



**ITA TUNNELLING**  
**AWARDS 2018**



# The Immersed Tunnel of Hong Kong-Zhuhai-Macao Bridge Link

Country: China

Presented by : Liang Heng



**ITA TUNNELLING**  
**AWARDS 2018**



## Project stakeholders :

### Client's name:

Hong Kong-Zhuhai-Macao Bridge Authority

**Contractors:** China Communications Construction Company Ltd.,

### Consultants:

AECOM Asia Company Ltd

COWI A/S , Demark

Shanghai Municipal Engineering Design Institute (Group) Co., Ltd, Joint Venture

Tunnel Engineering Consultants (TEC, Netherlands)

Guangzhou Metro Design and Research Institute Co., Ltd

### Supervisor:

Sino-railway Wuhan Major Bridge Engineering Consultancy Co., Ltd. Joint Venture

### Other stakeholders:

The governments of Hong Kong , Guangdong Province and Macao



**ITA TUNNELLING**  
**AWARDS 2018**



## Short Description of Project



## Description of HZMB Link

- Hong Kong-Zhuhai-Macao Bridge Link is a mega sea crossing, connecting Hong Kong, Zhuhai and Macao
- This link is about 55 km long, consists of bridges, artificial islands and tunnels.





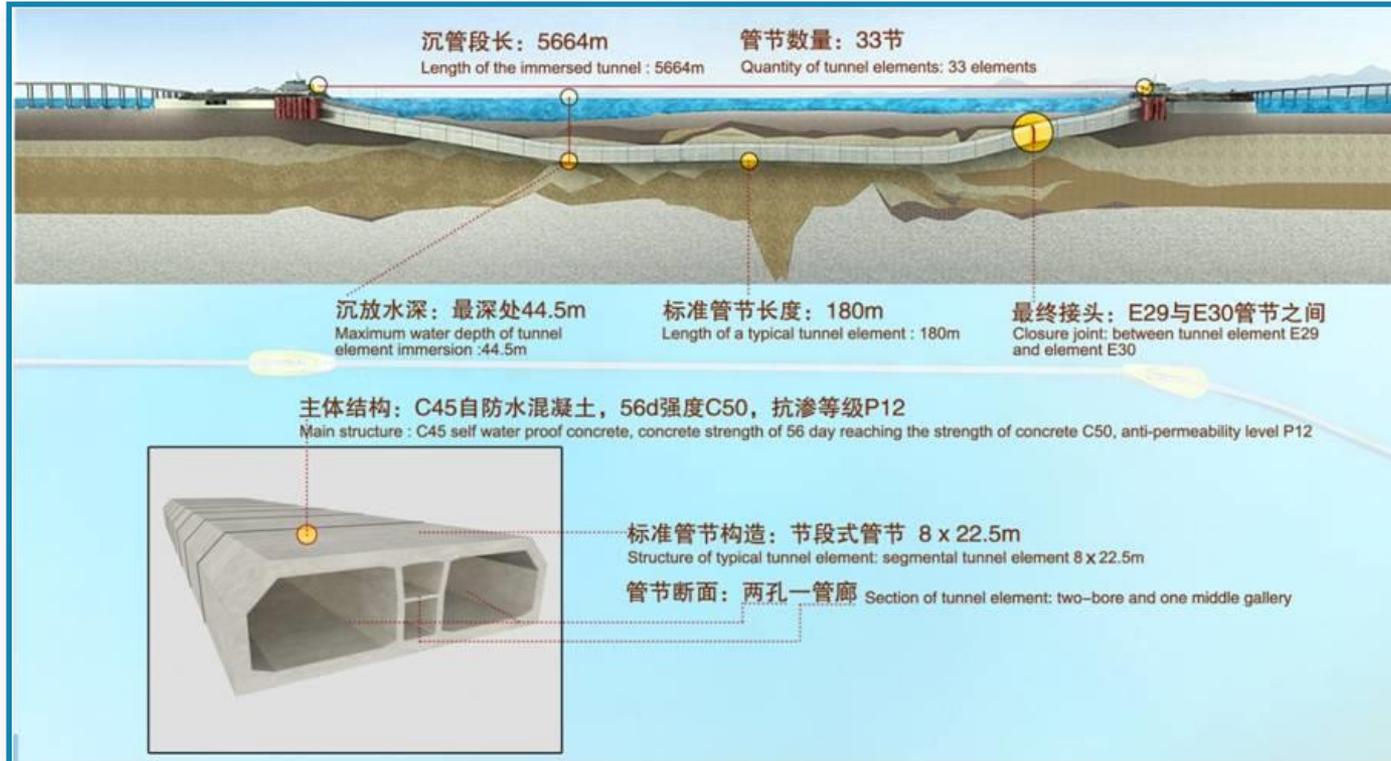
## Description of HZMB immersed tunnel

- The HMZB tunnel is 6.7 km long of which the immersed section is 5.6km long.
- It is made up of 33 tunnel elements of which 28 straight elements and 5 curved elements.





- Typically a tunnel element (180m in length), 11.4m in height, 37.95m in width, is made of segments, has a weight of approx. 76,000 tons;
- The HZMB tunnel is placed on a very deep level of about 45 m below sea, the back cover is up to 22 m thick.





**ITA TUNNELLING**  
**AWARDS 2018**



## Why HZMB project should be awarded



# Reason 1 : Difficulties



ITA TUNNELLING  
AWARDS 2018

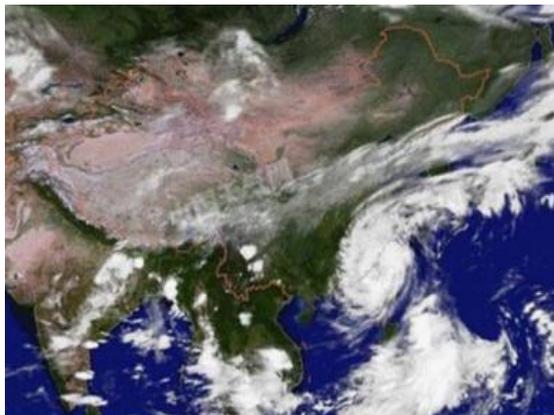
## ENVIRONMENT CHALLENGES



Project crosses the busiest navigation area of China.



Located within the protection zone of the Chinese white dolphin, a highly protected sea mammal.

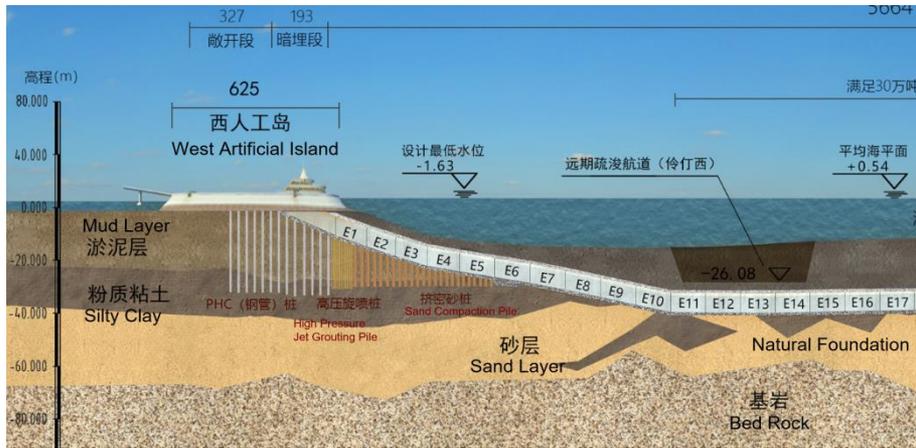


Typhoons and tropical cyclones, strong wind, high humidity also frequently occur in the region.



ITA TUNNELLING  
AWARDS 2018

## ENVIRONMENT CHALLENGES



The seabed consists of soft marine deposits and alluvium reaching 30 m deep.



High frequency of back siltation



# Reason 2 : Innovations



ITA TUNNELLING  
AWARDS 2018



Because:

It is one of **the deepest immersed tunnels** in the world and also the **longest** highway immersed tunnel.

The project is **the first** immersed tunnel built in open sea in China.

Numerous challenges and difficulties need to be solved.  
**Innovation** is the only way to achieve that.

We can conclude the innovations as the following 6 items:



**ITA TUNNELLING  
AWARDS 2018**

## MAIN INNOVATION TECHNOLOGY



1

**Combination of Advanced Foundation Techniques**

2

**Semi-Rigid Tunnel Concept**

3

**Curved Immersed Tunnel Element Prefabrication**

4

**Alerting and Forecasting System for  
Towing and Immersion Operation**

5

**the Final Closure Joint**

6

**Artificial Island Construction with Large Steel  
Cylinders**



# Video



ITA TUNNELLING  
AWARDS 2018



# Reason 3 : Environment Protection



**ITA TUNNELLING  
AWARDS 2018**



Tunnel site crosses the protection zone of **Chinese White Dolphin**



1, Prefabrication + Installation, minimized the activities and work in the sea

2, upgraded the construction vessels acoustics settings to minimize the noise and the interruption to ecosystem.

3, installed water recycle system on the artificial islands for cooling , watering

**Result: No** environment complaint

**Chinese White Dolphin** can be seen living around site

Chuzhou-Nanjing 7<sup>th</sup> November 2018

HZMB Immersed Tunnel



ITA TUNNELLING  
AWARDS 2018



this project was evaluated as  
**Green construction Site**  
by China Construction Association



ITA TUNNELLING  
AWARDS 2018



# Reason 4 : Safety Performance



**ITA TUNNELLING**  
**AWARDS 2018**



**NO** construction-related fatalities



ITA TUNNELLING  
AWARDS 2018



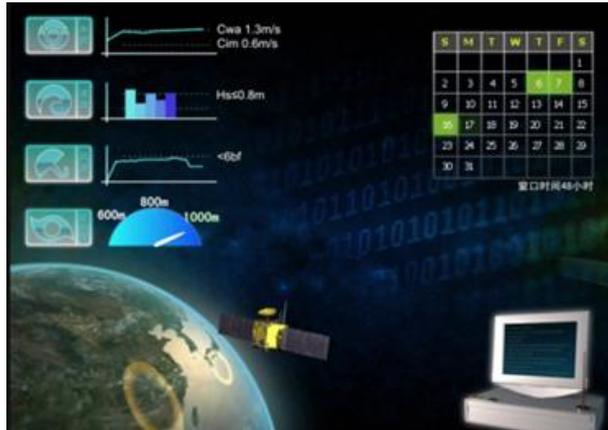
# 6S Management



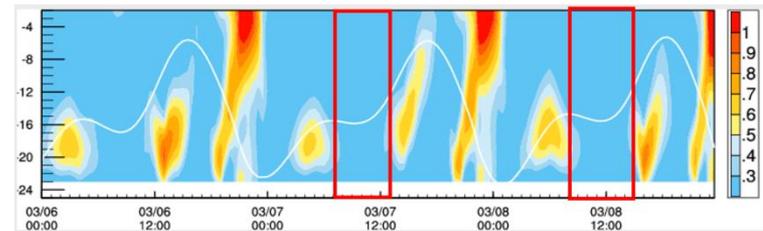
Chuzhou-Nanjing 7<sup>th</sup> November 2018



HZMB Immersed Tunnel



Chuzhou-Nanjing 7<sup>th</sup> November 2018

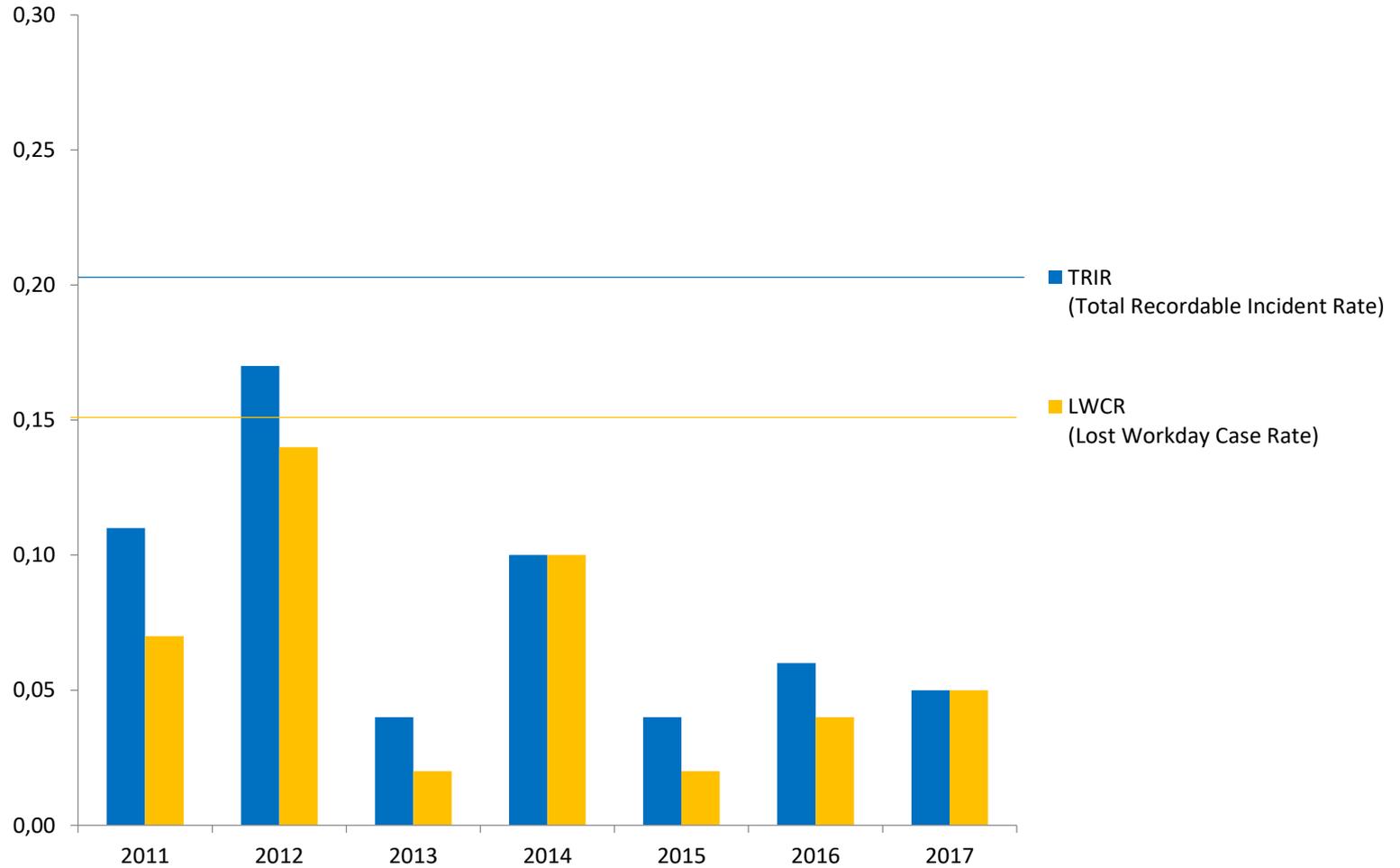


HZMB Immersed Tunnel



**ITA TUNNELLING  
AWARDS 2018**

## Safety Statistics as per OSHA definitions



Chuzhou-Nanjing 7<sup>th</sup> November 2018

HZMB Immersed Tunnel



**ITA TUNNELLING  
AWARDS 2018**



this project was evaluated as  
**AAA level Safety Site**  
( the highest standards of safety and appreciation)  
by Safety Branch of China Construction Association.



ITA TUNNELLING  
AWARDS 2018



Reason 5 :  
Cost Saving



**ITA TUNNELLING  
AWARDS 2018**



Artificial Island Construction  
with Large Steel Cylinders

**VS**

Artificial Island Construction  
with dredging and rocks



**Save time: 2 years**  
**Save cost: 21.16 million Euros**

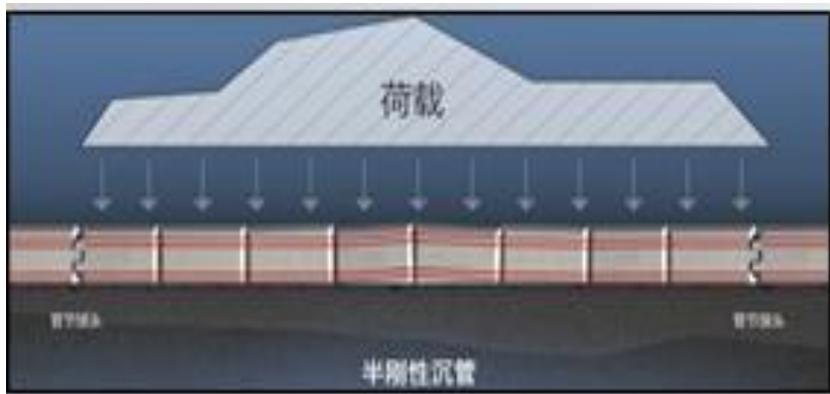


ITA TUNNELLING  
AWARDS 2018



Semi-rigid tunnel concept VS

Rigid tunnel concept



Save time: 1.5 years  
Save cost: 130 million Euros



**Final joint is prefabricated and installed by crane**

**VS**

**Final joint casting on site , using the framework underwater**



Save time: 0.5 year



ITA TUNNELLING  
AWARDS 2018



# Reason 6 : Sustainable Development



1. **Curved elements prefabrication** technology was developed for the first time
2. **Semi-rigid tunnel concept** was developed and used for the first time
3. Composite scheme of **Rock Block +Gravel Bed** for tunnel foundation was developed and used for the first time
4. New product and construction method have lead to great **development and innovation and invention** in the equipment and control / survey system.
5. **Artificial Island Construction with Large Steel Cylinders** was developed and used in Other Project .



**ITA TUNNELLING  
AWARDS 2018**

AS A WHOLE



**Put China to be one of the leaders  
in immersed tunnel countries**



**A great opportunity to stimulate  
innovation and education  
for engineering community**



**Remarkable infrastructure  
integrated Chinese engineers' painstaking work,  
wisdom and spirit.**