

**Forum on China-US Transportation
Symposium on Safety and Disaster-relief Coordination**

Safety Management and Emergency Relief of Hangzhou Bay Bridge

— Department of Communications of Zhejiang Province





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Hangzhou Bay Bridge

Preface

Overview

Safety Management

Emergency Relief

Difficulties and Challenges



- Zhejiang owns a great number of bridges. Till 2011, the number has been 45578, among which 196 bridges are super large bridges, such as Hangzhou Bay Bridge, Zhoushan Bridge, Jiashao Bridge (under construction), Xiangshangang Bridge (under construction).
- The management system of the roads and bridges in Zhejiang consists of government leading, industry regulation and owner in-charge.
- Recently, Zhejiang Province is consistently exploring and practicing the Safety Management and Emergency Relief of super large bridges. Experiences will be introduced, taking Hangzhou Bay Bridge as an example.



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Hangzhou Bay Bridge

Overview



- Length of 36 km
- Investment of 13.4 billion
- Highway
- Dual-direction, six-lane

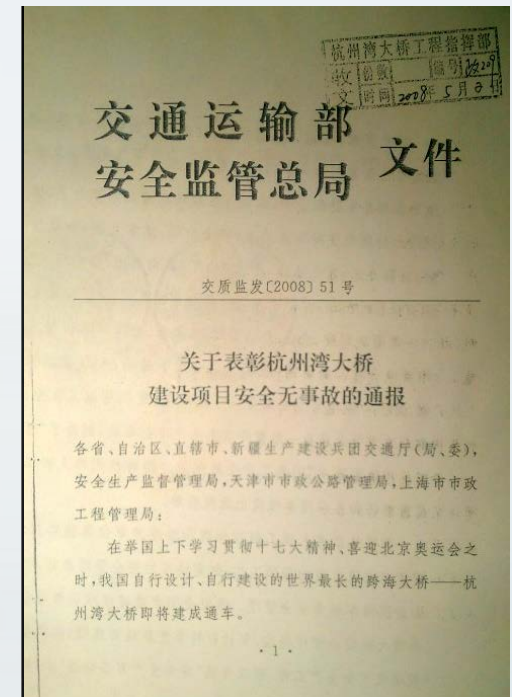


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Overview-Role in the Economy



- Second Prize of National Science and Technology Progress Award, 2011.
- China Construction Luban Award, 2010-2011.
- Zhan Tianyou Award of China Civil Engineering, 2011.
- Construction Safety: Ten Billion RMB Output with Zero Death

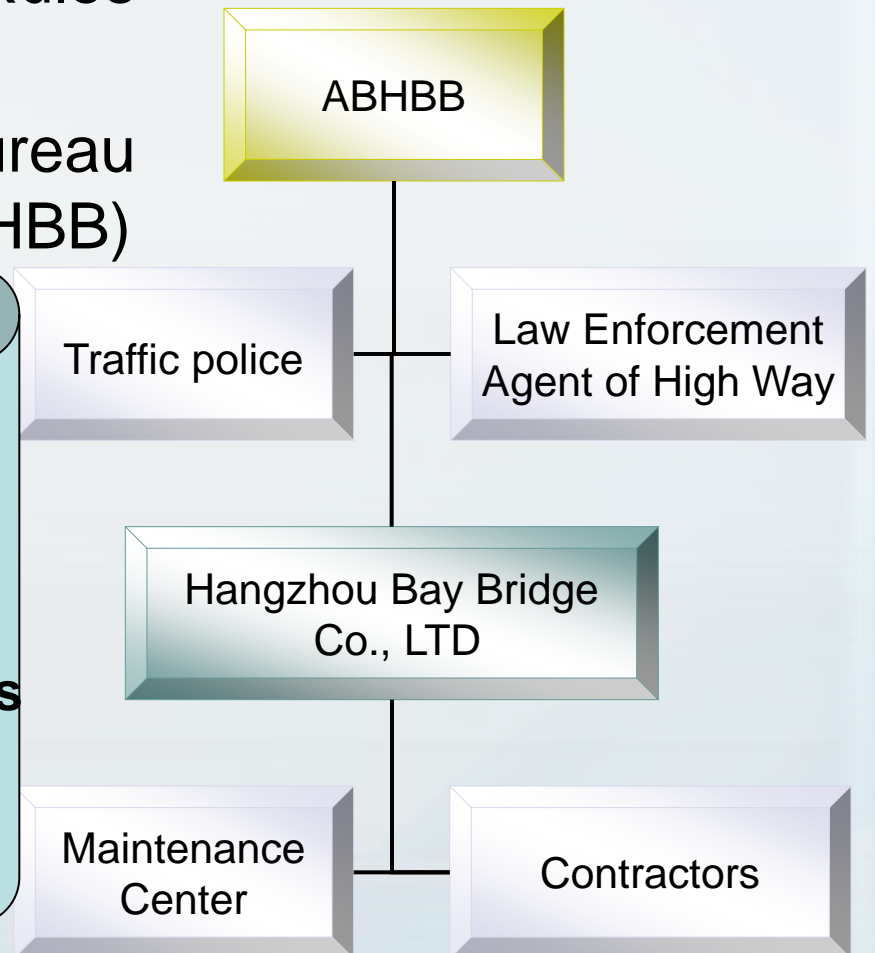




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Hangzhou Bay Bridge

Overview-Administration System

- Formulate the Regulating Rules of Hangzhou Bay Bridge
- Set up the Administration Bureau of Hangzhou Bay Bridge (ABHBB)



Leader: Administration Bureau
Main body: Owner Corporation
Guarantee: Logistics departments
Supporter: Maintenance centers



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Hangzhou Bay Bridge

Safety Management-Operational Condition



**large tide range
high speed flowing
deep scouring**

average velocity	2.39m/s
maximum velocity	5.16m/s
maximum tide range	7.57m
average tide range	4.65m

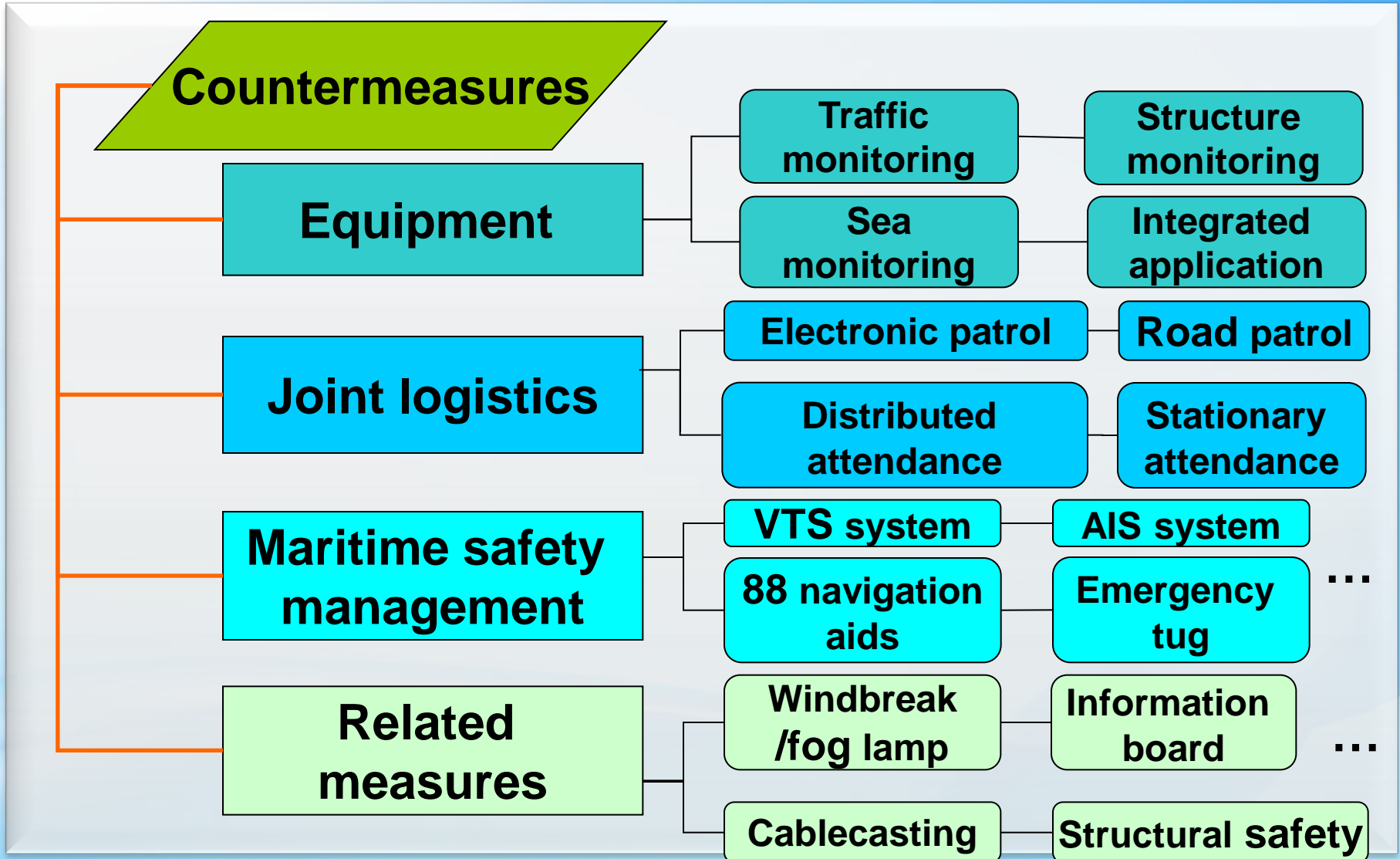
**Small-range disastrous
climate is common.**



**Mass fog happens
frequently**



Safety Management-General Frame





- **Full-coverage and intelligent monitoring**
- **Maritime safety**
- **Joint logistics**
- **Related measures**



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Hangzhou Bay Bridge

Full-coverage and intelligent monitoring

Traffic safety
of the bridge

Structural
safety

19 sets of
equipments

Maritime
safety

Integrated
application

Bridge Monitoring and Control System



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Hangzhou Bay Bridge

Bridge monitoring and control



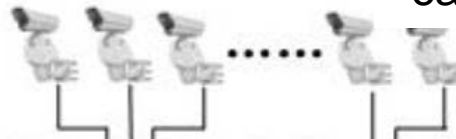
weather monitoring system



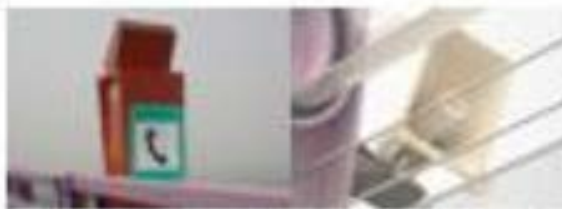
orientation control system



419 video cameras



lamps

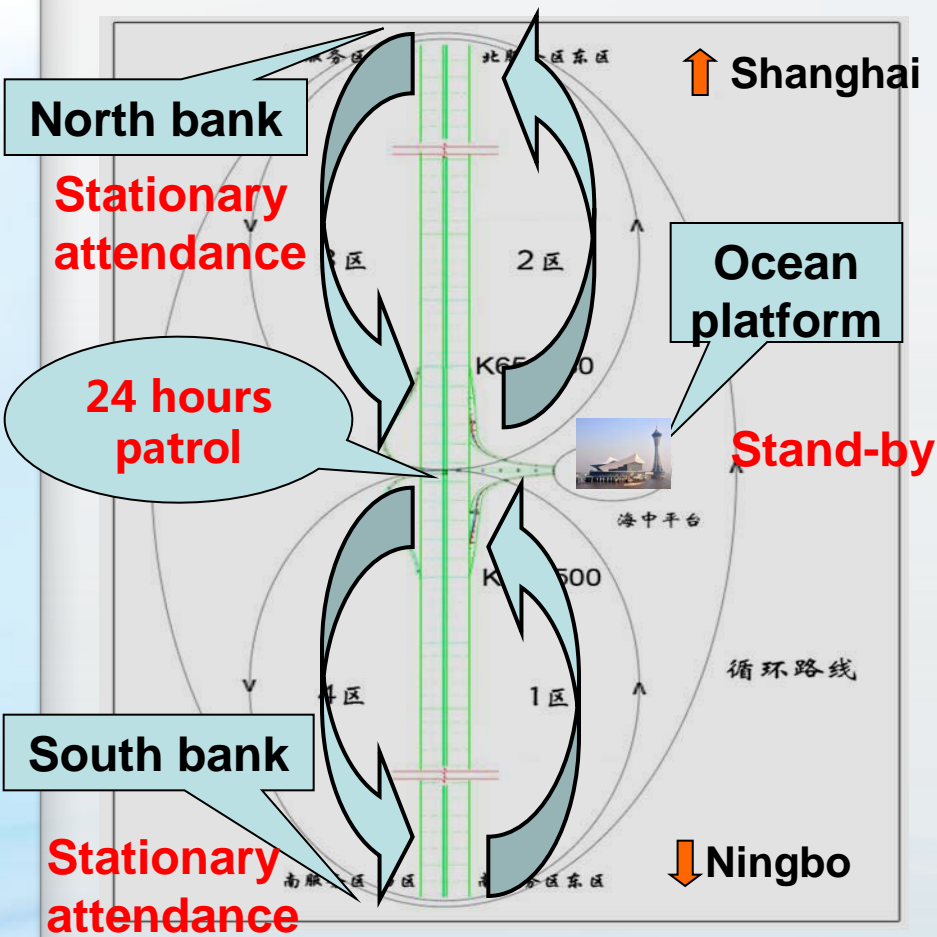


emergency telephone and cablecasting



health monitoring system

Joint logistics



Scheme of the joint logistics

- Zone 1 : south bank-platform
- Zone 2 : platform-north bank
- Zone 3 : north bank-platform
- Zone 4 : platform-south bank





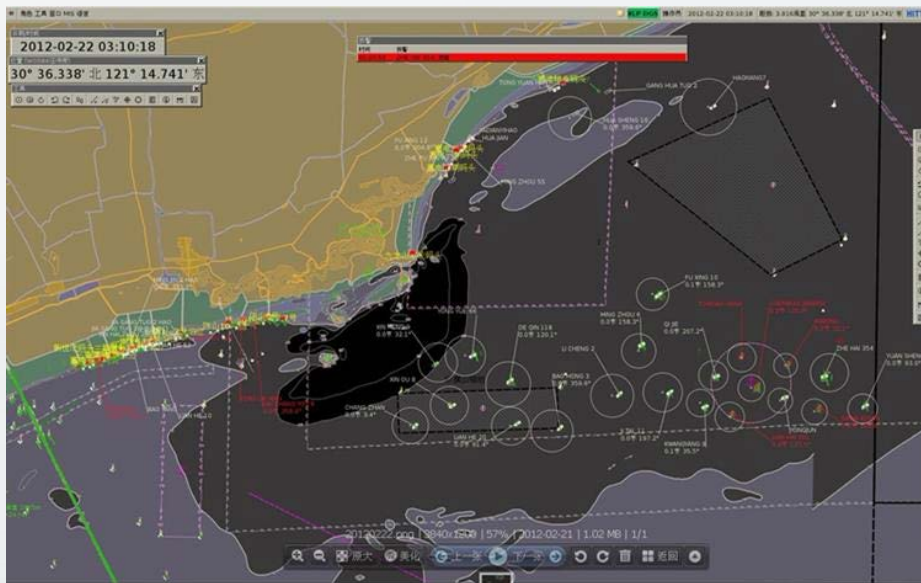
Achievement of the goals of joint logistics

Main objective	Requirements	Implementation
Arrival time for accidents on-deck and obstacle clearing	Patrol car arrives in 20 minutes in daytime and 25 minutes at night. Heavy traffic arrives in 30 minutes. Large vehicle arrives in 50 minutes.	100% of the vehicles arrives in the specified time and half of them arrive in 10 minutes.
Incident detection rate of monitoring center	More than 65% , aim to 70%.	Average rate is more than 73%.
Safe operation and equipment soundness	Registration rate is up to 98%, prosecution rate is 95% , wind-up-case rate is 95% , repair rate is 100%.	<u>All the requirements are satisfied.</u>



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Maritime safety



**Monitoring center of
vessel traffic service**

**Monitor and regulate the
vessel within the bridge
area using VTS and AIS**





Anti-collision chains of non-navigable span



88 navigation aids

Monitoring center and VTS, AIS

Maritime safety management



Emergency tug and patrol vessel



Anti-collision boxes

Anti-collision boxes



Related countermeasures



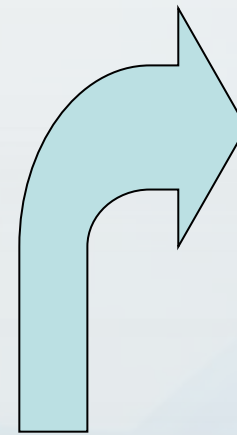
(c) 过渡段风障



(d) 引桥护栏加高段

- **1.5m-high windbreaks distributed along the north and south channel bridge**

• **level 8**



**level 10
or more**

• **Safe level of wind speed**



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Hangzhou Bay Bridge

Related countermeasures



1844 fog
lamps along
the road

Related countermeasures



Cablecasting

- 10 information boards
- 27 lane controlling flags

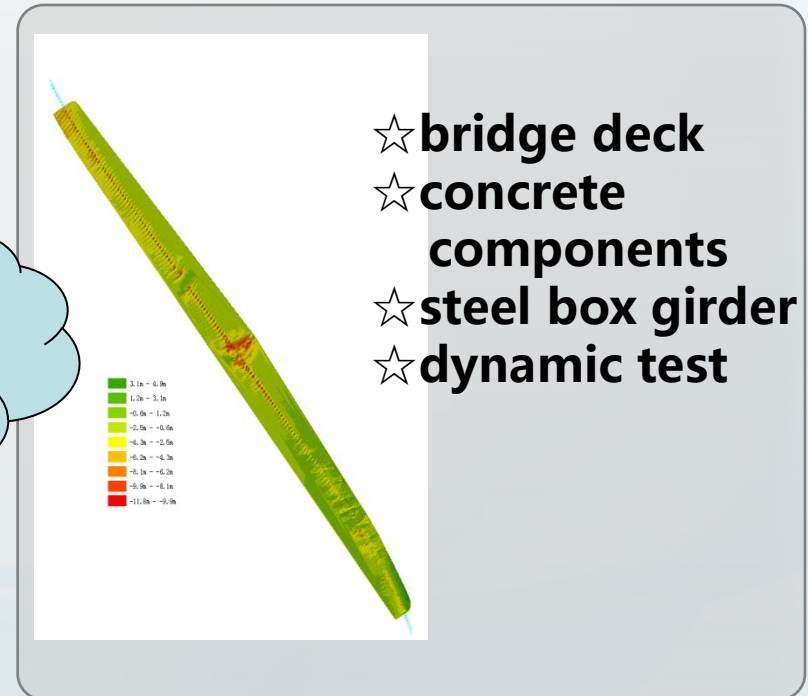


Detection and evaluation of the structure safety



Alarming of the structure safety

Inspection items :
bridge tower;
channel bridge;
girder;
settlement of bridge piers;
vibration.



Safe, Unimpeded, Harmonious, Efficient

- No major traffic accident happens during the operation
- 0.33 accidents per ten thousand vehicles



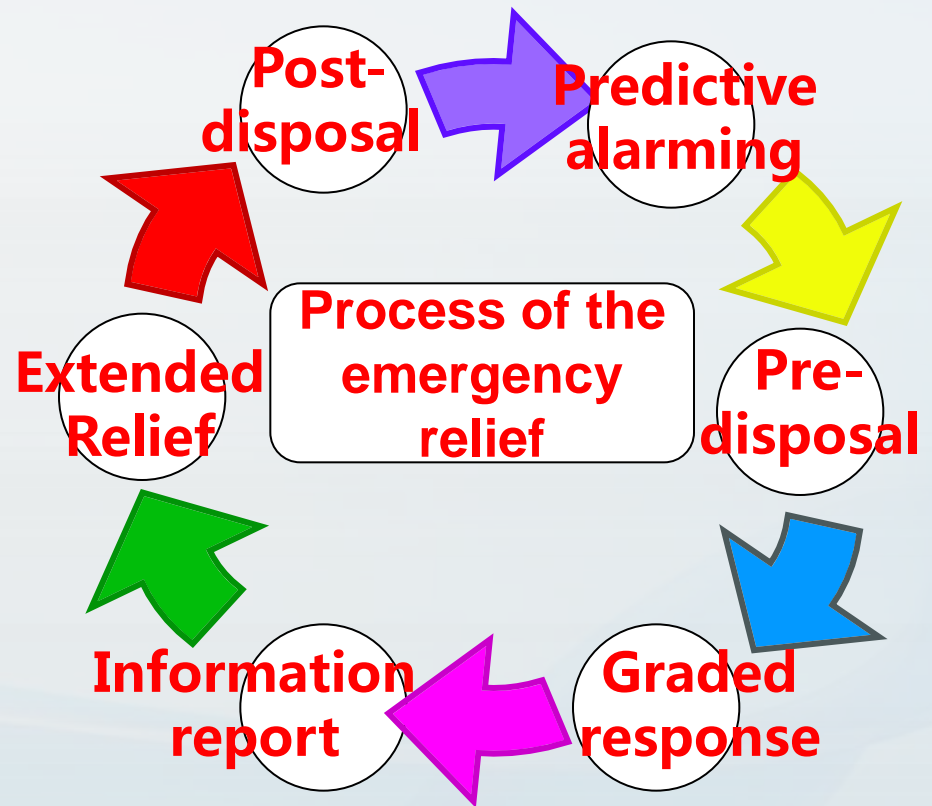


Emergency plans of Hangzhou Bay Bridge

Provincial plan
of Zhejiang

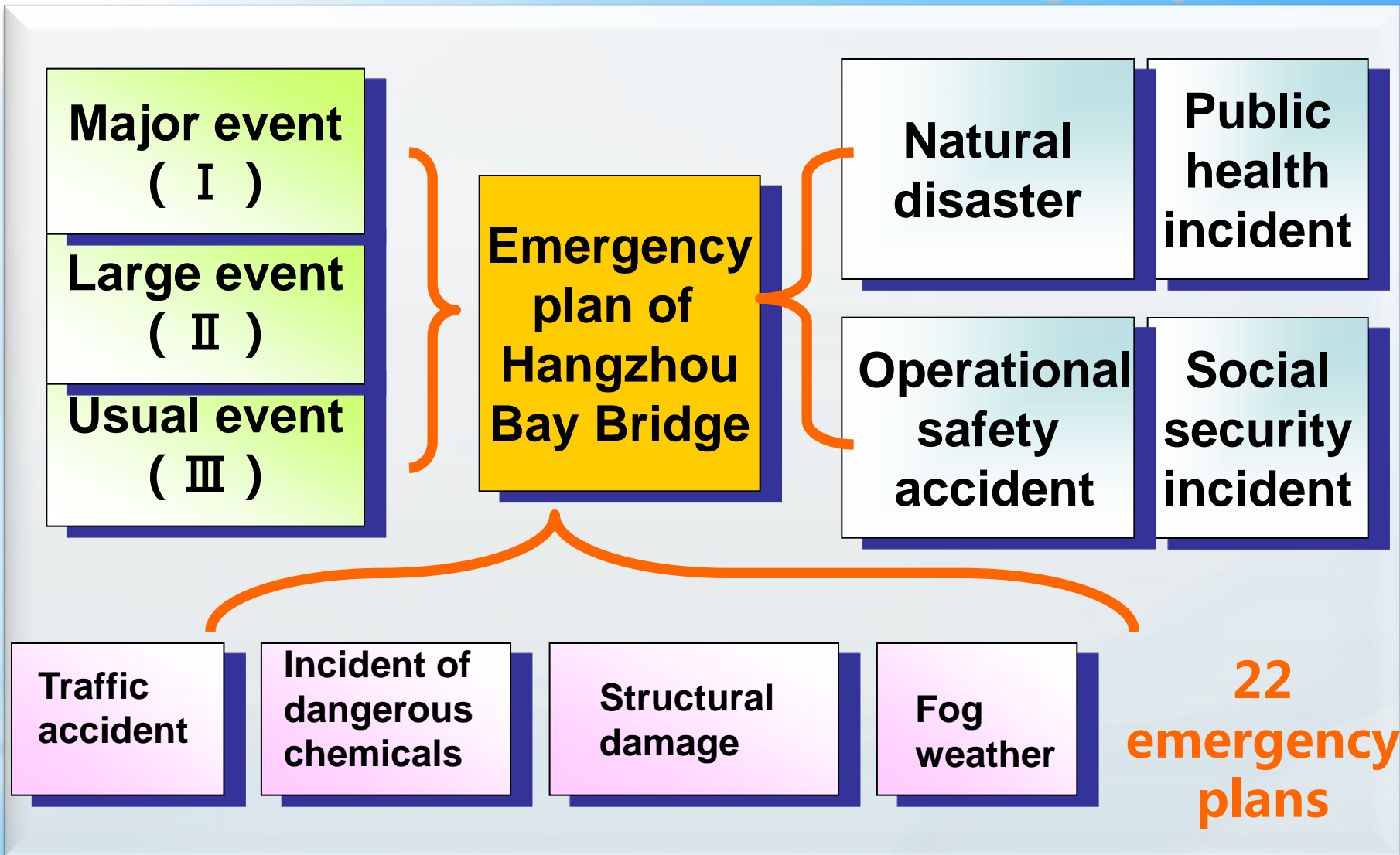
City plan of
Ningbo

Bureau plan of
the administration
bureau





Emergency relief





Emergency relief





Relief liquid caustic soda leaking incident



Alarm

Locate the incident using video cameras

Countermeasures of caustic soda, alert of conservation and fire control

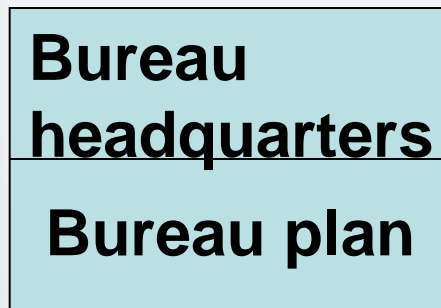
Rescue and release information





Emergency relief

(Usual event)

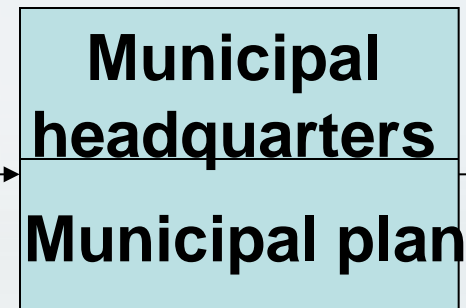


report

municipal
relief ?

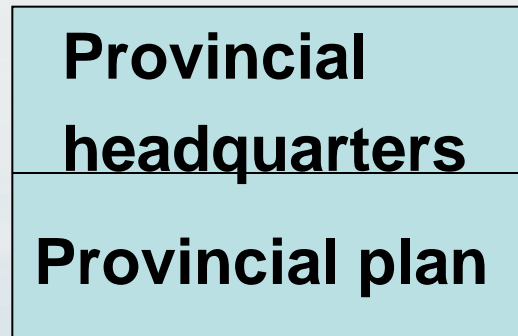
Y

(large event)



N

Y

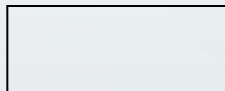
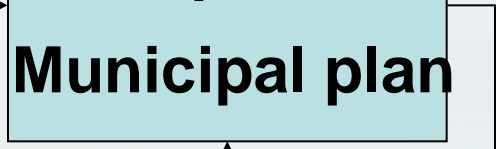


N

provincial
relief

report

(major event)



Emergency relief



Fire drill



**Dangerous
chemicals drill**



Preview of the plan



Emergency tug drill

Emergency relief

- Vehicle could turn around in the ocean platform to reduce the relief time





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Emergency relief

- Rescuing drill of the helicopter in the platform

**Helipad
and dock**



VTS monitoring center on the 2nd floor of the sightseeing tower





Difficulties and challenges

1. Difficulties in operation management caused by complex climate such as strong tide estuary.
2. Prevention and treatment of the structure diseases.



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**Thank you for
your attention!**