OVM 欧维姆

OVM250/OVMAT Multi-Strand Stay Cable Systems

Liuzhou OVM Machinery Co., Ltd.

CONTENTS

CONTENTS

01 Development Path

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1993

OVM multi-strand stay cable was developed and applied on Liuzhou Huxi Bridge.

Liuzhou Huxi Bridge

1998

Shantou Queshi Bridge

OVM250 multi-strand stay cable system was successfully developed and applied on Queshi Bridge.

2002

OVM250 cable is used for the buckle cable during the bridge arch assembling. The replaceability of the cable was verified.

Shanghai Lupu Bridge

01 Development Path

2003

The first multi-strand cable stayed bridge constructed with guyed FT method. The safety and reliability of OVM250 system used in low stress (less than 10% GUTS) has been verified.

Jinshajiang bridge, Yibing Zhongba

2006

Ailan Bridge, Taiwan

First verified by USA and Swiss labs in accordance with international criterion, and first applied to Taiwan cable-stayed bridge engineering.

2008

OVM250 multi-strand cable system entering Iran Market for the first time.

Laly Bridge, Iran

01 Development Path

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2011

Large size stay cable (OVM250-139) passed the fatigue test with high stress amplitude 250MPa, which is the cable fatigue test with the highest stress amplitude of the oversized cable in the world.

Tongling Yangtze River Bridge

2012

New Fengping Bridge, Taiwan Hualian

OVM250 multi-strand cable has withstood the earthquake occurred in Feb 2018

2013

The 8th multi-strand cable-stayed bridge in Korea

The 4th Kum Kang Bridge, Korea

01 Development Path

OVM250 successfully applied to:

- The world's largest span steel truss cable-stayed bridge - Guizhou Yachi River Bridge
- The world's tallest bridge - Bidu Expressway Beipanjiang Bridge
- The largest bridge in East Africa - Kigamboni Bridge, Tanzania

Fire protection, blast protection and anti-vandalism increased to OVM250 multi-strand cable system according to the requirement specified in Rod El Farag bridge specification.

2016

2017

Yachi River Bridge, Guizhou

Bidu Expressway Beipanjiang Bridge

Kigamboni Bridge, Tanzania

Rod El-Farag Bridge, Egypt

01 Development Path

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2001

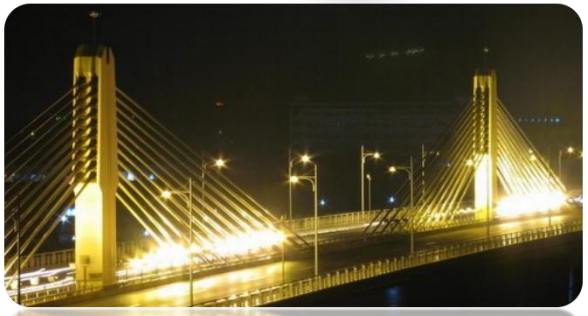
The first extra-dosed bridge of China. The first generation extra-dosed stay cable developed by OVM applied on this bridge.

Lanzhou Xiaoxihu Bridge, Gansu

2003

The pier height of this bridge is 150.7 meters. It is the highest in Asia.

2008



Zhangzhou War Preparation Bridge, Fujian

The saddle of individual steel tubes applied on this bridge.

Xianshenhe Bridge, Jincheng,Shanxi

01 Development Path

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2011

The individual replaceable anti-slipping technology is applied to this bridge for the first time

Fenhe Bridge, Shanxi

2013

The sixth generation saddle with one-side two-way anti-slipping device first applied on this bridge.

Xiaobantian Bridge, Taiwan

2015

The sixth generation saddle with one-side two-way anti-slipping device applied on this bridge. The cable of 99 strands is the biggest cable has ever been used.

Chaoyang Bridge, Nanchang, Jiangxi

01 Development Path

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2016

Henan Shangdeng South-to-North water diversion bridge, the main span is 265m.

South-to-North
Water Diversion Bridge

2018

Fudiankou Bridge,
Wuzhou, Guangxi

Fudiankou Bridge, the main span is 270m.

2018

The under construction project of Wulongjiang Bridge is the largest Extra-dosed cable stayed bridge in china with a main span of 288m.

Wulongjiang Bridge,
Fuzhou,Fujian

01 Development Path

CONTENTS

02 Project Application

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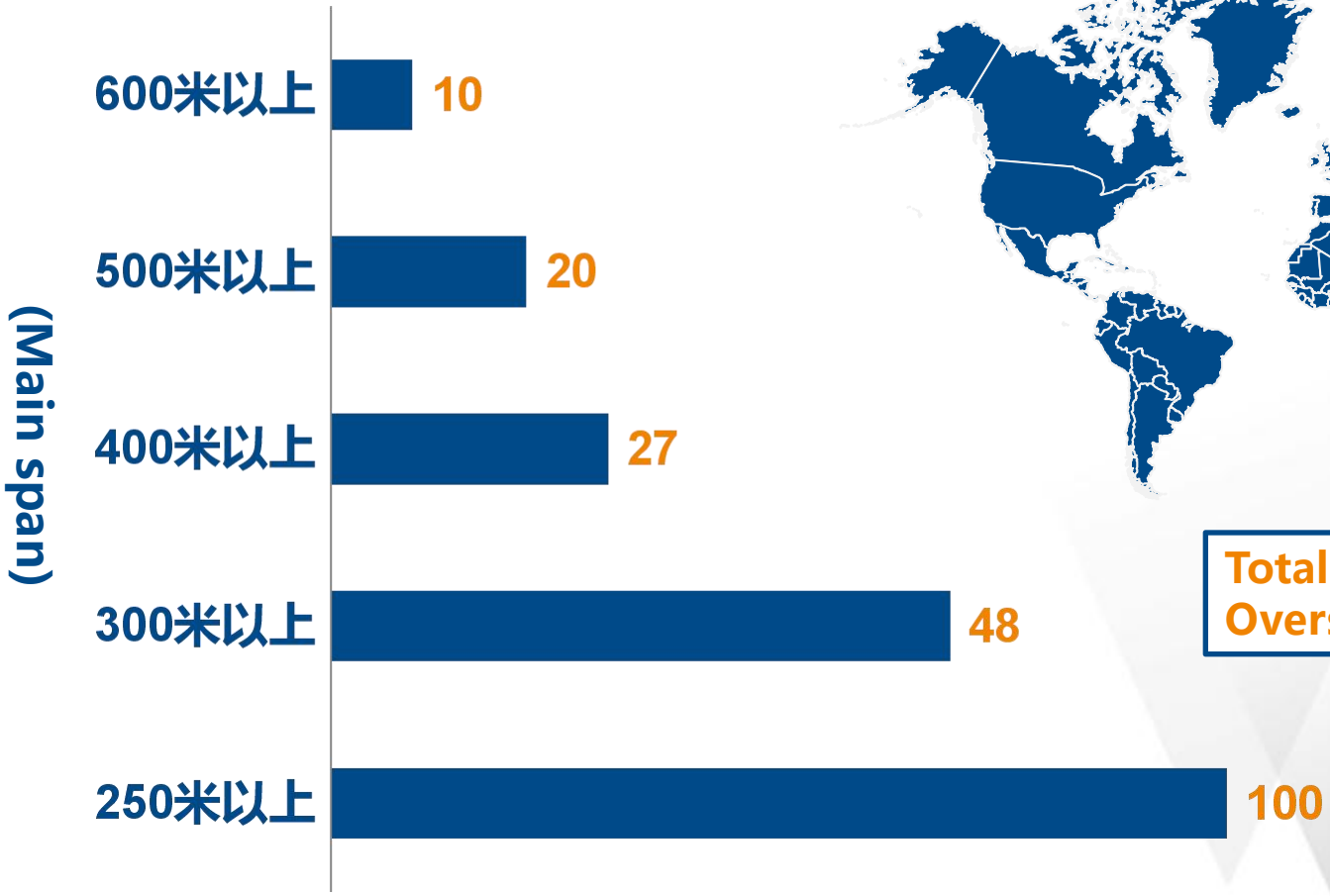
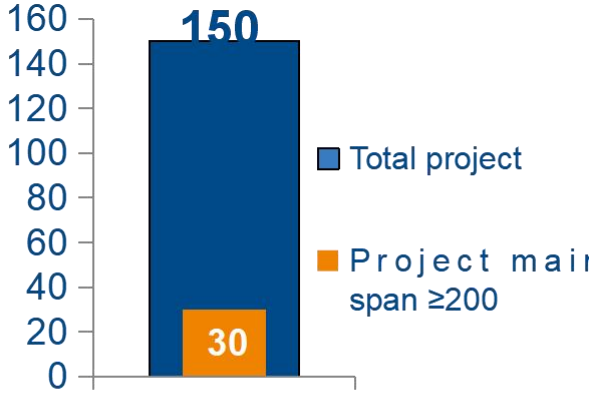
OVM Cable-Stayed Bridges - Multi-strand & PWS (1997~2019)



Total: 250 Bridges
Overseas: 36 Bridges

02 Project Application

From 2001 to 2019, OVM have been successfully applied cable for 150 extra-dosed bridges all over the world, among them, 25 are overseas projects, which are distributed in Korea, India, Colombia, Bangladesh, Taiwan and other countries and regions . There are 30 projects with main span more than 200m (including 200m).



Extrados...

02 Project Application

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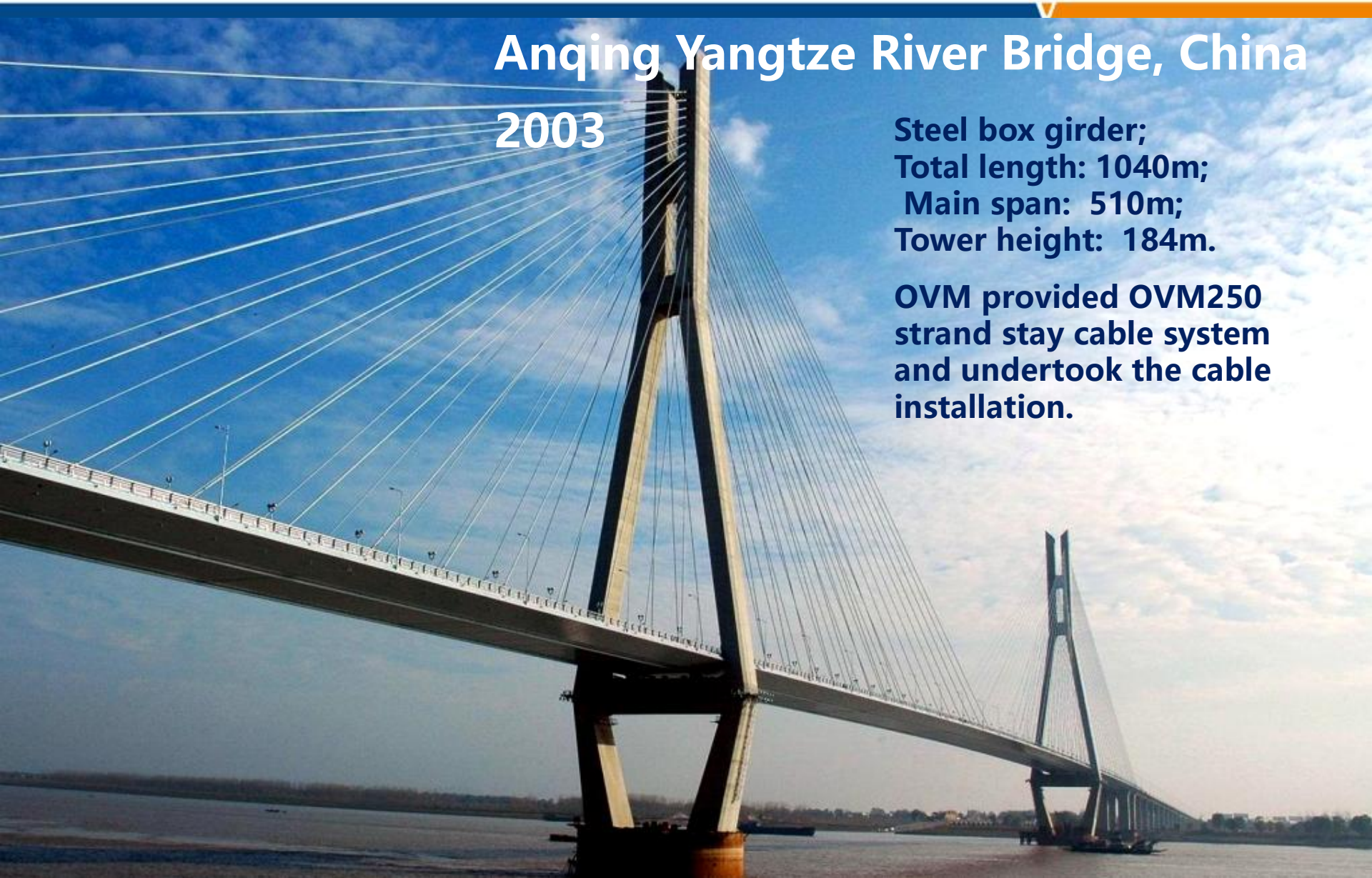
Shantou Queshi Bridge

1999

Main span 518m, total 160 cables. OVM provided OVM250 strand stay cable system and undertook the cable installation.

02 Project Application



Anqing Yangtze River Bridge, China

2003

Steel box girder;
Total length: 1040m;
Main span: 510m;
Tower height: 184m.

OVM provided OVM250 strand stay cable system and undertook the cable installation.

02 Project Application

OVM 欧维姆

Tonling Highway-railway Bridge over Yangtze River, China

2015

The total length of the main bridge is 1920m. It is a double-tower, five-span steel truss girder cable-stayed bridge with a main span of 630m. The stay cable is arranged in a fan-shaped three cable plane, and there are 228 stay cables.

02 Project Application

Yachihe Bridge, China

2017

The total length of the main bridge is 1466.5m, the main span is 800m. It is the world´s largest span steel truss cable-stayed bridge. 192 cables of 2300 ton strands, the installation period was only 6 month。

02 Project Application

Beipanjiang Bridge, China

2017

02 Project Application

Nanxi Bridge Over Yangtze River, China

2019

02 Project Application

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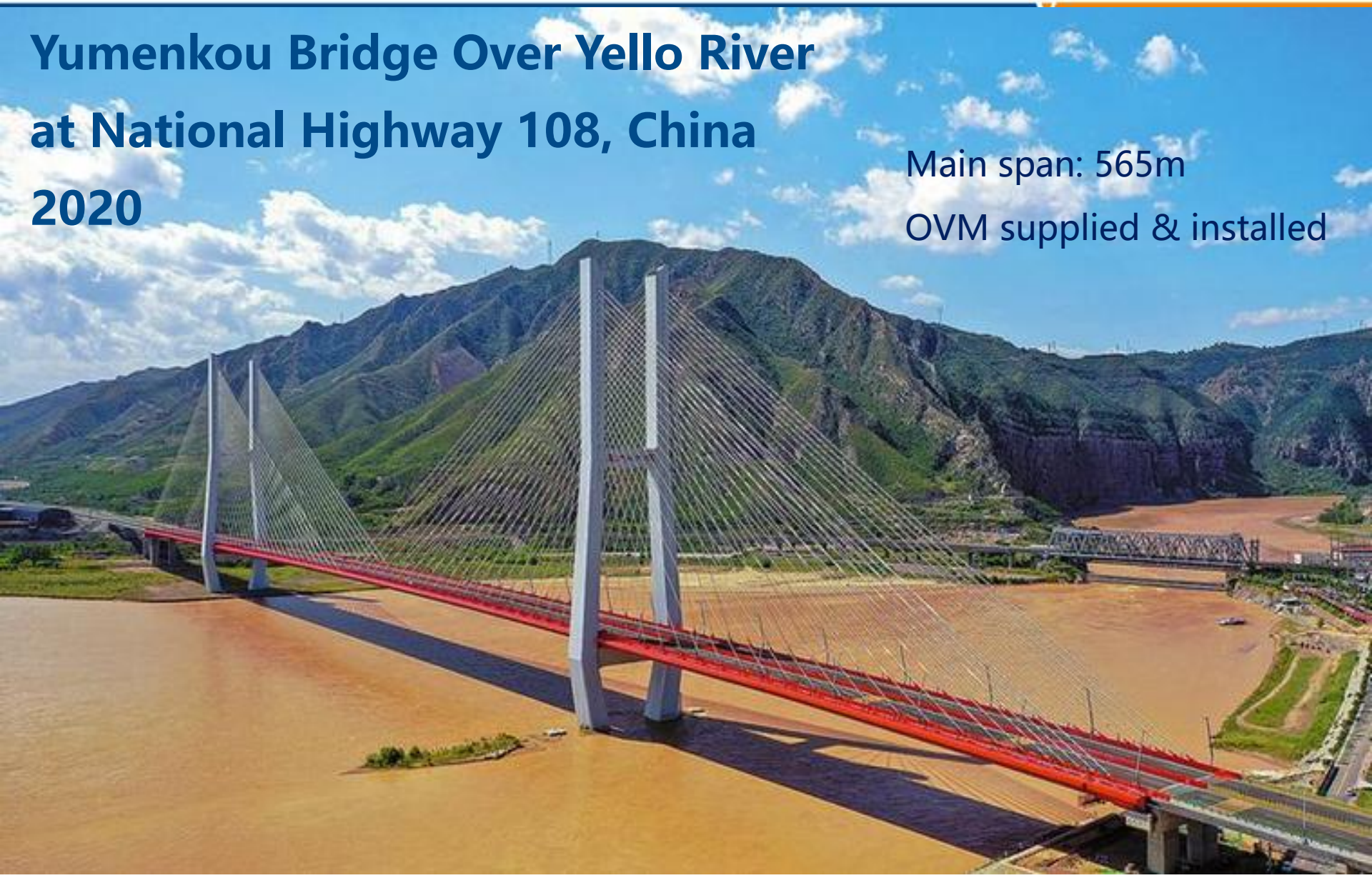
Yumenkou Bridge Over Yello River at National Highway 108, China 2020

Main span: 565m

OVM supplied & installed



02 Project Application

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The largest bridge in East Africa;
Main span:200m;
The largest cable has 160 strands.

Kigamboni Bridge,
Tanzania
2013

02 Project Application

Rod El Farag Bridge, Egypt

2019

The bridge is located in Cairo, Egypt, across the Nile River, with a main span of 304m. The bridge has a total of 160 stay cables and uses the OVM250 strand cable system. The shearing type high damping rubber damper is used for cables over 80 meters. Fire protection, blast protection and anti-vandalism measures are applied to the stay cables.

02 Project Application

Ahwaz 8th Bridge,

Iran

2012

Main span: 212m
OVM supplied OVM250 stay cable systems, tension equipment and construction service.

02 Project Application

Legoland Bridge, Korea
2018

Main span:200m，
Total 53 cables，48 stay cables，5 horizontal cables.
High damping rubber damper applied to the cables over 80m

02 Project Application

Zuari Bridge, India
2020~

A double-tower double cable-stayed steel truss cable-stayed bridge.

The largest cable-stayed bridge under construction in India.

Main span: 360m

Total of 224 cables.

02 Project Application

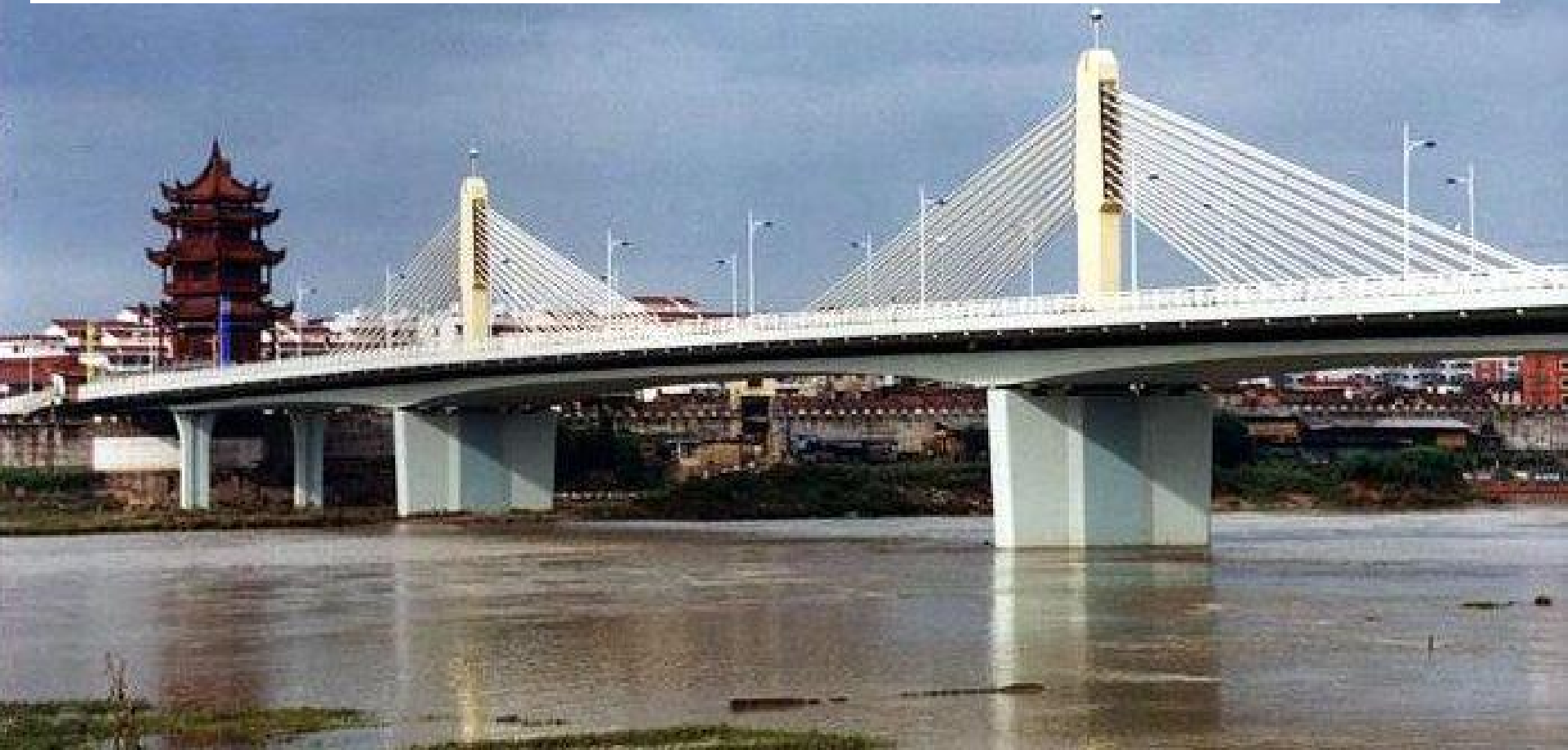
Sei Alalak Bridge, Indonesia 2021

Main span 85m.
OVM supplied 24 sets stay cables

02 Project Application

ZHANGZHOU WAR PREPARATION BRIDGE, CHINA, 2001

- First extra-dosed bridge of China
- Span: 81+132+81m
- OVM Supplied the stay cable system and undertook the cable installation



02 Project Application

Lanzhou Xiaoxihu Bridge, Gansu, 2003

- Span: 81+136 m+81
- OVM Supplied the stay cable system and undertook the cable installation. OVM patented Individual steel tubes saddle first used in this bridge

Canon EOS 40D [EF-S17-85mm f/4-5.6 IS USM] F10.0 2.5s ISO200

02 Project Application

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Xianshenhe Bridge, Jincheng, Shanxi, 2008

- Span: 123+123
- Pier height: 150.7m, the highest in Asia.
- OVM Supplied the stay cable system and undertook the cable installation.

02 Project Application

Chaoyang Bridge, Jiangxi, Nanchang, 2015

- Span: 79+5x150+79
- OVMAT-99 stay cable is the biggest cable has ever been used in China.
- OVM Supplied the stay cable system and undertook the cable installation.

02 Project Application

Gandel Yellow River Bridge, Inner Mongolia, 2017

- Span: 80+5x120+80
- The first suspended cantilevered large-armed winged extra-dosed bridge in China.
- OVM Supplied the stay cable system and undertook the cable installation.

02 Project Application

TAIWAN XIAO BANTIAN BRIDGE, CHINA, 2013

- Span: 90+180+90
- The replaceable one-side two-way anti-slipping device first applied to this bridge
- OVM Supplied the stay cable system and provided the cable installation technical service.

02 Project Application

Foshan West Station Bridge, Guangdong, 2015

- Span: 96+176+96
- Strand replacing test was successfully carried out on the bridge.
- OVM Supplied the stay cable system and undertook the cable installation.

02 Project Application

Wangjiahe Grand Bridge, Shaanxi, 2021

- Span: 125m+4x230m+125m, tallest pier 188.5m
- OVM250AT-43/55
- OVM supplied 150 sets stay cable system and undertook the cable installation.

02 Project Application

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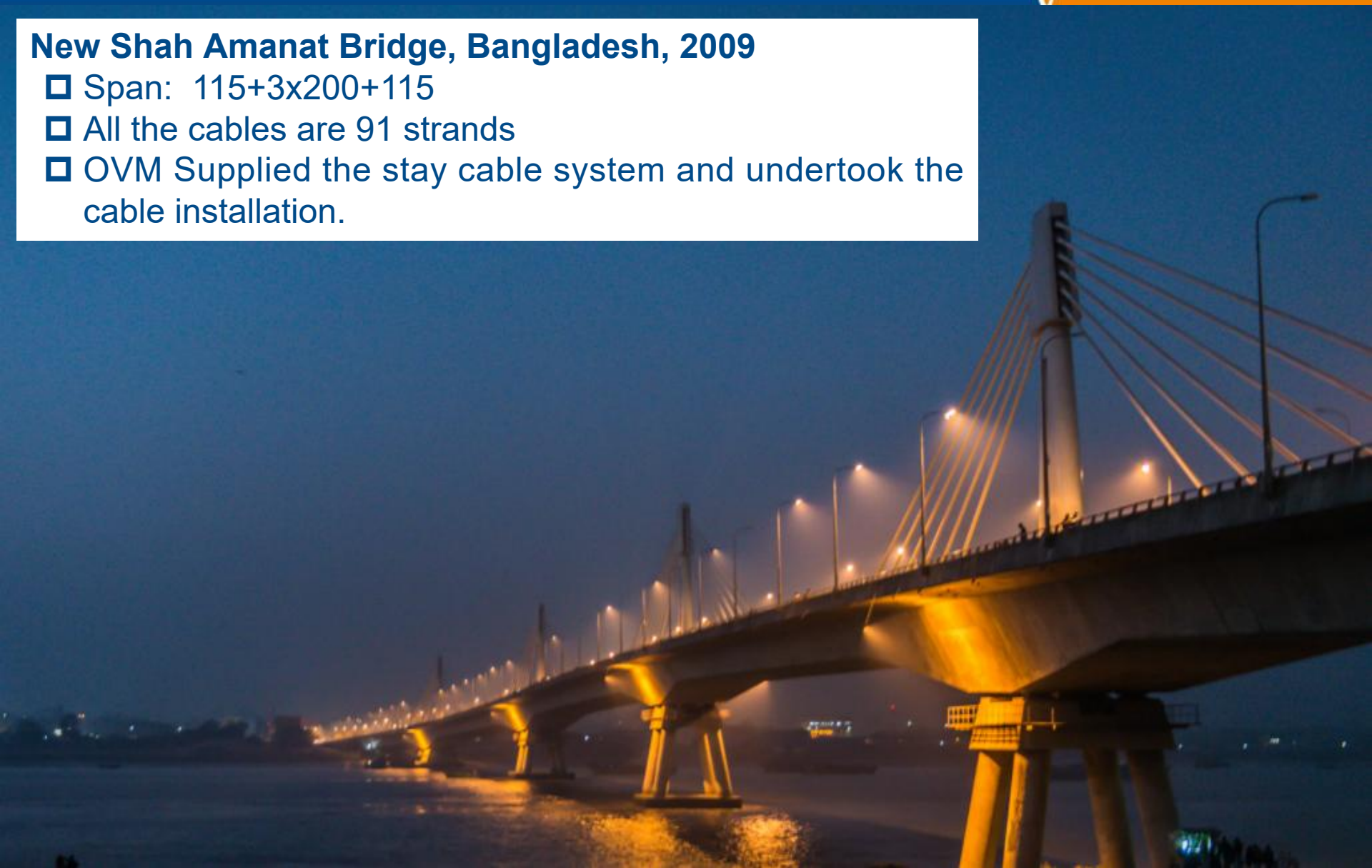
Kum-kang 1st Bridge ,Korea, 2010

- Span: 100+3x180+100
- OVM Supplied the stay cable system and provided the cable installation technical service.

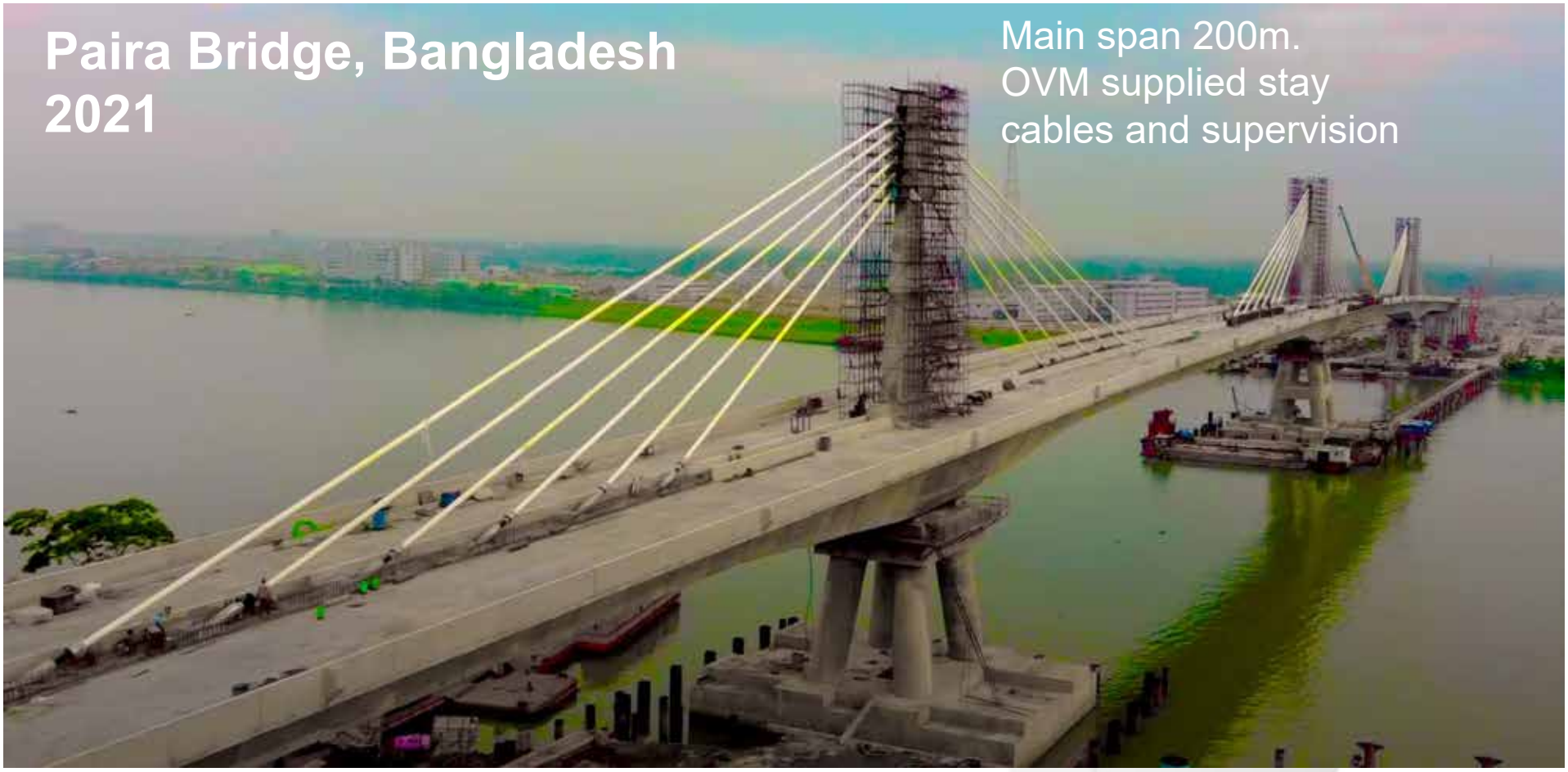
02 Project Application

New Shah Amanat Bridge, Bangladesh, 2009

- Span: 115+3x200+115
- All the cables are 91 strands
- OVM Supplied the stay cable system and undertook the cable installation.



02 Project Application



02 Project Application

02 Project Application

OVM 欧维姆

02 Project Application

02 Project Application

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The statistics of the cable stayed bridges with the main span more than 500m that OVM250 multi-strand stay cable system were / are to be used.

No.	Project	Main span	World ranking	Cable size	Finishing time
1	Wuhu second Bridge, Anhui	806m	**2**	OVM250-22~43	2017
2	Yachihe Bridge, Guizhou	800m	**4**	OVM250-43~85	2016
3	Beipanjiang Bridge, Guizhou	720m	**6**	OVM250-22~43	2016
4	Tongling Yangtze River Bridge	630m	**10**	OVM250-61~127	2015
5	Liupanhe Bridge, Guizhou	580m		OVM250-27~73	2017
6	Nanxi Yangtze River Bridge	572m		OVM250-43~85	在建
7	Yumenkou Yellow River Bridge	565m		OVM250-37~91	在建
8	Shanghai Lupu Bridge	550m		OVM250-7~55	2002
9	Shantou Queshi Bridge	518m		OVM250-19~43	2000
10	Anqing Yangtze River Bridge	510m		OVM250-22~55	2004
11	Hongshuihe Bridge, Guizhou	508m		OVM250-27~73	2017

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CONTENTS

03 OVM Capabilities

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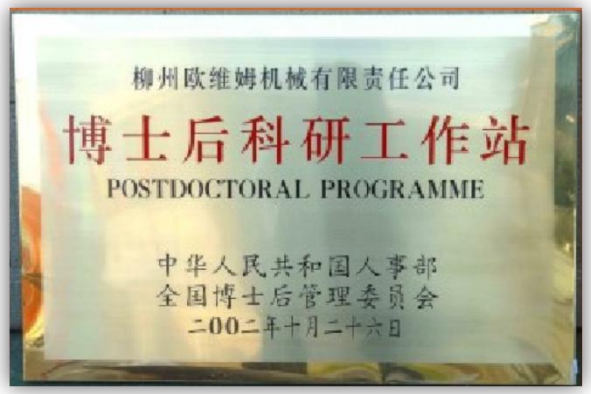
R&D Capabilities

Technology Innovation Platform

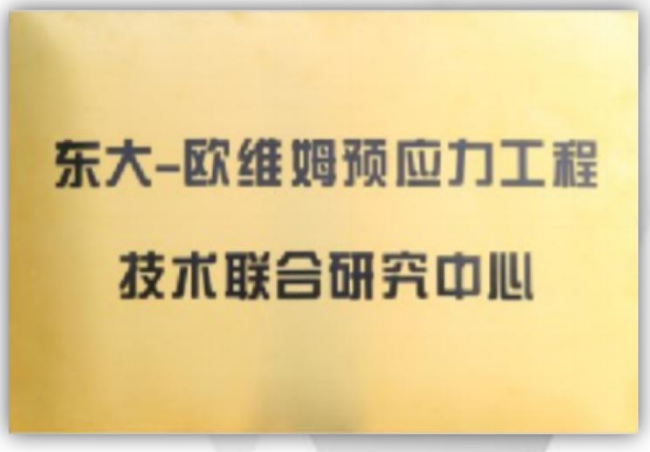
Academician Workstation



Postdoctoral Research Station

Nationally Recognized Technology Center

Tongji University - OVM Prestressing Research Center



Dongnan University - OVM Prestressing Research Center

03 OVM Capabilities

R&D Capabilities

Test center

- OVM test center has CMA and CNAS certified Qualification. We have more than 400 sets of various equipments and can carry out impartial testing services. It is the most professional and most complete laboratory in prestressing field of China.

03 OVM Capabilities

Production capacity

Four production bases of OVM

The company occupies a total area of 461,254m², Production area of 198,000m²

03 OVM Capabilities

Quality Assurance System

ISO9000 Quality Certificate

BSI Quality Certificate

CNAS Laboratory Certificate

Environmental management System Certificate

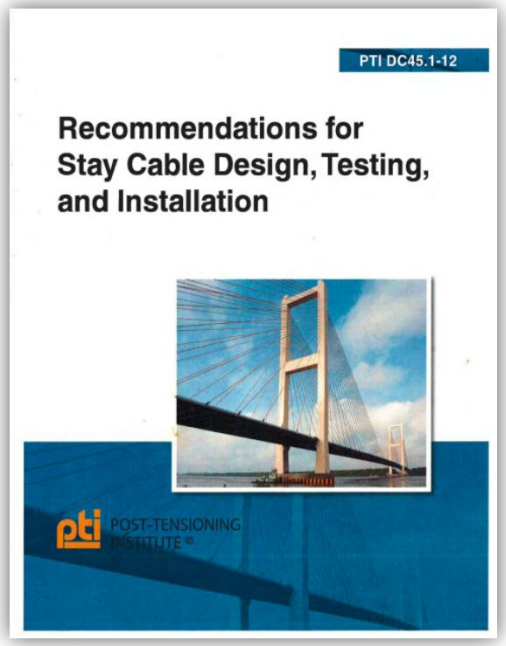
Occupational Health management System Certificate

CONTENTS

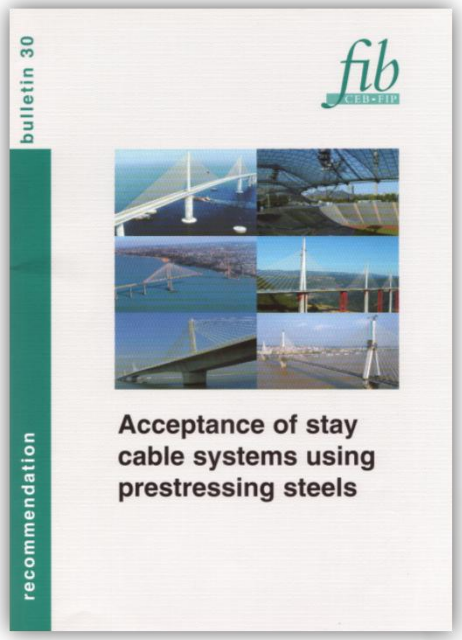
04 System Introduction

4.1 OVM250 Multi-Strand Cable System

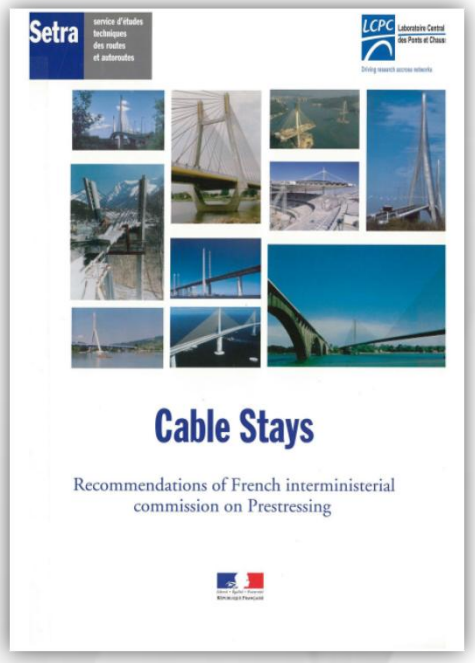
Design basis of OVM250 stay cable system



PTI



fib



CIP

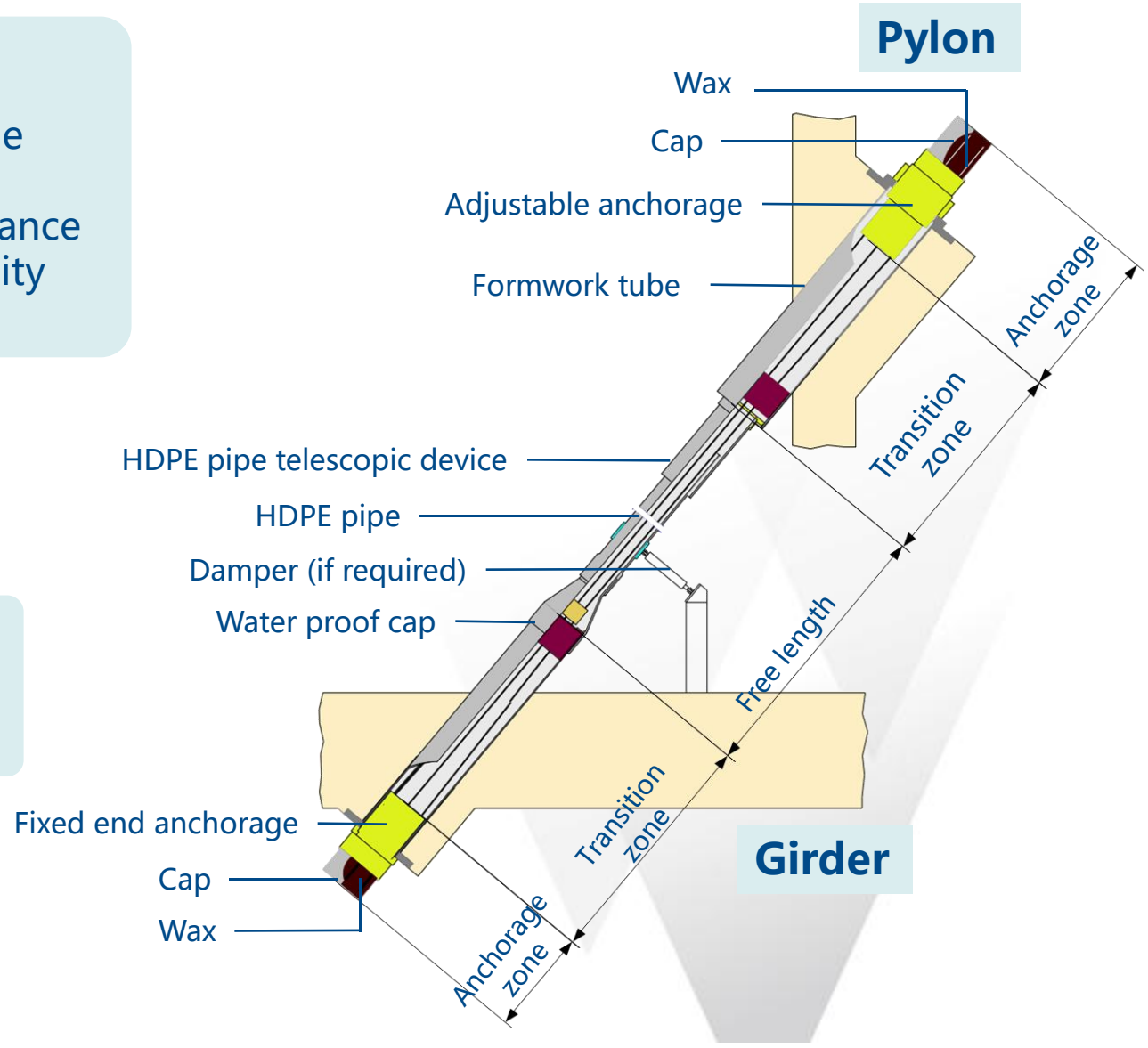
04 System Introduction

4.1 OVM250 Multi-Strand Cable System

Characteristics

- Excellent static and fatigue performance
- Excellent sealing performance
- Reliable corrosion durability
- Good wind resistance

- **Anchorage zone:** Anchorage, cap, corrosion material
- **Transition zone:** damper, waterproof cap, PE pipe telescopic device
- **Free length:** PE-sheathed strands, HDPE pipe



04 System Introduction

4.1 OVM250 Multi-Strand Cable System

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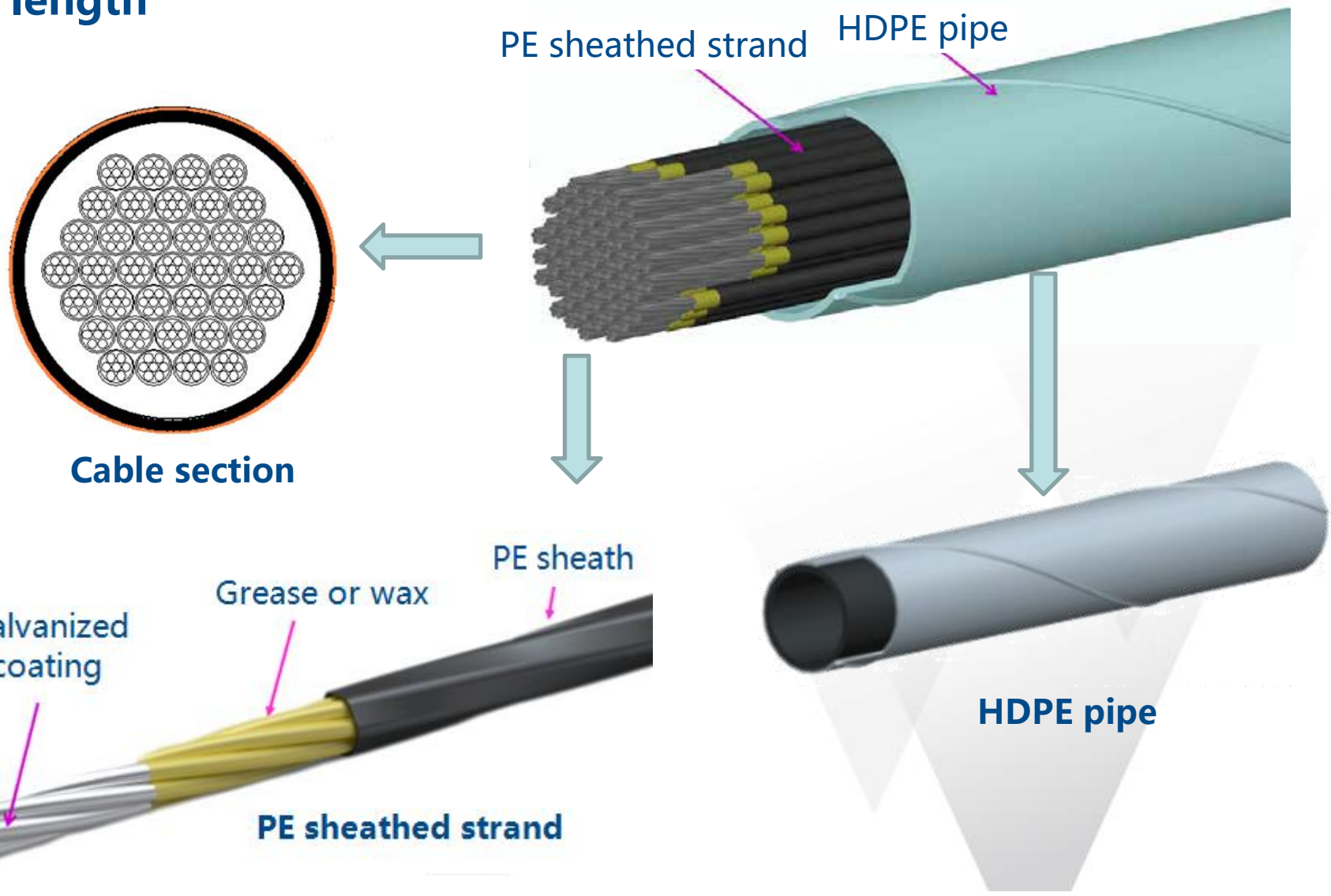
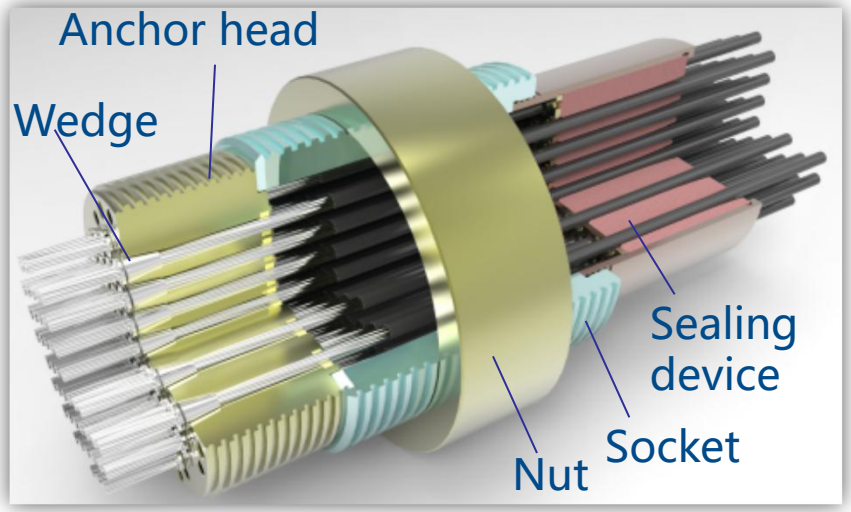
Free length



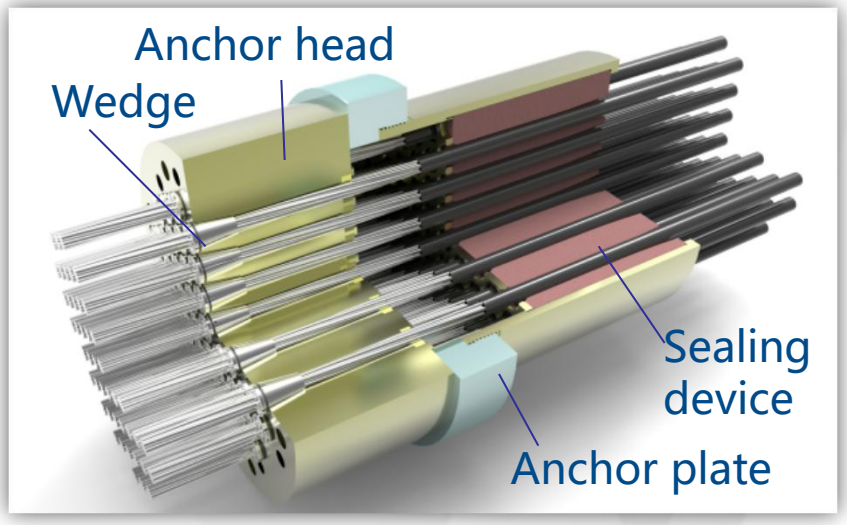
04 System Introduction

4.1 OVM250 Multi-Strand Cable System

OVM250 multi-strand cable anchorage



Adjustable anchorage



Fixed-end anchorage

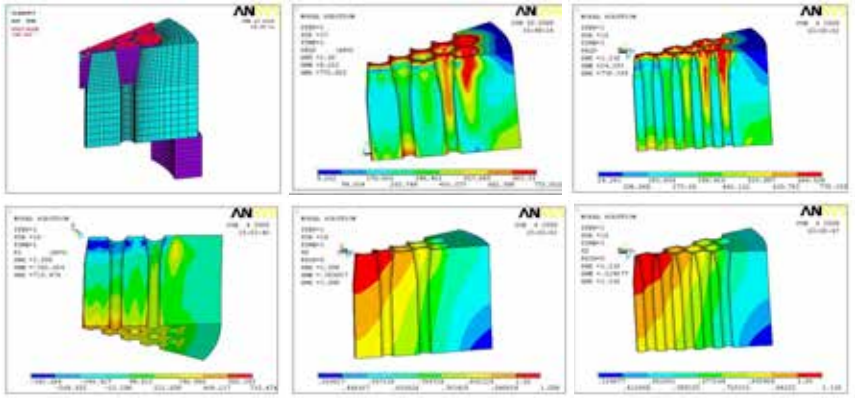
04 System Introduction

4.1 OVM250 Multi-Strand Cable System

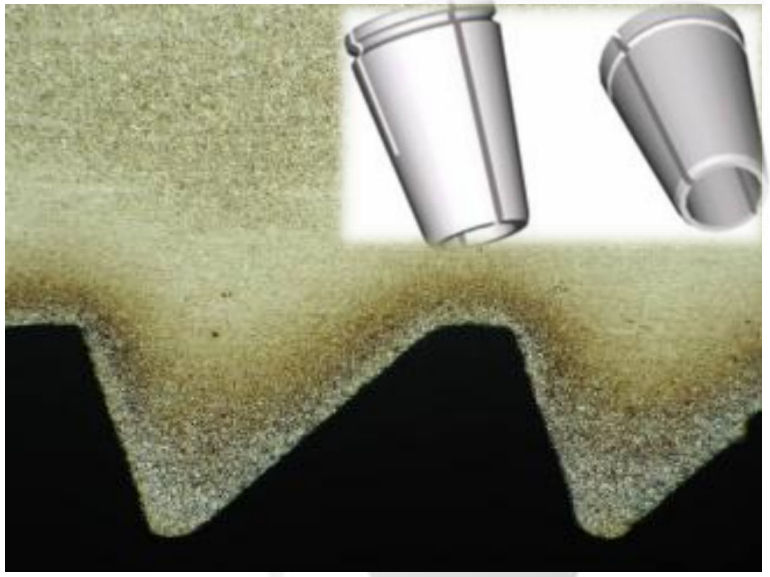
(1) Static and fatigue performance

The following measures ensure the high performance of anchorage

- Anchorage designed by reliability method and finite element analysis.
- Carburization applied to ensure the requirement for wedge of both hardness of teeth and toughness inside.
- The wedge can resist 300MPa stress amplitude at upper stress of 45% ultimate strength for 2 million cycles.



Finite element analysis



Carburized layer of the wedge teeth

04 System Introduction

4.1 OVMAT Multi-Strand Cable System

Structure of OVMAT Stay Cable system

Anchorage zone：anchorage, cap, anti-corrosion material

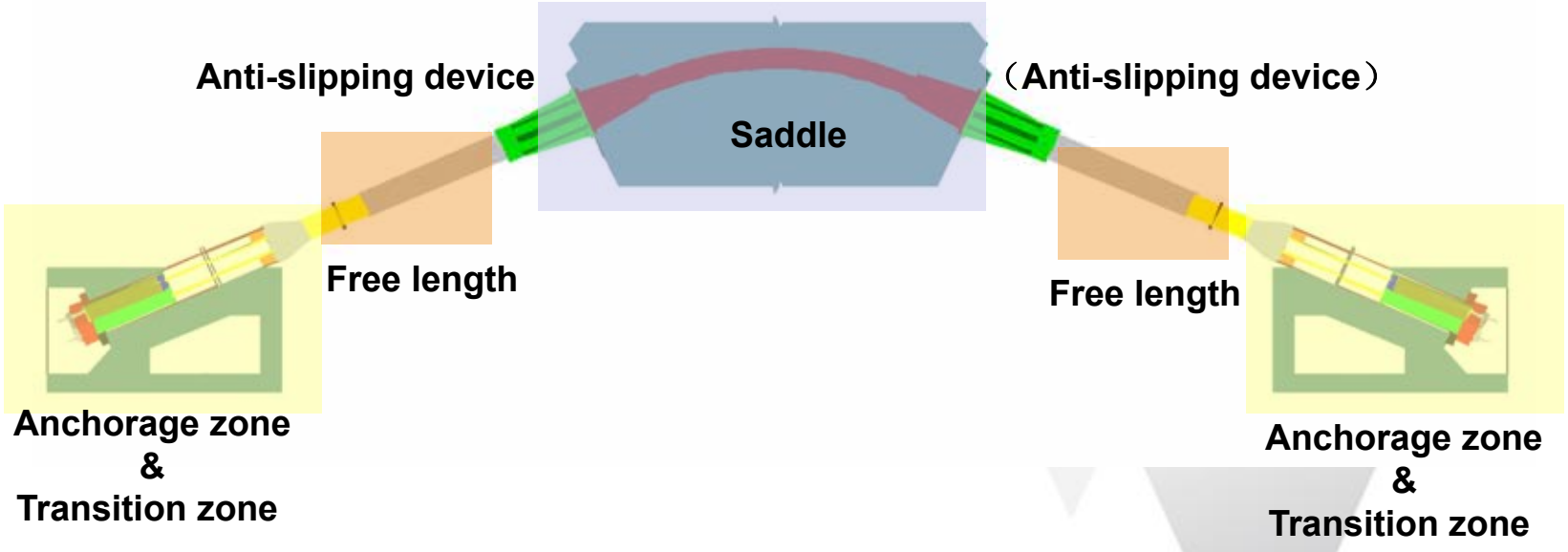
Transition Zone：

at girder end: waterproof cap, damper (or deviator), collar, etc.

at pylon end: anti-slipping device, telescopic device for HDPE pipe

Free length：HDPE pipe, PE sheathed strand (galvanized and waxed)

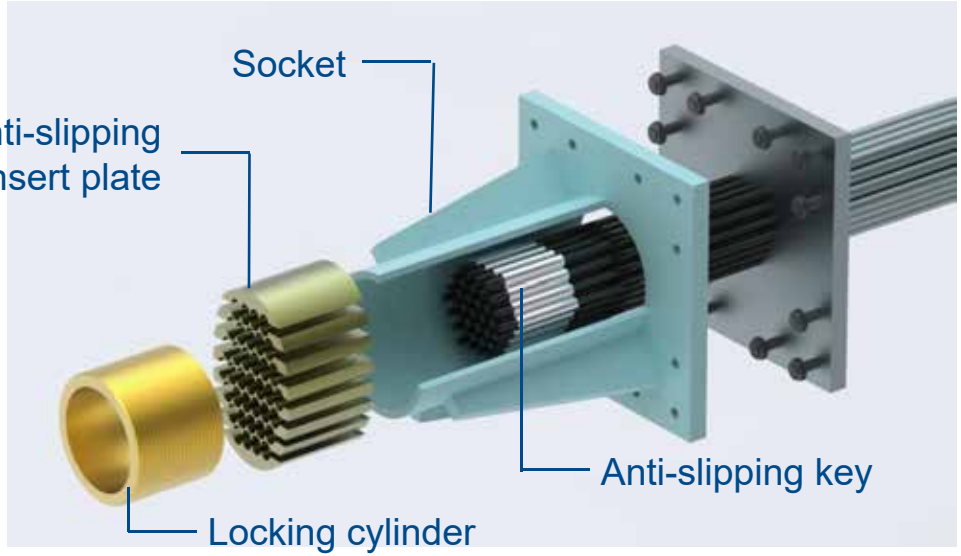
Saddle：individual steel tube saddle



04 System Introduction

4.1 OVMAT Multi-Strand Cable System

One-sided two-way anti-slipping device



Cross section of saddle

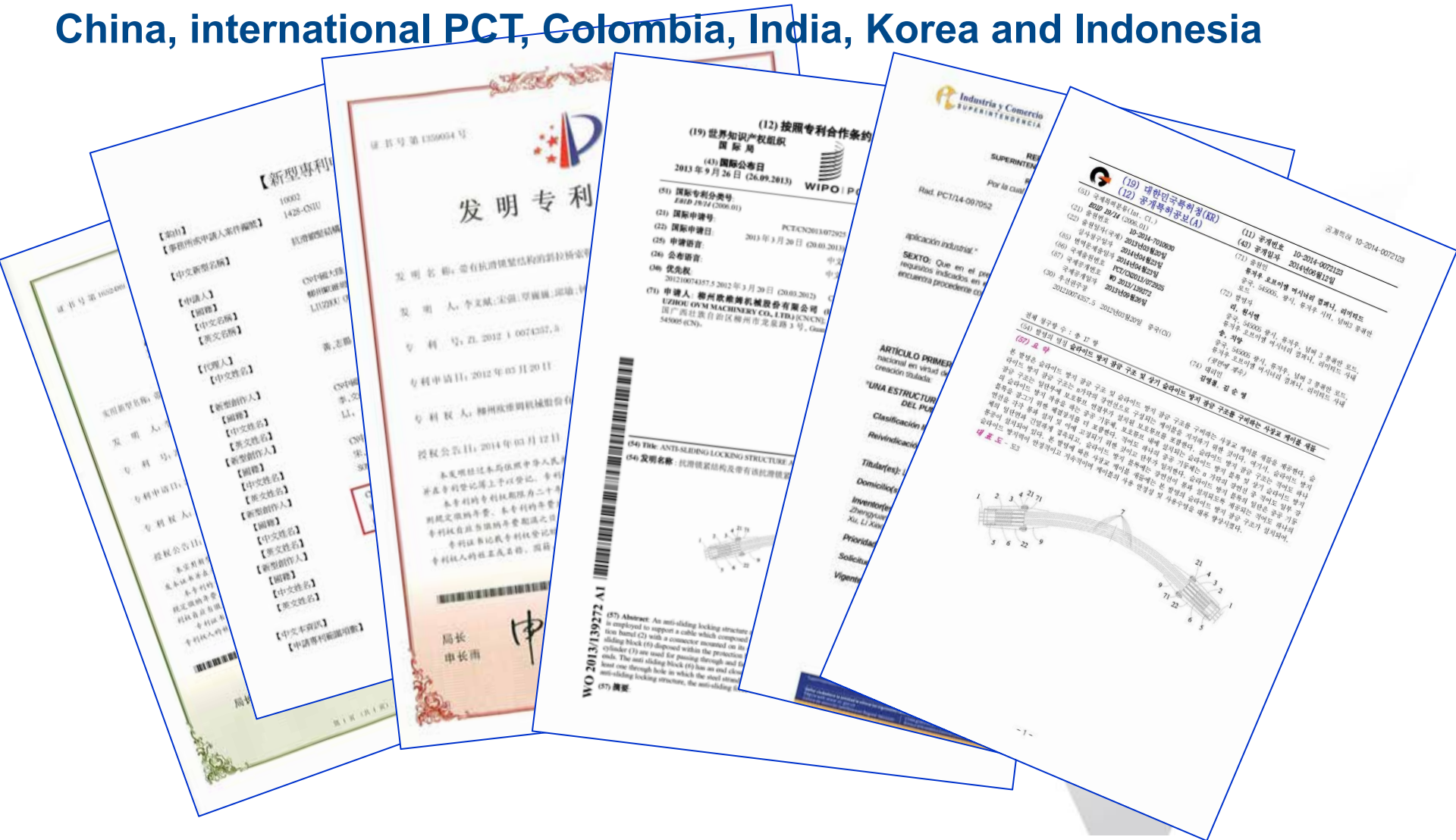
Advantages

1. Good static and fatigue performance
2. Safe and reliable anti-slipping
3. Achieving anti-slipping during construction
4. Strand can be replaced individually
5. Easy installation

04 System Introduction

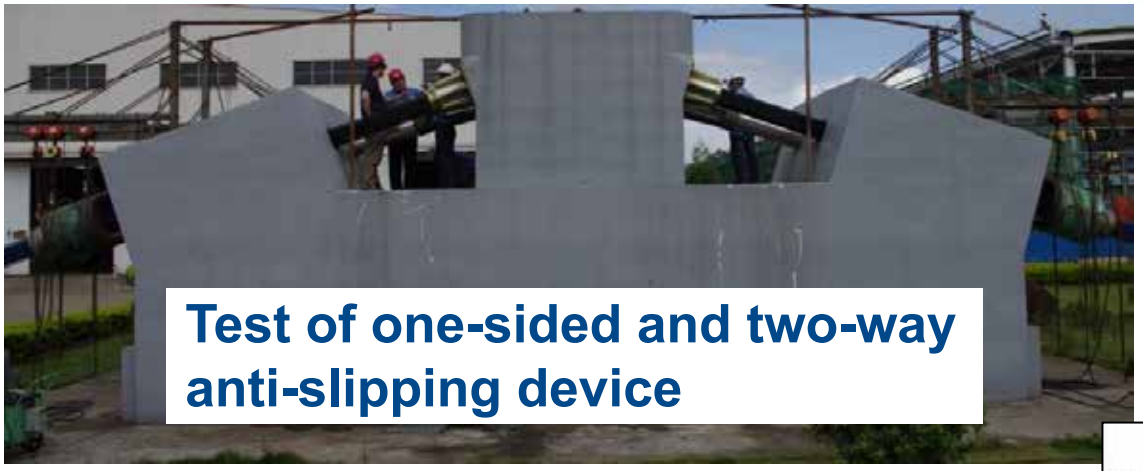
4.1 OVMAT Multi-Strand Cable System

Invention patent of one-sided and two-way anti-slipping device: China, international PCT, Colombia, India, Korea and Indonesia

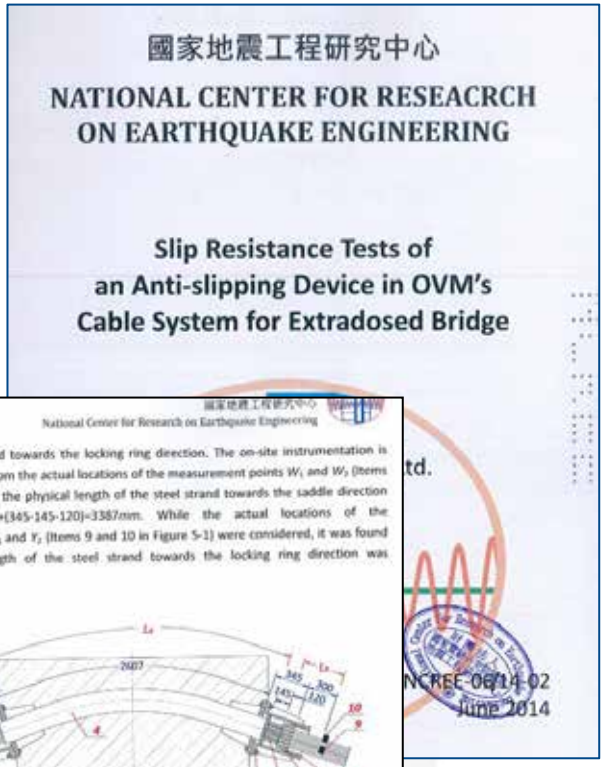


04 System Introduction

4.1 OVMAT Multi-Strand Cable System



Test of one-sided and two-way anti-slipping device



04 System Introduction

4.2 Key Technology

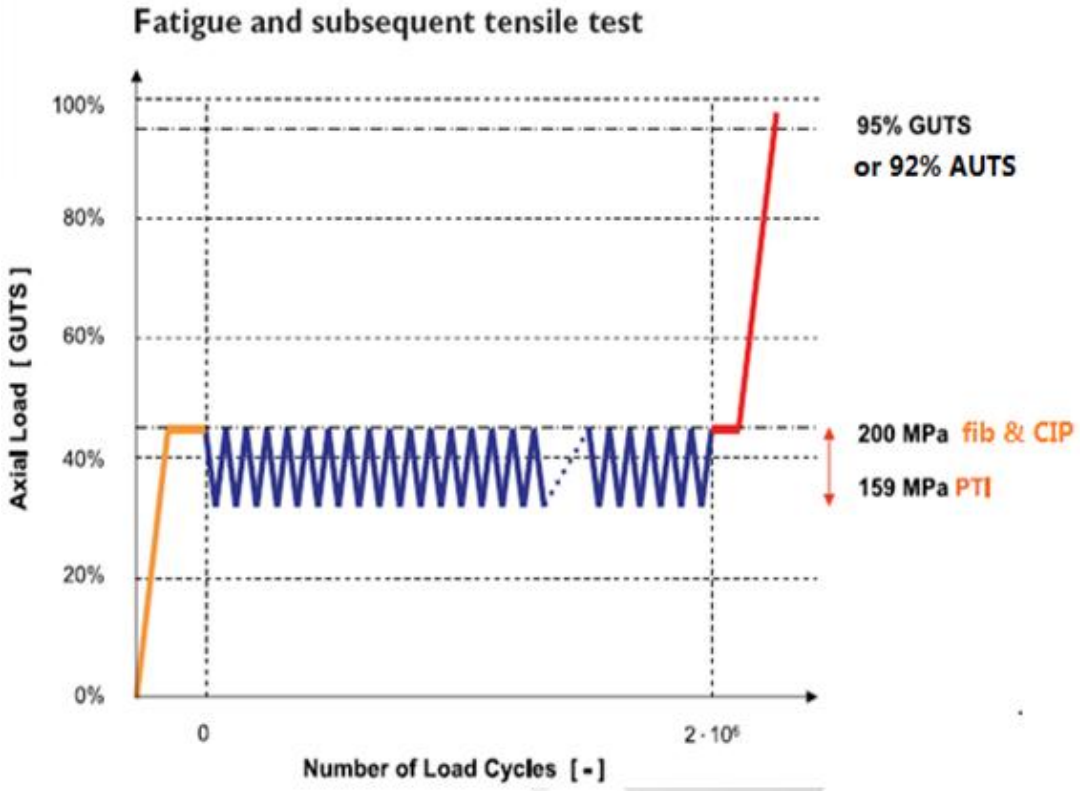
(1) Static and fatigue performance

OVM250 anchorage conforms to the latest Criteria PTI, fib and CIP

Static performance	η	ε
	≥95%	ϵ_{apu}≥2%

Fatigue performance:
Upper load: 45%GUTS
Stress amplitude: 200MPa.
Cycles: 2 million
Wire breaking: ≤ 2%

Static test after fatigue
Max force:
Lager one: 95% GUTS , 92% AUTS



04 System Introduction

4.2 Key Technology

(1) Static and fatigue performance

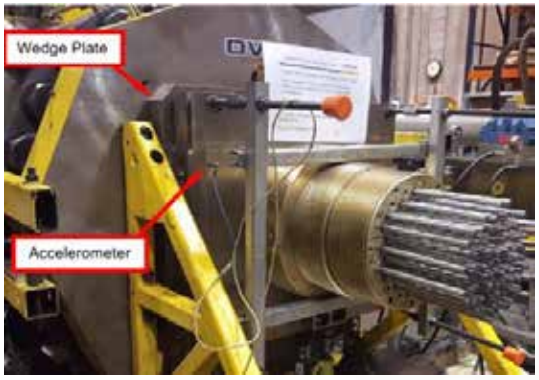
Anchorage size	OVM250-55		Upper load	0.45f_{GUTS}
Laboratory	CTL(USA)		Stress amplitude	200MPa
Referring Criteria	CIP		Angular deviation	10mrad(0.6°)

04 System Introduction

4.2 Key Technology

(1) Static and fatigue performance

Anchorage size	OVM250-73		Upper load	0.45f_{GUTS}
Laboratory	CTL(USA)		Stress amplitude	200MPa
Referring Criteria	fib bulletin 30		Angular deviation	10mrad(0.6°)

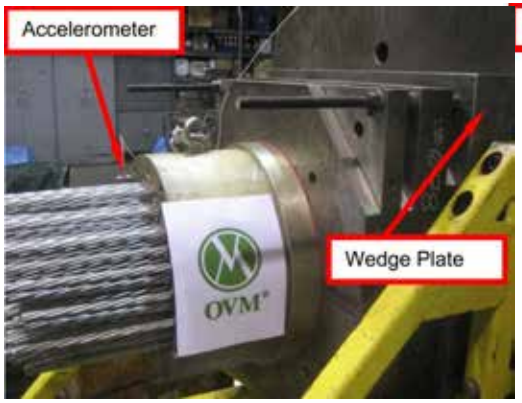


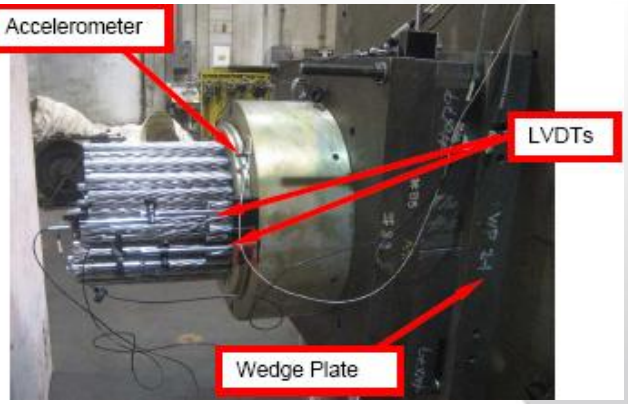
04 System Introduction

4.2 Key Technology

(1) Static and fatigue performance

Anchorage size	OVM250-109		Upper load	0.45f_{GUTS}
Laboratory	CTL(USA)		Stress amplitude	200MPa
Referring Criteria	fib bulletin 30		Angular deviation	10mrad(0.6°)



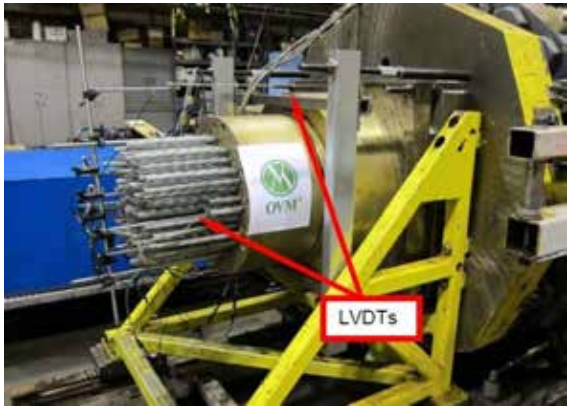


04 System Introduction

4.2 Key Technology

(1) Static and fatigue performance

Anchorage size	OVM250-139		Upper load	0.45f_{GUTS}
Laboratory	CTL(USA)		Stress amplitude	250MPa
Referring Criteria	fib bulletin 30		Angular deviation	10mrad(0.6°)



04 System Introduction

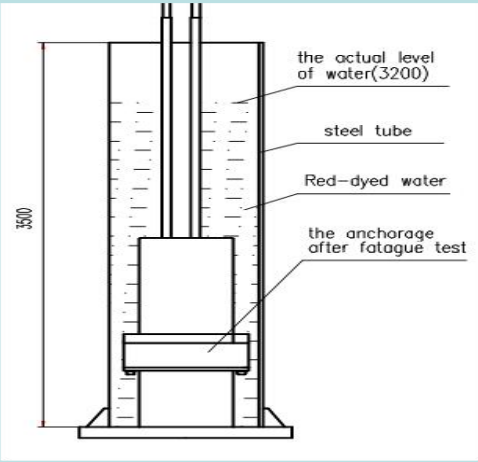
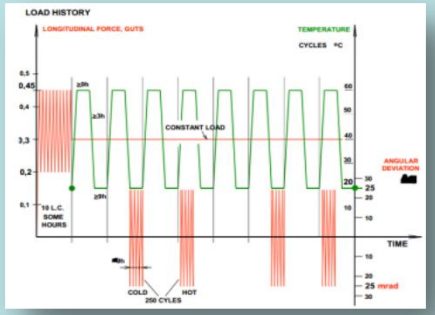
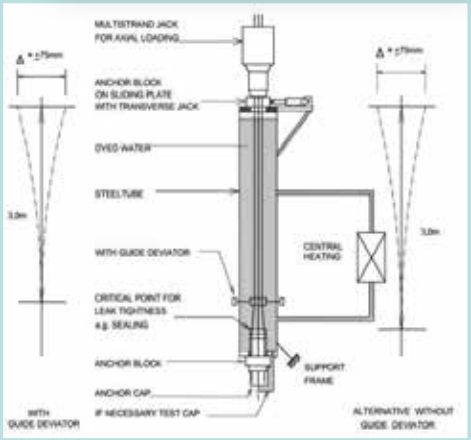
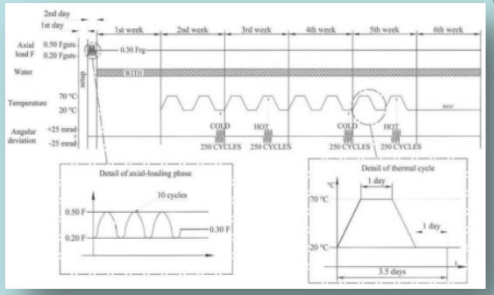
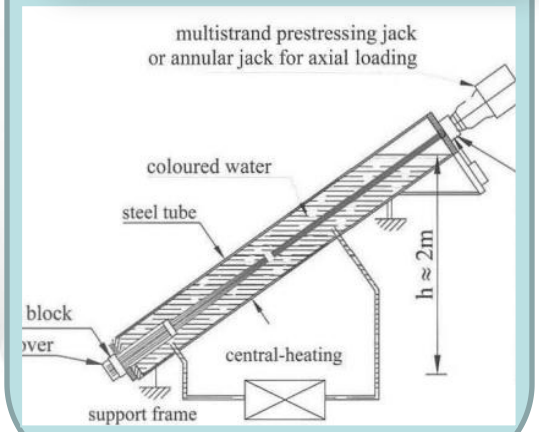
4.2 Key Technology

S/N	TYPE	LAB	CRITERIA	UPPER STRESS	STRESS RANGE MPA	YEAR
1	OVM250-31	EMPA	PTI	0.45GUTS	159	2006
2	OVM250-31	CTL/USA	PTI	0.45GUTS	159	2006
3	OVM250-42	EMPA	PTI	0.45GUTS	159	2007
4	OVM250-55	CTL/USA	CIP	0.45GUTS	200	2009
5	OVM250-43	CTL/USA	PTI	0.55GUTS	140	2010
6	OVM250-55	CTL/USA	PTI	0.45GUTS	159	2010
7	OVM250-37	CTL/USA	fib	0.45GUTS	200	2011
8	OVM250-109	CTL/USA	fib	0.45GUTS	200	2011
9	OVM250-27	CTL/USA	PTI	0.55GUTS	140	2011
10	OVM250-27	CHEQIC/CHINA	PTI	0.45GUTS	200	2011
11	OVM250-19	CTL/USA	PTI	0.55GUTS	140	2012
12	OVM250-79	CTL/USA	PTI	0.45GUTS	159	2013
13	OVM250-43	CTL/USA	PTI	0.55GUTS	140	2013
14	OVM250-139	CTL/USA	fib	0.45GUTS	200	2013
15	OVM250-37	CSSRC/CHINA	PTI	0.45GUTS	159	2016
16	OVMAT-55	CTL/USA	PTI	0.45GUTS	159	2016
17	OVMAT-55	CTL/USA	PTI	0.55GUTS	140	2016
18	OVM250-37	CSSRC/CHINA	PTI	0.45GUTS	159	2017
19	OVMAT-73	CTL/USA	PTI	0.55GUTS	140	2017
20	OVM250-73	CTL/USA	fib	0.45GUTS	200	2017
21	OVM250-37	CSSRC/CHINA	CIP	0.45GUTS	200	2018
22	OVM250-55	CTL/USA	CIP	0.45GUTS	200	2018
23	OVM250-61	CTL/USA	CIP	0.45GUTS	200	2018
24	OVM250-15	CSSRC/CHINA	PTI	0.45GUTS	200	2018
25	OVM250-55	CTL/USA	PTI	0.55GUTS	140	2018
26	OVM250-22	CSSRC/CHINA	PTI	0.45GUTS	200	2019
27	OVM250-55	CTL/USA	PTI	0.45GUTS	200	2019
28	OVM250-55	CSSRC/CHINA	fib	0.45GUTS	280	2019
29	OVM250-55	CSSRC/CHINA, CTL/USA	PTI	0.45GUTS	200	2021

04 System Introduction

4.2 Key Technology

(2) Water-tightness performance

	PTI	fib	CIP
Test method	Sank 96 hours after fatigue test		
Test setup		 	 

04 System Introduction

4.2 Key Technology

(2) Water-tightness performance

Water-tightness test:

OVM250-37 anchorage, according to CIP, the height of water of 3m.

OBM250-55 anchorage, according to fib bulletin 30, the height of water of 3m


OVM International LTD
OVM250-55 Cable 9b Leak tightness Test Witness Report
CTLGroup Project No. 251620
Page 11 of 21
December 8, 2017

8. CABLE AND FIXTURE ASSEMBLY

The strands were installed and stressed to the axial fixture as shown in Figure 9. The condition of the anchor head is presented in Figure 10.

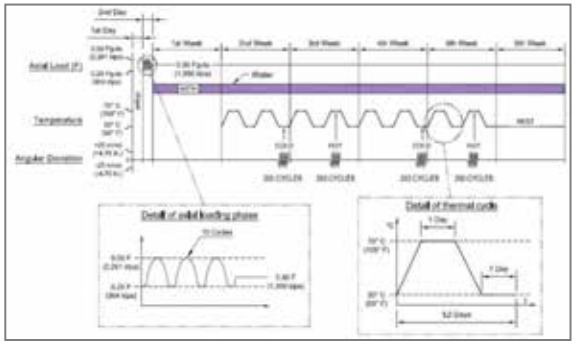
Figure 9 Cable Installed in the Fixture

(a)

(b)

Figure 10 Anchor End Conditions

CTLGROUP



OVM250-37

OVM250-55

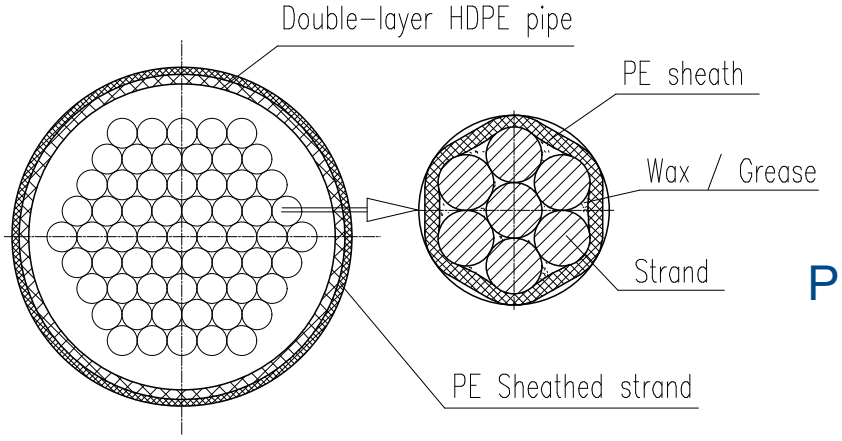
04 System Introduction

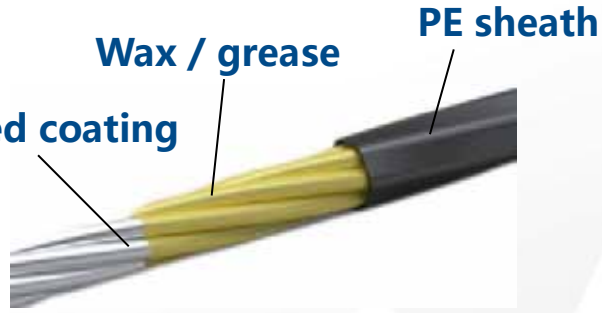
4.2 Key Technology

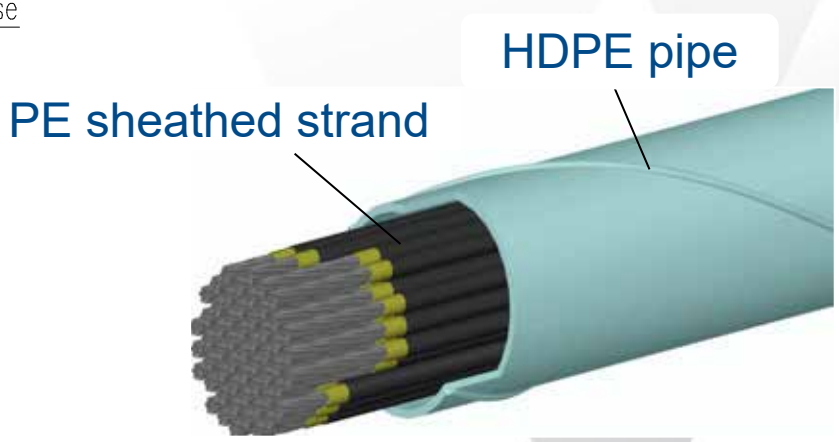
(3) Corrosion protection

- Multi-layer protection system

  OVM250 strand cable system has four layers corrosion protection, galvanized coating, wax and PE sheath of individual strand, and the HDPE pipe for the whole cable。







(3) Corrosion protection

- **Corrosion for anchorage**

  The surface of anchorage parts are treated with thermal spraying of zinc coating， and the internal of the anchorage is injected with the same wax used for the strands.

The strand terminations out of the anchorage are to be entirely covered by a cap. The cap is removable for inspection of the strand terminations.

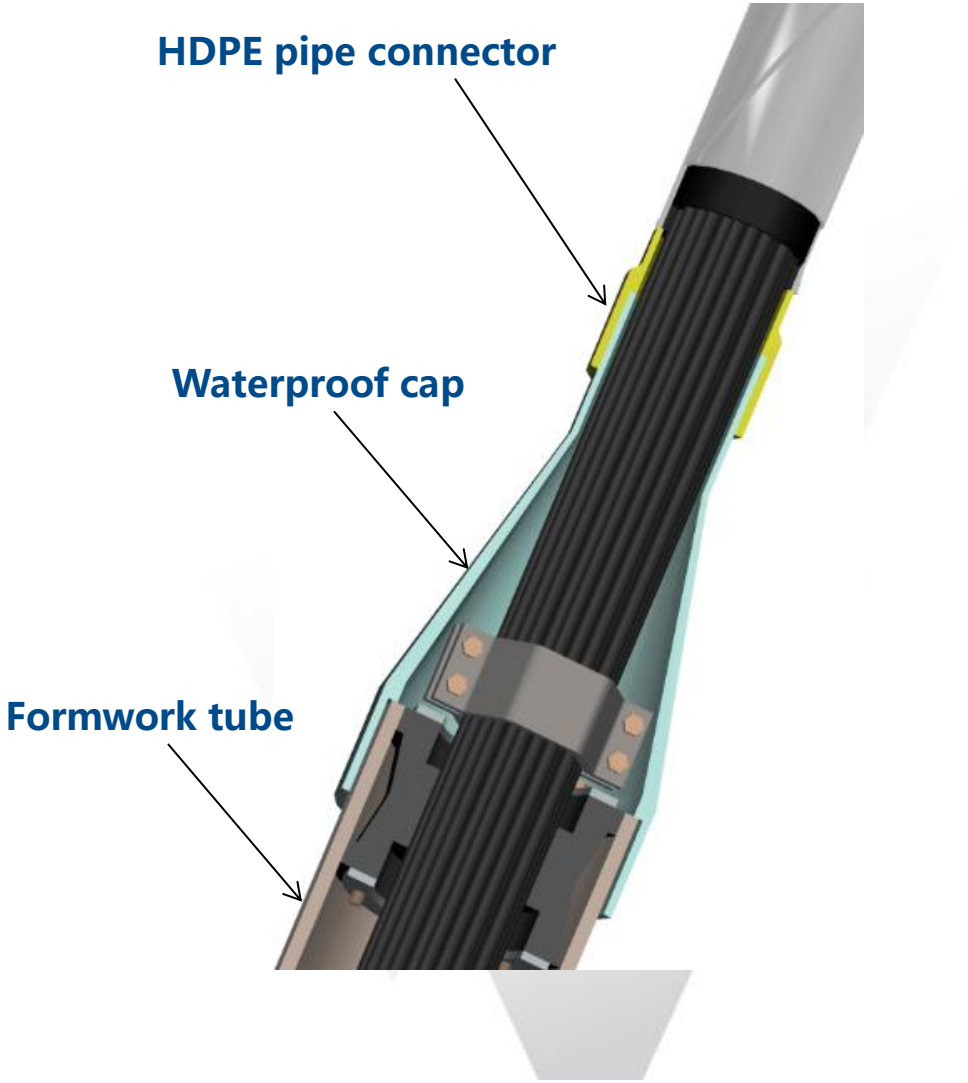
04 System Introduction

4.2 Key Technology

(3) Corrosion protection

- **Sealing at joints**

The HDPE pipe connector covers to the waterproof cap and the waterproof cap covers to the formwork tube with a lapping length, which can ensure the water can not enter the cable.



(4) Vibration controlling

Aerodynamic measures, structural measures and mechanical measures are mainly used to restrain the vibration caused by wind and rain excitation. In order to effectively control the vibration of the cable, the international regulations put forward the following requirements for the vibration control of the cable:

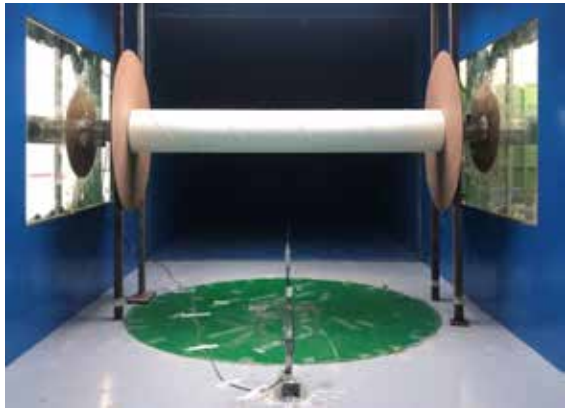
Criteria	Drag coefficient	Logarithmic decay rate	Amplitude	Lifetime
PTI	$C_D = 0.6 \sim 0.8$ Recommend: $C_D = 0.7$ (clause 5.1.5)	$S_c = \frac{m\delta}{2\pi\rho D^2} \geqslant 5$		
CIP	In subcritical range: $C_D = 1.2$ In Supercritical range: $C_D = 0.5 \sim 0.6$ Recommend: $C_D = 0.7$(clause 4.1.1)	$\delta \geq 3\%$	Not exceed 10mm at wind speed of 15m/s (Clause 4.4).	15 yeas
fib		$\delta = 3 \sim 4\%$	±L/1700 at the first and second order (Clause 3.6)	25 years (Clause 4.5.2)

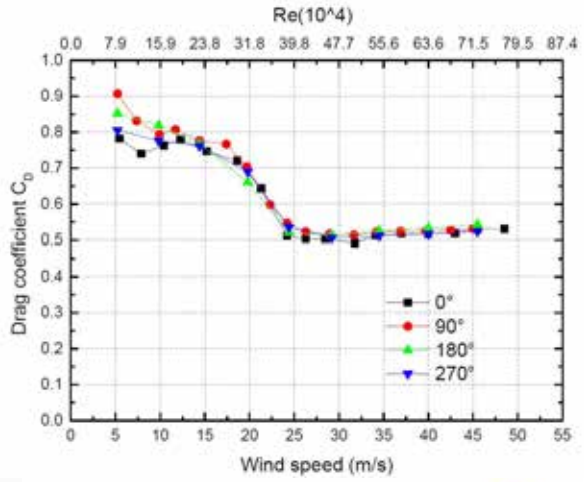
04 System Introduction

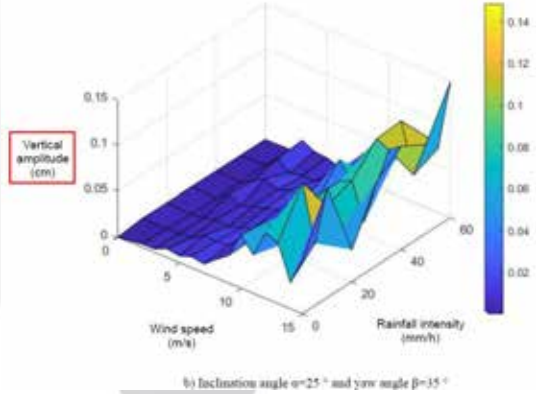
4.2 Key Technology

(4) Vibration controlling

The wind load performance of the cable is deeply studied through wind tunnel test, and the surface shape of the cable is optimized. The reasonable spiral design makes the drag coefficient of the cable meet the requirement of CD≤0.6.







b) Inclination angle α=25 ° and yaw angle β=35 °

04 System Introduction

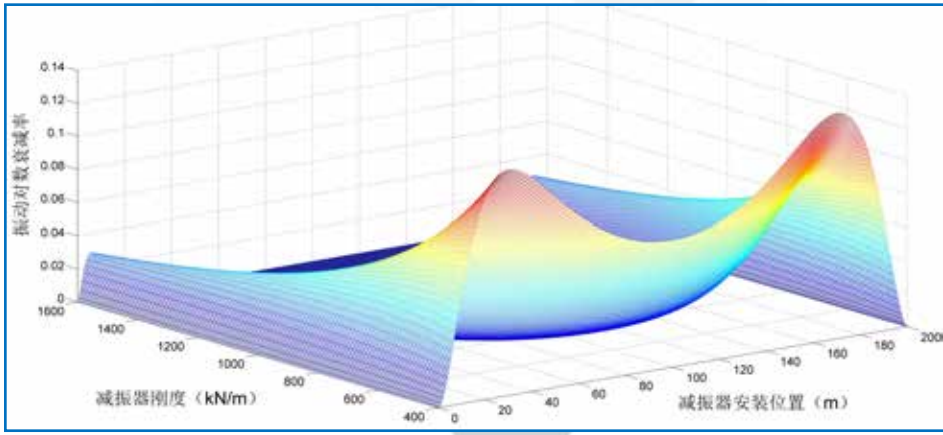
4.2 Key Technology

(4) Vibration controlling

The installation of the damper is one of the most effective measures to control the vibration of the cable. The commonly used dampers are listed here after.

Rubber damper (Deviator)	Viscous damper	MR damper	High damping rubber damper (shear type)	Viscous damper (shear type)	Friction damper
					

OVM has carried out a comprehensive study on the cable vibration controlling and designed cable vibration damping products that meet the requirements of international regulations.

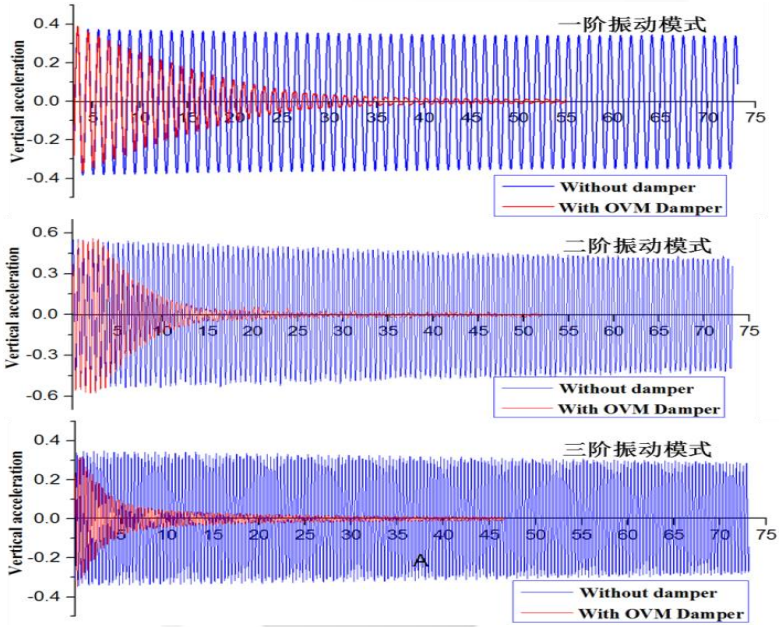


04 System Introduction

4.2 Key Technology

(4) Vibration controlling

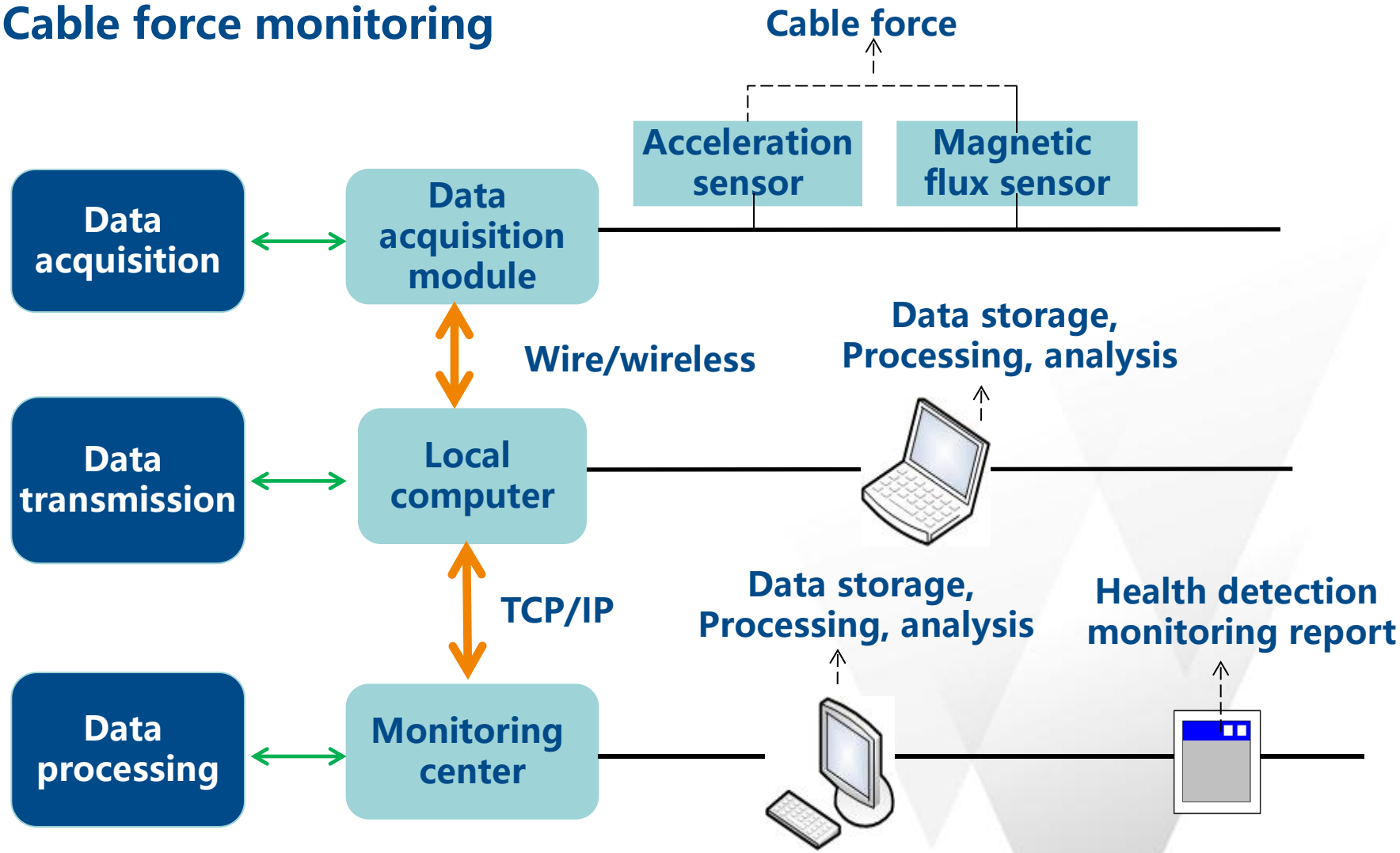
OVM viscous type, MR type and shearing high damping rubber type and other cable dampers have good vibration-reducing performance through test and verification, and meet the vibration-reduction requirements of domestic and foreign engineering projects. .



04 System Introduction

4.2 Key Technology

(5) Cable force monitoring

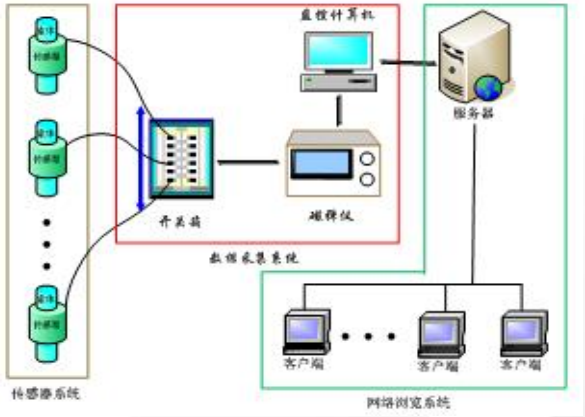


04 System Introduction

4.2 Key Technology

(5) Cable force monitoring

The magnetic flux sensor measures the cable force by utilizing the principle of magnetoelastic effect of ferromagnetic materials. The stress (or cable force) is to be measured through measuring the magnetic permeability changes correspond to the impulse voltage applied to the sensor.

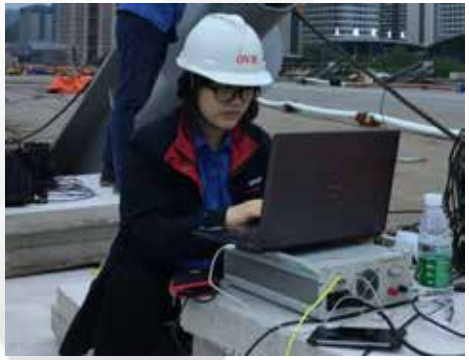


04 System Introduction

4.2 Key Technology

(5) Cable force monitoring

Acceleration sensor: By collecting the vibration frequency under different cable forces, the curve relationship between the cable force and the vibration frequency is obtained; The cable force value can be calculated by measuring the vibration frequency of the cable.



(6) Fire Protection

The terrorist activities and accidental fires and explosions frequently cause serious threats to the bridge structure. Permanent damage to the bridges and even bridge collapses can result in casualties, affecting traffic quality and causing huge economic losses.

In order to ensure the safety of the cable, the international regualtions put forward the requirements for fire, blast & vandalism protection

PTI	4.5 Fire resistance qualification testing The rating shall be stated as a time of protection of the stay cable specimen from an external source of 1100°C。The proposed fire resistant stay cable specimen must demonstrate fire endurance of 30 minutes or greater, as determined by the time required to reach a temperature of 300°C。 The cable shall be tensioned to 0.45Muts at a temperature of 300°C and held for no less than 30 minutes. The load test phase is acceptable if the cable is able to resist the applied load for 30 minutes without slip or failure of anchorage components.
fib	3.1.2 Fire，impact，vandalism 4.4.5 Anti-vandalism pipes
CIP	3.1.4 Fire near cable stays

04 System Introduction

4.2 Key Technology

(6) Fire Protection

- OVM successfully developed the fire test equipment of 1100 ºC and the anchorage performance test equipment under 300 ºC.
- Fire endurance test with 1100 ºC in 90 minutes and anchorage performance test at 0.45MUTS with 300 ºC for 30 minutes were witnessed by the third party.

Anchorage performance test at 0.45MUTS under 300 ºC

Fire endurance test with 300 ºC

04 System Introduction

4.2 Key Technology

(7) QA&QC

OVM欧维姆	ITP for Fabrication of OVM250AT Stay Cable	Doc. No.	Rambungan-ITP-2020-11
		REV.	C
		PAGE	1 / 22

Inspection and Test Plan Submission

Part A: Liuzhou OVM Machinery Co., Ltd.

(as Supplier, hereafter call or state as "OVM")

Add:No.1, Yanghui Road, Liuzhou, Guangxi, 545006, P.R.China

Email: sales@ovm.cn Website: http://www.ovm.cn

Tel: +86 772 3116402 Fax: +86 772 3118665

The following document is hereof submitted to the ENGINEER for review in according with the Requirements in the Contract.

Sub: Inspection and Test Plan for Fabrication of OVM250AT Stay Cable of Batang - Rambungan Bridge, Malaysia

Our Version Control

REV.	VERSION DESCRIPTION	PREPARED BY	CONTROLLED BY	APPROVED BY	APPROVED DATE
A	First issued				
B	Sencond issued				
C	Third issued				

OVM欧维姆	Inspection and Test Plan for Fabrication of OVM250AT Stay Cable	Doc. NO.	Rambungan-ITP-2020-11
		REV.	C
		PAGE	14 / 22

Table 2：ITP for PE sheathed strand

Act No	Category		Applicable Standard or Document	Characteristics and acceptance criteria	Test method	Frequency	Documentation
01	Raw material	(PE sheath) PE100	Batang - Rambungan Specification, UK NA to BS EN 1993-1-11, clause NA.2.24 and Table NA.1 and NA.2.	Density at 23℃:≥0.94 g/cm3	ISO 1183	/	MC and/or previous report
				Melt flow index of 5kg at 190℃:<0.15g/10min	ISO 1133		
				Tensile strength at yield point at 23℃:>19MPa Elongation at break at 23℃:≥500%	ISO 527-2	3 tests every 10 tons.	Test report
				Ultraviolet radiation stability(of external layer)：condition E	ASDM D 3350	/	MC and/or previous report
				Carbon-black content：2.3±0.3% by weight	ISO 6964		
				Carbon-black dispersion index: <3	ISO 4437		
				Carbon-black dispersion level:<C2	ISO 4437		
				oxidative induction time at 200℃:>20min	ASDM D 3350		
		Galvanized	NF A 35-035，fib	Nominal diameter:15.7(-0.2/+0.4)mm	OVM drawing & Rambungan	≥1 test every 20 tons.	MC and/or test report

OVM欧维姆	Inspection and Test Plan for Fabrication of OVM250AT Stay Cable	Doc. NO.	Rambungan-ITP-2020-11
		REV.	C
		PAGE	21 / 22

able 4: ITP for Performance Test on assembled cable

No	Category	Applicable Standard or Document	Characteristics and acceptance criteria	Test method	Frequency	Documentation
1	Fatigue and tensile tests for (OVM15.7-55)	PTI,2012	PTI,2012	PTI,2012	1 unit	Prior test report
	Fatigue and tensile tests for (OVM15.7-73)	fib Bulletin 30, 2005	fib Bulletin 30, 2005	fib Bulletin 30, 2005	1 unit	Prior test report
2	Water-tightness test (OVM15.7-37)	CIP 2002，fib Bulletin 30, 2005	CIP 2002	CIP 2002	1 unit	Prior test report
3	Slip Resistance and Strand Replacement Tests (OVM15.7-43)	fib Bulletin 30, 2005	fib Bulletin 30, 2005	fib Bulletin 30, 2005	1 unit	Prior test report
4	High Temperature Heat insulation Test for OVM Stay Cable System (OVM15.7-73)	PTI DC45.1-18	60 minutes at a temperature of 1100°C, does not exceed 300°C	PTI DC45.1-18	1 unit	Prior test report
5	High Temperature (300℃) Load Test (OVM15.7-73)	PTI DC45.1-18	0.45 MUTS at a temperature of 300 degrees C and held for no less than 30 minutes	PTI DC45.1-18	1 unit	Prior test report
6	Wind tunnel testing on stay pipe (Cable wind load performance test and Wind-rain	JTGT 3360-01-2018 Wind-resistant Design Specification for Highway	/	/	1 test	Prior test report

04 System Introduction

4.2 Key Technology

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(7) QA&QC

OVM QA Document, OVM

OVM Ref No 流水号编号	LS(欧日) 202?06-6-Anchorage 1st Batch

QUALITY CERTIFICATE

质量保证书

Client/客户名称: The Arab Contractors "Osman Ahmed Osman & Co."

Order No./订单号: 01-OVM-A. C. -2016

Project/项目名称: ROD EL FARAG Project-Egypt

OVM INTERNATIONAL LTD.

柳州欧维姆进出口有限公司

Address: No. 1 Yanghui Road, Yang He New Industrial Area, Liuzhou, Guangxi, P. R. China Postcode: 545006
Tel: +86-772-3116402 Fax: 772-3116665 Email: sales@ovm.cn Website: http://www.ovm.cn http://www.ovmchina.com

OVM QA Document, OVM

Catalog 目录

Address: No. 1 Yanghui Road, Yang He New Industrial Area, Liuzhou, Guangxi, P. R. China Postcode: 545006
Tel: +86-772-3116402 Fax: 772-3116665 Email: sales@ovm.cn Website: http://www.ovm.cn http://www.ovmchina.com

OVM	Inspection Certificate 3.1 检验证 3.1	Part No./Revision 型号 OVM250A-55S.0	检验证 3.1 编号 No. of Insp. Cert.3.1	1/5-(55)

Acc. DIN EN 10204

Anchor Head at tensioning end/张拉端锚板 Specification/规格: OVM250A-55S-1

Order No./订单号: 01-OVM-A. C. -2016 Project/项目名称: ROD EL FARAG Project-Egypt

Order quantity/订货数量: 24 pcs.(件)

Standard 标准	Material 材质	Charge No. 材料炉号	Element 成分(%)	C	Si	Mn	P	S	Ni	Cr	Cu	Yield strength 屈服强度 (MPa)	Ultimate strength 抗拉强度 (MPa)	Elongation 伸长率(%)	Remarks 备注
[illegible]	[illegible]	[illegible]	规定值 Specified	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	encl. MC of raw material 附原材料质量证书
			测定值 Measured	0.40	0.21	0.67	0.012	0.009	0.03	0.82	0.06	/	/	/	

Test item 检验项目	Technical Requirement 技术要求	Test Result 检验结果	Remarks 备注
Surface hardness test 表面硬度	[illegible]	Yes☑ No☐	Encl. hardness inspection records 附硬度检验记录
UT 超声波探伤	Severity level 4 as per Table 4 specified in GB/T 6402-2008 [illegible]	Yes☑ No☐	Encl. UT reports 附超声波探伤报告
MT 磁粉探伤	Quality class 2 specified in Table 7 of Chapter 8 in NB/T47013.4-2015 [illegible]	Yes☑ No☐	Encl. MT reports 附磁粉探伤报告
Galvanizing 镀锌	Thickness of coating 20~40 μm	Yes☑ No☐	Encl. galvanizing inspection records 附镀锌检验记录
Dimension 尺寸	Meet the requirement of the drawing 符合图纸要求	Yes☑ No☐	
Appearance quality 外观质量	Meet the requirement of the drawing 符合图纸要求	Yes☑ No☐	

Approval for delivery/准予放运 Yes☑ No☐

Delivery comply with the contract requirement/按合同要求交付 Yes☑ No☐

assembling and packaging meet the design requirement /组装与包装符合设计要求 Yes☑ No☐

Test 检验员 [signature] Signature/签字 [signature] Date/日期 2017.5.27 Stamp of Company 印章

P4

MILL CERTIFICATE

CUSTOMER : OVM INTERNATIONAL LTD L/C No. :

PROJECT NAME : ROD ELFARAG PROJECT-EGYPT MC No. : F1568

COMMODITY : PE SHEATHED GALVANIZED STRAND DATE : DEC. 28, 2016

GRADE : PEJ-X-15.7-1860 SPECIFICATION : NF A35-035/XP A35-037

QUANTITY : 159 COILS NET(KGS) : 382,636 PAGE: 4

No.	Heat No.	Coil No.	Coil No	Weight	Dia.	P.E THICKNESS	WAX COATING WEIGHT	Pitch	Maximal Load	0.1% Proof Load	Elongation	Elasticity
Standard Value				kg	15.50 ~ 16.10 mm	1.5 ~ 2.0 mm	10 ~ 30 g/m	220 ~ 251 mm	≥ 279.0 kN	≥ 248.0 kN	≥ 3.5 %	185 ~ 205 GPa
70	16341571	[illegible]	[illegible]	[illegible]	15.79	1.67	22	232	> 287.0	287.7	> 4.5	[illegible]
71	16341571	[illegible]	[illegible]	[illegible]	15.79	1.66	21	230	> 282.0	[illegible]	> 4.5	[illegible]
72	16341571	[illegible]	[illegible]	[illegible]	15.79	1.66	20	232	> 286.5	[illegible]	> 4.5	[illegible]

04 System Introduction

4.3 Professional Team with International Experience

04 System Introduction

4.3 Professional Team with International Experience

OVM 欧维姆

40+ cable-stayed projects per year

20+ cable-stayed projects at the same time

500+ cable-stayed projects worldwide

04 System Introduction

4.4 Cable Installation

1. Brief

Rod El Farag bridge consists of double H-shaped pylons and the distance betwee
two centers of pylons is 300m. Each pylon extends 76m above the deck. Two sid
spans are 120m. The stay cables have a semi-fan arrangement and carry the deck
four plans. There are totally 160 OVM250 stay cables (OVM250-55、61、73、85、9
109、127) and they are stressed from the top of the pylon.

The cable is blast protected at a vertical height of 3m from the deck and fi
protected 8m from the deck.

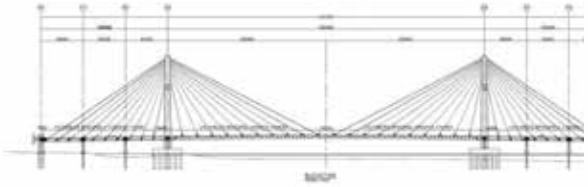


Fig. 1 Side view of Rod El Farag bridge

Rod El Farag bridge can be regarded as an integration of two stay cable bridge
which will be called bridge A (left) and bridge B (right) in this document, as shown
the following sketch. The stay cables on pylon R2 and R3 will be installed in the sam
way, this document is taking pylon R2 as an example.

This method statement of stay cable installation for Rod El Farag bridge is based
the Cable Stayed Bridge Method Statement, which was received in May, 2017, show
as appendix. This method statement is about the installation of stay cable.

The following standards or specifications are used as reference documents.

Technical Specification for Construction of Highway Bridge and Culverts (JTG
F50-2011)

Technical Conditions for Unbonded Steel Strand Stay Sable (JT/T 771 2009)

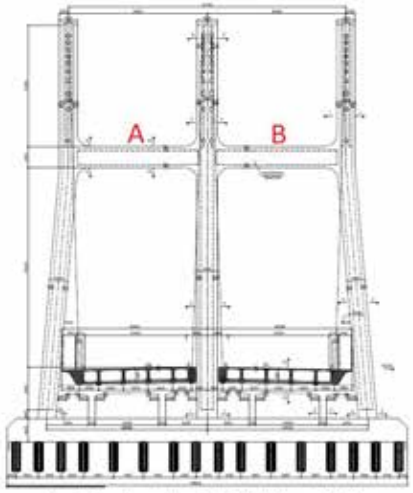


Fig. 2 Section view of Rod El Farag bridge

1. General arrangement

The stay cables will be installed by threading and stressing strands i
separately, and the force will be adjusted by multi stressing according
Strands will be cut at site, and HDPE pipe will be connected at site by
at site too.

It's concrete box girder at side span, the installation of the stay cable
out when the post tension tendons are stressed after the concrete rea
strength. It's steel – concrete composite girder at main span, the insta
cable will be carried out when the steel girder is connected with comp
girders by bolts, before or after the installation of concrete slab, which
the construction design or construction sequence prepared by bridge

36	Light torch	Nos.	10	
37	Lights	Nos.	30	
38	Shrink brand	M	100	30mm x 2mm
39	Distressing grease	Box	4	
40	Safety belt	Nos.	25	
41	Distinguisher	Nos.	20	
42	Safety net	Set	Some	Base on site

4. Estimated construction period

According to the received construction sequence drawing and technical meeting, at middle span the installation of composite girder contains the lifting of steel girder and the installation of stay cable. Stay cable will be installed after the lifting and connection of steel girder and before the installation of concrete slab. Based on previous construction experiences in many other stay cable bridges, cable force adjusting is mostly needed after the installation of concrete slab. So one erection cycle of a composite girder is estimated to be around 16 days, shown as following table.

No.	Erection		Man	Days														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Composite girder	Prepare the lifting machine																	
2		lift steel girder and adjust																	
3		make bolt connection																	
4		adjust the position of lifting machine																	
5		install concrete slab																	
6		cast stitching and curing																	
1	Stay cable	material handling	6																
2		prepare working platform	6																
3		cut strands	6																
4		weld HDPE pipe	6																
5		install anchorages	6																
6		lift and install HDPE pipe	20																
7		install and stress strands	20																
8		adjust cable force	6																

04 System Introduction

4.4 Cable Installation

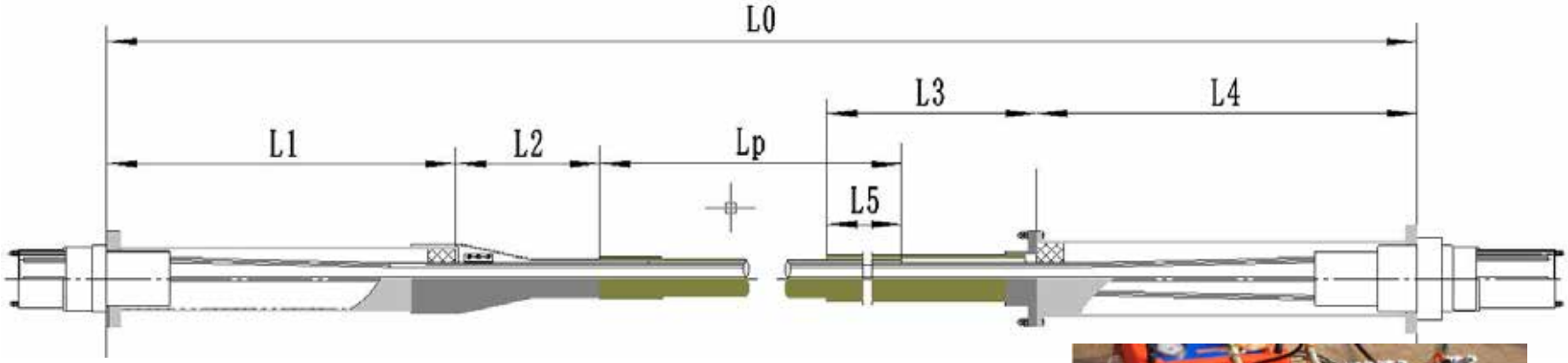
Scaffolding platform

Packing

04 System Introduction

4.4 Cable Installation

(1) HDPE Pipe Welding



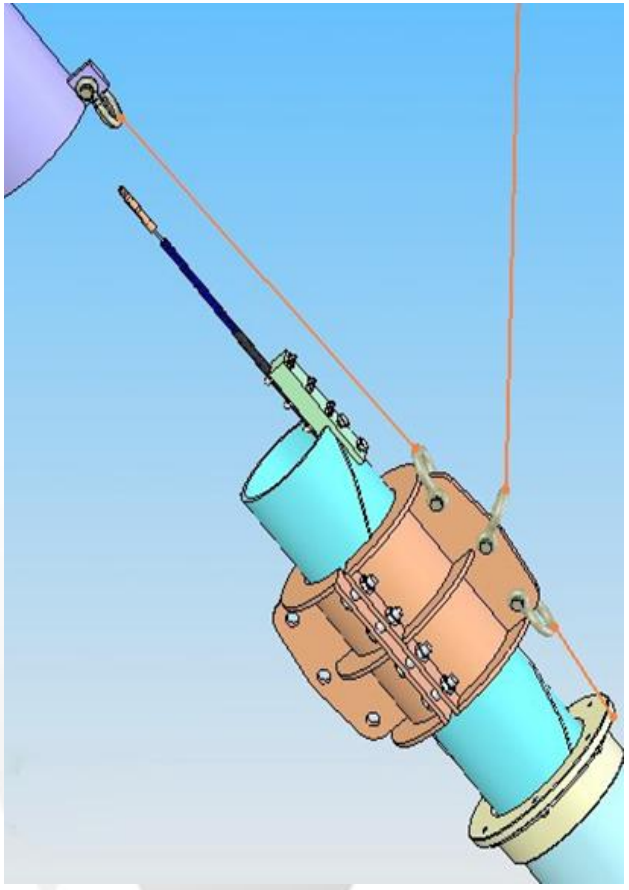
Lp=L0-L1-L2-L3-L4+L5
Where:
L0-Length of stay cable (length between two bearing plates;
L1- Length of formwork tube at deck;
L2-length of water-proof cap (anti-vandalism tube) between formwork tube and HDPE pipe;
L3-Length of telescopic pipe;
L4-Length of formwork tube at pylon
L5-Lapping length of HDPE pipe and telescopic pipe

- Welding temperature
- Endothermic time
- Welding pressure
- Bead height
- Cooling time

04 System Introduction

4.4 Cable Installation

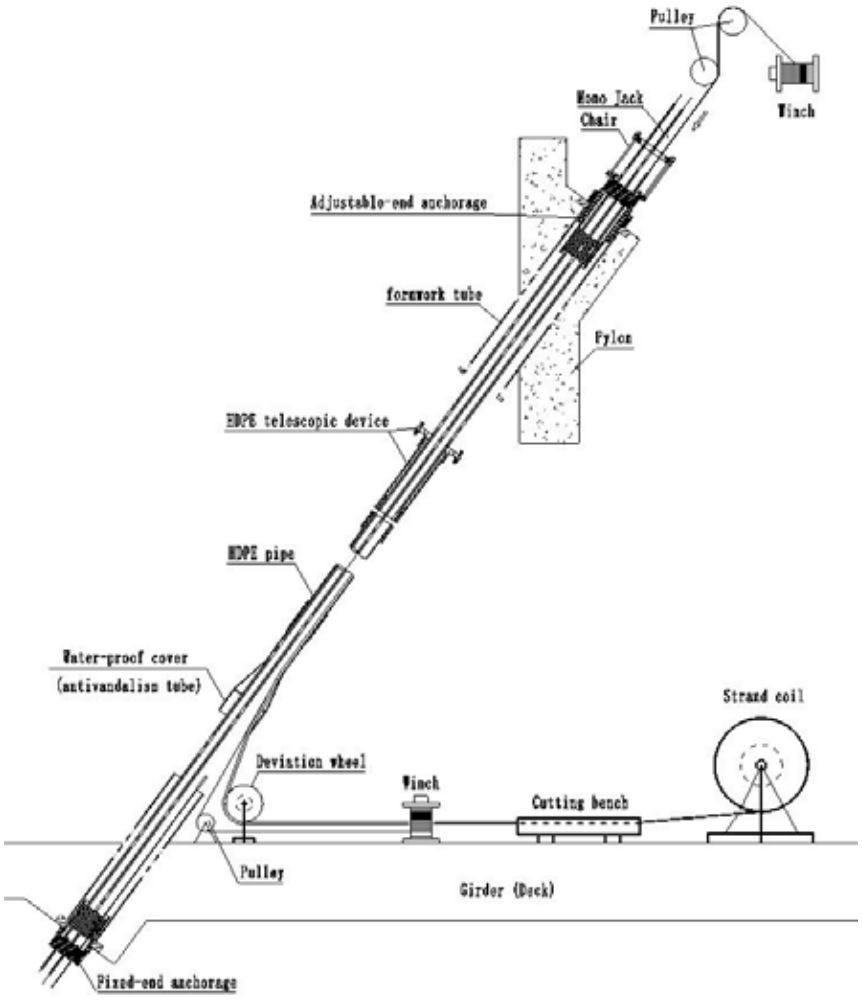
(2) Lifting of the HDPE pipe



04 System Introduction

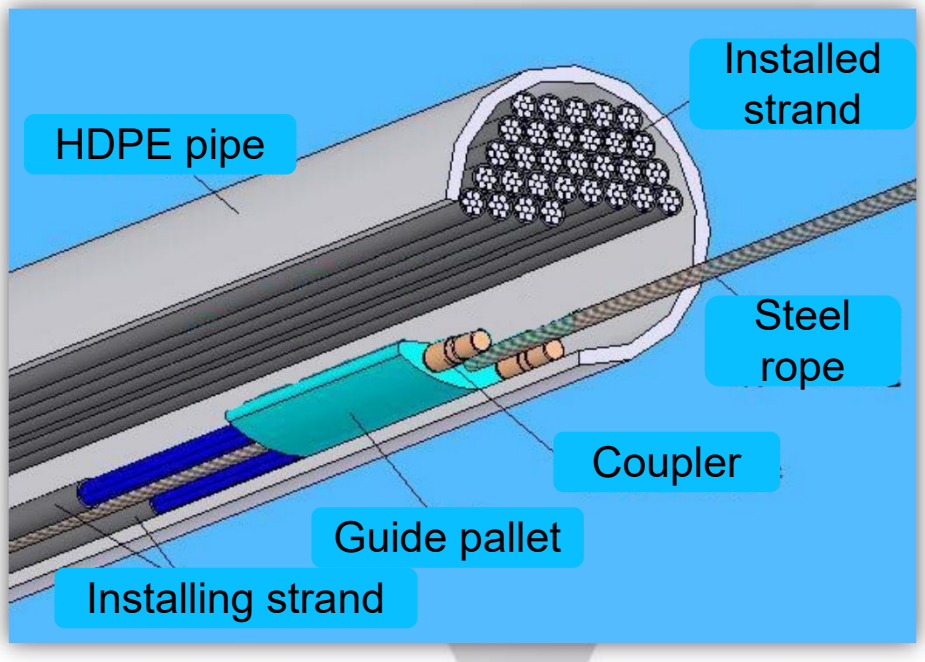
4.4 Cable Installation

(3) Individual Strand Threading Method



Option 1: Reciprocating traction installation method

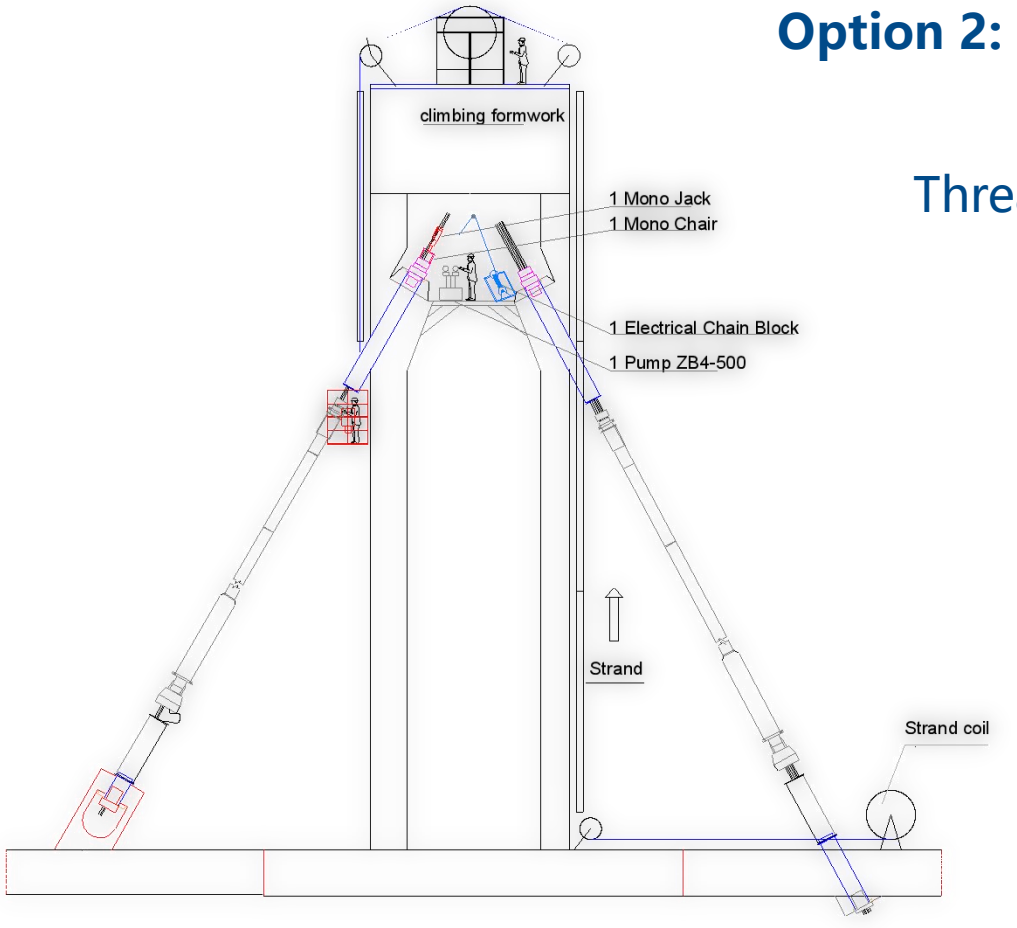
Threading speed: average 45 m / min



04 System Introduction

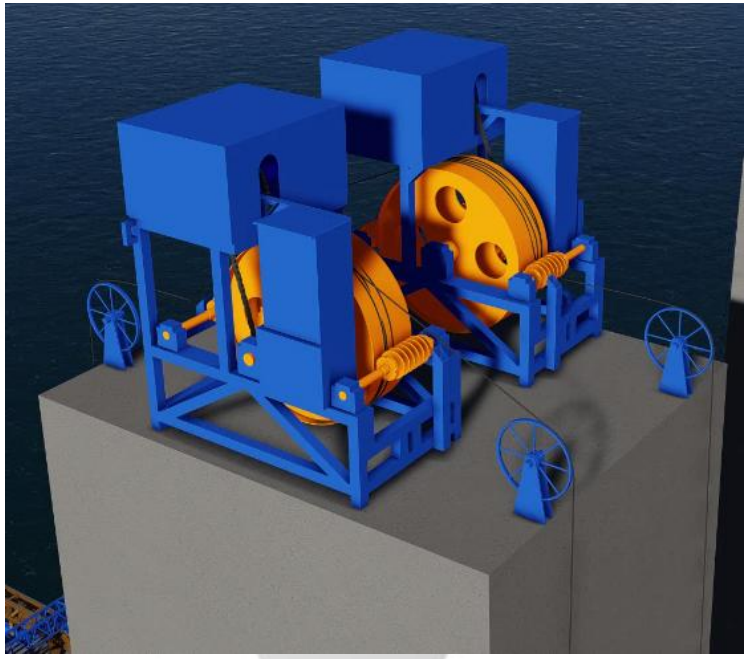
4.4 Cable Installation

(3) Individual Strand Threading Method



Option 2: Continuous threading method assisted by threading machine

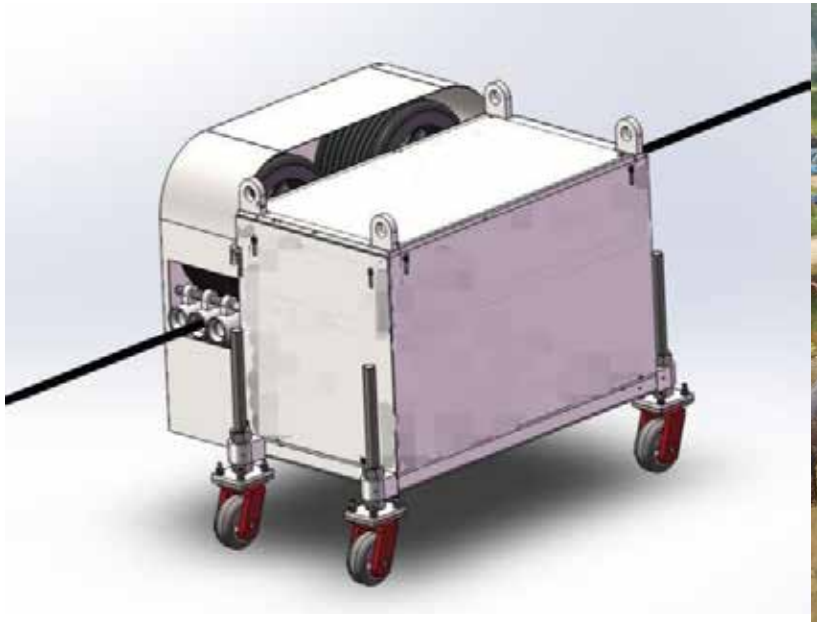
Threading speed: 40~45 m / min



04 System Introduction

4.4 Cable Installation

(3) Individual Strand Threading Method

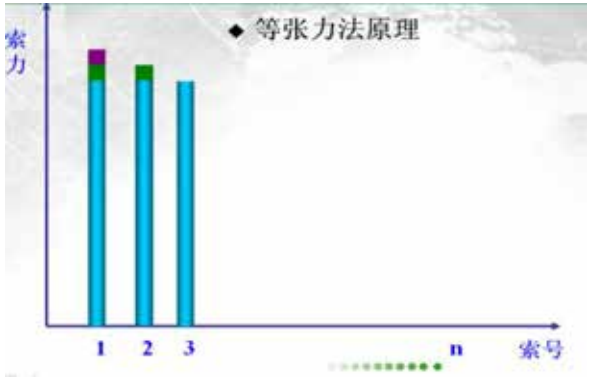


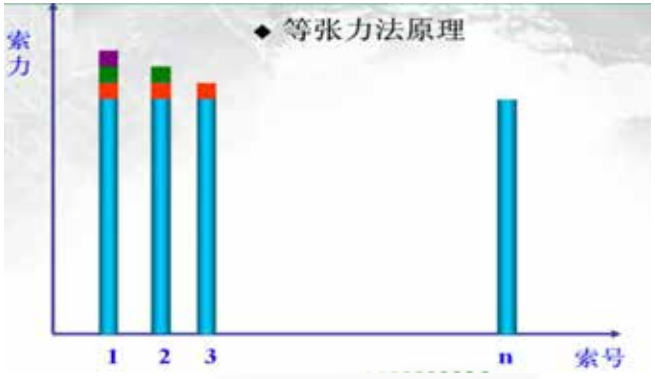
Patented Threading Machine for Extradosed Bridge

04 System Introduction

4.4 Cable Installation

(4) Principle of equal tension method

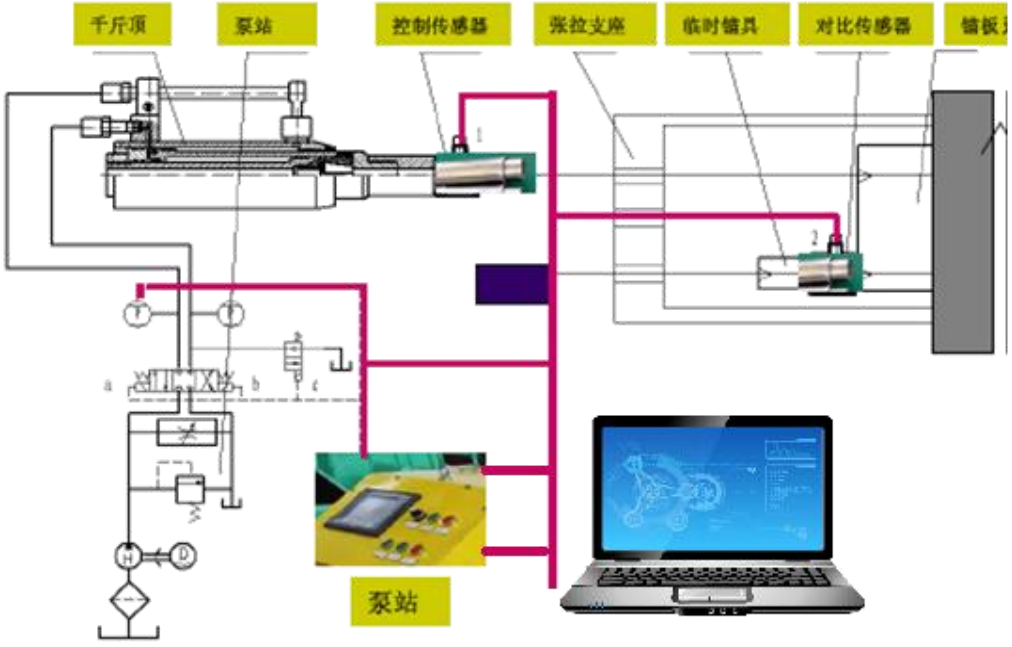




Install the pressure sensor on the first strand of the second row holes at adjustable anchorage and stress the strand to the target force. When the second strand is tensioned to about the target force, the force of the first strand will be reduced due to structural deformation and temperature change, the display value of the sensor will reduce correspondently, adjust the stressing force of the second strand according to the value change of the sensor, while the forces in two strands are the same, anchor the wedge to the conical hole. Install and stress all strands of the cable in this way, the force in all strands will be nearly the same, which can ensure the discrete force error not more than 2.5%. .

04 System Introduction

4.4 Cable Installation



Individual strand tension must be carried out in accordance with the monitoring instructions.

In order to reduce the cumulative errors caused by environment, equipment and human factors during construction process , a dedicated computer-controlled tensioning system including automatic parameter acquisition, processing, analysis, calculation is recommended to use.

The discrete force error of each strand in the cable is not more than 2.5%. It is recommended that a corresponding intelligent cable force detection system is used in the construction process。

04 System Introduction

4.4 Cable Installation

Wax Injection and Protection

Q&A

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