Submersible Bridges
In Myanmar Rural Areas

Yin Yin Swe
Deputy Director General
Department of Rural Road Development

Agenda

- Organizational Structure of Ministry of Construction
- DRRD Policy & Vision
- National Strategy for Rural Roads & Access
- The Origin of Submersible Bridge
- What's Submersible Bridge
- Advantages of Submersible Bridge
- Submersible Bridges Constructed by JIP
- Submersible Bridges Constructed by DRRD
- 2nd Mino Best Project Award by REAAA

Organizational Structure of Ministry of Construction

Ministry of Construction

Department of Building

Department of Highway

Department of Bridge

Department of Urban and Housing Development

Department of Rural Road Development

DRRD Policy

- Improvement of socio-economic life of people through development of rural road and bridge

Vision

- To implement sustainable rural roads and bridges including the routes supported for the agricultural productivity to the market
- To improve socio-economic development of rural populace
- To support national logistics
- To provide year-round access to 90% of the rural population by connecting at least 80% of all villages across the country

DRRD manage a network of under

60,000miles of rural roads network with 24,183 registered bridges
49,216 registered villages

22% - connected by higher-level roads
28% - all season roads
36% - dry season rural roads access
14% - no road access to all

50% (Half of villages) - no road access in rainy season
14 million people – physically isolated

A third of 24,183 registered bridges are timber bridges that require frequent replacement.

Need to replace by more resilient infrastructure

National Strategy for Rural Roads and Access

- **Responds to the lack of all season rural roads in Myanmar that is affecting rural people's access to health services, education, employment opportunities, markets and other services and facilities, limiting their development and that of the country as a whole.**
- **Describe to improve rural access through the provision of all season rural roads access by 2030, as a key approach to developing rural areas and addressing rural poverty and inequalities in Myanmar.**

90% of all registered villages to have all season access by 2030

Crossing the River Before Bridge Construction

Poor access to school, hospital, workplaces

School Children

Children walk across a river at the risk of drowning and often absent from school during rainy season.

Crossing the River Before Bridge Construction

Farmers

A farmer puts the luggage on the head and soaks up to the waists while walking across a river.

Crossing the River Before Bridge Construction

Inconvenient transportation preventing economic development in rural areas

Boat

Residents are often waiting for a boat on a riverbank and loading heavy luggage every time

Ox Cart

Ox carts are also used when and where the water level is not high enough to use boats

Crossing the River Before Bridge Construction

People have big difficulty crossing the creek in rainy season.

Crossing the River Before Bridge Construction

People have big difficulty crossing the creek in rainy season.

Crossing the River Before Bridge Construction

People have big difficulty crossing the creek in rainy season.

Crossing the River Before Bridge Construction

People have big difficulty crossing the creek in rainy season.

The Origin Of Submersible Bridge

Message from JIP(Japan Infrastructure Partner)

- In 2015, JIP learned the new of Itone Bridge has been swept away by flood.

- JIP, believe Submersible Bridge is a key approach to developing rural areas and reducing rural poverty and in equalities in the country.

- It improves quality of rural transportation, and then rural people access to education, employment opportunities, market, health, other services and facilities, promoting their development.

The Origin Of Submersible Bridge

Message from JIP(Japan Infrastructure Partner)

- JIP hope that Submersible Bridge will work effectively for long time and people will construct this type of bridge in all Myanmar in near future.

- JIP recommended Myanmar MOC engineers to study ‘Submersible Bridge’ which will be medium scale structure between the ordinary type bridge and the causeway and the construction cost is much smaller than the ordinary bridge.

- Finally, JIP decided to construct actual Submersible Bridge (Itone Bridge) and transfer the concept of Submersible Bridge and its construction technology to Myanmar.

Submersible Bridge in Japan

Current status in Myanmar rural area is quite similar to early status of ‘Showa Era’ of Japan (1960s)

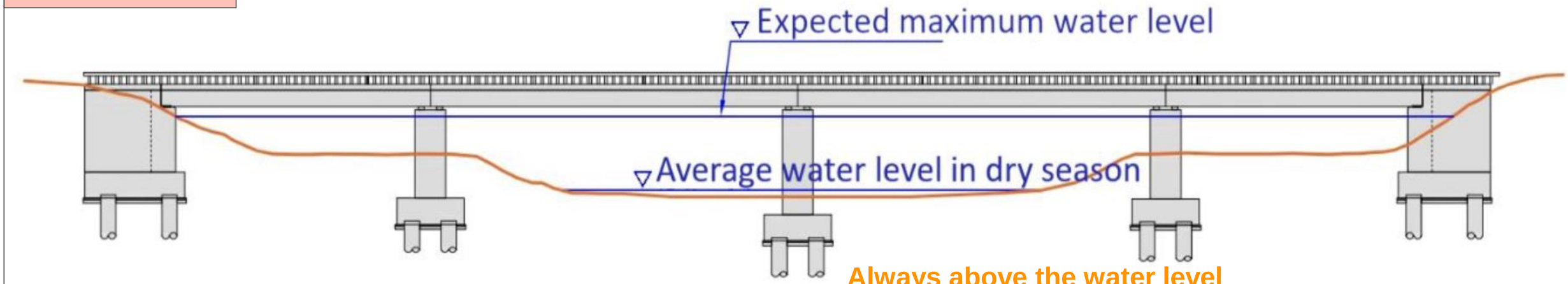
A submersible bridge built in
Japan **55 years ago** is still in use and there are many similar ones.

What's Submersible Bridge?

A submersible bridge is a bridge purposely arranged to be below the level of high floods and so designed and constructed that high floods may pass over it without damage to the structure.

Normal Bridge

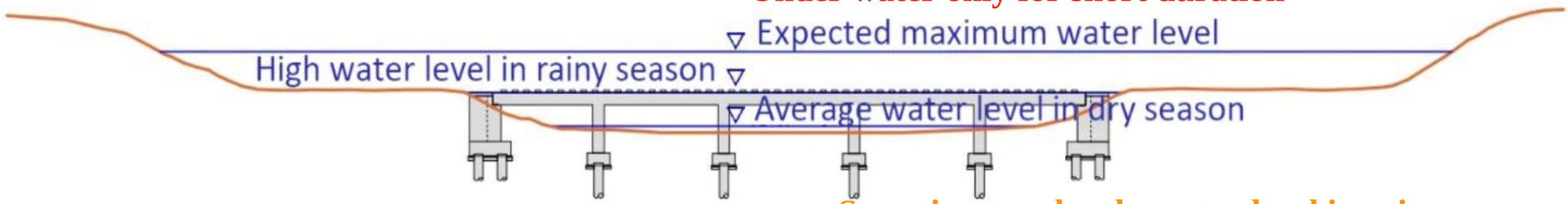
Abnormal high water level happened once in 30~50 years



Always above the water level

Submersible Bridge

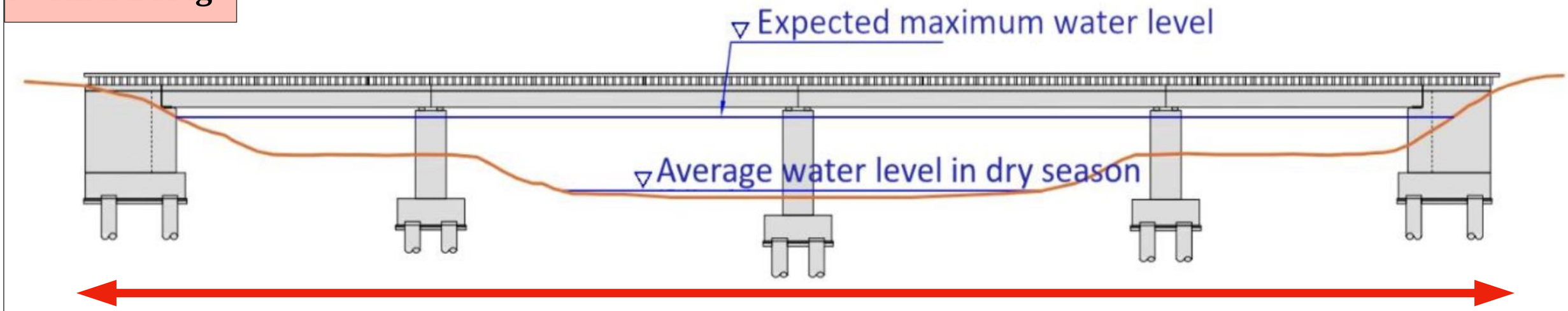
Under water only for short duration



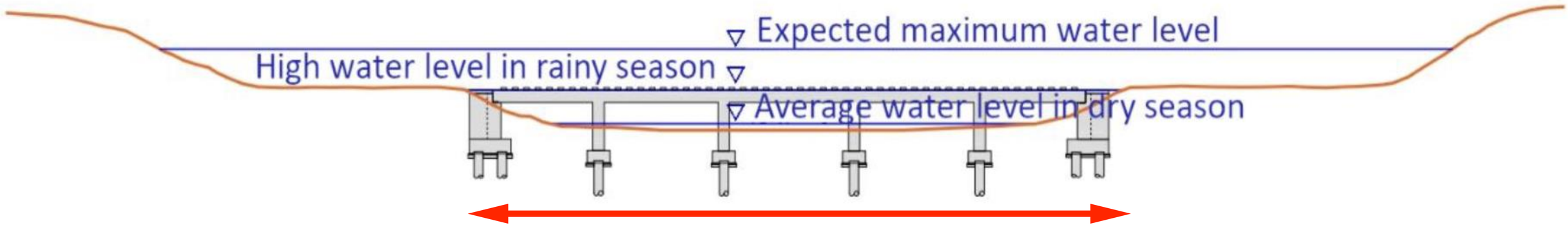
Sometimes under the water level in rainy season

Length Comparison

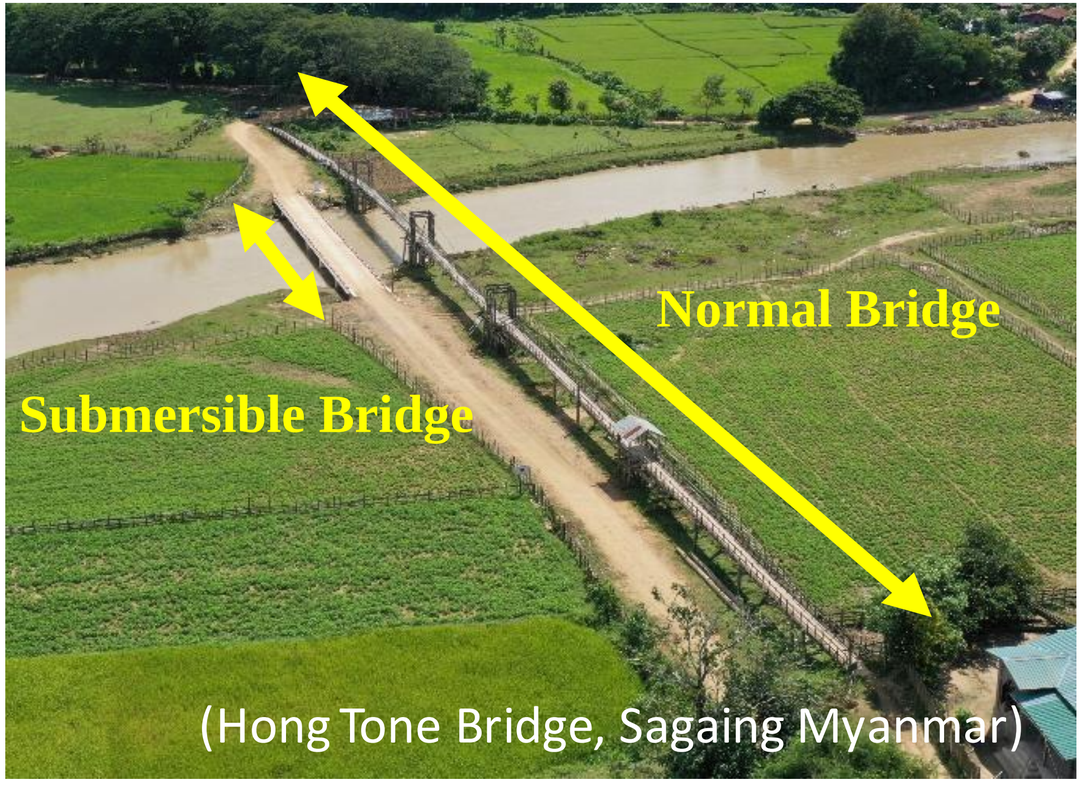
Normal Bridge



Submersible Bridge



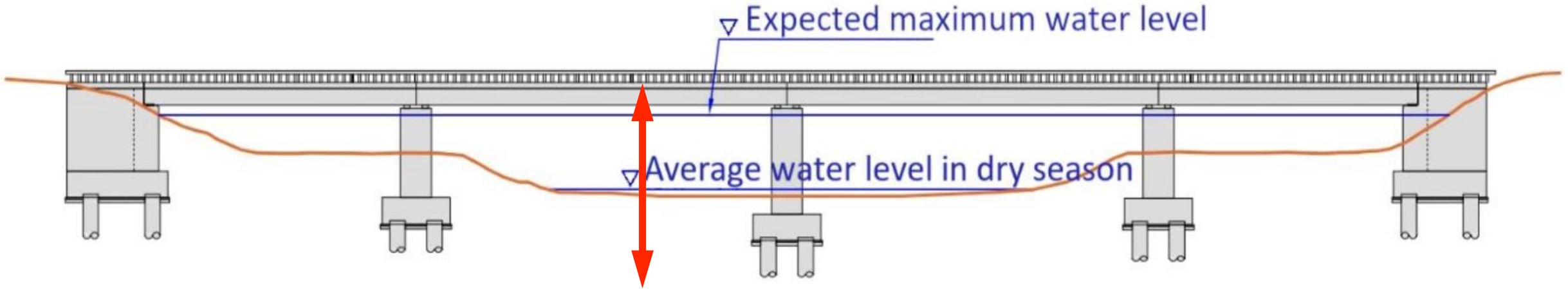
Length Comparison



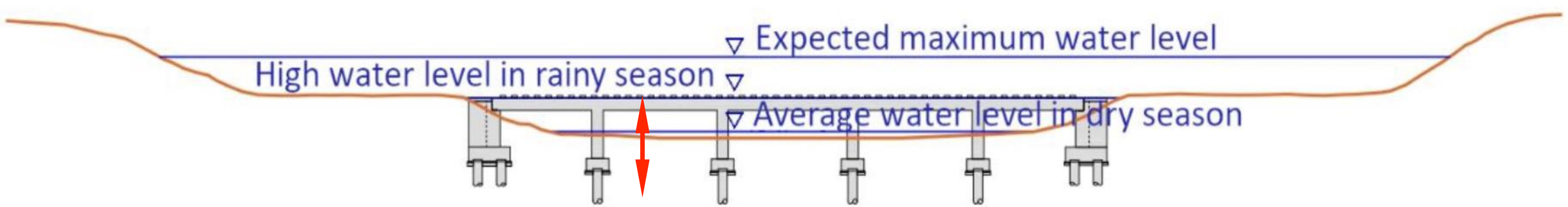
A pedestrian bridge **built by local people** above the high water level is much longer than a submersible bridge built aside.

Height Comparison

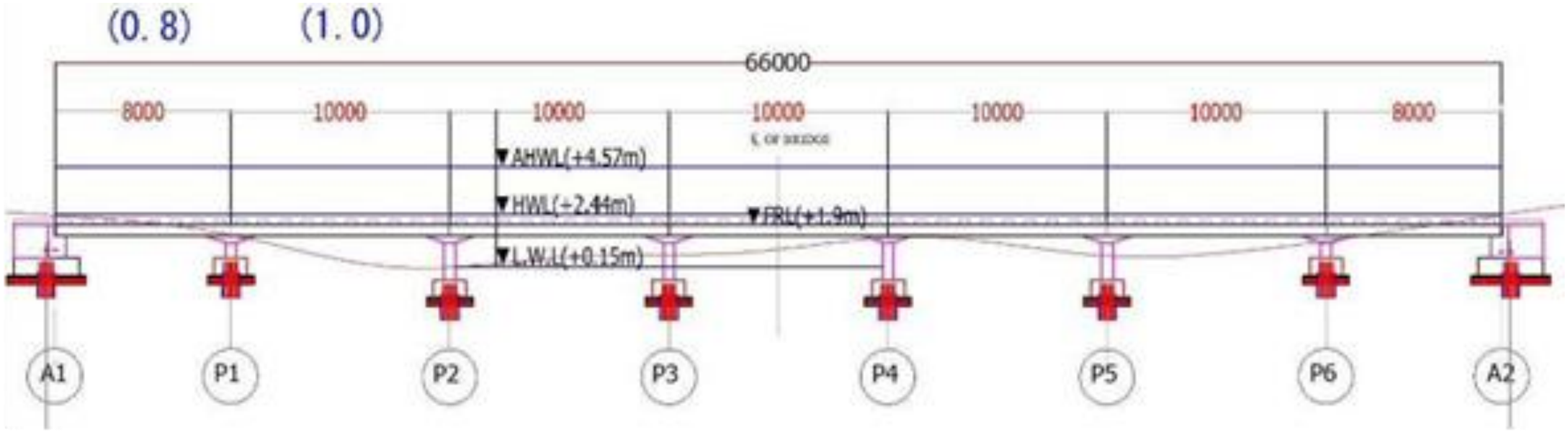
Normal Bridge



Submersible Bridge



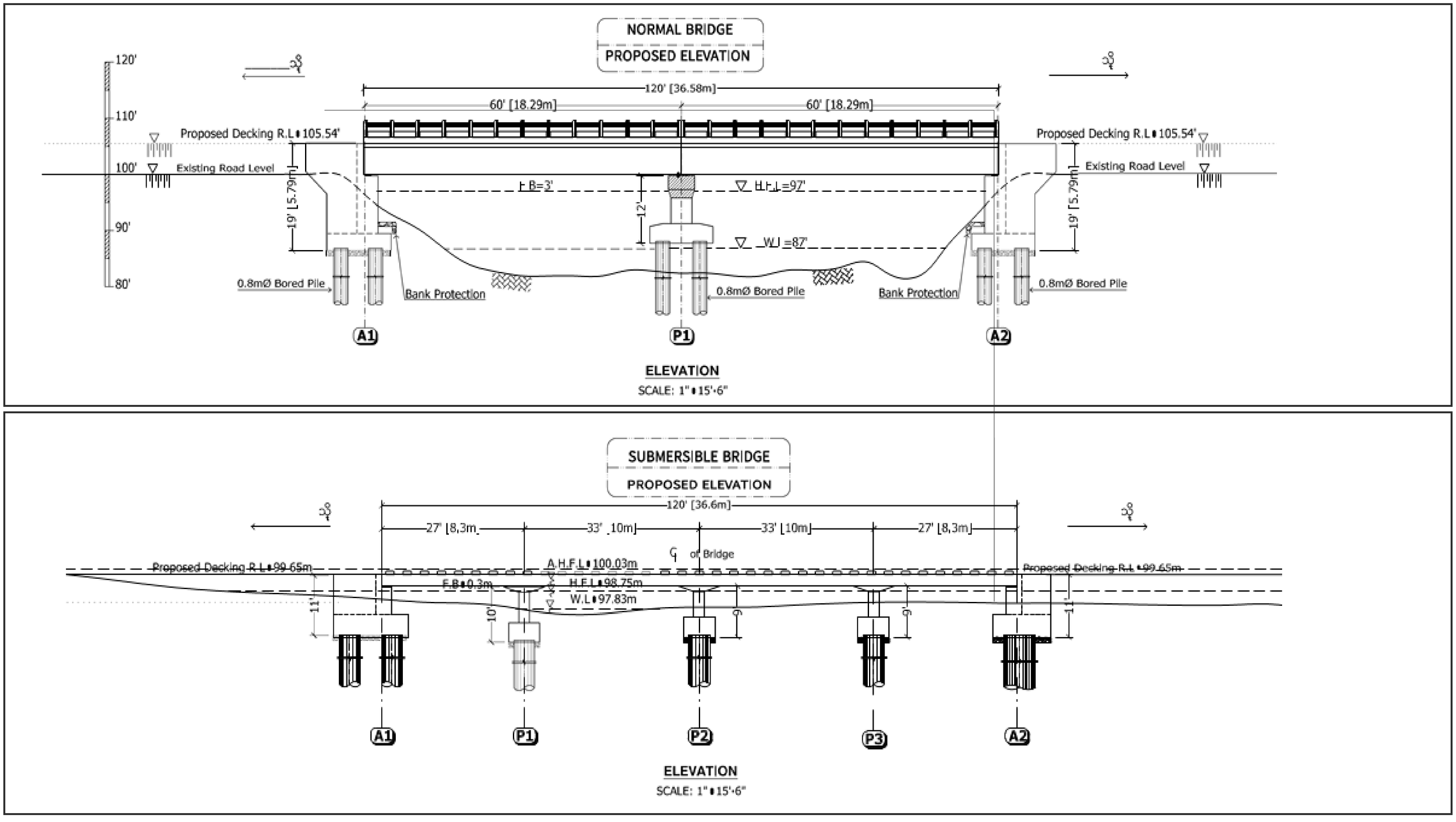
Span Arrangement Example Submersible Bridge



The center span ℓ ′10 Total length()

8	10	8						26
8	10	10	8					36
8	10	10	10	8				46
8	10	10	10	10	8			56
8	10	10	10	10	10	8		66
8	10	10	10	10	10	10	8	76

Comparison of Normal Bridge and Submersible Bridge



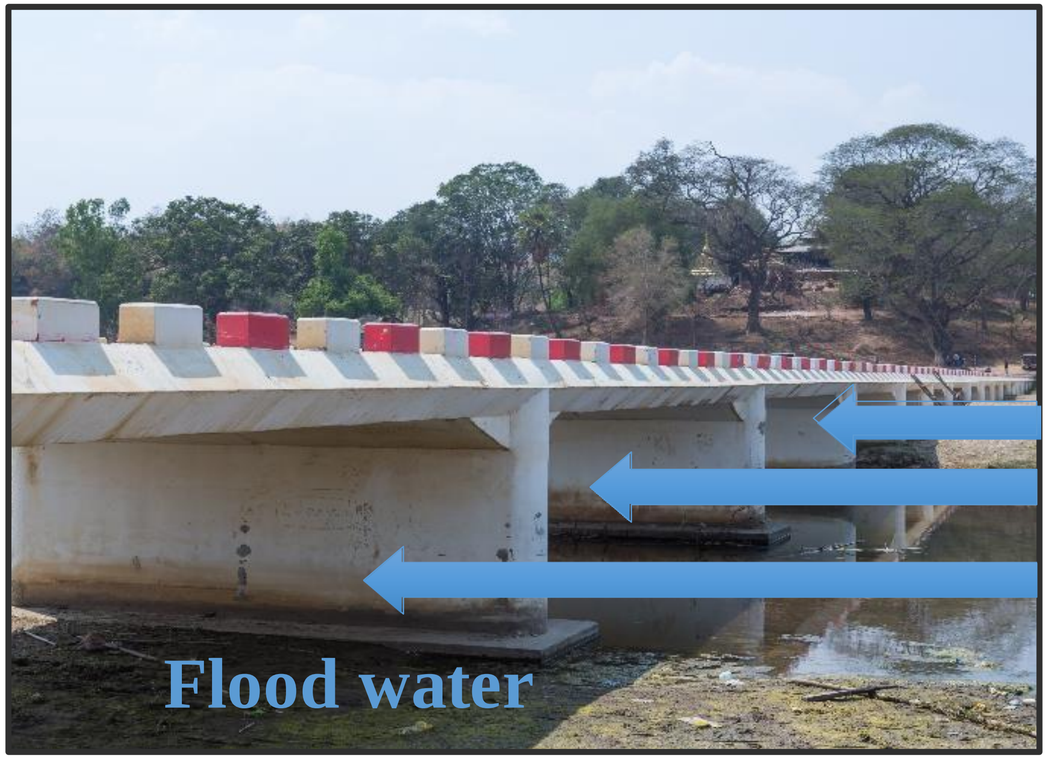
Comparison of Normal Bridge and Submersible Bridge

Sr No	Particular	Comparison of Design and Specifications		Remark
		Normal Bridge	Submersible Bridge	
1	Type of Bridge	Simply Supported	Continuous	
2	Design Loading	HS 20-44 (25 ton)	13 ton	
3	Girder/Slab Base Level	At least A.H.W.L	At least H.W.L	
4	Placement of the pile tip sufficiently in the hard stratum	N value - 40	N value - 30	
5	Nos. of Bored Pile for Pier	At least 4nos	2 nos	
6	Size of Pier Cap	Large (eg- min 12'x20')	Small (eg- min 5'-3"x18'-9")	
7	Type of Pier	Shaft & Cross Beam	Wall Type	
8	Height of Pier	Longer Pier	Shorter Pier	
9	Type of Superstructure			
(a)		Girder & Overlay Slab tk= (eg. 4'-8"+8"=5'-4")	Overlay Slab tk= (eg. 1'-8")	
(b)		Handrail & Deflector	Curb	
10	Project Cost	More Project Cost than Submersible Bridge	Low Cost	
11	Usage of Bridge	Can pass anytime	Can't pass during heavy rain	

Comparison Of Normal Bridge and Submersible Bridge

Normal Bridge

Submersible Bridge



Advantages of Submersible Bridge

- **Low position -> Easy foundation & shorter length**
- **Locally available materials and construction methods**
- **Short construction period (less than half year: in dry season)**
- **Being impassable only few days a year: a few hours a time**
- **Simple design -> Easy maintenance**
- **Simplified structure -> reduced the resistance of flood stream**
- **Decades of life time with easy maintenance**
- **Partial Budget (not totally budget) for long submersible bridge**

Phase(1) for Major Portion and can use with temporary access and remaining portion in later year.

Submersible Bridge Construction

Locally available materials

Cast-in-place piling

Local Contractors using Residence Workers

Submersible Bridge in Action

Dry Season

Rainy Season

Submersible Bridge In the Rainy Season

Tha Khin Bridge

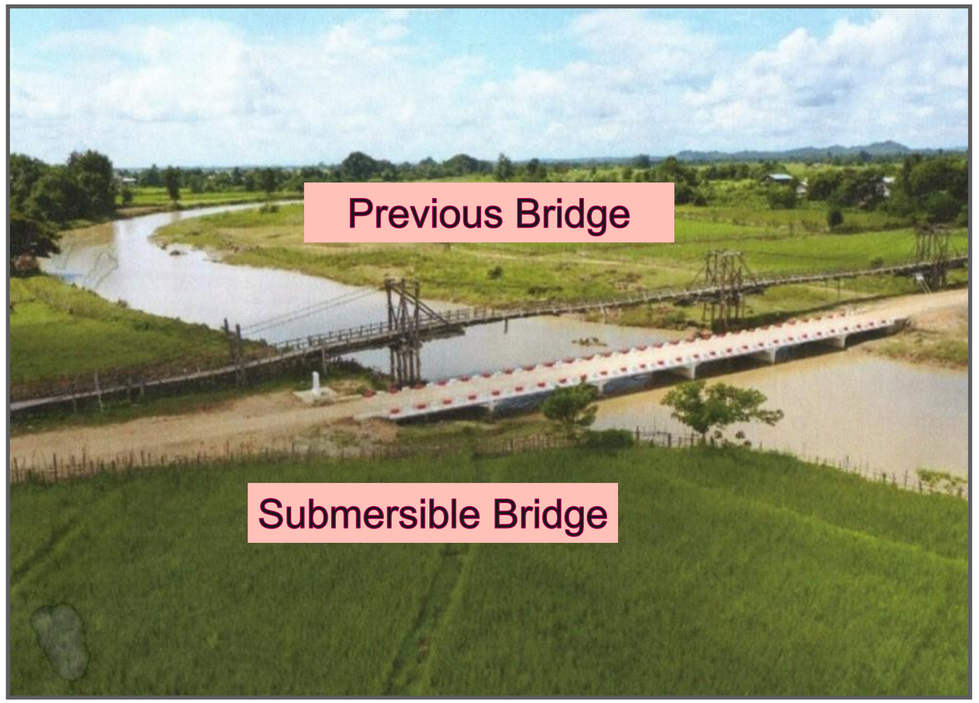
Myitta Bridge

Submersible Bridge In the Rainy Season

In the biggest flood in decades (June 2018, Magway)

The bridges had no damage and drift wood were cleaned by the residents quickly.

Comparison of Old and New Bridge



Man Hae-Hong tone Bridge, Kachin State

Itone Bridge, Bago Region

Comparison of Old and New Bridge

Previous bridge

Submersible bridge

Tha Kin Bridge, Magway Region

Moe Nine Bridge, Karen State

Bridge Opening Ceremony

Enthusiastic welcomes were given by the residents at every ceremony

After Construction

The quality of life in rural areas improved significantly

School Children

Children can go to school **safely and regularly** without worries about falling behind in their studies.

Farmers

Cows and ox carts still used commonly in farming can take advantage of the bridges in rainy season.

After Construction

Hopeful signs of economic development brought by the improved access to cities

Transportation

Residents start using **regular bus services** or buying own cars and bikes to go to cities

Agriculture

Farmers can sell more products at markets timely and gain more **stable income**

Submersible Bridge Constructed by JIP

2020
Lay Tan Bridge
Thit Khauk Bridge
Khone Gyi Bridge

2018
Teza Bridge
Htain Linn Bridge
Thuriya Bridge

2019
Thakin Bridge
Myitta Bridge
Ohn war Bridge
Nga Min Bridge
Yin Bridge

2017
Yoma Bridge

2020
Kyar Inn Bridge

2021
Moe Nine Bridge

- **(14) submersible bridges constructed by JIP, supported by DRRD**
- **Maintenance and management of bridges after construction by DRRD**

Submersible Bridge Constructed by JIP

No	Name	Length	State/Region	Year
1	Yoma	60 m	Bago	2017
2	Teza	83 m	Magway	2018
3	Htain Linn	66 m	Magway	2018
4	Thuriya	66 m	Magway	2018
5	Thakin	178 m	Magway	2019
6	Myitta	76 m	Magway	2019
7	Ohn war	66 m	Magway	2019
8	Nga Min Chaung Kuu	43 m	Magway	2019
9	Yin Chaung	44 m	Magway	2019
10	Lay Tan Chaung Kuu	56 m	Sagaing	2020
11	Thit Khauk Chaung	66 m	Sagaing	2020
12	Khone Gyi Chaung	122 m	Sagaing	2020
13	Kyar Inn Chaung Kuu	56 m	Kayin	2020
14	Moe Nine Chaung Kuu	152 m	Kayin	2021

Pictures of Submersible Bridge(JIP)

Yoma(2017)

Teza(2018)

Htain Linn(2018)

Thuriya(2018)

Pictures of Submersible Bridge(JIP)

Thakin(2019)

Myitta(2019)

Ohn War(2019)

Nga Min Chaung(2019)

Pictures of Submersible Bridge(JIP)

Yin Chaung(2019)

Lay Tan Chaung(2020)

Thit Khauk Chaung(2020)

Khone Gyi Chaung(2020)

Pictures of Submersible Bridge(JIP)

Kyar Inn(2020)

Moe Nine(2020)

Technology Transfer

Technical trainings for local engineers while construction

Workshop

JIP holds multiple times **workshops** for local engineers (construction workers, government officers, students etc.) **near each construction site** during the construction period.

On-site instruction

JIP members give **on-site instructions** at construction sites for students and construction workers responding to their requests.

Submersible Bridges Constructed by DRRD

2019
Than Chake-Myot Hla Bridge
Nga Bat Ae-Nga Hlaing Bridge

2020
Sa-pa-oae Chaung
Saw-Khwin Chaung
Pinn Chaung
Sar Bwaut
Thayet-minhla
Shwe Twin Tu-Mouk Tin
Pyama-Kyuntie
Kyaw Chaung
Pa Dan-Myit Phyar

2021
Pain Nae Pin-NgaThan Gaung
Pani Chaung
Man Chaung
Mwae Chaung

2019
Thit Cho Pin

2021
Nant Thar Chaung
Yamar Chaung
MaGyi Sauk

2019
Naung Hoi

2019
Gyo-A Nout Taw
Latt Pan Chine

2021
Latt Pan Chine
Thin Pone

- **(24) submersible bridges constructed by DRRD**

Submersible Bridges Constructed by DRRD

No	Name	Length	State/Region	Year
1	Than Chake-Myot Hla	56 m	Magway	2019
2	Nga Bat Ai-Nga Hlaing	36.57 m	Magway	2019
3	Sa-pa-oae Chaung	27.43 m	Magway	2020
4	Saw-Khwin Chaung	76.2 m	Magway	2020
5	Pinn Chaung	97.53 m	Magway	2020
6	Sar Bwaut	102.1 m	Magway	2020
7	Thayet-minhla	45.72 m	Magway	2020
8	Shwe Twin Tu-Mouk Tin	76.2 m	Magway	2020
9	Pyama-KyunTie	228.59 m	Magway	2020
10	Kyaw Chaung	91.43 m	Magway	2020
11	Pa Dan-Myit Phyar	274.3 m	Magway	2020
12	Pain Nae Pin-Nga Than Gaung	250 m	Magway	2021

Submersible Bridges Constructed by DRRD

No	Name	Length	State/Region	Year
13	Pani Chaung	182.87 m	Magway	2021
14	Man Chaung	182.87 m	Magway	2021
15	Mwae Chaung	122 m	Magway	2021
16	Thit Cho Pin	26 m	Sagaing	2019
17	Nant Thar Chaung	209.1 m	Sagaing	2021
18	Yamar Chaung	185 m	Sagaing	2021
19	Ma Gyi Sauk	35.96 m	Sagaing	2021
20	Gyo-A Nout Taw	42.67 m	Mandalay	2019
21	Latt Pan Chine	42.67 m	Mandalay	2019
22	Latt Pan Chine	54.86 m	Mandalay	2021
23	Thin Pone	91.43 m	Mandalay	2021
24	Naung Hoi	32 m	East Shan	2019

Pictures of Submersible Bridge(DRRD)

Than Chake-Myot Hla(2019)

Nga Bat Ai-Nga Hlaing(2019)

Thit-Cho-Pin(2019)

Gyo-A Nout Taw(2019)

Pictures of Submersible Bridge(DRRD)

Let-pan-chine No(1)(2019)

Sa-pa-Oae Chaung(2020)

Naung-hoi(2019)

Saw Khwin(2020)

Pictures of Submersible Bridge(DRRD)

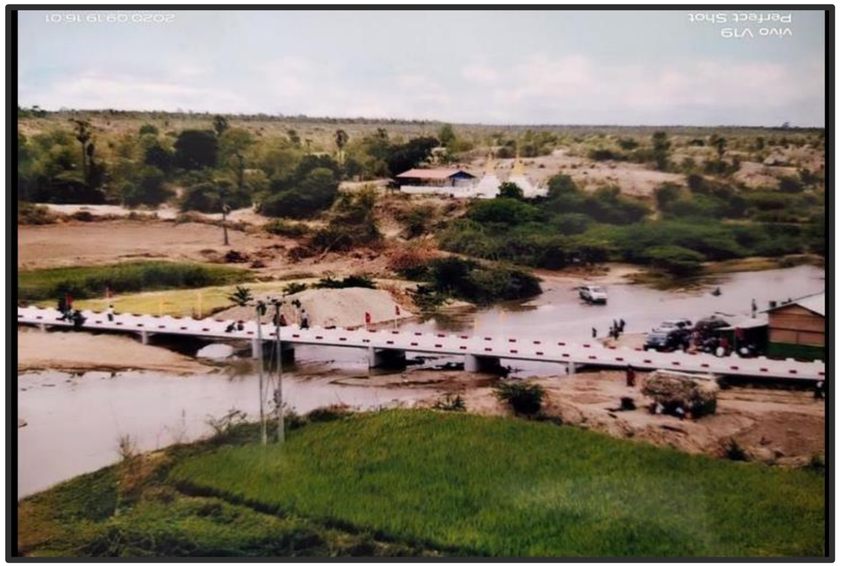
Sar Bwaut(2020)

Thayet-Minhla(2020)

Shwe Twin Tu-Mouk Tin(2020)

Pya ma-Kyun Tine(2020)

Pictures of Submersible Bridge(DRRD)



Pin Chaung(2020)

Let-pan-chine No(2)(2021)

Pain Nae Pin-Nga Than Gaung (2021)

Thin Pone(2021)

Submersible Bridge Under Construction in 2021(DRRD)

Kyaw Chaung Bridge

Nant Thar Chaung Bridge

Yamar Chaung Bridge

Mann Chaunge Bridge


Road Engineering Association of Asia and Australasia
CONSTRUCTION OF SUBMERSIBLE BRIDGES IN RURAL AREAS IN MYANMAR
2ND MINO BEST PROJECT AWARD
(Category II-Community Road)
NPO JAPAN INFRASTRUCTURE PARTNERS

Road Engineering Association of Asia and Australasia

2nd MINO BEST PROJECT AWARD

Is Awarded to the

SUBMERSIBLE BRIDGES IN RURAL AREAS IN MYANMAR

As one of the Outstanding COMMUNITY ROAD PROJECTS constructed in the Asian and Australasia Region.

16th REAAA Conference

Theme: "Shaping the Future of Road Engineering with Advanced Technologies“

13 – 15 September 2021

Manila, Philippines

ROMEO S. MOMO

REAAA President

2nd MINO BEST PROJECT AWARD NOMINEES
CATEGORY II (COMMUNITY ROAD)

No.	Project Name	Country	Organization
1.	Construction of submersible bridges in rural areas in Myanmar	Japan	Department of Rural Road Development, Ministry of Construction, Myanmar NPO Japan Infrastructure Partners (JIP)
2.	Anduyan Bridge	Philippines	Department of Public Works and Highways
3.	Pulilan-Baliuag Diversion Road	Philippines	Department of Public Works and Highways
4.	National Highway 2275 Huay Rai-Ban Klang Rehabilitation Project	Thailand	Department of Highways, Ministry of Transport, Bangkok, Thailand
5.	New bridge on Nenggiri River, Pulau Setelu Village	Malaysia	JKR LEMBAGA KEMAJUAN KELANTAN SELATAN (KESEDAR)

Evalution Criteria of REAAA

Category ll (Community Road)

a. Social effectiveness and impact

- Economic benefit to the community compared to the cost of the project-stimulation of economic growth, lifestyle, amenity, etc. at the local level
- Impact on traffic flow-improved traffic flow, reduced congestion, delays,
- Impact on road safety- reduced road trauma (fatalities, injuries, etc.).

b. Technical Excellence

- Innovation in design, construction, materials quality, including the use of local, non-standard, materials, etc.
- Problem solution
- Cost-effectiveness

c. Environmental Friendliness/ Awareness

- Environmental impact during and after construction
- Reduced greenhouse gas emissions, etc.

Conclusion

Advantages

- Lower Cost and Shorter Construction Period
- Locally Available Technology and Human Resources
- More Bridges in Rural Area with the Same Budget

Impacts

- Poverty Alienation and Inequalities Reduction
- Development of Socio-Economic Life in Rural Area
- Contribution to National GDP

DRRD

- More Submersible Bridges in Rural Areas
- Regular monitoring and Evaluation
- Applying Lesson-learnt for Better Submersible Bridges

နိဂုံးချုပ်ဆော်

- Capital Budget Constraints and State/Regional Budget Constraints
- Welcoming Contributions for More Submersible Bridges in Rural Areas
- From Today Attendees to Donate One in Your Own Rural Area

Thank you for your kind attention

Yin Yin Swe
Deputy Director General
Department of Rural Road Development
+9595031537
yinyinswe.drrd@gmail.com