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Wenchuan Post- Earthquake Highway Recovery and Rehabilitation Planning

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Introducing Wenchuan Earthquake Recovery Experience of Transportation Infrastructure

Wenchuan *Post- Earthquake Highway Recovery and Rehabilitation Planning*

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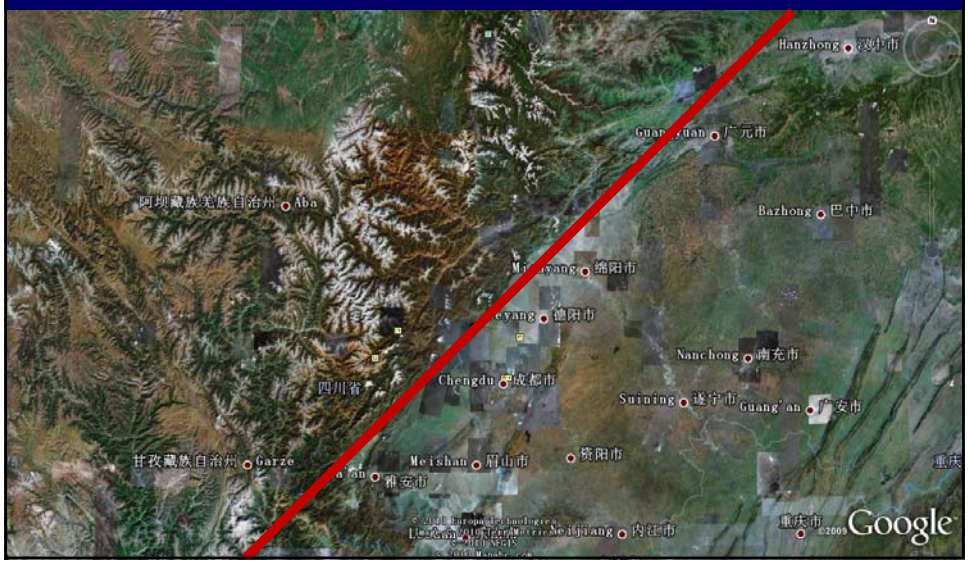
The Wenchuan Earthquake on May 12, 2008 brought severe damages to the disaster areas 。

Highway Network-- Before the Earthquake

Divided by the longmenshan fault, the topography, Geography, Highway network density, Grade, Social and economic development etc. are totally different.



West of the line are mountainous, highway corridor is very narrow, generally compile with valley line and ridge crossing line .

In this area, due to topography. Geography condition, there a lot of geo-hazards, such as collapse, landslide, mud-rock flow, rockfall.

Constraint to topography, Geography condition and construction budget, the highway network in the disaster area are low density、low grade, and low anti-disaster capability.

Disaster area in Sichuan, total highways are 45897km，of which class 4 and below wre 38265km，take up 83.4% 。

in Gansu, total highways are 8809km， of which class 4 and below are 7685km，87.2%。

in Shanxi, total highways are 7965 km，of which class 4 and below take up 89.4%。

The Earthquake also brought severe damages to most highway traffic facilities in the disaster areas.

Some county, such as Wenchuan、Maoxian、Beichuan、Qingchuan and Pingwu, became solitary inland after the earthquake.

Direct lose of highway infrastructures in the area amount to 61.2 billion RMB 。

In order to carry out Recovery and Rehabilitation after Wenchuan Earthquake orderly and effectively, Ministry of Transport cooperated with Sichuan, Gansu and Shanxi provinces DOT wasted no time to compile the *Post-Earthquake Highway Reconstruction Planning.*

Overall Recovery and Rehabilitation Planning after Wenchuan Earthquake

- City
- rural
- infrastructure
- Housing
- Public severs
- Industry
- Market
- Disaster proof
- Land use

highway

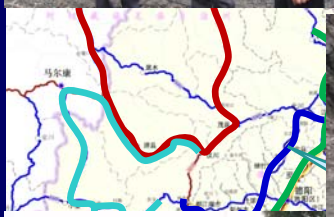
Planning Basis:

Guideline of Recovery and Rehabilitation planning after Wenchuan Earthquake, State Council.

Policies and Measures for support Recovery and Rehabilitation after Wenchuan Earthquake, State Council.

In order to comprehend highway damages and collect data in disaster area, pave the way for recovery and rehabilit-ation planning, MOC send four groups to the area in may 22 to 25,2008。

The investigated highway included G212、G213、G317、G318、S105、S106 and rural roads。



Highway damage ——direct and induced

Subgrade and pavement

路面沉陷

崩塌落石

路面垮塌

堰塞湖

direct　　induced

Slop and Retaining wall

岩石崩塌

雨后塌方

滑坡推挤

震后危岩

direct　　induced

Bridge

collapse

misplacement

direct

landslide

Rock fall

induced

Tunnel

Rock fall

Land slide

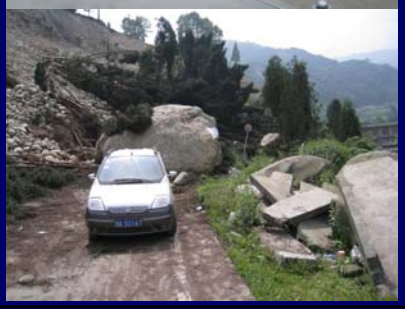
direct

Water creep

induced

Rural roads and Passenger station

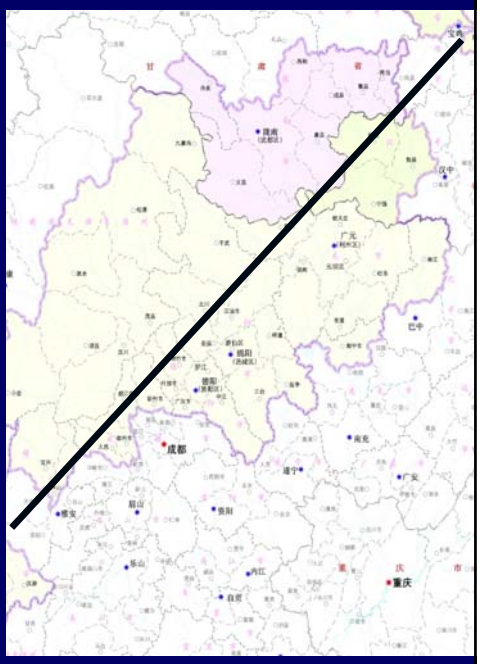
Rural road



Passenger station

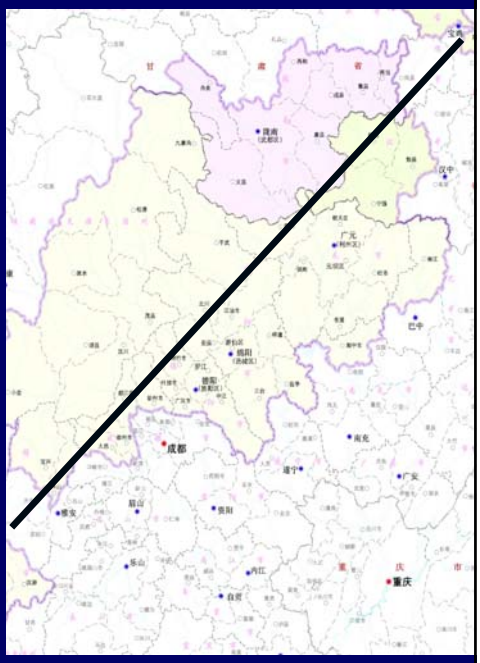
Characteristic of highway damage

1、large scope: 9 expressways total 102km、27 national and Provencal highways total 2611km, 31412km rural roads and some passenger stations are damaged at different level. Cause direct lose 61.2 billion RMB



Characteristic of highway damage

2、The severity of the highway damages was determined by the distances between the highways and the longmenshan fault, i.e., the closer the distance was, the more severe the damages were. Besides, the seismic waves tend to spread along the fault zones, thus the towns, villages and highways near the fault zone were severe destroyed.



Reason of highway damage

Topography and geography: severe down cutting of the valley, steep slopes, fragile geological environment

Earthquake magnitude: The magnitude of the Wenchuan earthquake was Ms 8.0

Seismic fortification intensity: In accordance with the *Seismic Intensity Zoning Map of China* the average regional seismic intensity is generally no more than VII, but the actual intensity of this earthquake at the heavy disaster area was about IX-XI, far beyond the seismic fortification intensity.

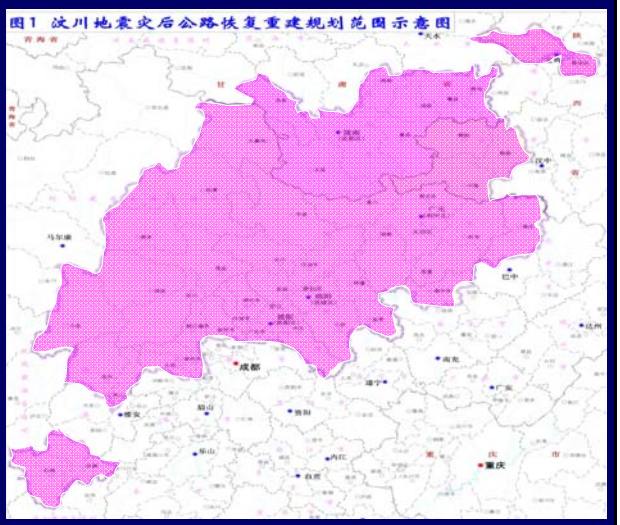
highways Anti-disaster capability : while class four and below are the majority , low grade highway in the disaster area Anti-disaster ability are very low.

Scope and time limit of planning

Scope:

According to the guideline issued by state council, the planning area including 39 counties in Sichuan, 8 counties in Gansu, and 4 counties in Shanxi, total 51 counties.

Time limit: 3 years, 2008 to 2010。



Planning Target

In about 3 years, Recovery and rehabilitation transport infrastructure, ensure traffic capacity of main national and provincial highways and improve their anti-disaster ability. Build lifeline network, providing safety, relievable, and convenient highway network.

Determination of Lifeline Highways

After the earthquake, duo to highway damage traffic to Wenchuan, Maoxian, Beichuan, Qingchuan and Pingwu was cut-off, this counties became solitary inland.

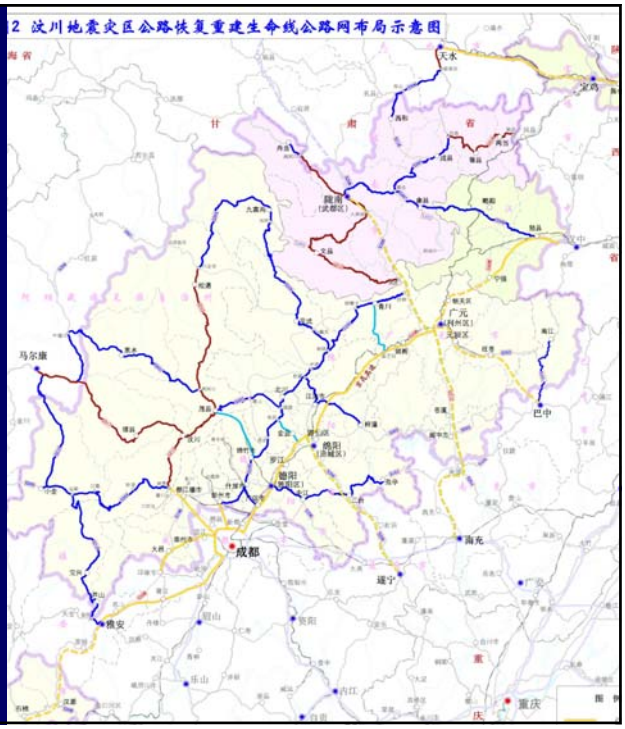
According to analysis the reason of highway damages and learning from international experience, we determine the lifeline highway network based on the standard that each county has two or more highways which have higher disaster resistance capabilities running in more than two directions .

Definition of Lifeline Highways

highways that have better construction condition, stronger disaster resistance capability, So it have the capability to guarantee emergency traffic. During construction of lifeline highway projects, the seismic design standards of important structure should be considered one degree higher than other highways.

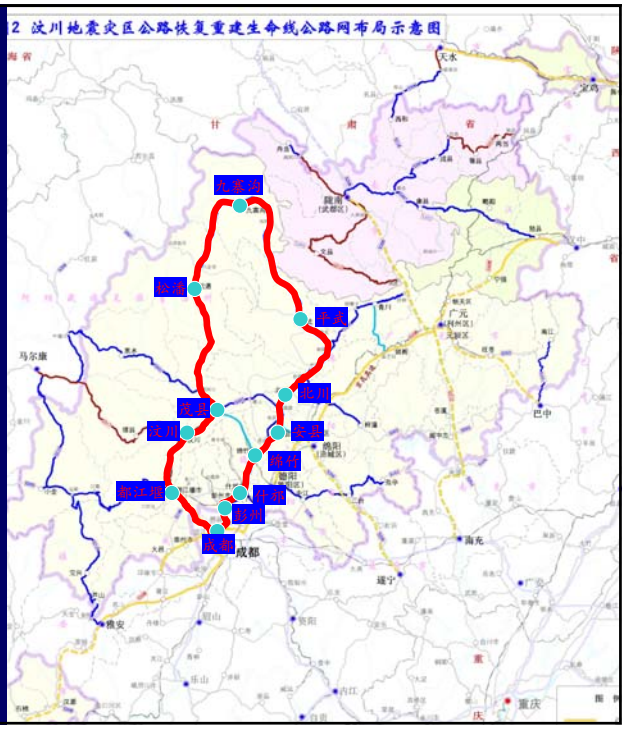
Layout of lifeline network:

“one ring、three ordinate,、four horizontal, ten connections”. total 4911 km。



“one ring”:

Changsu- Dujiangyan—Wenchuan—Maoxian—Songpan—Jiuzhaigou—Pingwu—Beichuan—Anxian—Mianzhu—Shifang—Pengzhou—Chengdu。

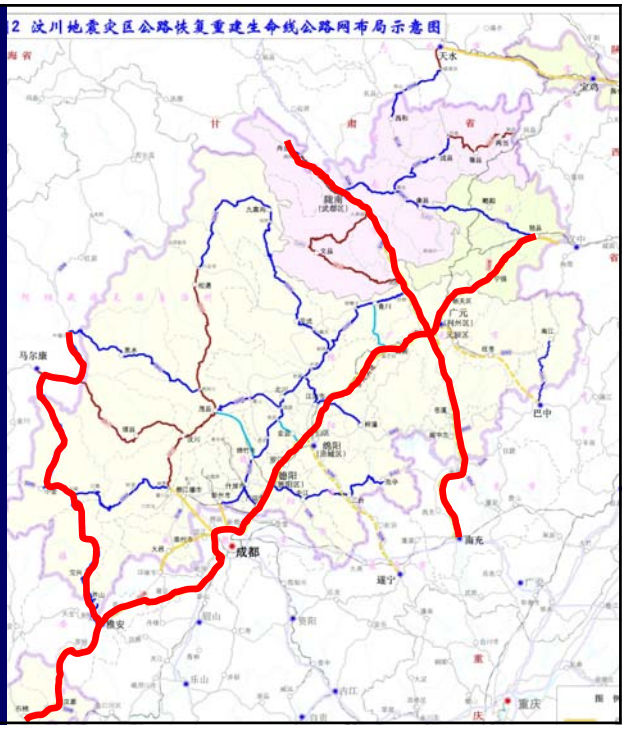


“three ordinate”:

1: Mianxian-Guangyuan-Mianyang-Changdu-Ya’an

2: Zhouqu-Wudu-Guangyuan-Nanchong

3: Zhongrangkou-Xiaojin-Baoxin-Ya’an



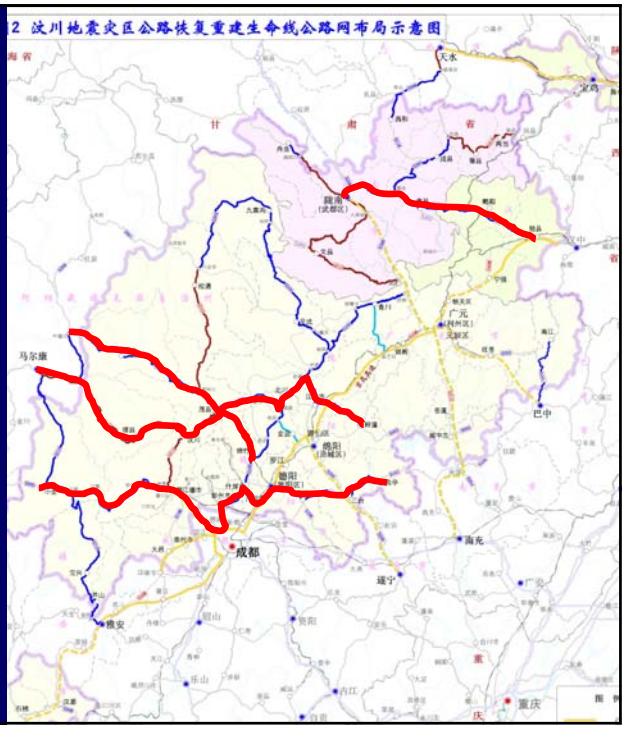
“four horizontal”

1: Mianyang-Leyang-Kangxian-Wudu

2: Mianzhu-Maoxian-Hishui

3: Zitong-Beichuan-Wenchuan-Ma’erkang

4: Yanting-Zhongjiang-Guanghan-Doujiangyan-Xiaojin



“ten connections”

1: baoji-xihe

2: liangdang-wudu

3: wudu-wenxian

4: qingchuan-pingeu

5: qingchuan detour

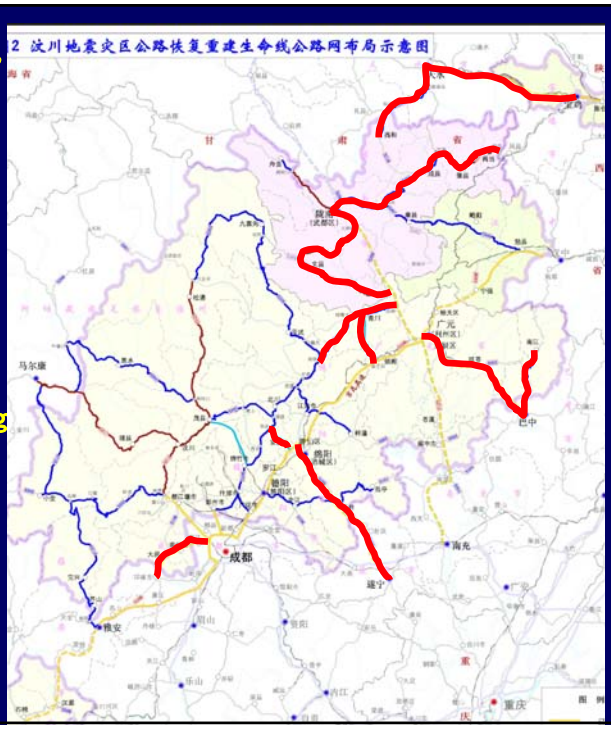
6: guangyuan-bazhong

7: nanjiang-bazhong

8: anxian-mianyang

9: mianyang-suining

10: wudu-qionglai



Scale of highway recovery and rehabilitation

highway recovery and rehabilitation including expressways、national and provincial highways, rural roads and passenger stations:

1、expressway 1599km，of which rehabilitation 5 existing expressways 619km, 6 continued expressways 412km，timeline startup 4 expressways 568km;

2、 6 national highways 1910km，22 provincial highways 3323km and other highways 848km;

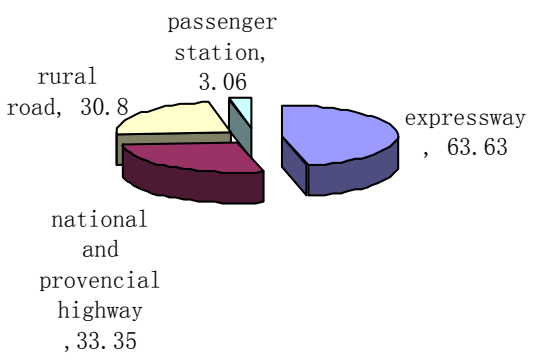
3、rural roads 39948km，of which new construction 9342 km;

4、412 county passenger stations， 363 village passenger stations。

Budget

To complete the planning ,need to input 130.84 billion RMB.

of which 103.72 billion within 3 years。



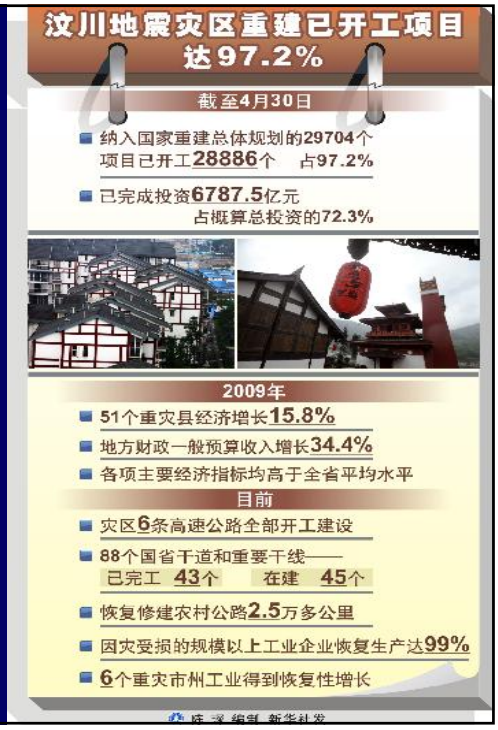
Technical Strategy

- Raise seismic fortification standard of the lifeline networks.
- Focusing on reconstruction and in combination with new construction.
- Flexibility in highway design , Respecting the nature and adapting to local conditions.
- Strengthening the observation and precaution, reducing the influence of secondary damages.

——July 22,2008, MOC finished 《Recovery and rehabilitation of highway planning after Wenchuan Earthquake》。

—— Sept.19, 2008, the planning integrated into the 《Overall Recovery and rehabilitation planning after Wenchuan Earthquake 》, issued by State council .

Progress



Progress －Transport

Till April 30, 2010，Sichuan DOT completed 389 transport projects, more then 80% of all the projects, input 63.91 billion RMB，about 76% of budget 。All the transport projects will be completed within 2 years.

Practice effect

This year the area (wenchuan, zhouqu) had experienced extraordinarily flood and mud-rock flow, the lifeline highways which are completed generally bear the test, and played “life line” in emergency rescues.

But there still some problems

Some bridges with low elevation, and small spin.

Highway occupy river bed : wash out。

路基因挤压河道，且处于河流顶冲处而被冲毁

Lack of retaining wall : wash out

因防护及水工工程不足造成路基路面被冲毁

Principal of Design

Respect nature

Flexibility design

Thanks !