	2004
3	Rumbai Jaya, Riau	150	150	2002.
4	Rumpiang, Kaltim	754	200	2008
5	Batang Hari II	804	150	2009
6	Siak III, Riau	520	15+120+15	2011
7	Teluk Mesjid, Riau	1500	90+250+90	20012
8	Malo	178	128	2007
9	Ogan Pelengkung	100	100	2008
10	Kahayan Hulu	640	150	1995-2000
11	Barito Hulu, Kalteng	561	150	2008
12	Mahulu, Kaltim	800	200	2003
13	Palu IV, Sulteng	300	125	2006
14	Pela, Kaltim	420	150	2010
15	Sei Tayan, Kalbar	1420	75+200+75	On Going

Steel Arch Bridge

Kahayan Bridge

Palangkaraya, Kalimantan Tengah, 2000,
Main Span Arch Steel Box
Span 150 meter, Total Span 635 meter

Steel Arch Bridge

Martadipura Bridge

Kotabangun, Kalimantan Timur, 2004
Main Span Steel Truss Arch Bridge
Span 200 meter, Total Span 560 meter

Steel Arch Bridge

Rumbai Jaya Bridge

Riau, 2002
Main Span150 meter and Total Span 450 meter

Teluk Masjid Bridge

Siak Indrapura, Riau
Continuous Steel Arch Bridge
(90+250+90m), Total Span 1500 m

Special Bridges

E. Cable-Stayed Bridge

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Batam-Tonton, Batam	Cable-Stayed	350	1998
2	Pasopati, Bandung	Cable-Stayed	106	2005
3	Siak Indrapura, Riau	Cable-Stayed	200	2007
4	Grand Wisata Overpass	Cable-Stayed	81	2007
5	Suramadu, Jatim	Cable-Stayed	434	2008
6	Siak IV, Riau	Cable-Stayed	156	On going
7	Galalapoka	Cable-Stayed	150	On going
8	Melak	Cable-Stayed	340	On going
9	Sukarno, Menado	Cable-Stayed	110	On going
10	Mahkota II, Kaltim	Cable-Stayed	370	On going

Cable-Stayed Bridge

Batam – Tonton Bridge

Batam, Kepulauan Riau, 1998
Bridge Span (147 + 350 + 147 meter) = 664 meter.

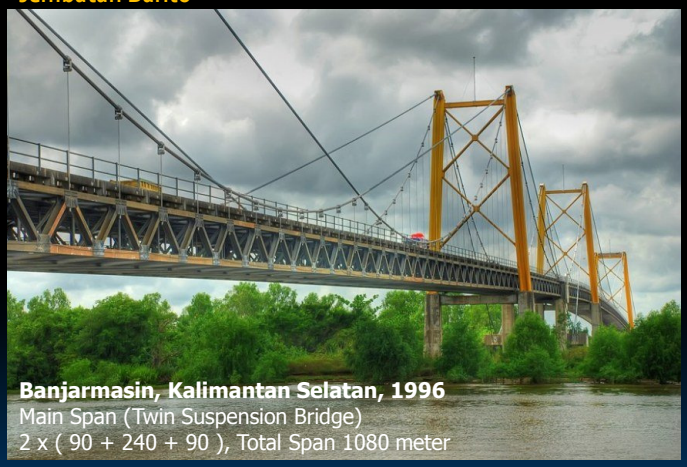
Special Bridges

F. Suspension Bridges

No	Bridge Name	Total Span (m)	Main-Span (m)	Year of Construction
1	Membramo, Irian Jaya	Suspension	235	1994
2	Barito, Kalsel	Suspension	240	1995
3	Mahakam II, Kaltim	Suspension	270	2001

Suspension Bridge

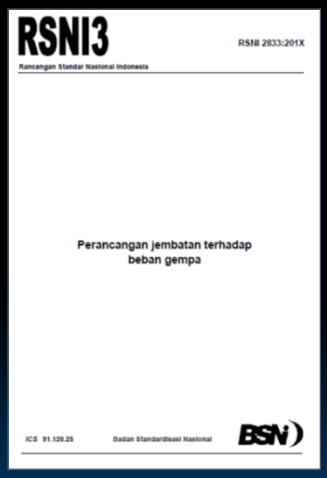
Jembatan Barito



Banjarmasin, Kalimantan Selatan, 1996
Main Span (Twin Suspension Bridge)
2 x (90 + 240 + 90), Total Span 1080 meter

STANDARDS, NORMS, MANUALS AND GUIDELINES

Norms, Standard, Guideline & Manual
(Design Standards)


RSNI3

RSNI 2833:201X

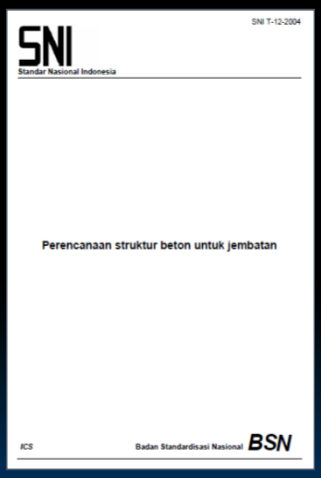
Rancangan Standar Nasional Indonesia

Perancangan jembatan terhadap beban gempa

ICS 91.120.25

Badan Standardisasi Nasional

BSN


SNI T-12-2004

SNI

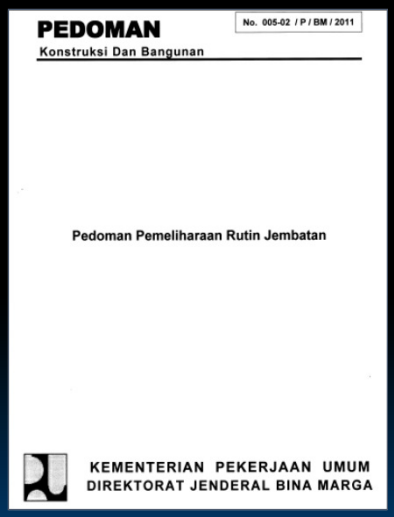
Standar Nasional Indonesia

Perencanaan struktur beton untuk jembatan

ICS

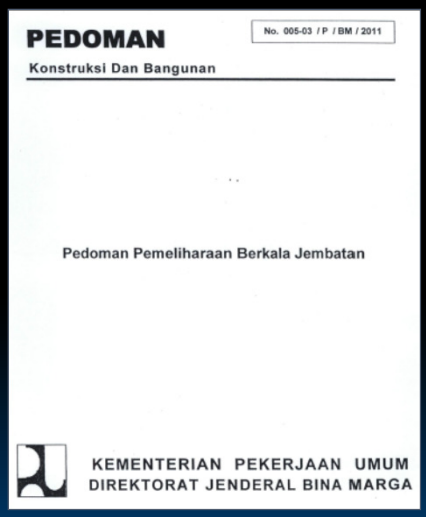
Badan Standardisasi Nasional BSN

Norms, Standard, Guideline & Manual
(Guideline for Routine and Periodical Maintenance)


PEDOMAN
No. 005-02 / P / BM / 2011
Konstruksi Dan Bangunan

Pedoman Pemeliharaan Rutin Jembatan

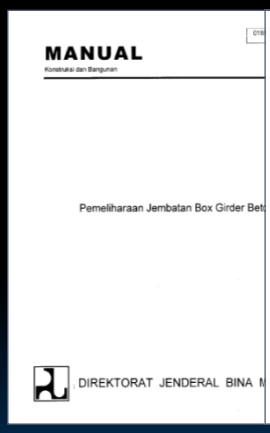
KEMENTERIAN PEKERJAAN UMUM
DIREKTORAT JENDERAL BINA MARGA


PEDOMAN
No. 005-03 / P / BM / 2011
Konstruksi Dan Bangunan

Pedoman Pemeliharaan Berkala Jembatan

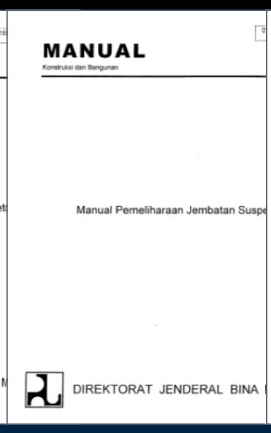
KEMENTERIAN PEKERJAAN UMUM
DIREKTORAT JENDERAL BINA MARGA

Norms, Standard, Guideline & Manual
(Manual for Maintenance of Special Bridges)


MANUAL
Konstruksi dan Bangunan

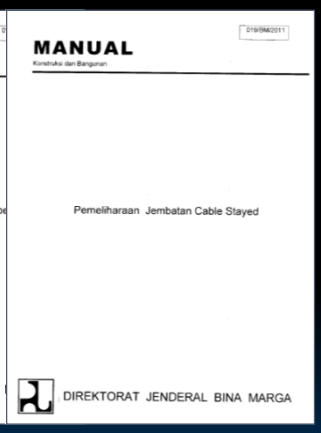
Pemeliharaan Jembatan Box Girder Bet

DIREKTORAT JENDERAL BINA


MANUAL
Konstruksi dan Bangunan

Manual Pemeliharaan Jembatan Suspe

DIREKTORAT JENDERAL BINA


MANUAL
Konstruksi dan Bangunan

Pemeliharaan Jembatan Cable Stayed

DIREKTORAT JENDERAL BINA MARGA

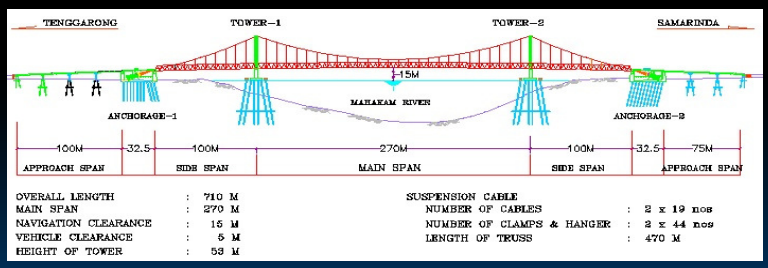
CURRENT INSPECTION AND MAINTENANCE STRATEGIES

Current Condition of Bridges Construction in Indonesia

Some bridges have a sub-standard performances due to improper design, construction and operational/maintenance

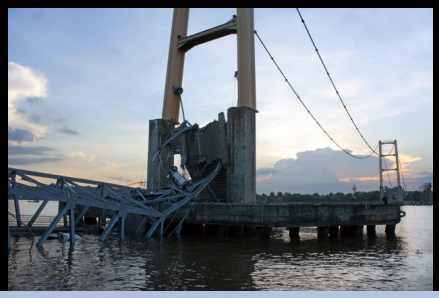
Why?

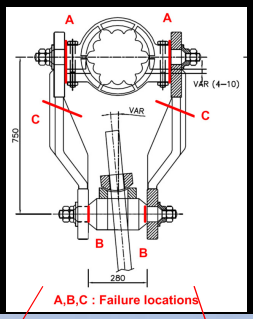
The Collapse of Kukar Bridge



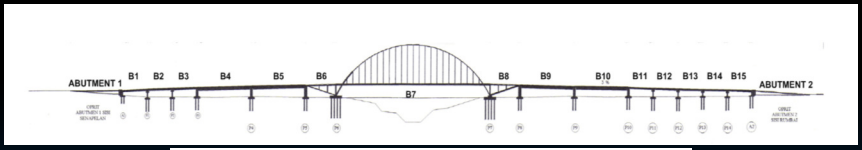
(Ref : H. Vaza dan I. Suhendra, 2002)

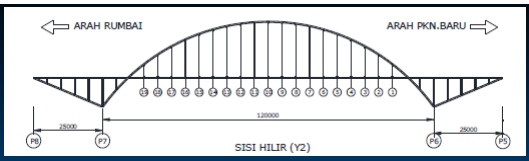
The Collapse of Kukar Bridge



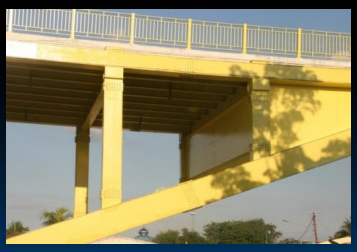


Problems of SIAK 3 Bridge





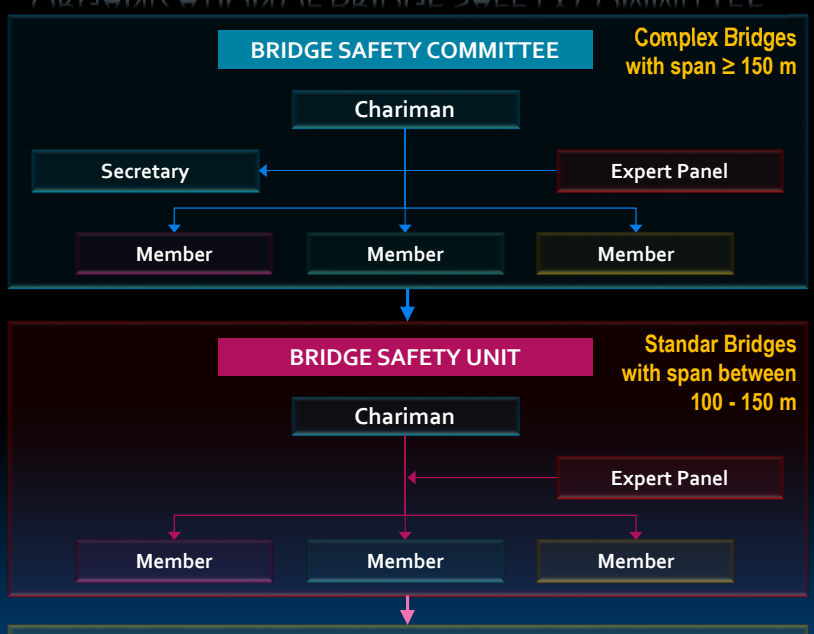
Deformation Problems in SIAK 3 Bridge

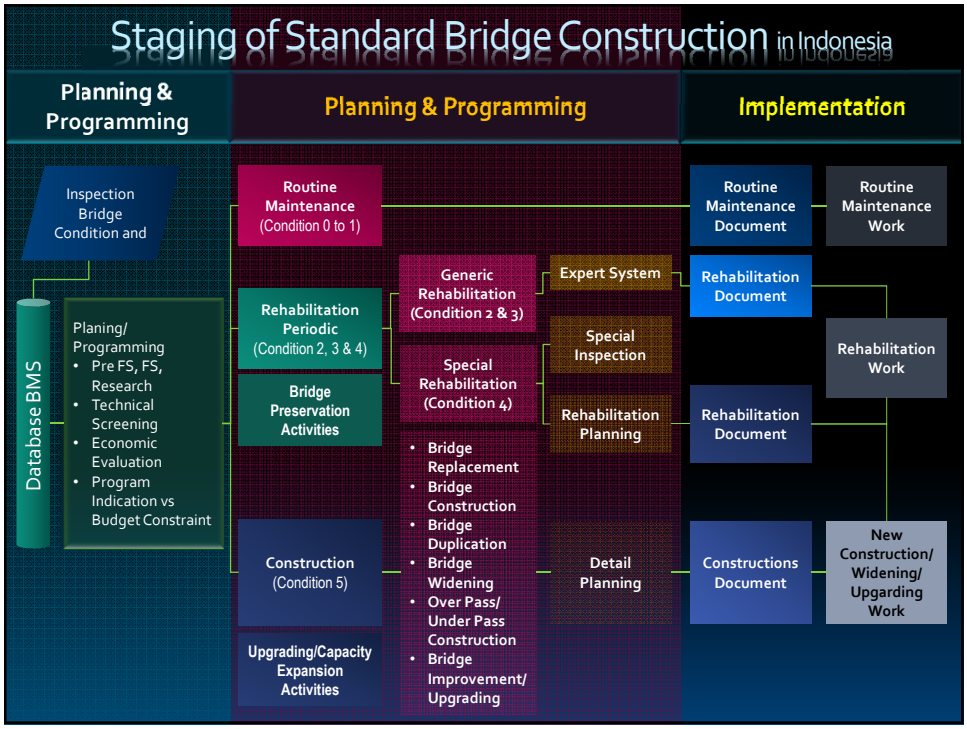


Problems

PROGRAMMING	DESIGN	CONSTRUCTION	OPERATION & MAINTENANCE
1. Bridge conditions are not always up-to-date: • System is there, but has not been carried out consistently. • There are large number of bridges, spreading in wide area. While, the number of inspectors is still limited.	1. Lack of human resources development. 2. Lack of coordination between units.	1. Lack of human resources development. 2. Lack of coordination between units. 3. Lack of knowledge on construction technology.	1. Lack of human resources development 2. Lack of knowledge on maintenance technology 3. Lack of coordination between units.

ORGANIZATION OF BRIDGE SAFETY COMMITTEE





Bridge construction in Indonesia is managed through Bridge Management System (BMS), and it comprises of planning/programming, feasibility study, design, construction, operation and maintenance.

Bridges Condition Inspection Procedure

BMS 1992

Parameter Evaluation	Criteria	Rating	
		No	Yes
S (structure)	Are the defects harmful or otherwise?	0	1
R (rating)	What is the level of defect, severe or mild?	0	1
K (quantity)	Is the defect extensive (widespread) or localized? For example, the defect only affects to more less 50% of the length, width or volume of the element	0	1
F (function)	Do these elements still function?	0	1
P (effect)	Whether the defects seriosly affect other elements or traffic flow?	0	1
Bridge Rating: Br = S + R + K + F + P		0	5

Category of Performance

Each bridge element is individually assessed with the same evaluation parameters up to the highest hierarchy element of the bridge as a whole unit. The elements of conditions assessment system can be described as follows:

0. Elements/bridges in good condition and without damage
1. Elements/bridges suffered minor damage, only require routine maintenance
2. Elements/bridges damage that requires monitoring or periodic maintenance
3. Elements/bridges damage that requires immediate action
4. Elements/bridges in critical condition
5. Elements/bridges is not functioning or collapse

Problems During Inspection

1) Lack of understanding of the inspector on bridge elements (elements name, function, etc.)
2) Lack of understanding on type of damages (types, causes, and impacts)
3) Lack of experience in using BMS`92 guidelines.
4) Lack of accuracy of the inspector in finding damages to the bridge elements.
5) Method of bridge inspection does not comply with the guidelines.
6) No access for inspector and bridge inspection tools to the sites.

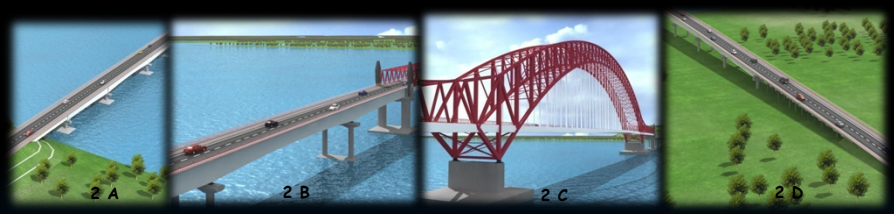
FUTURE DEVELOPMENT

FUTURE DEVELOPMENT

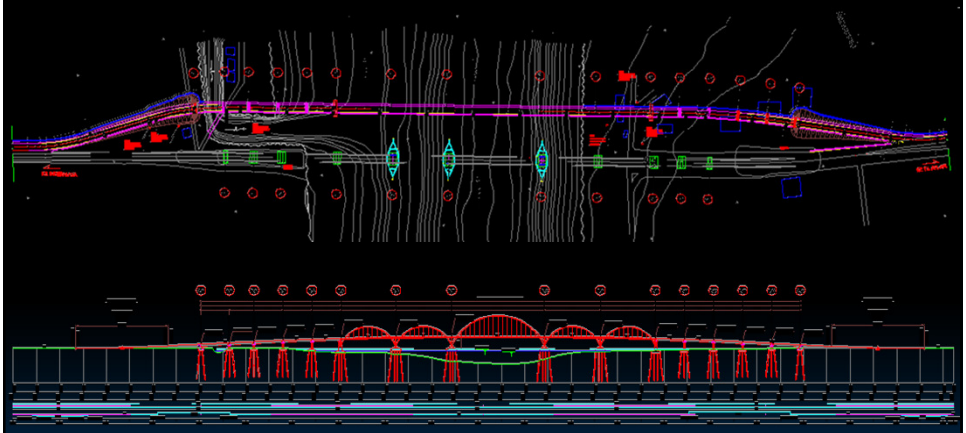
- Many bridges, including special bridges, are still needed to bridge rivers, valleys in Indonesia
- With the autonomous system adopted in the local government, the demand for new bridges construction to connect isolated area is increasing the last ten years
- Because of that, in near future, Indonesia is going to have increasing numbers of long –span bridges

SEI TAYAN BRIDGE

Configuration	Bridge Type	Bridge Span
2 A	Steel Girder Composite	120 m (3 @ 40m)
2 B	Continuous Steel Girder Composite	600 m (4 @ (45m - 60m - 45m))
2 C	Continuous Steel Arch	350 m (75m - 200m - 75m)
2 D	Pile Slab	70 m (14 @ 5m)



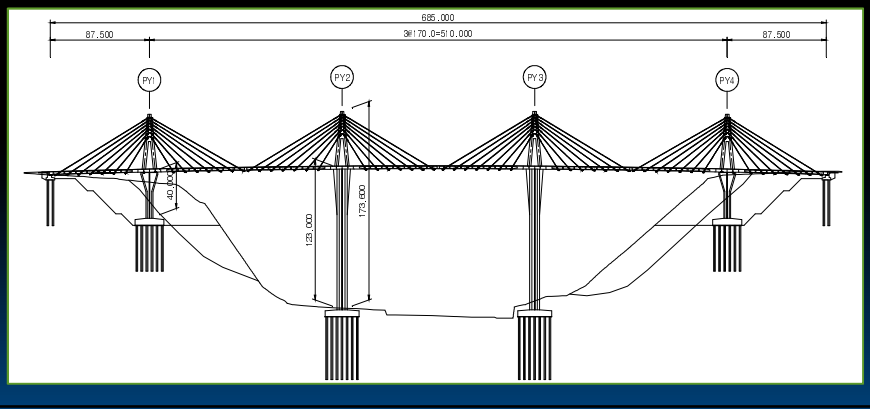
MUSI II BRIDGE



Main Bridge Span:
Steel Arch Rib 60m + 60 m + 100 m + 60 m + 60 m

NGARAI SIANOK BRIDGE

- **Bridge Type : Concrete Cable-Stayed Bridge(4 Pylons)**
- **Construction Method :**
  - **Central Span: FCM Method using F/T**
  - **Side Span : FSM Method using temporary bent**
- **Span Composition: 87.5+3@170.0+87.5=685.0m**
- **Width: B=24.0m (4 Lanes – 2way)**



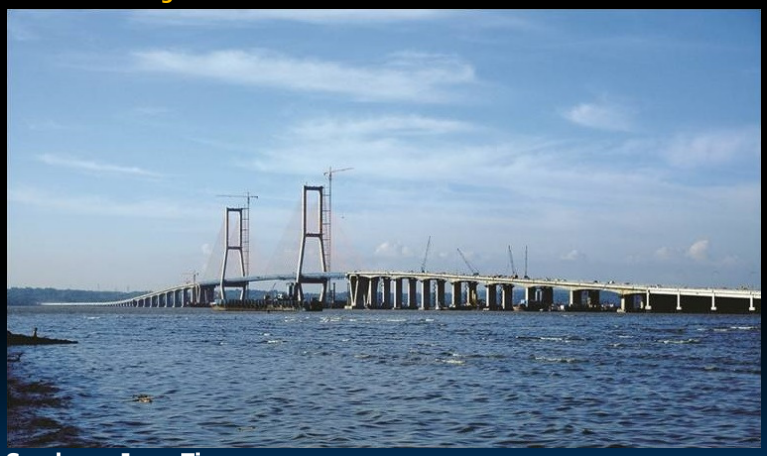
OTHER DEVELOPMENT

- The desire to connect big islands in Indonesia, such as between Sumatera and Java Islands
- This is relevant with MP3EI program (to improve connectivity among centers of economy in Indonesia)
- The first interisland connectivity has been constructed in 2009, i.e. Java and Madura Bridges
- The next one will be the Sunda strait bridges, connecting Sumatera and Java Islands

Cable-Stayed Bridge

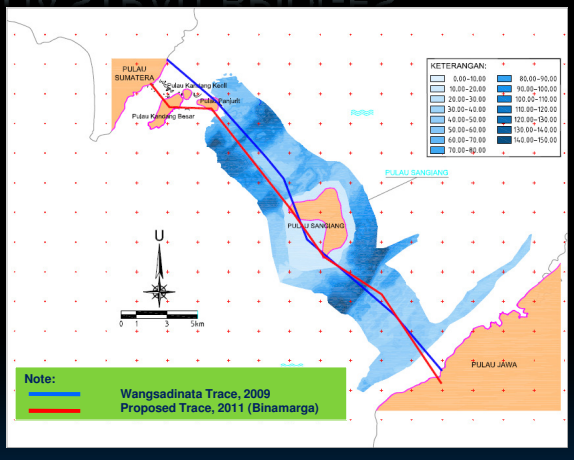
The First Interisland Bridge Connecting Java & Madura Islands

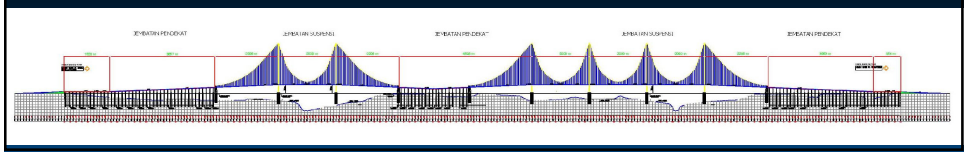
Suramadu Bridge



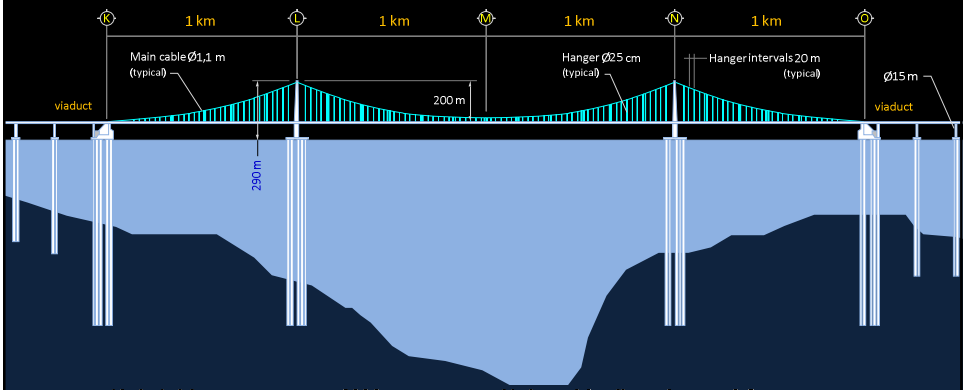
Surabaya, Jawa Timur
Main Span (Cable-Stayed Bridge)
192 + 434 + 192 meter, Total Span 5400 meter

SUNDA STRAIT BRIDGES





SUNDA STRAIT BRIDGES



Main bridge span	2000 m	Main cable diameter	1.1 m
Pylon height	295 m	Hanger diameter	250 mm
Deck width	43 m	Hanger intervals	20 m
Deck height	9 m	Cable strength	1540 MPa
Pylon materials	Concrete	Function	Rails &
Deck materials	Steel		highways

CLOSURE

CLOSURE

- There are still many things to be done to prepare our construction industries in designing, constructing and maintaining bridges.
- We need to compile best practices from all over the world regarding designing, constructing and maintaining the special types of bridges
- We know that many other countries have progressed far ahead of us in the state of the art of bridge constructions and maintenance
- Networking with other countries that have more experiences and knowledge has to be established.

THANKYOU