



Disaster Management in Taiwan

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Senior Executive Officer

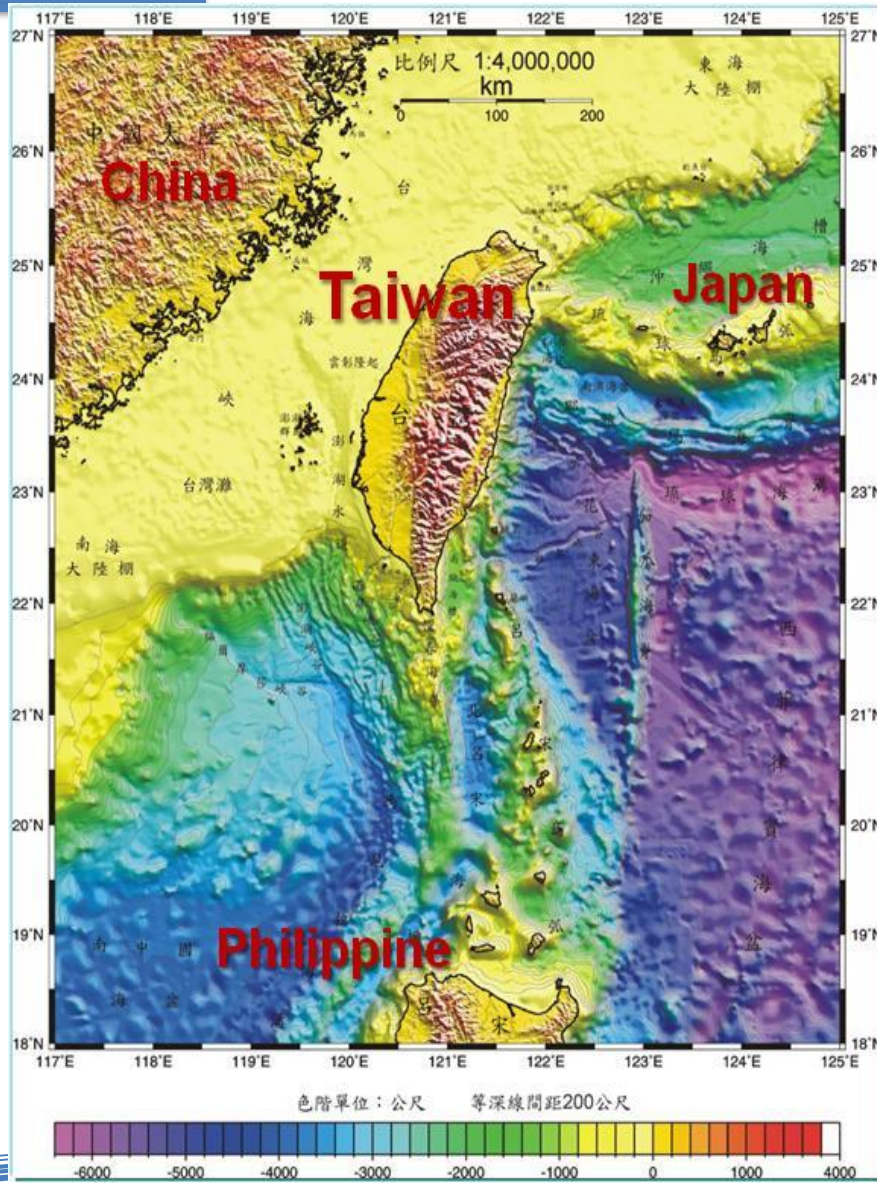
Office of Disaster Management, Executive Yuan

Outline

- **Introduction**
- **Emergency Management System**
- **Disaster Response Mechanism**
- **Disaster preparedness and response innovations in Taiwan**
- **Conclusion**

Introduction

Basic Information of Taiwan



- **Geographic features**
 - 400 km from north to south
 - 145 km from east to west
 - **Area: 36,000 Km² over 70% in slope land**
- **Population (Jan, 2012)**
 - **23,230,506 in total, 67.70% in urban areas**
 - **Density: 641/ Km²**
- **Tectonic Conjunctions:**
 - **Philippine Sea plate**
 - **Euro-Asia Plate**
- **High risk of Typhoon**
 - **3-5 typhoons/year**

268 Mountains over 3,000m



Major Natural Disasters in Taiwan



**Typhoon
(Morakot, 2009)**



**Urban flood
(Nari, 2001)**



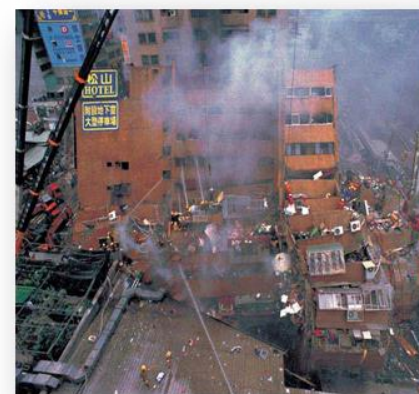
Debris flow



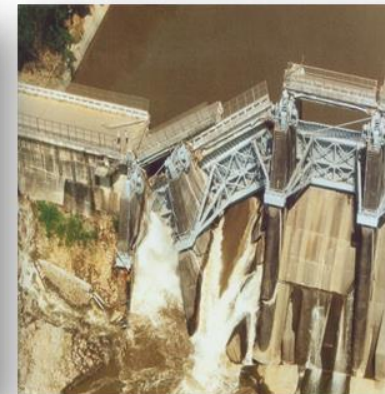
Landslide



**Earthquake
(Chi-Chi, 1999)**



**Residential
Building**

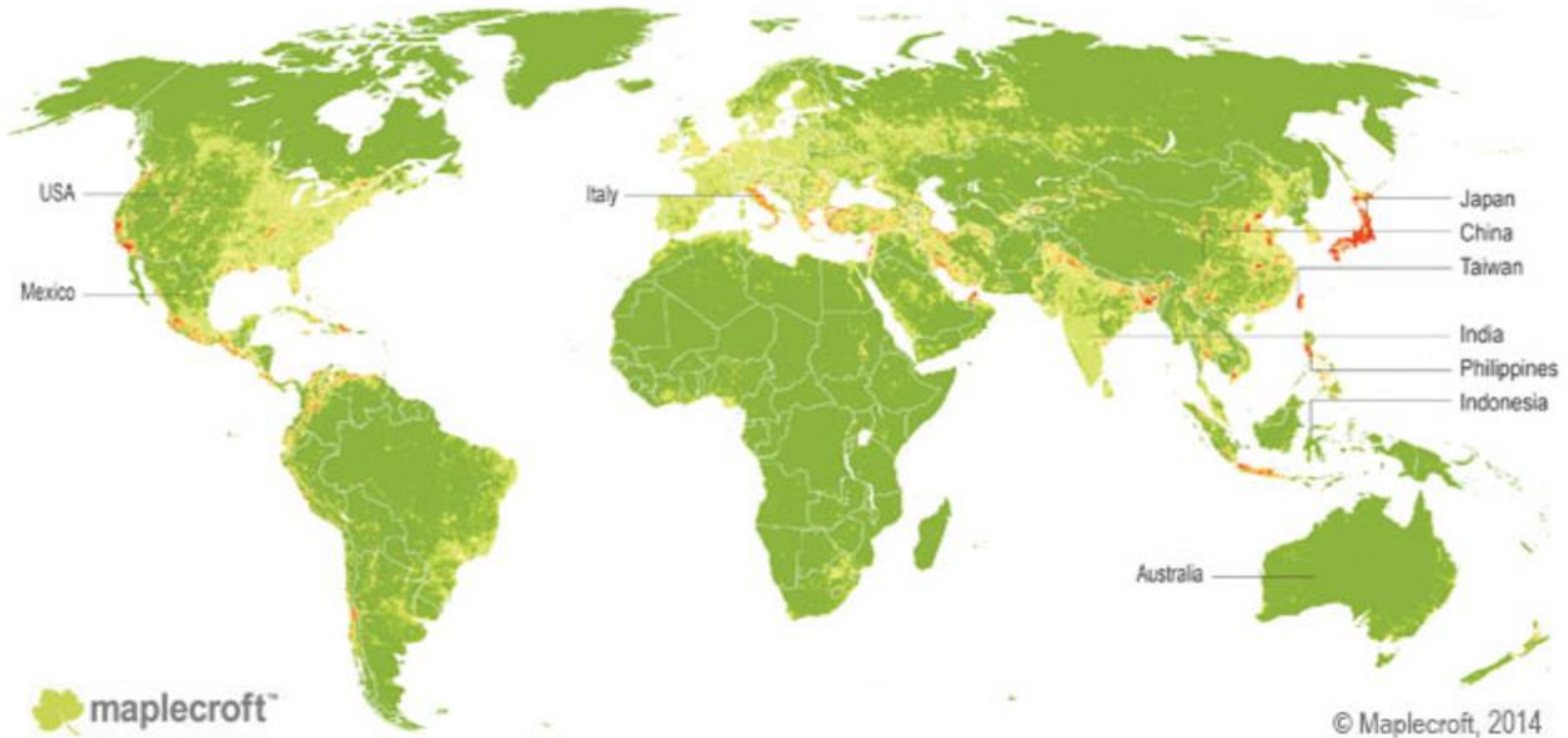


Infrastructure



Collapsed school

Natural Hazard Risk: Absolute Economic Exposure Index 2014



Rank	Country	Category
1	Japan	Extreme
2	USA	Extreme
3	Taiwan	Extreme
4	China	Extreme
5	India	Extreme

Rank	Country	Category
6	Mexico	High
7	Philippines	High
8	Italy	High
9	Australia	High
10	Indonesia	Medium

Legend	
	Extreme
	High
	Medium
	Low
	No data

Emergency Management System

Disaster Management system

◆ Single Hazard Disaster Management Approach

◆ Tree levels of government DM Structure

Central Government

Municipality and County Government 22

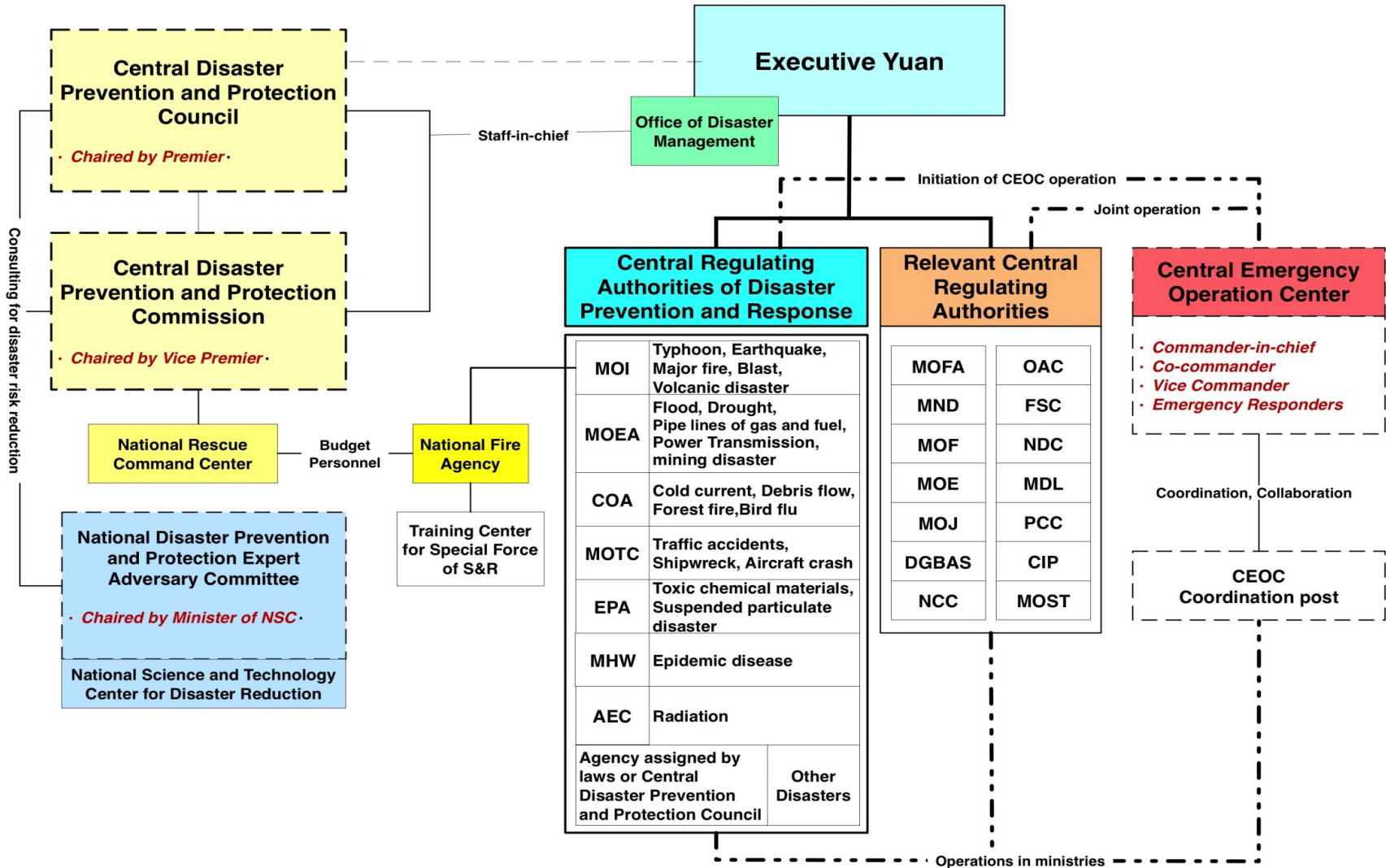
Township (District) Government 368



Disaster Responsible Authorities

(Responsible Authority)	(Type of Disasters)
Ministry of Interior	• Typhoon 、 Earthquake 、 Fire 、 • Explosion 、 Volcanic Disaster
Ministry of Economy	• Flood 、 Drought 、 • Pipeline(oil 、 electricity 、 industrial gas)
Atomic Energy Council	Radiation
Council of Agriculture	• Debris Flow 、 Cold Current 、 • Forrest Fire
Department of Transportation	• Plane Crash
Department of Environment Protection	• Hazardous Materials • Suspended Particulate Disaster
Ministry of Health and welfare	• Epidemic Disease

Central Government Disaster Management



Disaster Response Mechanism In Taiwan

Central Emergency Operation Center (CEOC)

- Initiated by Disaster Responsible Agencies
- Stationed by relating authorities and other units (NGO)
- 24 hours
- Analysis, coordination, command and support



National Search and Rescue Command Center

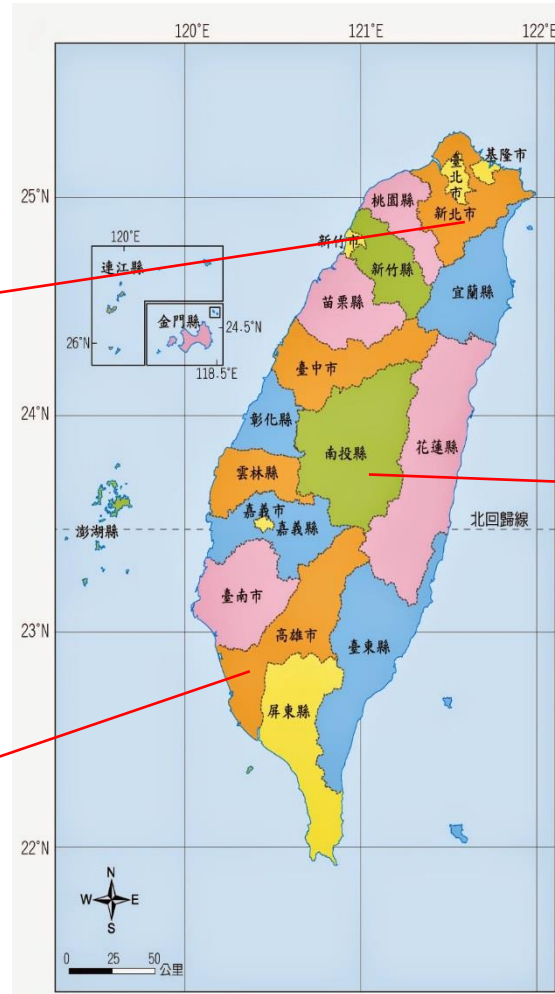


24 hours operation

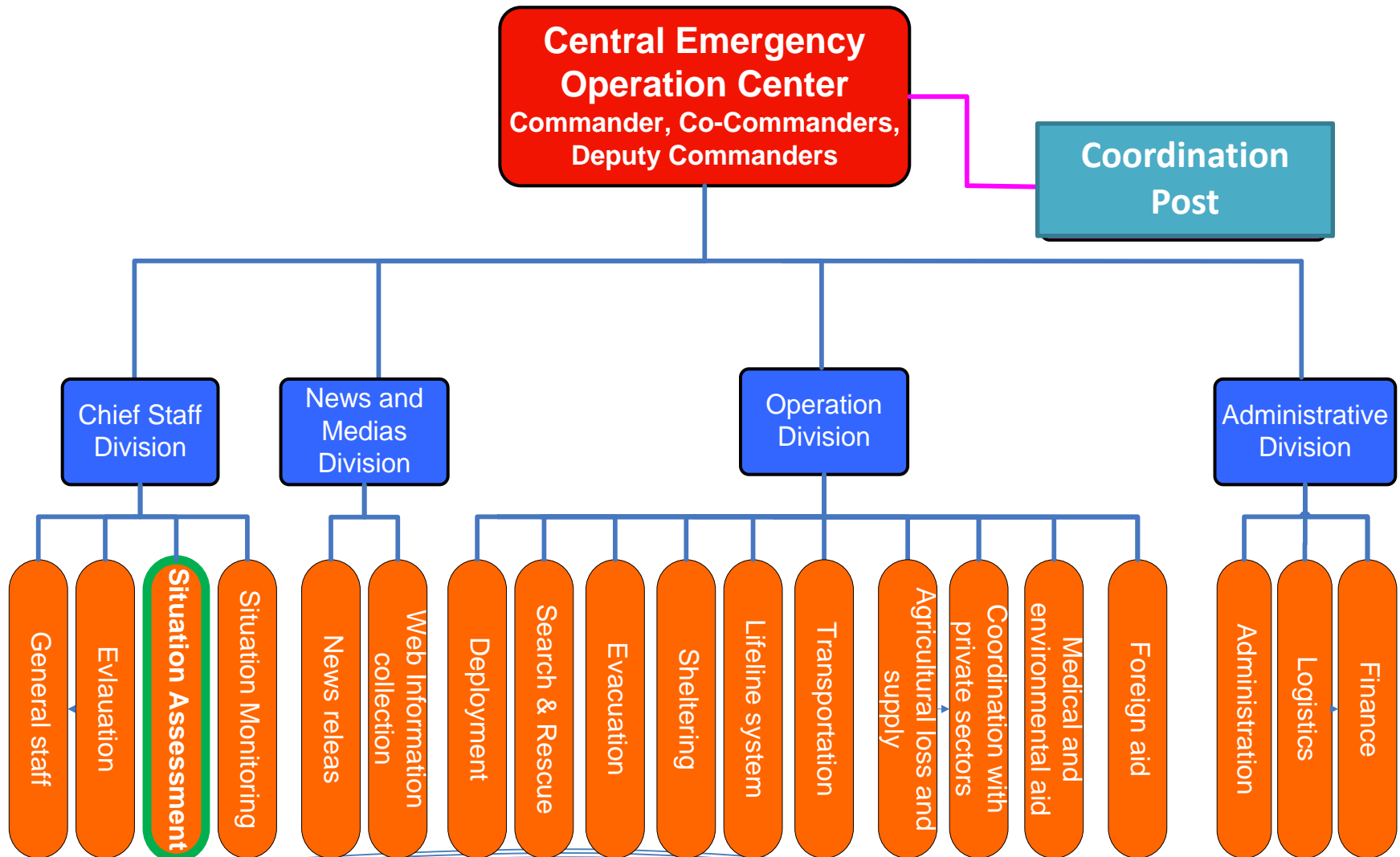
Liaison officers from related Agencies



Central and Back up Emergency Operation Center



Central Emergency Operation Center (CEOOC)



Integrated Decision Support System(CEOC)

社群網路

(google、facebook)

災情通報

(Local EOC、EMIC system)

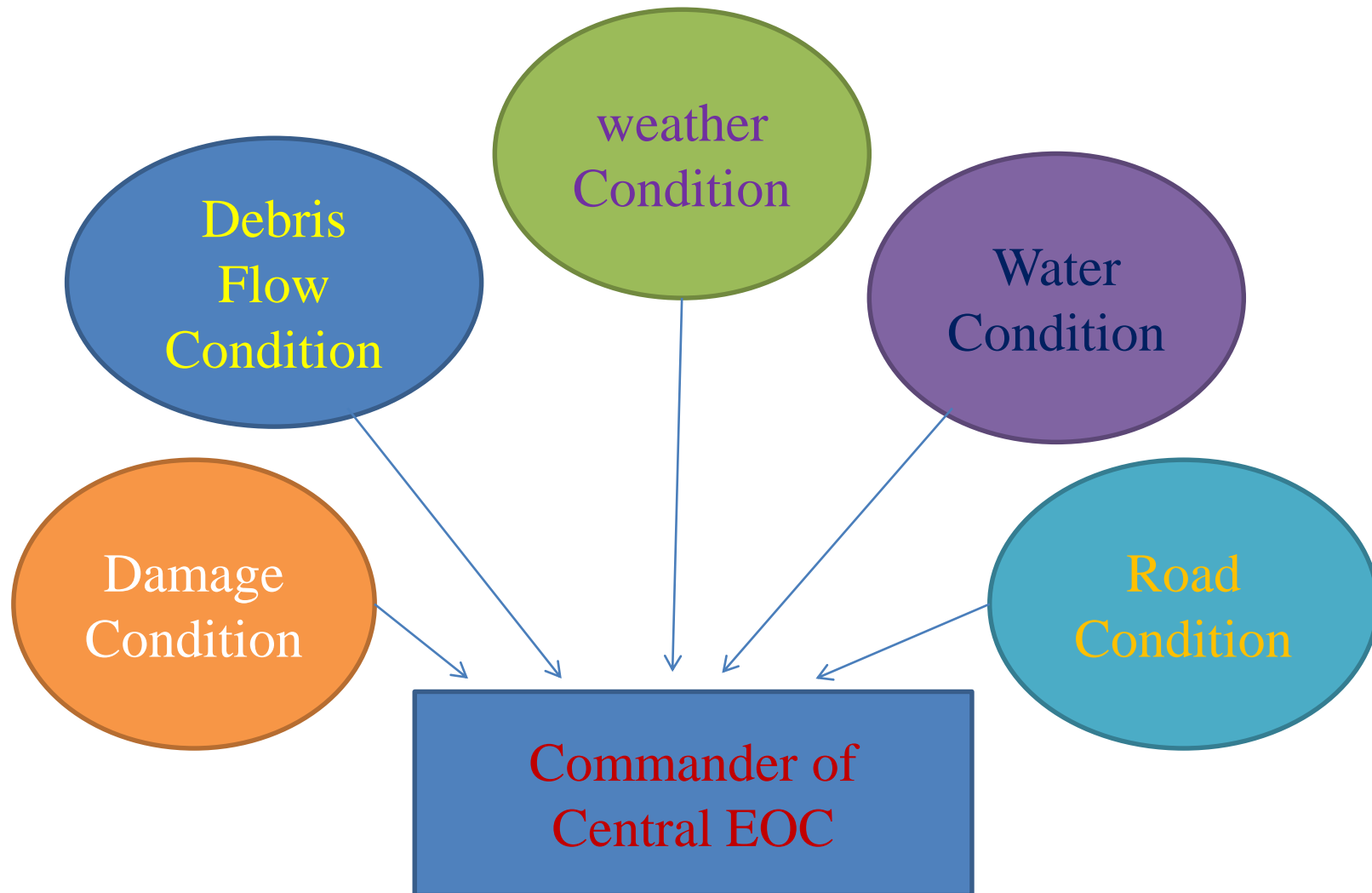
CEOC

媒體管理

(Media and Press)

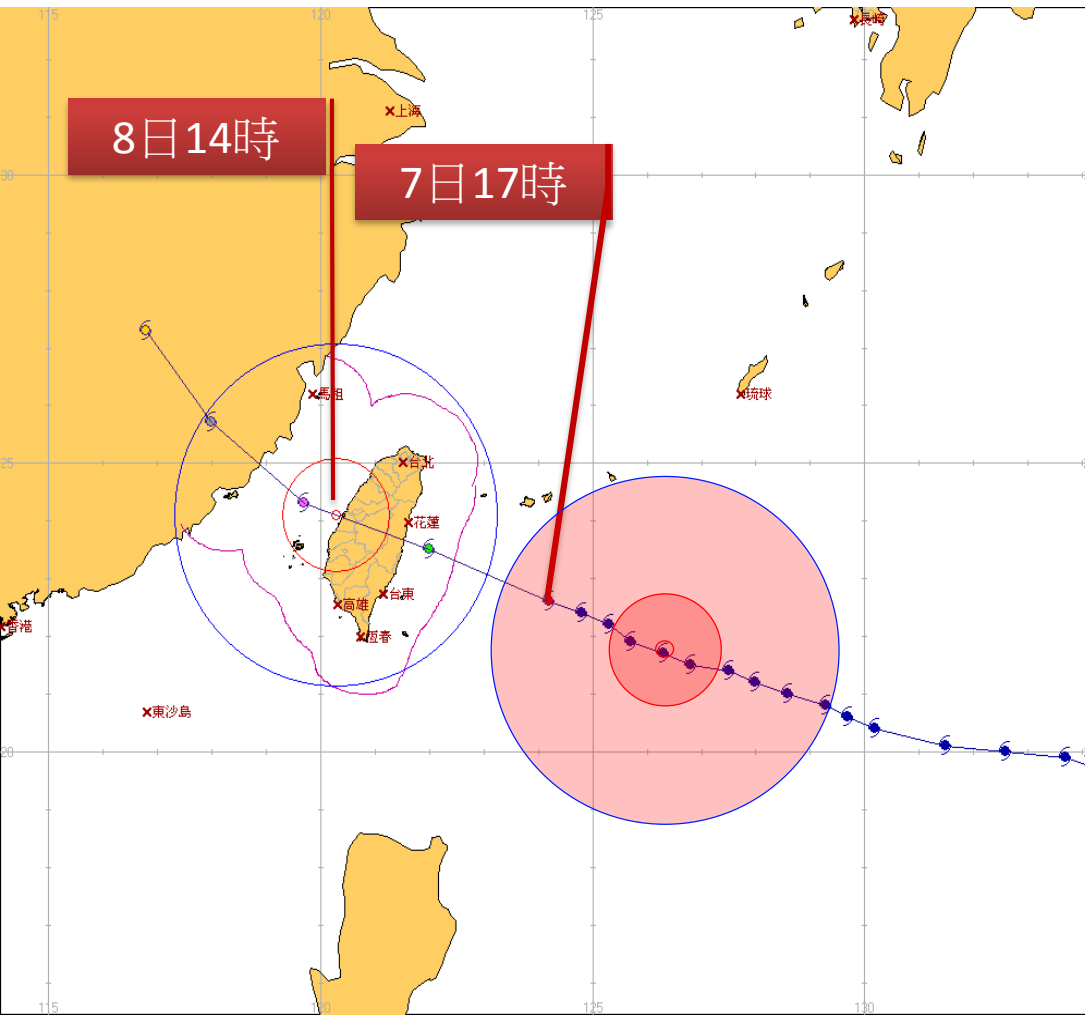
災情蒐整

(Helicopter、Satellite、
Aerial photo)



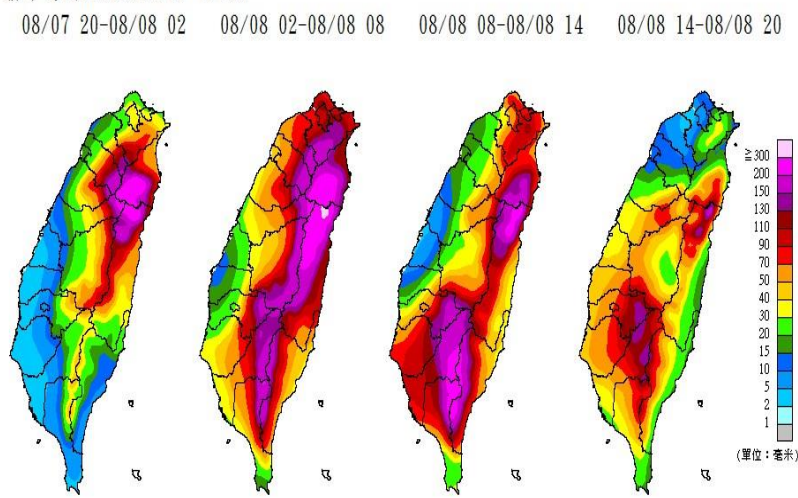
Weather Condition

Provide 6-12 hours wind speed and rainfall prediction



- 06日11時30分：發布海上警報
- 06日20時30分：發布陸上警報
- 07日11時：暴風圈進入近海
- 07日17時：暴風圈進入本島
- 08日07時：中心登陸
- 08日13時：中心離開本島
- 09日03時：暴風圈脫離本島
- 09日13時：暴風圈脫離近海

發布時間: 2015/08/07 17:30

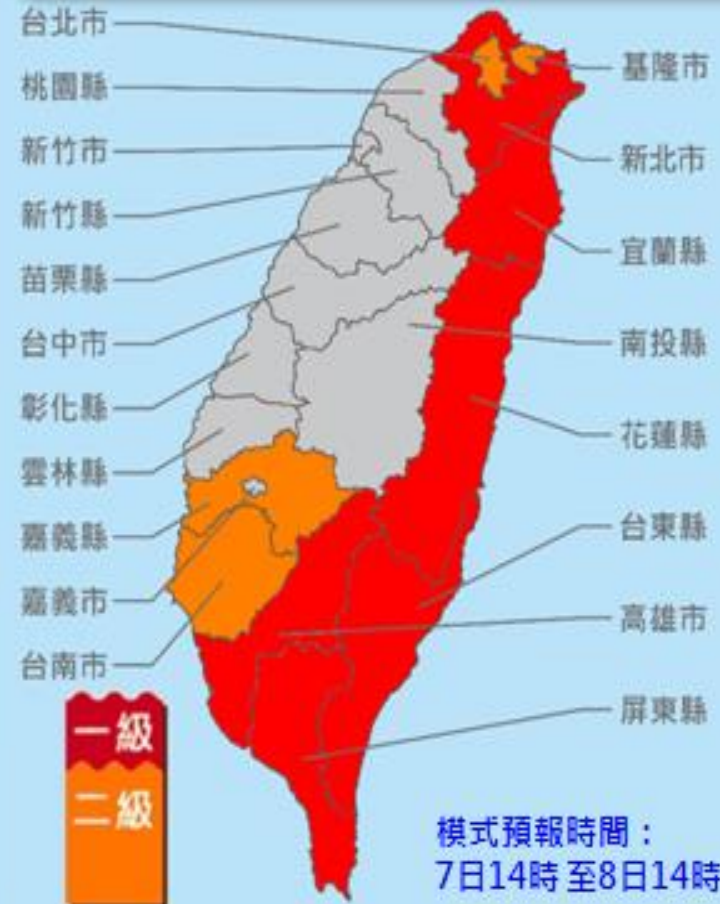


Water Condition

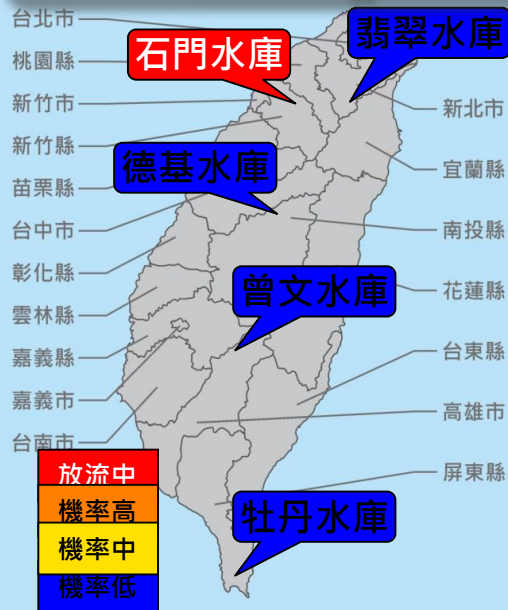
Clarity of drinking water

區域	調度區	水庫	目前		未來24小時濁度增加機率
			(NTU)	(NTU)	
北部	北基	新山水庫	500	—	中
		翡翠水庫	1,000	2.3	中
	臺北	直潭壩	1,000	9	
		板新	鳶山堰	1,000	—
	桃園	石門水庫	1,000	14	高高
	新竹	寶山第二水庫	1,000	0.9	中
隆恩堰		1,000	—	高	

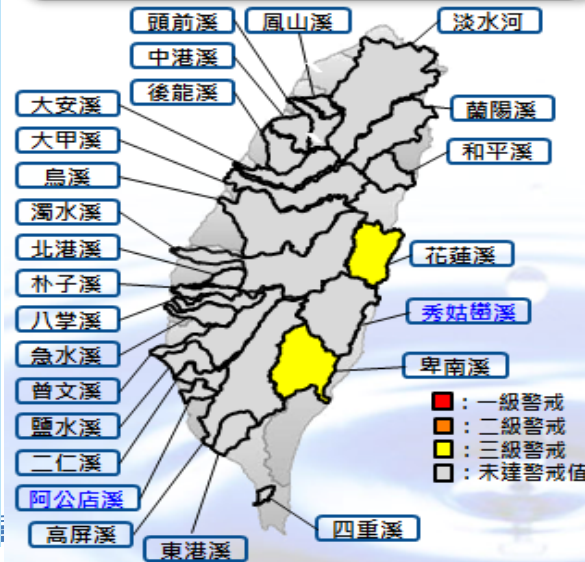
flood warning



Dam flood discharge warning



River band overflow warning



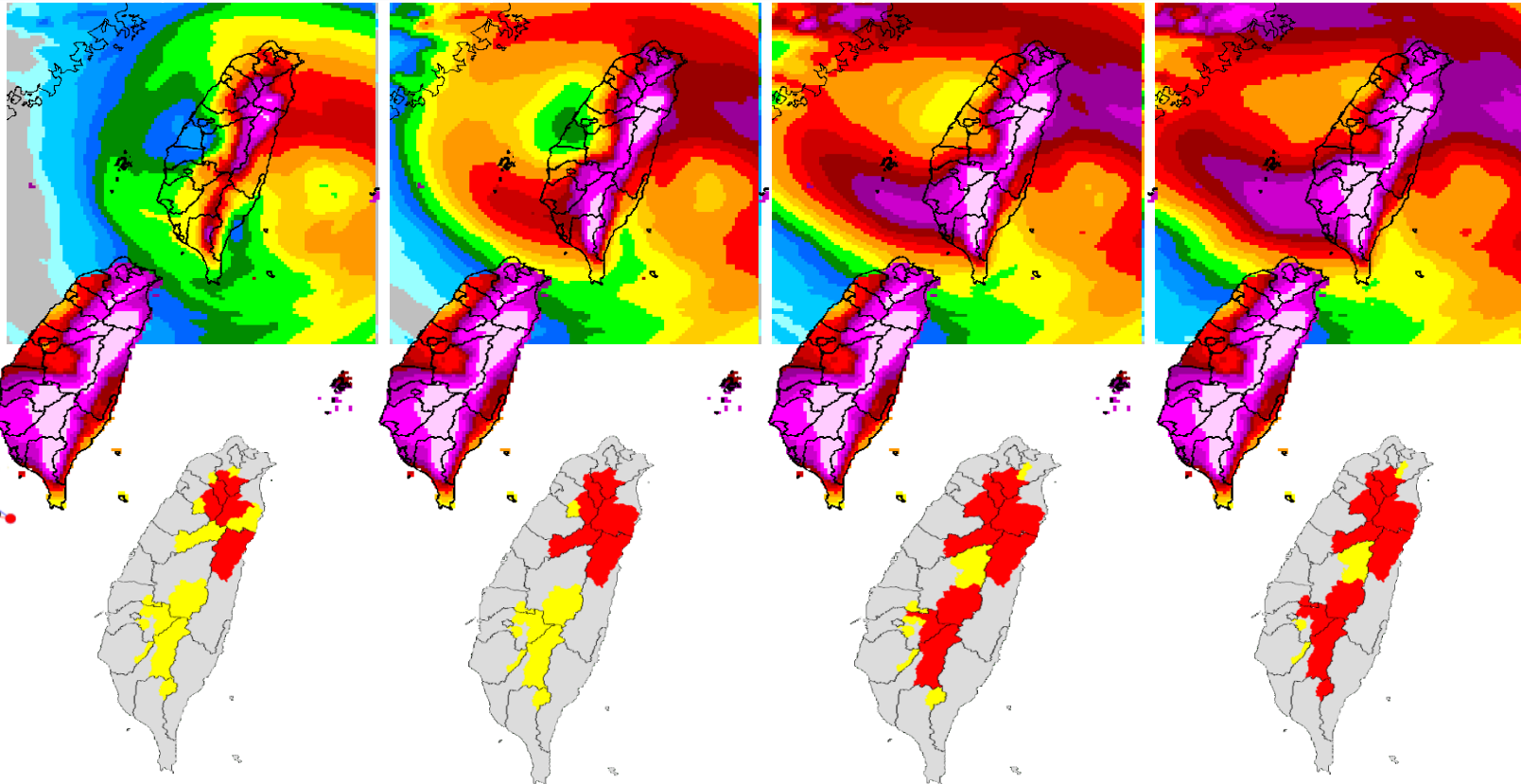
Debris Flow Condition

Debris flow	0708 8:00	0708 14:00	0708 20:00	0709 02:00
Yellow alert	24	24	25	26
Red alert	6	10	26	21

系集預報
累積雨量

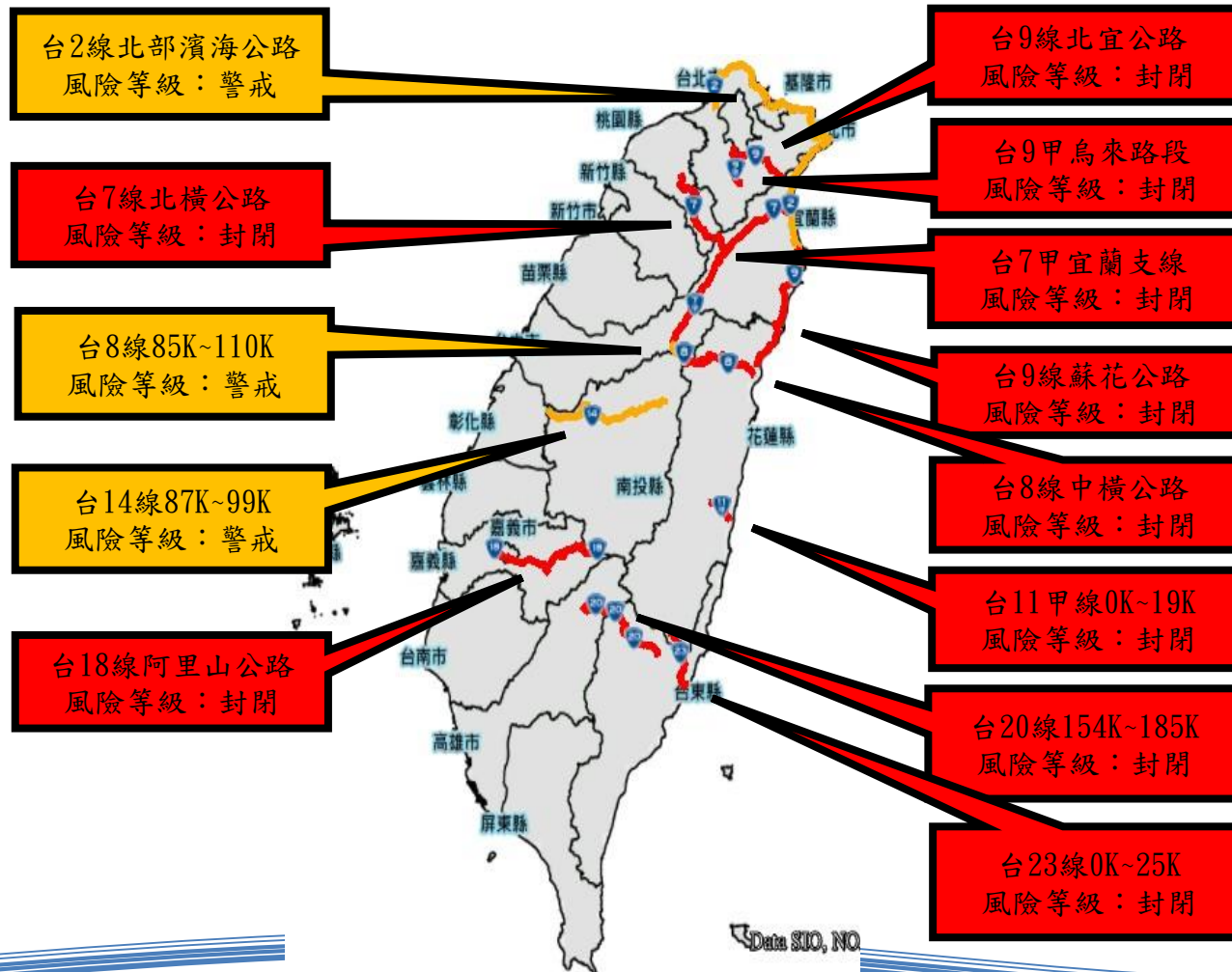
未來24小時
累積雨量

紅黃警戒
鄉鎮
分布圖



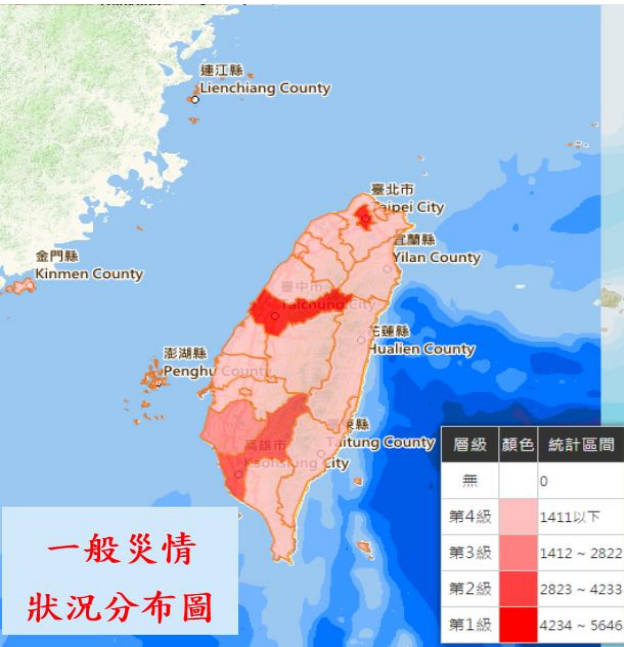
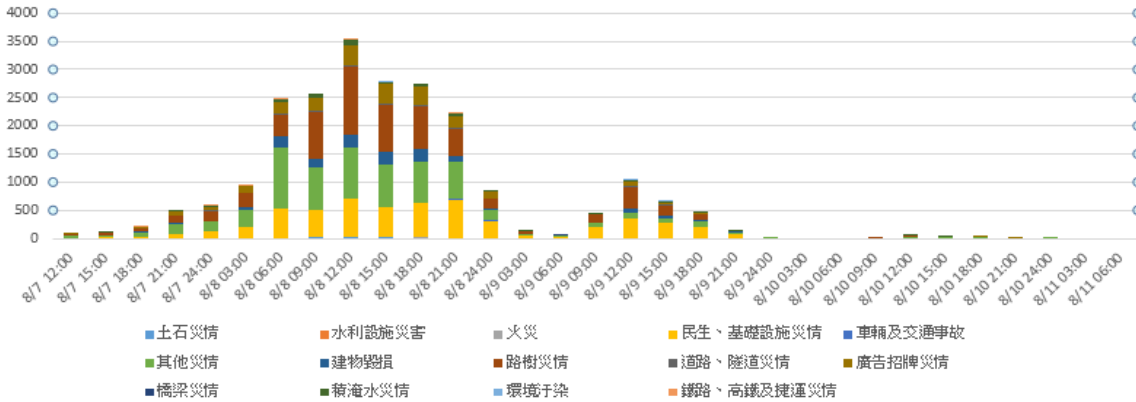
Road Condition

Roads closure alarm



Damage Condition

災情類別分時統計圖



縣市別	死亡	失蹤	受傷
宜蘭縣	4	0	6
新北市	3	4	52
高雄市	0	0	6
臺北市	0	0	128
臺中市	0	0	233
屏東縣	1	0	1
新竹縣	0	0	2
臺南市	0	0	5
臺東縣	0	0	2
桃園市	0	0	2
合計	8	4	437

新北市烏來區孤島救災現況



Principles of CEOC response

- Fast mobilization and deployment
- Active and full scope support functions
- Efficient coordination and cooperation
- High level Command and leadership

Hualien Earthquake



2018 02 12



2018 02 12



Damage map of Hualien city



CEOC earthquake response

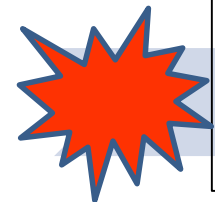
2/7 00:00
Activated

00:25 Minister
arrived in
CEOC、
00:50 Primer
arrived CEOC

01:50
CEOC meeting

President and Primer
inspect the disaster area
respectively

2/11 13:00 CEOC
dismissed



2/6 2018 23:50
Magnitude 6.0
Earthquake

2/7 00:15
C-130 Cargo
planes standby ;
00:19 S&R team
mobilized

01:40 Central
DM team
SR 71
helicopter

03:46
Arrived in
Hualien

Till 08:30 10 mission
sorties of C130, 590
people and 20 S&R dogs
transferred .



Disaster preparedness and response innovations in Taiwan

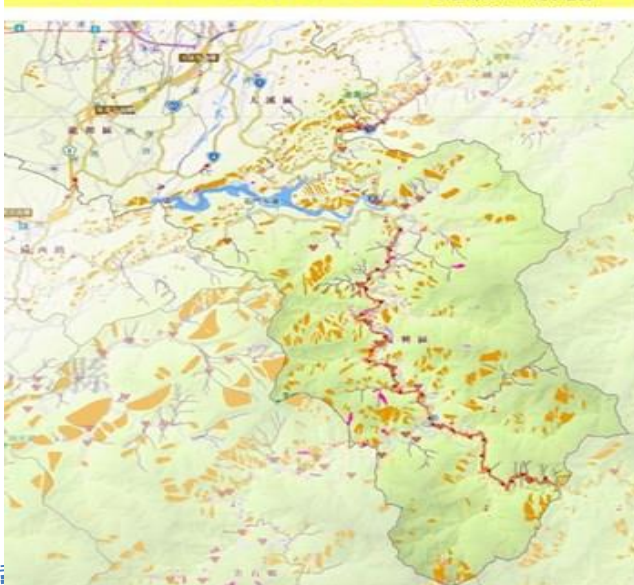
Preparedness Innovations

1. Potential Hazard Map

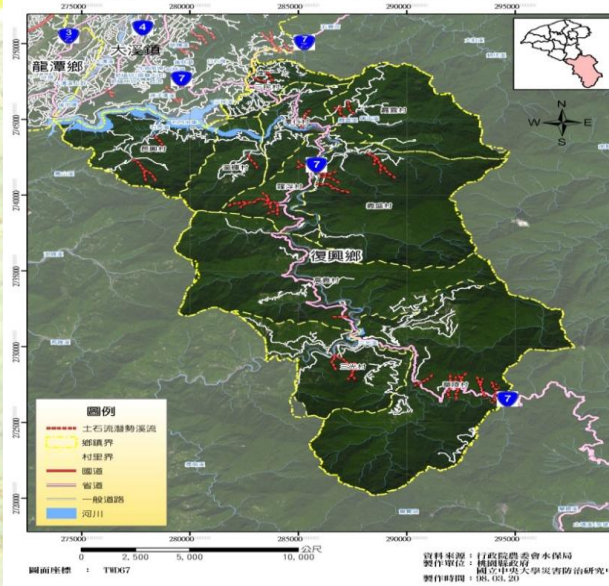
Disaster potential hazard map

- ◆ Earthquake(Fault), flood, mudslides, slope land and potential soil liquidation area .
- ◆ Totally 22 City and County, 368 Township government and 7,810 villages.

桃園市天然災害潛勢地圖 — 日暴雨600mm淹水潛勢



桃園縣復興鄉土石流分佈圖



指導單位/內政部 執行單位/桃園縣政府消防局 龜山鄉公所 樂善社區 國立中央大學災害防治研究中心

防災地圖 桃園縣龜山鄉樂善社區

樂善社區活動中心
樂善村康安街7-1號
(龍巖橋村)

樂善國小
樂善村11鄰康安街71號
(龍巖橋村)

大埔派出所
龜山鄉文德二路80號
(防救災資源)

坪頂消防分隊
樂善村文化一路53-1號
(防救災資源)

避難場所
防救災資源
疏散避難方向

災害通報單位

龜山鄉樂善村村長-柯建勳
電話：0933-785050
龜山鄉災害應變中心
地址：龜山鄉中山街二十六號
電話：03-3203711

坪頂消防分隊
地址：樂善村文化一路53-1號
電話：03-3318521

大埔派出所
地址：龜山鄉文德二路80號
電話：03-3181519

2011 CALENDAR

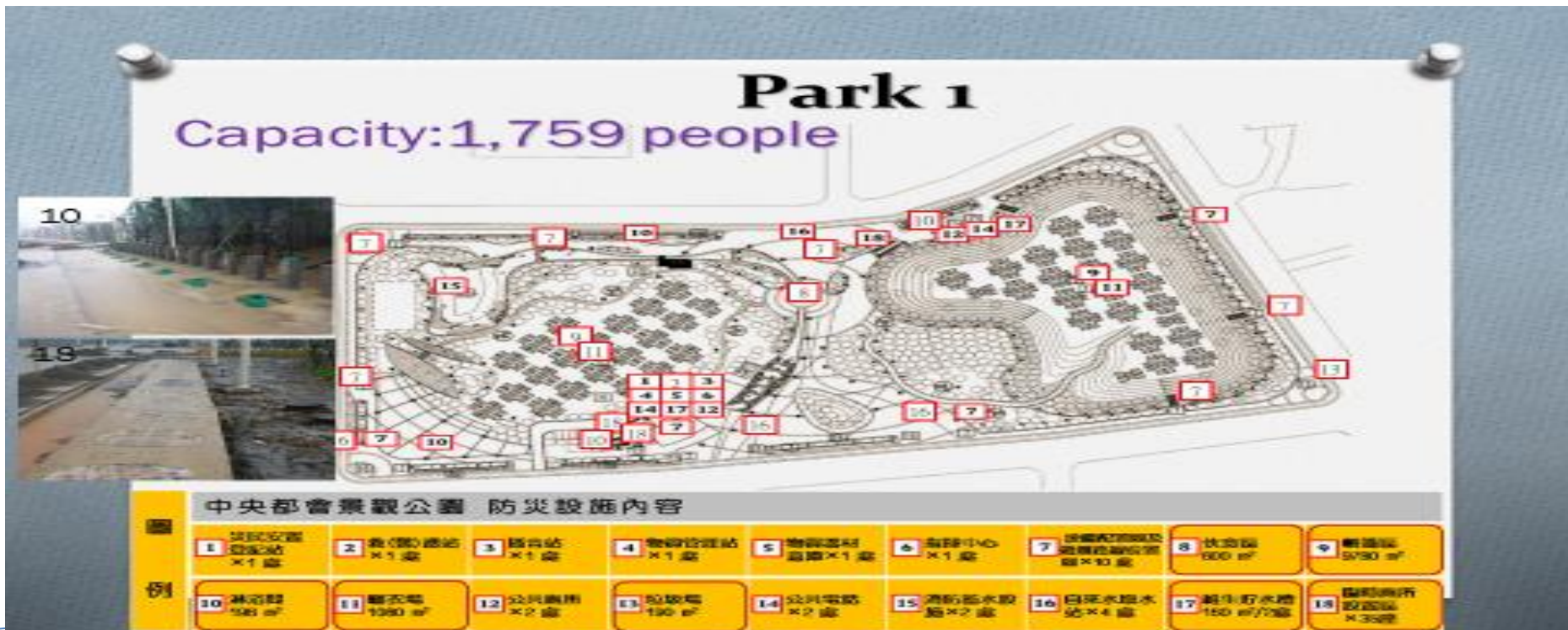
一月	二月	三月	四月	五月	六月
1月1日	2月1日	3月1日	4月1日	5月1日	6月1日
1月15日	2月15日	3月15日	4月15日	5月15日	6月15日
1月31日	2月28日	3月31日	4月30日	5月31日	6月30日

2012 CALENDAR

一月	二月	三月	四月	五月	六月
1月1日	2月1日	3月1日	4月1日	5月1日	6月1日
1月15日	2月15日	3月15日	4月15日	5月15日	6月15日
1月31日	2月29日	3月31日	4月30日	5月31日	6月30日

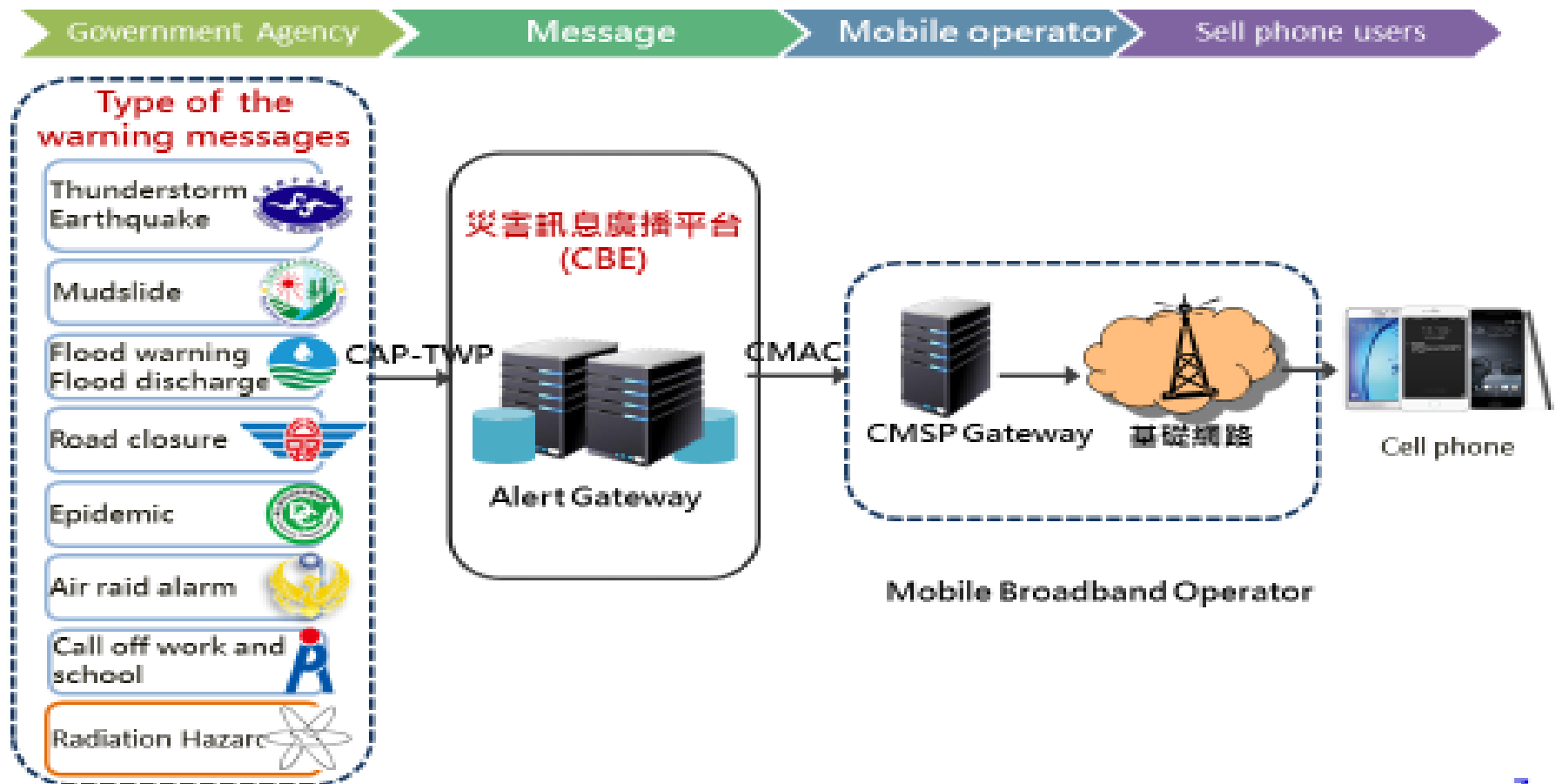
2. Disaster Prevention and protection Park

- Integrate park scenery, exercising area, water detention and disaster response, mass shelter function all together.



3. Public warning system, PWS

Cell Broadcasting Service, CBS



Public warning system

- **Automatic Cell Broadcasting mode, 5-10 seconds to all 4G cell phone users.**
- **Only to the appointed affecting areas or nationwide.**
- **With special sound and vibration**
- **Instant and real time warning.**
- **Government information, reliable and dependable.**
- **Free of charge.**

緊急警報

警訊通知

[萬安演習]北區萬安演習將於13:30~14:00實施警報發放，請配合憲警民防人員管制及引導進入防空避難設備；車輛除行駛於高速公路外，乘客皆須於停靠路邊後避難。內政部警政署。

中華電信 上午10:26 82%

搜尋

緊急警報 週五 上午11:45

警訊通知

您所在地區即將發生大雷雨，預計持續至06/02 13:15；請慎防劇烈降雨、雷擊、9級以上強陣風，溪(河)水暴漲，坍方、落石、土石流，低窪地區慎防淹水。氣象局

UDN NEWS 週五 上午10:56

緊急警報

警訊通知

[土石流警戒]臺北市士林區臨溪里解除全部土石流警戒。農委會水土保持局

設定

緊急警報

警訊通知

您所在地區即將發生大雷雨，預計持續至06/02 13:15；請慎防劇烈降雨、雷擊、9級以上強陣風，溪(河)水暴漲，坍方、落石、土石流，低窪地區慎防淹水。氣象局

設定

搜尋

最近通知

緊急警報 2分鐘前

警訊通知

[地震報告]02/11 01:12高雄市近海發生規模5.6有感地震，詳細資訊請參考氣象局網站，氣象局。

緊急警報 16分鐘前

國家級警報

[地震速報]02/11 01:12左右嘉南地區發生有感地震，預估震度4級以上地區：臺南、高雄、屏東，氣象局。

13:30 64% 13:30

13:30

17°

龍興里

3月2日, 週四

新 03/02 10:07

警訊通知

[萬安演習]東區萬安演習將於13:30~14:00實施警報發放，請配合憲警民防人員管制及引導進入防空避難設備；車輛除行駛於高速公路外，乘客皆須於停靠路邊後避難。內政部警政署。

類型：警訊通知

確定



電話



訊息



Play 商店

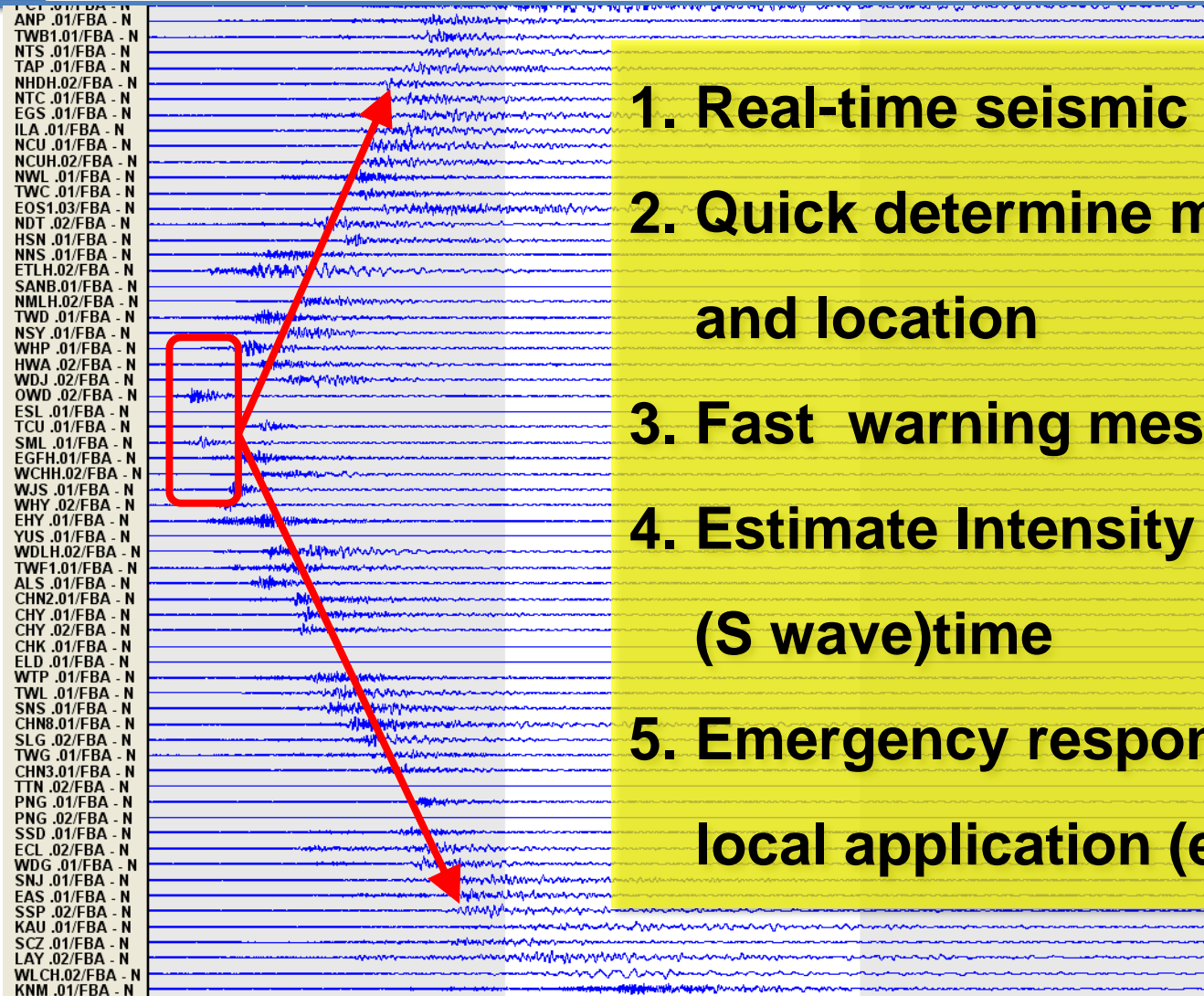


網際網路



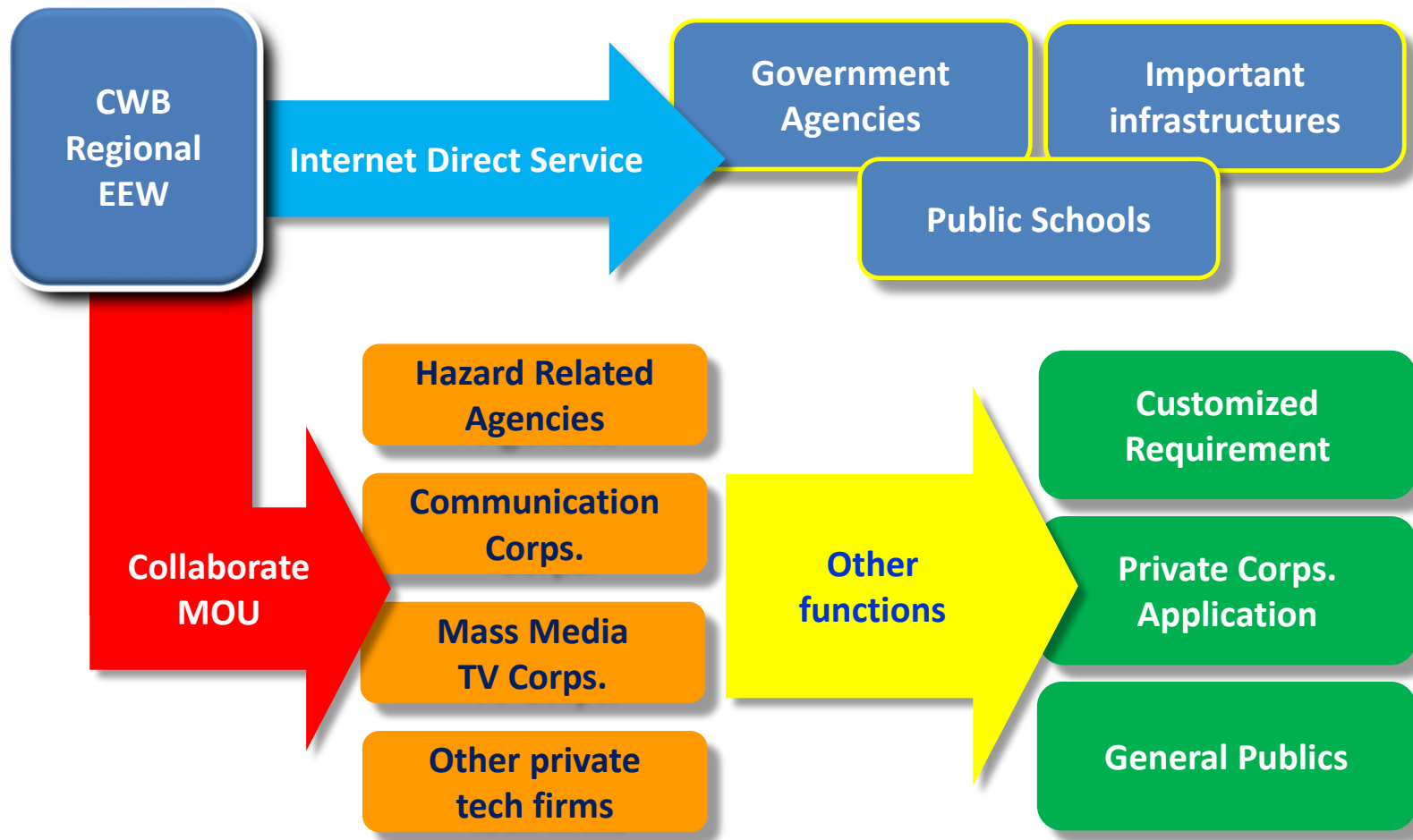
Apps

4. Earthquake Early Warning System



1. Real-time seismic network
2. Quick determine magnitude and location
3. Fast warning message
4. Estimate Intensity and arrival (S wave)time
5. Emergency response and local application (evacuation)

Earthquake Early Warning System



2019/04/18 Hualian Earthquake



EEW

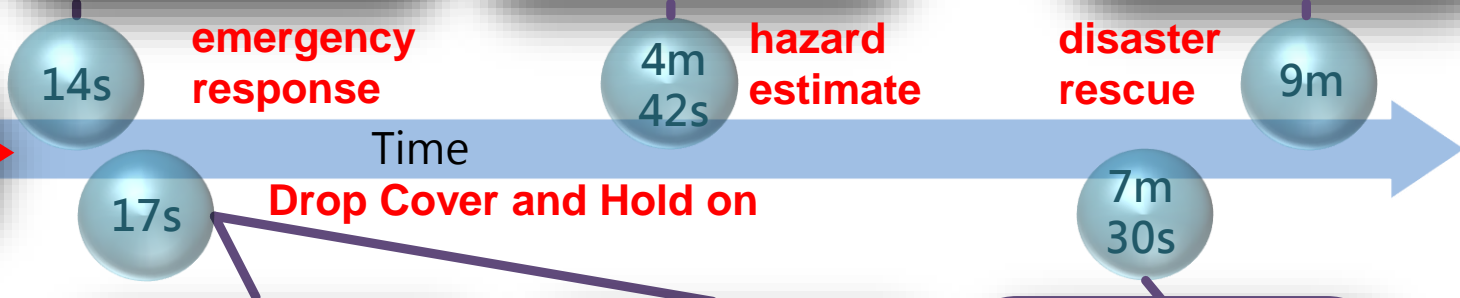


Official Report



CEOC

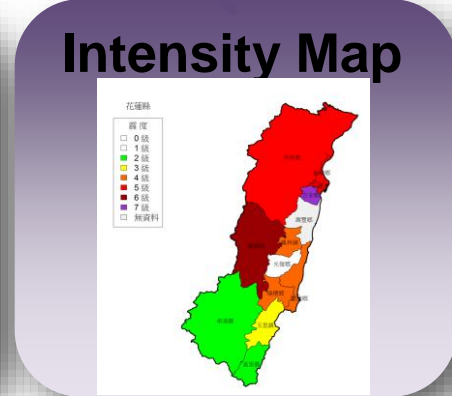
4/18 13:01 Earthquake occurred



PWS



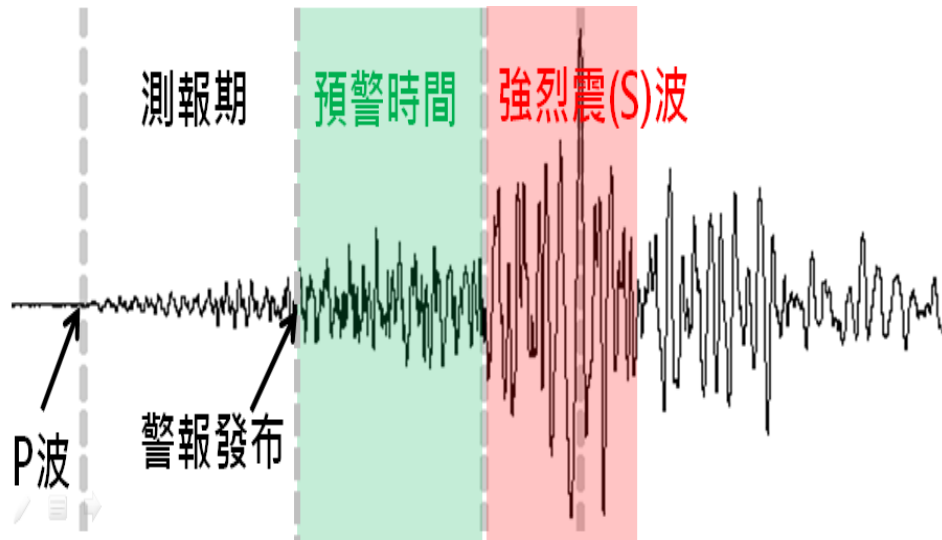
TV



Intensity Map

5. School Earthquake Alarm System

- 10-20 seconds warning time before the strong (S) wave arrived.
- Earthquake Alarm System in all 3,466 elementary and junior high schools nationwide.



6. Application of communication software in DM

- Developed by NCDR
- All 22 alerts at 4 categories (free)
- Subscribers close to **1 m** users



Wearer and EQ

Typhoon	Tsunami
Thunder storm	Strong winds
Torrential rain	Low temperature
Debris flow	Earthquake
Dense fog	

Hydraulic situation

Floods	Dam discharge
High water level in river	Alert on flood gate
Alert on water level	

Transportation

Railway accident	Highspeed rail accident
Road closure	Temporary parking info

Others

Pandemics	Security
Cross-boundary outbreak	Office and school closure



Application of communication software(APPs)

■ Apps from Central Government



Apps from Local Government



7. National Fire Agency Training Center — the cradle for emergency responders

- Covers an area of 109 hectare is now the biggest fire and emergency training base in Asia and third in the world.
- With 49 different training facilities including building, market, factory, airplane, vessel, mass rapid transit, high speed rail, tunnel, rapids, oil tank and various fire related simulation sites.



8. Shake-out Taiwan -- National Disaster Prevention day 21 SEP



Shake-out Taiwan -- National Disaster Prevention day 21 SEP

- First degree Emergency Operation Center was activated conducting earthquake scenario table exercise.
- Students Earthquake drill.
- Nuclear power plant radiation disaster exercise.
- Shake out Taiwan earthquake drill for citizens.
<http://comedrill.com.tw>
- Over 3,000,000 people participated each year.

9. School Earthquake Drill

- **Over 2 million students join the school earthquake drill in 09:21 at the same time**
- **Initiated by Public Warning System (cell phone message)**



10. Smart Earthquake Safety House

- ✓ Earthquake Early Warning System
- ✓ Artificial Intelligent
- ✓ Smart equipment and appliance



Earthquake Warning System



煙霧偵測器

Smoke Detector

火災發生時警鳴發報，
提醒家人進行緊急避難

In the event of a fire, an alarm is activated to alert residents to carry out emergency evacuation procedures.



排煙風扇

Exhaust Fan

接收到警報訊號，
同步啟動排煙風扇通風

The exhaust fan is turned on for ventilation when an alarm is received.



熱感偵測器

Thermal Detector

室內溫度升溫速度過快時，
立即發聲爭取應變時間

When rapid temperature increases are detected, an alarm goes off to alert residents.

地震預警主機

Earthquake Warning System

地震發生時立即警示，
發出警報廣播

It's immediately broadcasts an alarm when an earthquake occurs.



電子鎖

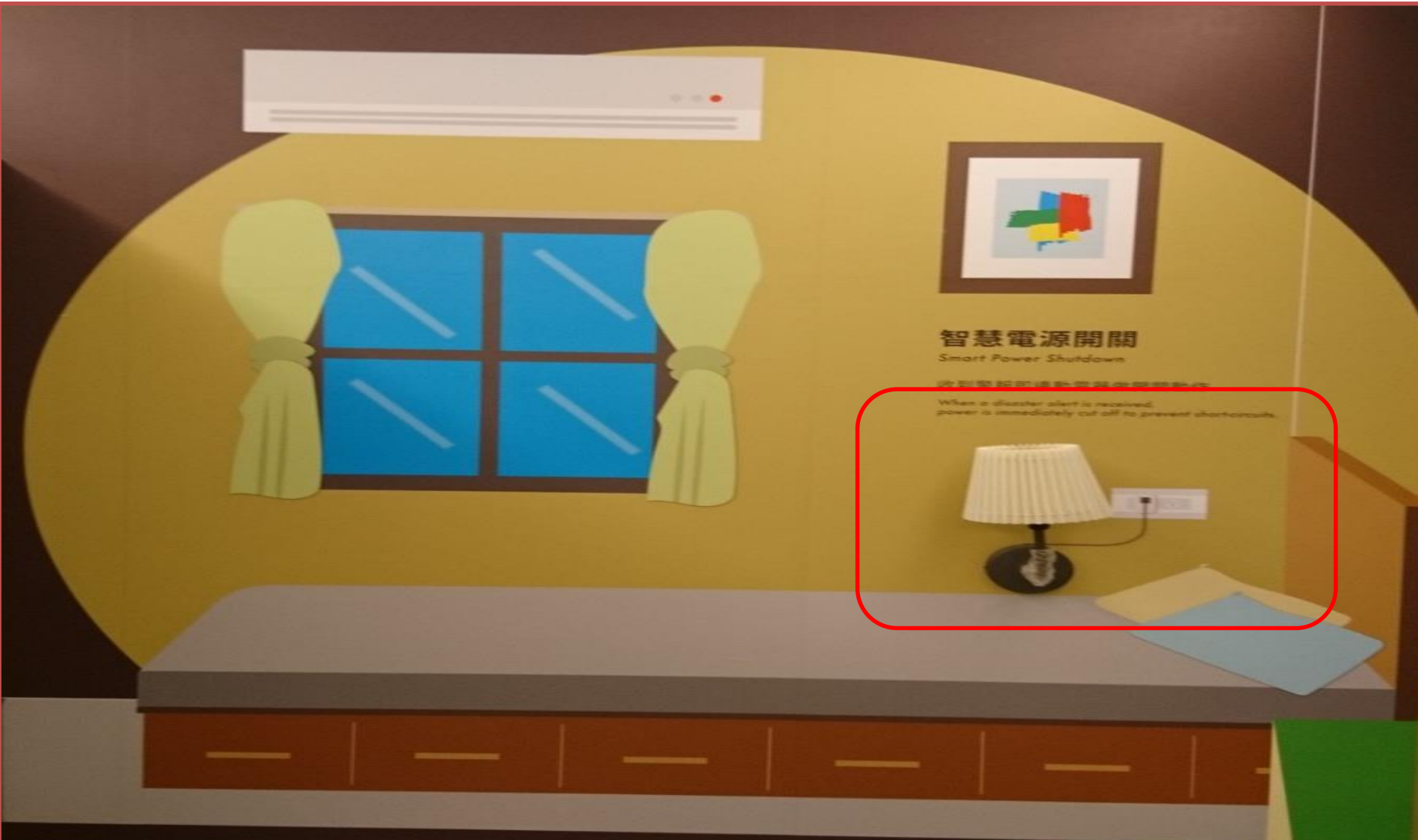
Electronic Lock

收到地震或火災警報立刻解鎖

When an earthquake or fire alarm is raised, the door is immediately unlocked for evacuation.



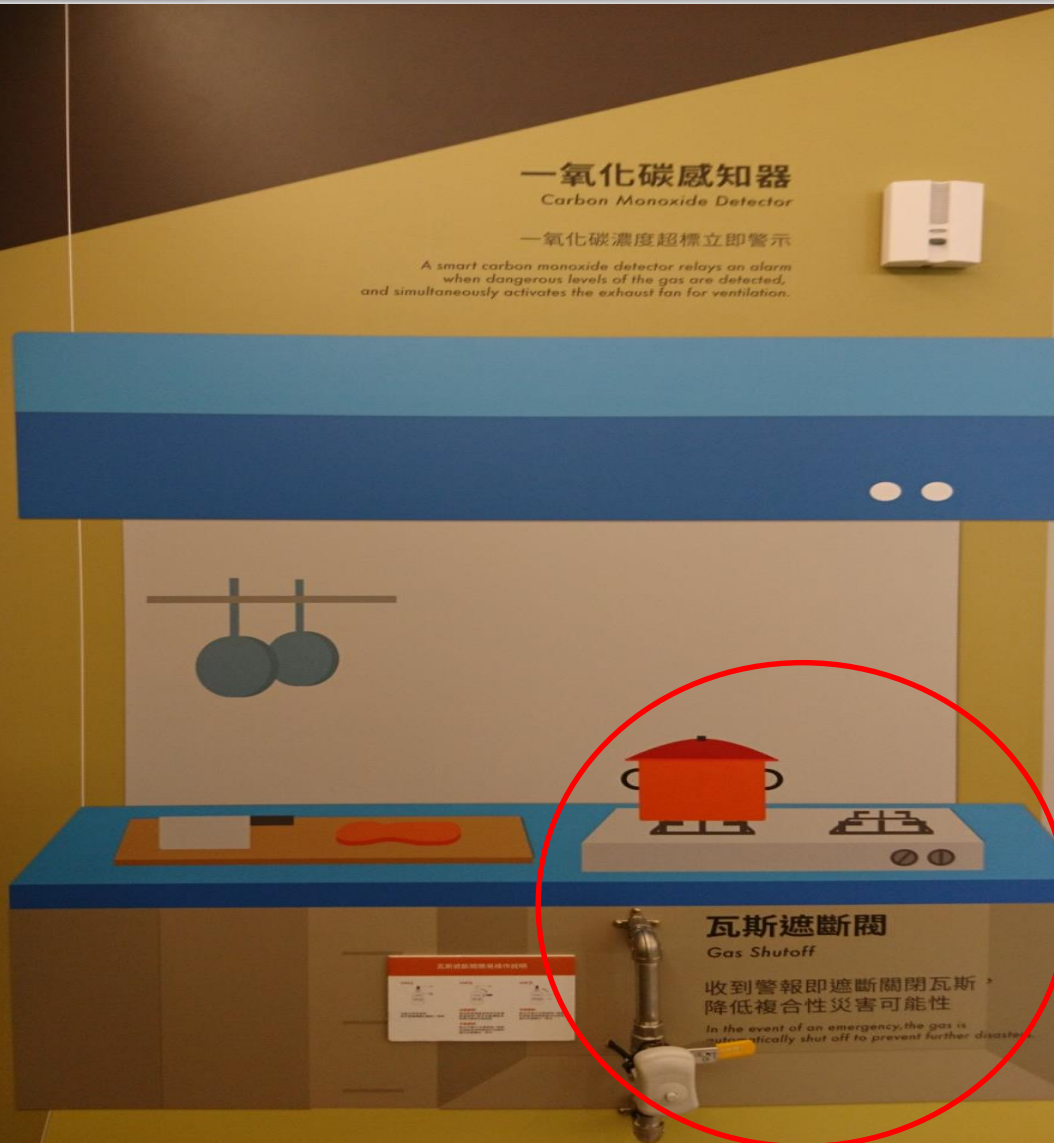
Smart Power Shutdown



智慧電源開關
Smart Power Shutdown

When a disaster alert is received, power is immediately cut off to prevent short-circuits.

Carbon Monoxide Detector



Safety Closet

Tested by National Center for Research of Earthquake Engineering



防震 衣櫃小知識

本櫃體非一般衣櫃，為特殊專利結構設計，經由國家地震工程研究中心抗壓測試。

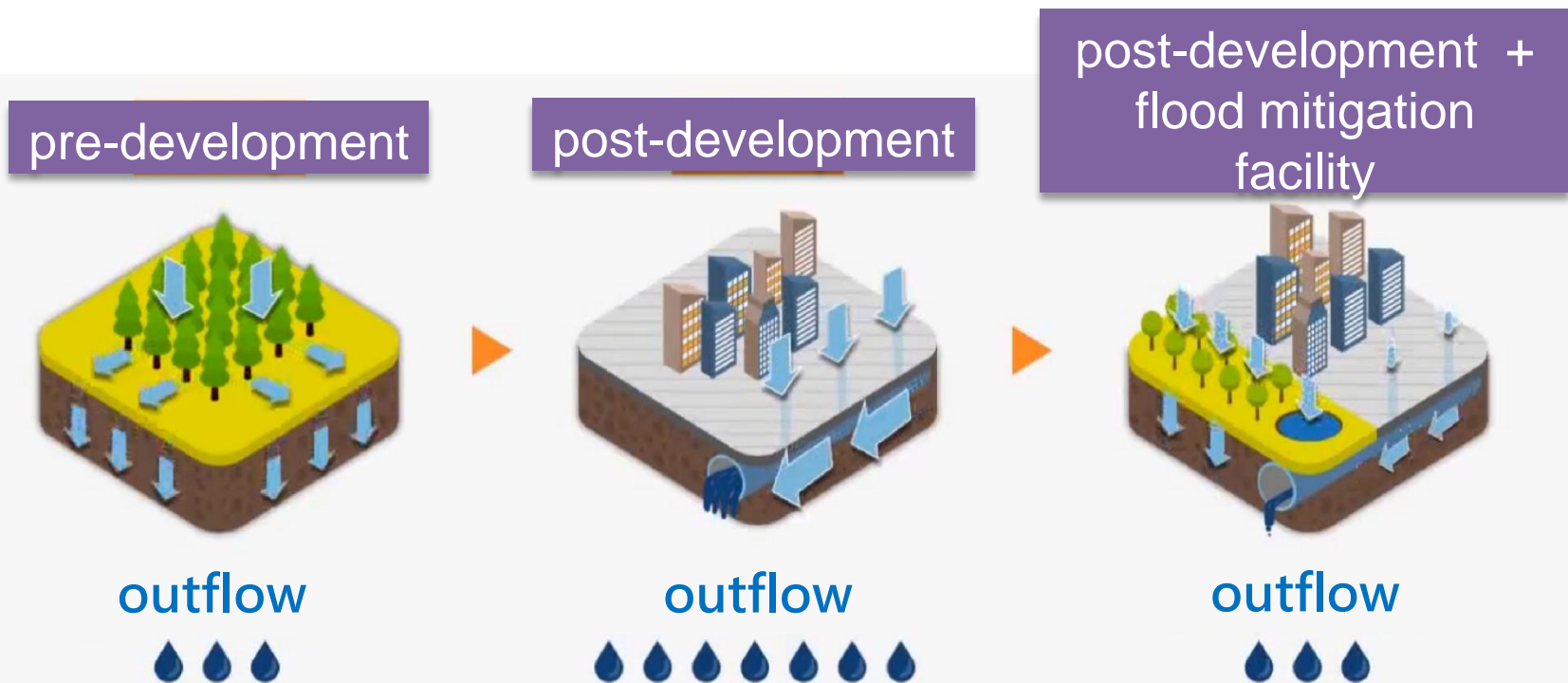
立面可載重 **40部轎車**

臥列可載重 **80部轎車**

座椅內放置
地震防災救難包

11. Flooding mitigation Innovation

- ◆ Urbanization increases flood risk
- ◆ The land developers construct the detention basins and Low Impact Development facilities.



Maple Garden

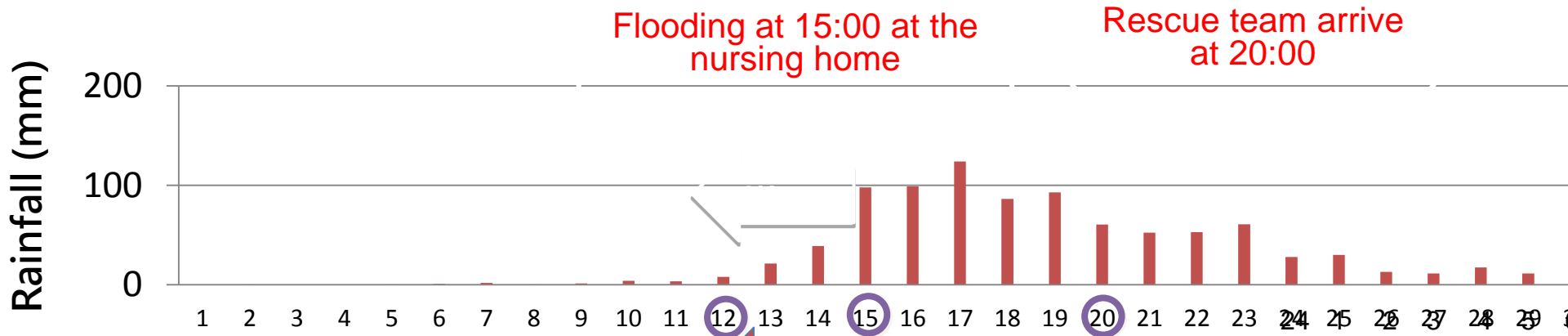
- ◆ “Maple Garden” in Taichung City has functions of flood detention, drainage and recreation.
- ◆ Constructed in 2012; total storage capacity is 200,000 m³.

Donghu Detention Basin In Dali Software Park

- ◆ Completed in 2014
- ◆ Total storage capacity of 8,000 M³
- ◆ Reduce flood risk of surrounding 10 ha, and protect 1700 residences

Early Warning

◆ Flooding case in Kaohsiung on Sep. 19 in 2010 (Typhoon Fanapi)



Get 8 hrs. early for response

Now: evacuation beforehand

Before: wait for rescue



【 Real-time warning notification 】

Local Broadcasting Service flooding warning

Message

Nursing home



Social welfare institutions and hospitals



School



Barracks



Industrial park

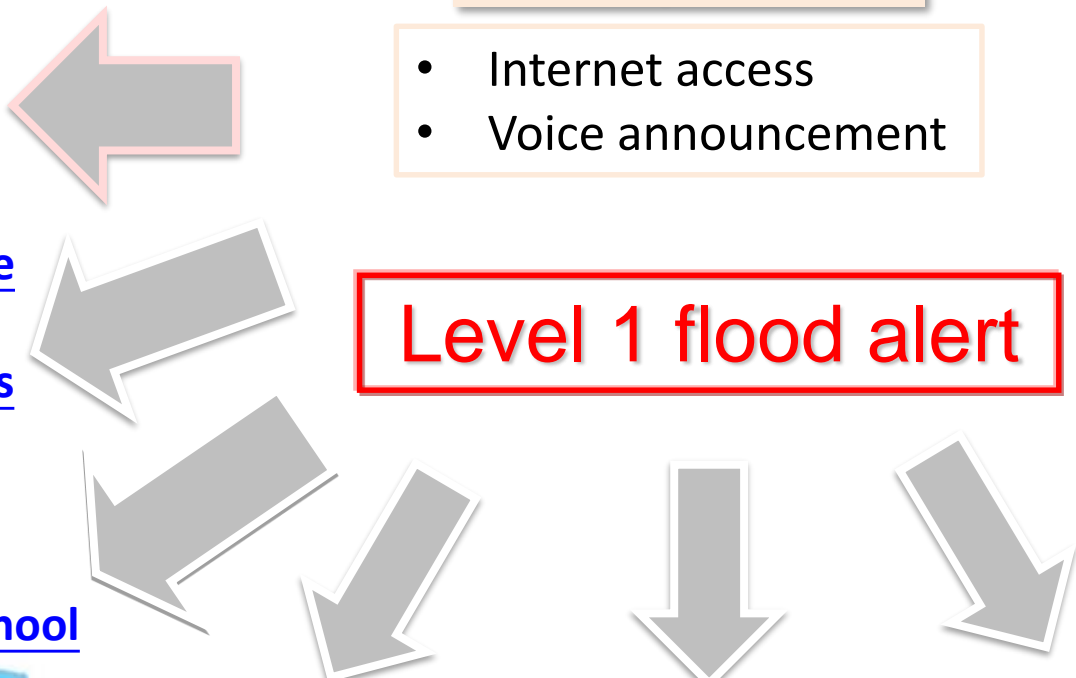


Government DM personnel

city-call

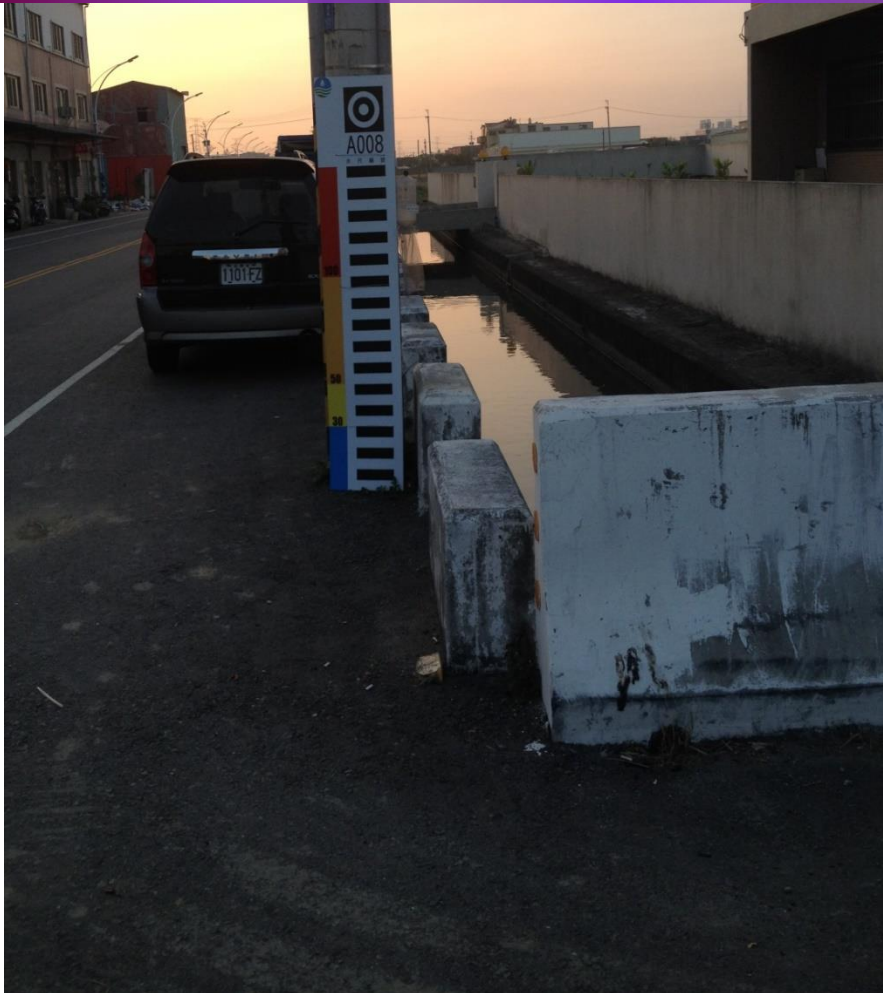
- Internet access
- Voice announcement

Level 1 flood alert



Smart Water Gauge

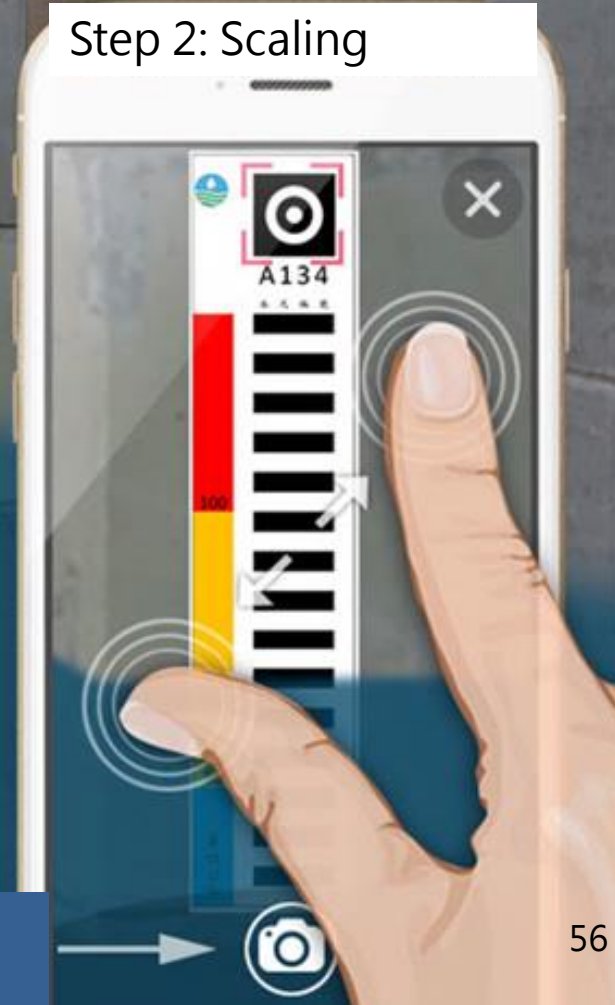
Use the concept of crowdsourcing to establish
a new model for civil disaster prevention



Step 1: Find a water gauge



Step 2: Scaling

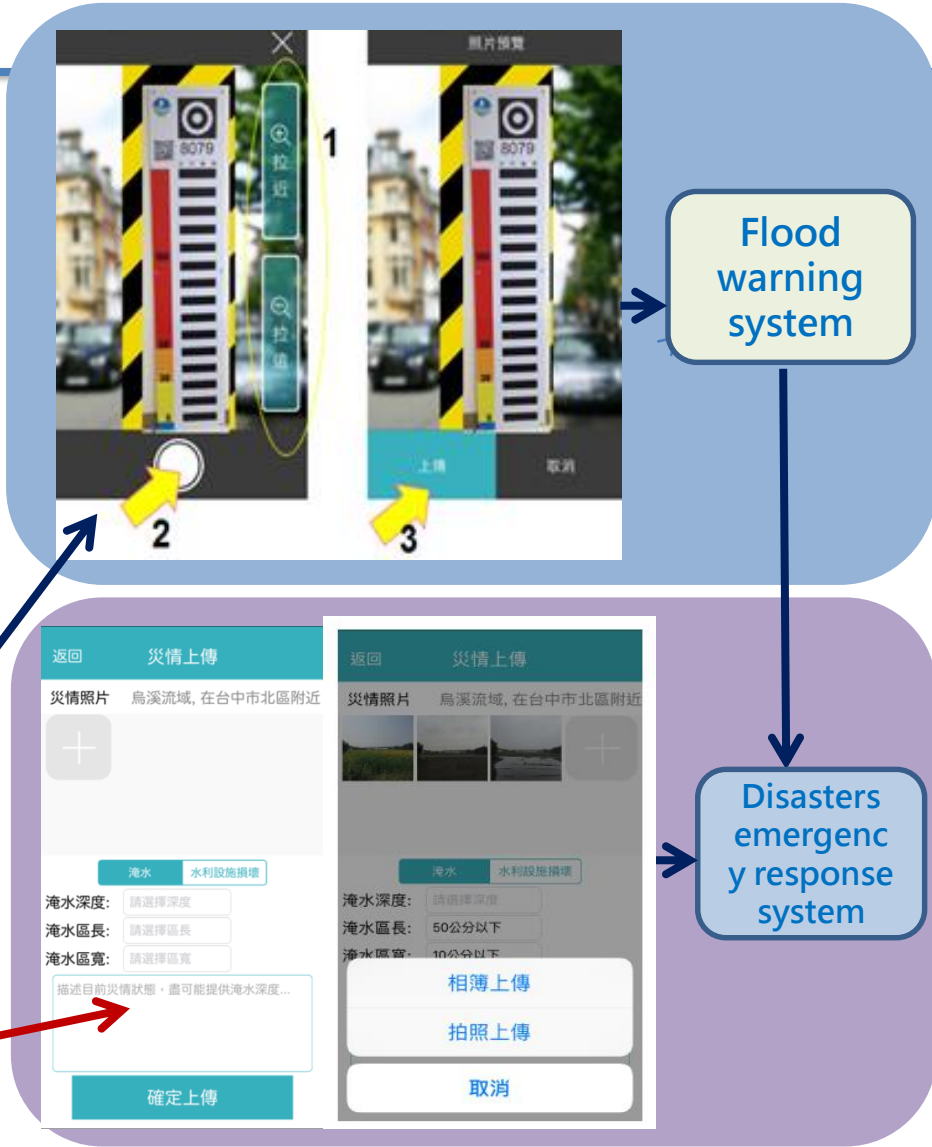
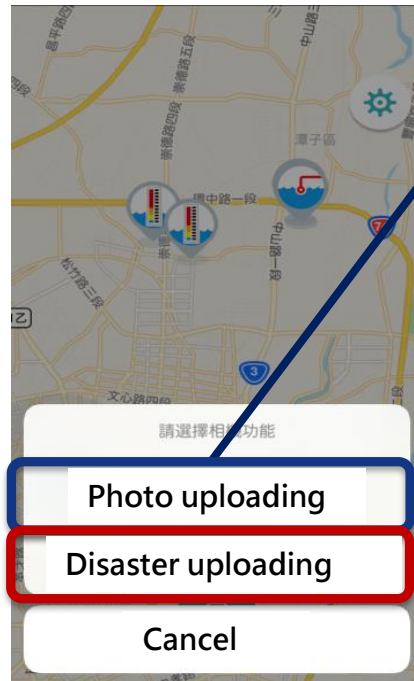


Step 3:
photo

Water information Notification APP

Functional operation

- Photo uploading
- Disaster uploading



Citizens and Business Notification



Flood warning sign

Public, Private and Partnership



Online report platform



- Convenient stores
- Gas stations
- volunteers

災情查報點逾

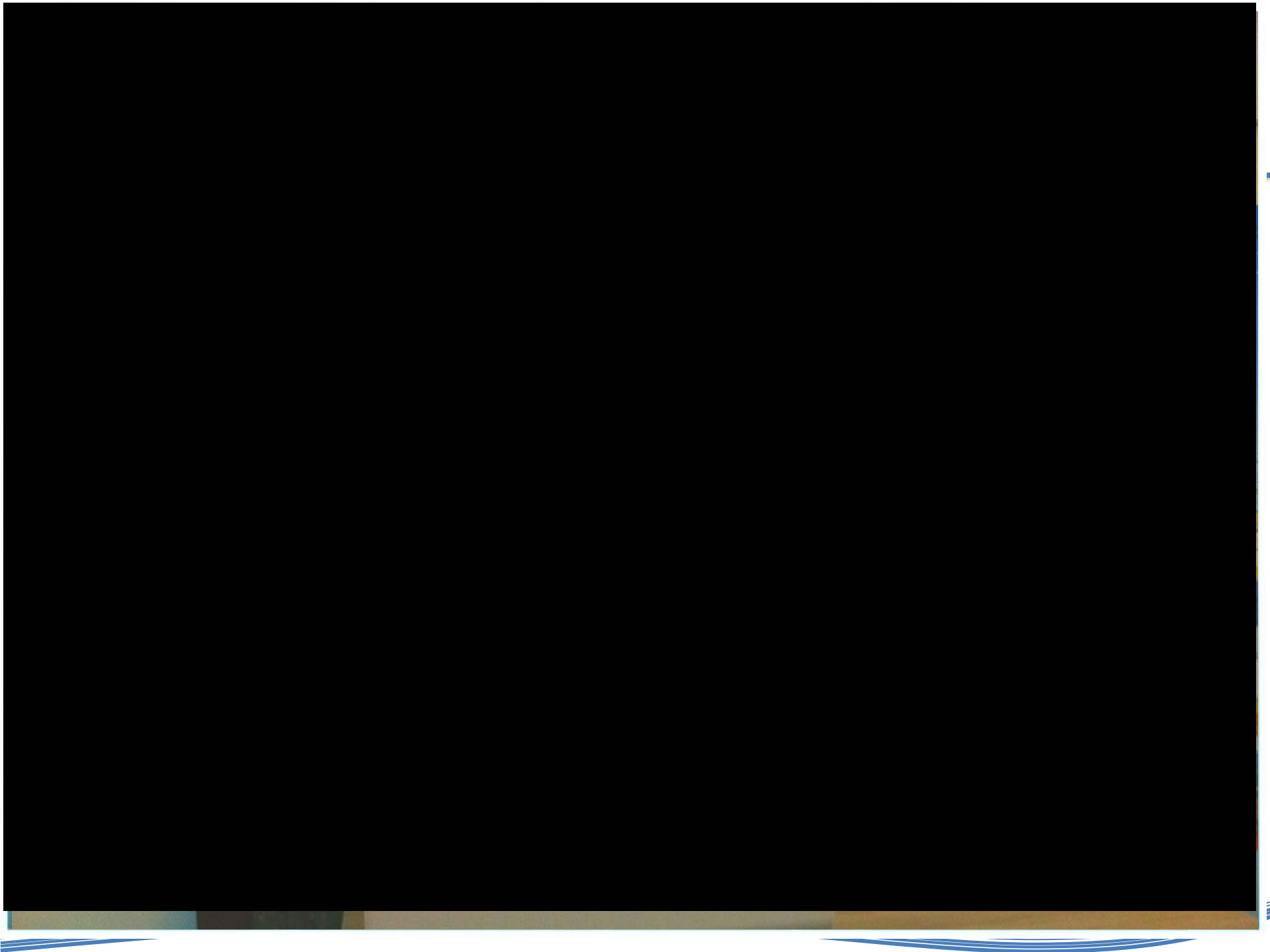
8,800 處



Voice survey by local calls

淹水災情通報





Disaster information showed in the point of sale (POS) screen



公路防救災GIS決策支援系統

重要省道公路通阻訊息：

台2線濱海公路	正常通行
台7線北橫公路	正常通行
台9線蘇花公路	道路封閉
台8線中橫公路花蓮路段	正常通行
台9線南迴公路	正常通行
台18線阿里山公路	道路封閉
台20線南橫公路	道路封閉
台7甲宜蘭支線	正常通行
台8線梨山至大禹嶺	正常通行
台14線埔霧公路	道路封閉
台21線新中橫公路	道路封閉

輕鬆掌握省道通阻資訊，請上Play搜尋
省道災情APP_

發佈時間：2012/8/31 10:00 交通部公路總局

Update every hour, broadcast every 10 minute for 10 seconds

颱風及豪(大)雨特報期間，警戒資訊每小時更新、每10分鐘輪播10秒鐘

經濟部水利署
淹水警戒



可能淹水區域：

縣市	鄉鎮市區
彰化縣	(一級)大城鄉
雲林縣	(一級)水林鄉、台西鄉、台西鄉、四湖鄉(二級)口湖鄉、麥寮鄉
嘉義縣	(二級)東石鄉



掌握即時防救災資訊，請上網搜尋：

防災資訊

搜尋

請搜尋關鍵字「防災資訊」或「行動水情APP」

12. NGO DM participation in Taiwan

Tzu CHI Foundation





> **600** Offices/Points in **61** countries/areas

Charity Relief in **100** countries/areas

Project Hope (school built)

230 schools in **16** countries

Permanent house

18,730 units in **15** countries

Free clinic service 2018

16,170 location-time in **50** countries

Free clinic beneficiaries

3,087,016 person-time

1 million volunteers around the world

10 million supporters & donors around the world



Tzu Chi Aligns with the UN Sustainable Development Goals, SDGs



1995~2018 Tzu Chi Relief Action to Earthquake Disasters

全球震災 慈濟馳援

全球板塊擠壓從未停止，能量釋放又累積；面對未知的瞬間賑災、備災的作為不能

2017 Mexico

2010 Haiti

2001 El Salvador

1999 Clumbia

2016 Ecuador

2007 Peru

2010 Chile

2012 Italy

2003 Iran

1998 Afghanistan

2005 Pakistan

2004 South Asia Tsunami

2003 / 2008 China

2015 Nepal

2001 India

1995 / 2011 / 2016 Japan

1999 / 2016 / 2018 Taiwan

2013 Philippines

2006 / 2018 Indonesia

1998 Papua New Guinea

2011 New Zealand

慈濟救災 防備災同步

1992~培訓急難救助專業

- 以男眾慈誠隊員為主，培訓急難救助的知識與技能，期使配合警政、消防單位救災



急救訓練課程持續至今，隊員演練心肺復甦術。(攝影/黃淑媛)

1996~推動「社區志工」模式

- 賀伯颱風來襲，為臺灣過往三十年間最大的天災。上人推動「社區志工」概念，將慈濟志工以所在社區為單位重新編組，期望建立社區關懷網絡

1999~九二一地震

- 社區關懷網絡建置近三年，是地震當時慈濟投入急難救助得以迅速動員的關鍵之一

2001~完善防救災機制

- 第一線救援工作為專業單位負責，慈濟志工參與急難救助工作以後動補給、醫療站設置、陪伴關懷受災民眾等第二線工作為主

- 2003年與消防署簽訂「救災物資空中運輸後勤支援補給計畫」，由消防署提供師資訓練、提升支援救災之效能

- 2004年由企業與專業志工組成的「慈濟國際人道援助會」，針對救災上的食衣住行通訊各項需求，進行後勤支援與研發，如環保毛毯及快速組裝的簡易屋等

2009~莫拉克風災

- 香積飯開始廣泛運用於災區
- 淹水退去後，汙泥厚重清掃不易，研發利於清運民宅汙泥的小山貓

2011~建構防救災圖資系統

- 與國家實驗研究院國家太空中心簽署「國外災區衛星影像支援合作」備忘錄，由太空中心無償提供衛星影像，提升海外救災情資判斷

2013~菲律賓海燕風災

- 自臺灣送抵包含Q-Water淨水器、香積飯、火箭爐、簡易屋、太陽能路燈、福慧床等研發產品投入賑災

2015~蘇迪勒颱風、復興航空南港空難

- Q-Water淨水器、清運汙泥的小山貓進入新北市烏來風災災區，協助民眾清理家園。爾後以全地形救災工作車取代小山貓，進行運送物資及清運汙泥之工作
- 行動廚房首度於南港空難現場供應熱食
- 2017年與健行科技大學合辦「無人飛行載具勘災與資料處理研習營」；與國防大學簽訂「慈濟防賑災資訊系統」研發合作，系統於隔年瑪莉亞強颱時啟用



志工藉由空拍教育訓練考取證照，可操作無人載具拍攝勘災畫面，爾後進行3D疊圖(左圖攝影/濶巧好)，以利救災行動的規畫。

2018~0823熱帶低壓水災

- 改良研發之防割手套、防穿刺鞋墊首度大幅使用，以保護投入災區的志工免遭異物所傷，並贈予整頓災區的國軍使用



防穿刺鞋墊

防割手套

- 2019年與國家災害防救科技中心(NCDR)，簽訂「災防科技合作協議」，透過「災害情資網」的圖資平臺，整合與應用災害防救資訊的相關研究與工作；與中央氣象局簽訂「防賑災氣象運用及教育推廣合作備忘錄」，並於慈濟苗栗園區啟用全臺第一個「慈濟防備災教育中心」

2018 Tzu Chi Relief Action Map

2018年慈濟救災地圖



美國加州林火



美國維吉尼亞州龍捲風



莫三比克垃圾山崩塌



柬埔寨水災



菲律賓水災



日本岡山水災





1999 Sept 21, 1:47 am
Magnitude 7.3



51,711 Houses Destroyed
53,768 Houses Damages



Nantou County,
Chi Chi Township



2,415 Death, 29 Missing
11,305 Injuries



364.7 Billions NTD losses
(11.64 Billions USD)



Emergency Relief Aid



Mobilized 100,000 volunteers in disaster area helping victim, logistics, traffic control, etc.

2001 Earthquake in India



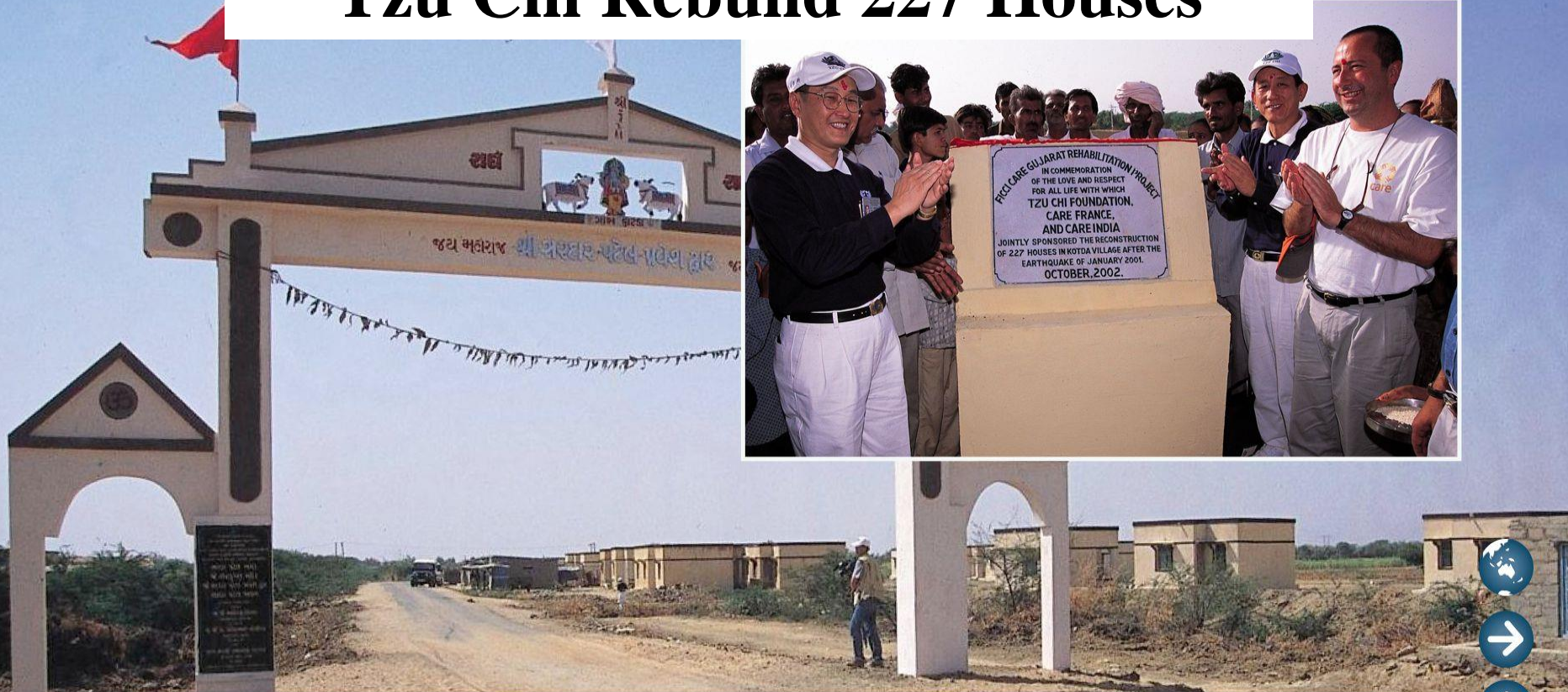
India 印度強震援助

2001.04.01 印度古茶拉底省普杰鎮 攝影：謝景貴

印度地震後災區斷垣殘瓦，超過兩萬名生命在這場世紀強震中犧牲。



Tzu Chi Rebuild 227 Houses



India 印度強震援助

2002.10.22 印度古茶拉底省安加爾地區可達達慈濟村 攝影：顏霖沼

慈濟與法國關懷機構(CARE)合作，為震災災民興建227戶大愛屋。



2003 Earthquake in Bam, Iran



2003.12.28-2004.01.21 伊朗卡曼省巴姆市 攝影者：顏霖沼/蕭耀華

地。志工走訪重災區，評估援助計畫。

Iran 伊朗巴姆強震救援

2004.01.29 伊朗卡曼省巴姆市吉曼羅帝街 攝影：顏霖沼

為八萬多位災民發放大米、醫藥箱、毛毯及生活用品。



Tzu Chi Rebuild 5 Schools



2004 Earthquake and Tsunami in South Asia



Tzu Chi Rebuild Over 3000 Houses and 3 Schools in Indonesia



Tzu Chi Rebuild Over 600 Houses and 3 Schools in Sri Lanka



2009 Typhoon in Taiwan





Tzu Chi Rebuild Over 1280 Houses, 2 Churches, 1 School in 3 Counties



Tzu Chi provide Over US \$ 70 Million for 96,976 Families with Respect



2013 Typhoon, Earthquake and Conflict in Philippines



Tzu Chi rebuild Over 2,500 Houses



2017 Earthquake in Mexico





TZU CHI INNOVATION SYSTEM

Charitable Technology

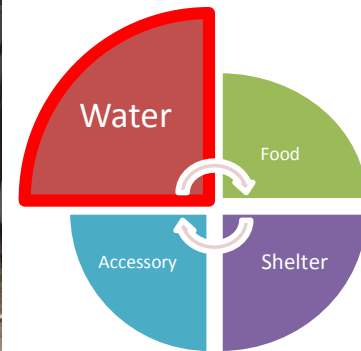
When disasters strike, aid providers are often challenged to offer food and water to victims as quickly as it is needed. Over the decades, Tzu Chi has developed some equipment to assist volunteers to deliver aid better and faster.

While a lot of equipment for conducting relief missions can be purchased on the open market, some special-purpose items are not commercially available. The product specifications for these items are often very exact and different from what most consumers desire. As far as manufacturers are concerned, the demand for these goods is too small. They do not mass-produce such equipment because there is no money to be made. What company would incur the expense of designing or modifying a product, just to get an order for five units once every three years?

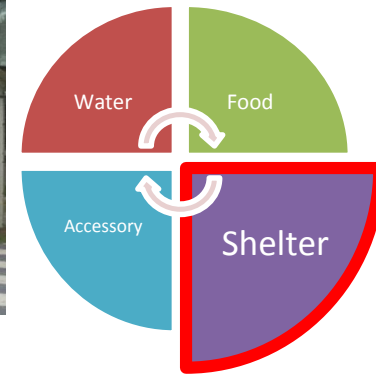
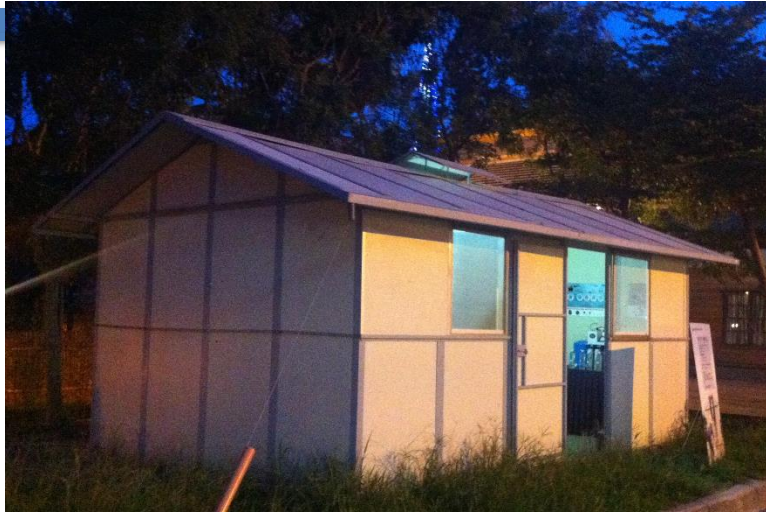
Tzu Chi has been involved with disaster relief for decades. The foundation's aim is to ease the suffering of disaster victims as quickly as possible. To enhance aid delivery capability, volunteers have created tools that are not commercially available. Because disaster areas typically lack resources, these customized items usually meet the following criteria: easy to use, practical, low maintenance, mobile, and stand-alone.

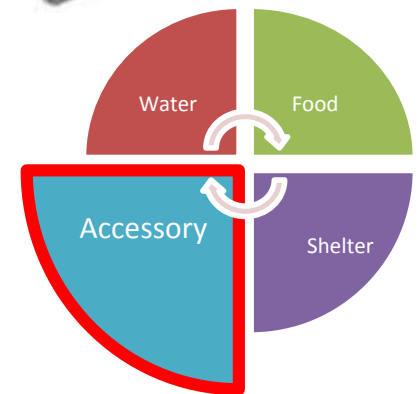
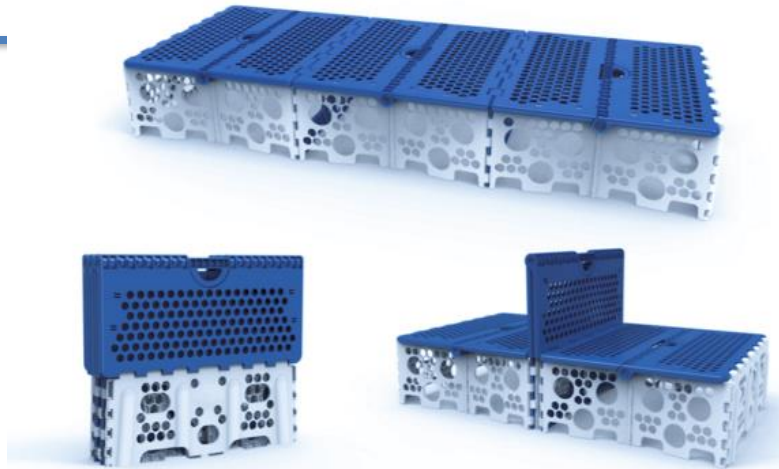
Here we showcase three items from the Tzu Chi aid toolkit.

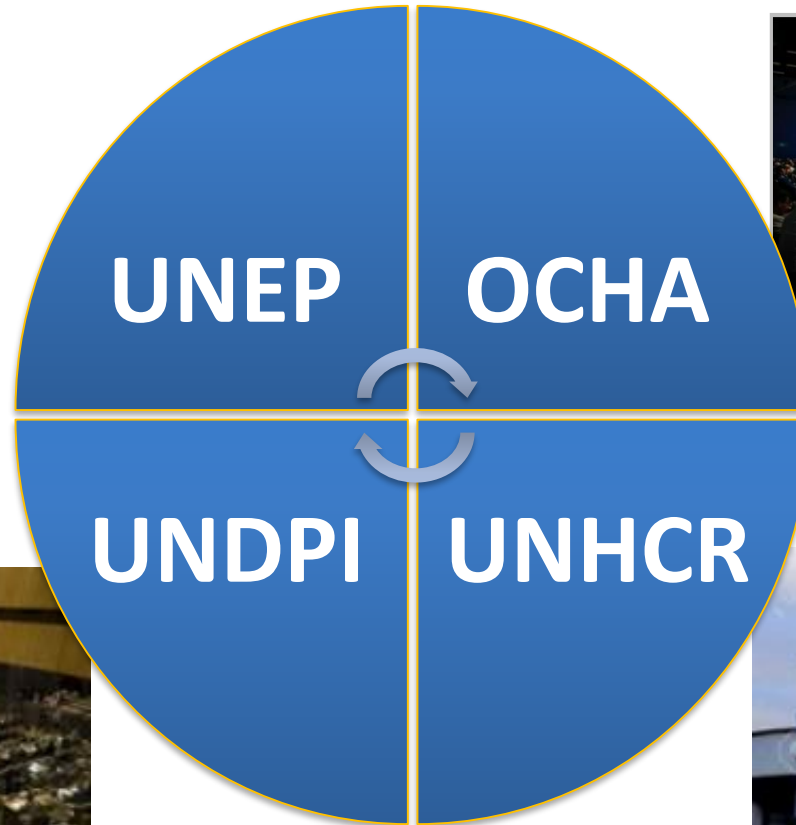












Response Innovations

1. Precautionary Evacuation

People in mountain area

Debris Flow Potential Area

List of residents

Enforced by Township Government

Assisted by fire, police and military

Mandatory (yellow, red alert)



Precautionary Evacuation

- Identify potential mudslides stream area(totally 1,705)
- Make potential hazard map
- Calculate the affected population and make a list
- Select and prepare the emergency shelters
- Decide precipitation alarm value (250-350mm)
- Decide the type of evacuation alarm (yellow and red alarm)
- Evacuation order and enforcement



Case of successful Precautionary Evacuation

Typhoon Fanapi, Sep. 2010, in Lai-Yi village



9/18

05:30

14:00

15:00

9/19

08:40

照片來源：水保局

23:00

Issue yellow alert

Land sliding Red alert

Evacuation operation

Typhoon landfall

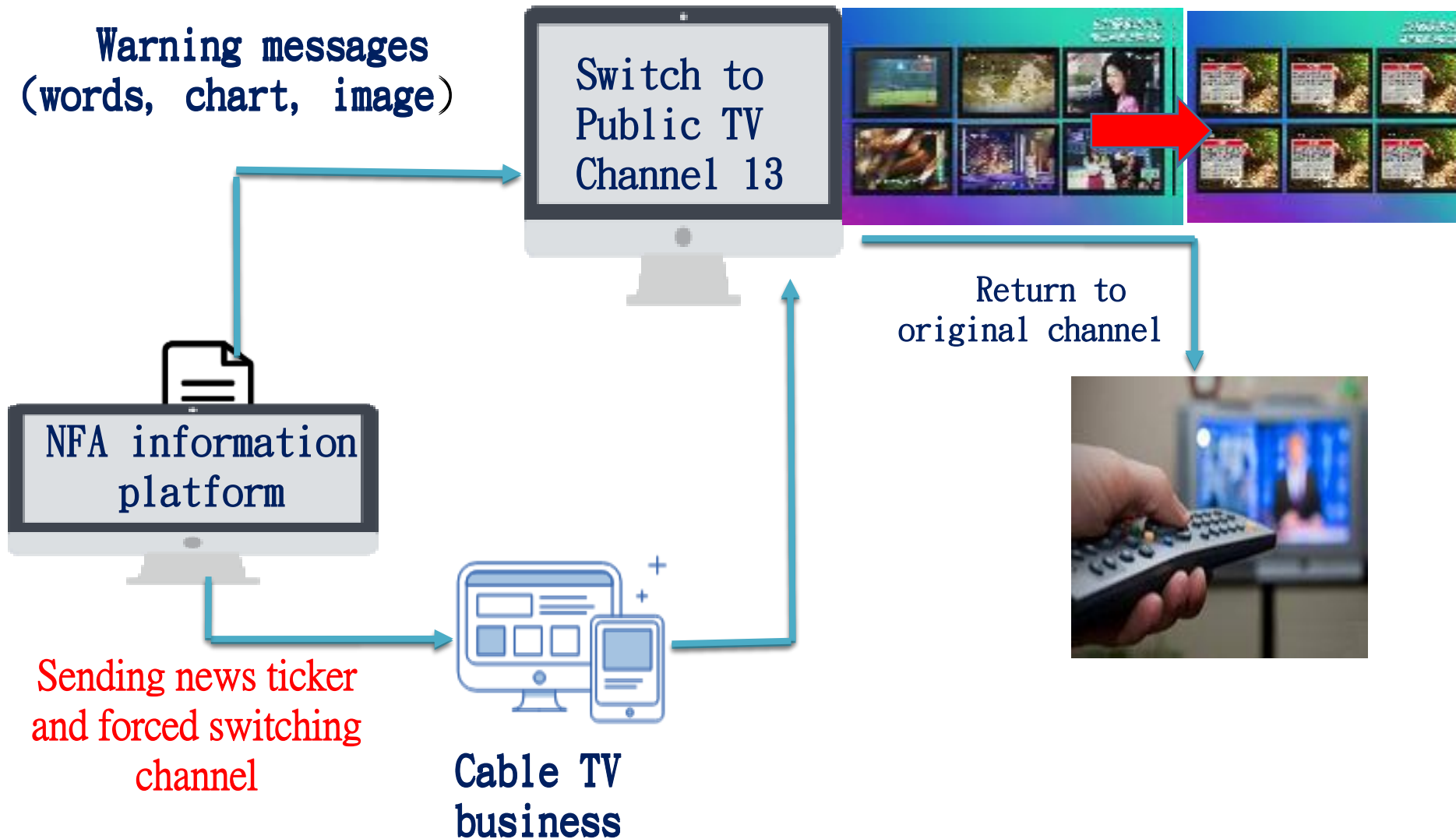
Landside in Lai-Yi



32 hours ahead



2. TV channel forced switching mechanism

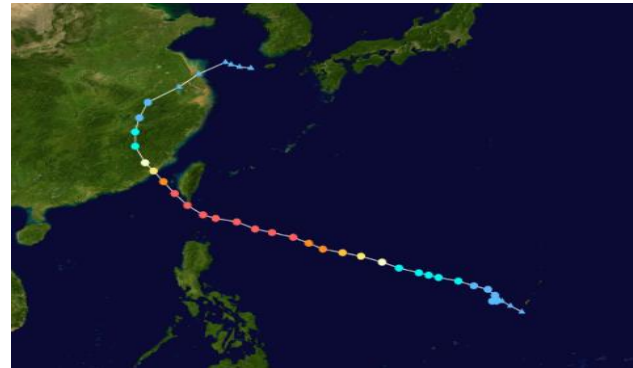
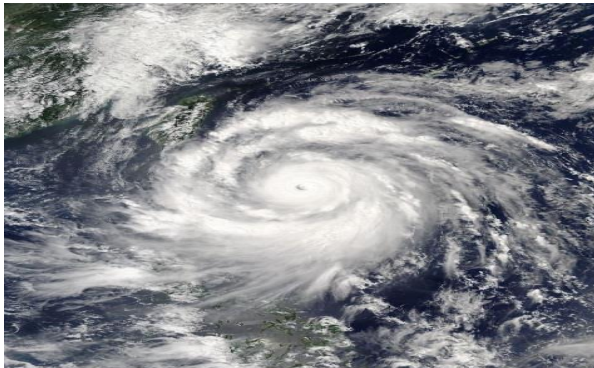


3. International Urban Search And Rescue Team Reception and Departure Centre(RDC)



4. Military Support

- Legal Authorization
- Active response to local disaster
- Pre-Disaster deployment to potential area.
- Military Liaison Officers station to all level EOC.
- Full support function of Disaster Management before, during and after the disaster.



Military Support



Personnel dispatch



Vehicle deployment



Preparedness

**Before
the
disaster**



Evacuation

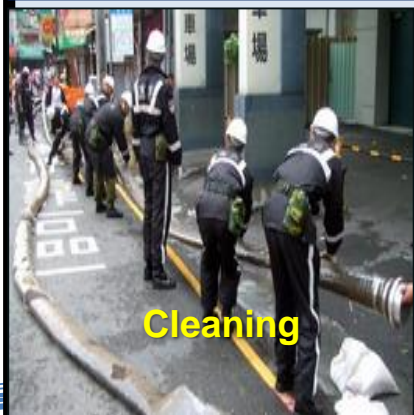


Search and rescue

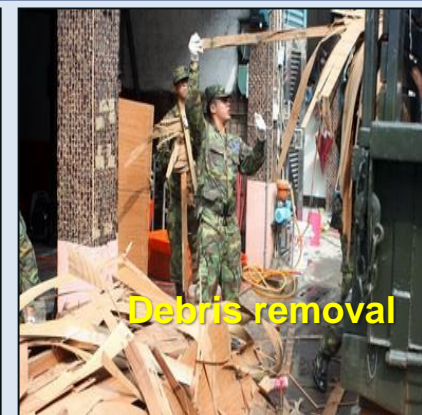


Resource supply

**During
the
disaster**



Cleaning



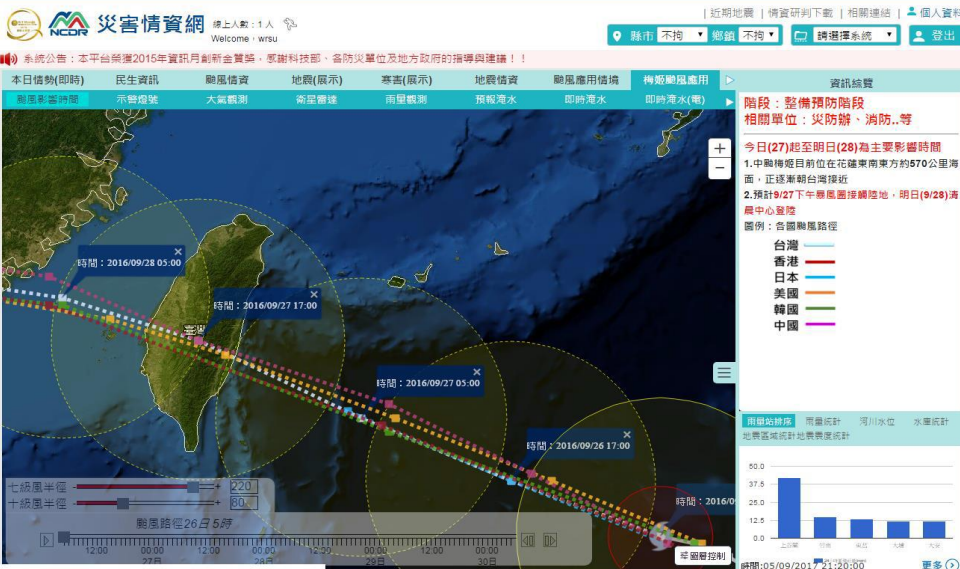
Debris removal



Sterilization

**After
the
disaster**

5. Right to know – Response Information



Disaster information network

- ✓ Potential maps
- ✓ Information analysis
- ✓ Hazard prediction
- ✓ Weather information
- ✓ CCTV monitoring



CEOC Information Station

- ✓ Response and resource
- ✓ Public warning
- ✓ Damage report
(transportation, public work, casualties)

CEOOC Disaster information Station

Weather information

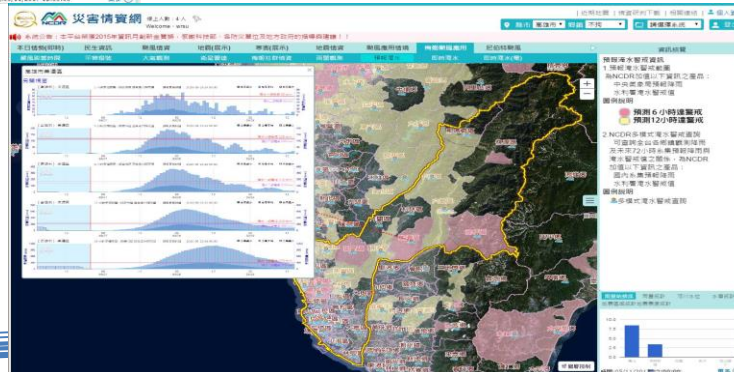


CCTV monitoring

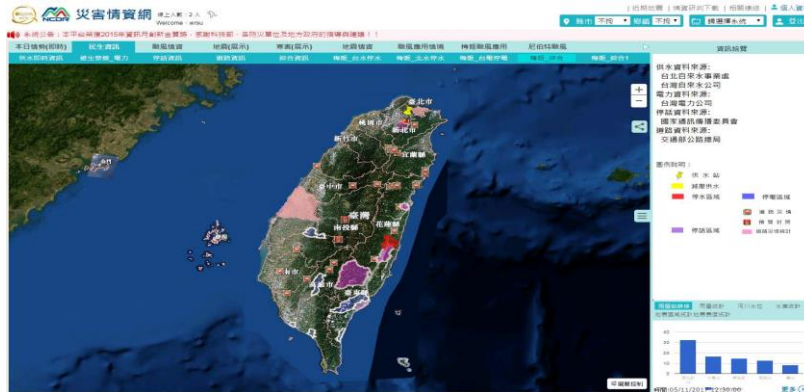


Rainfall prediction

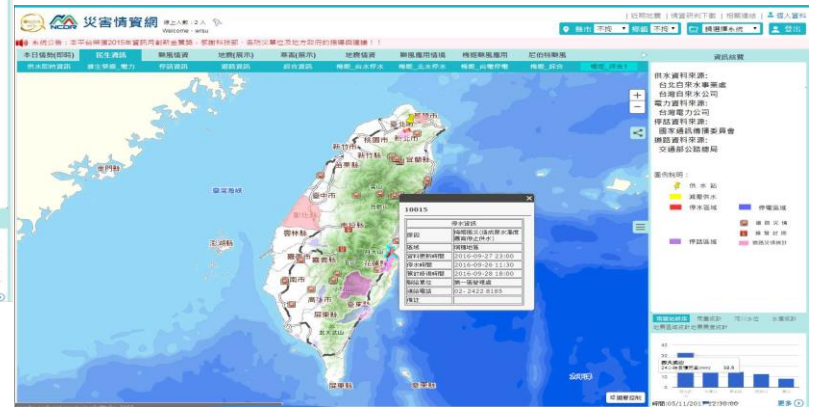
Flood warning



CEOC Disaster information Station



Dam discharge, Roads closure, Debris Flow warning



Power, Running water, gas and telecommunication condition

ET to recover or repaired

Current situation

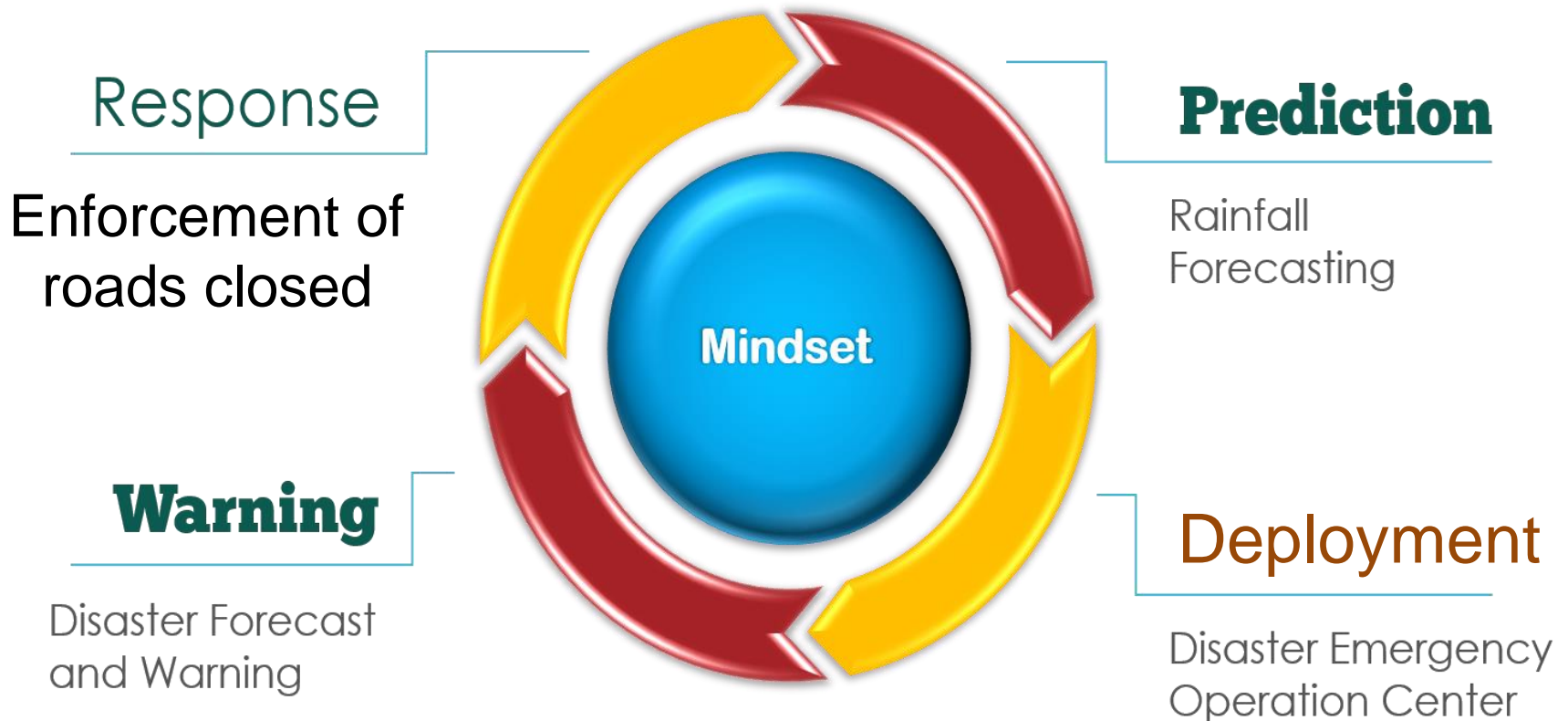


狀態	減壓
原因	台電停電
區域	政大一帶住戶
發生時間	2017-04-13 12:00:00
預計修復時間	2017-04-13 17:00:00
聯絡單位	臺北自來水事業處客服中心
聯絡電話	02-87335678
資料更新時間	2017-04-13 12:00:00

Suhua Highway



5. Smart Road Disaster prevention



Suhua Highway Road Disaster

21 Oct 2010, extreme rainfall, 181mm/h, typhoon period accumulation rainfall 939.5mm, caused 69 vehicles and 500 trapped, 26 dead or disappear, highway closed for 25 days.



Highway Disaster Early Warning Mechanism (HDEWM)

$$\text{RISK} = \text{HAZARD} \times \text{EXPOSURE} \times \text{VULNERABILITY}$$

危害度

交通量

脆弱度



1



1



1



1

0.5



1



0.5



1

0



1

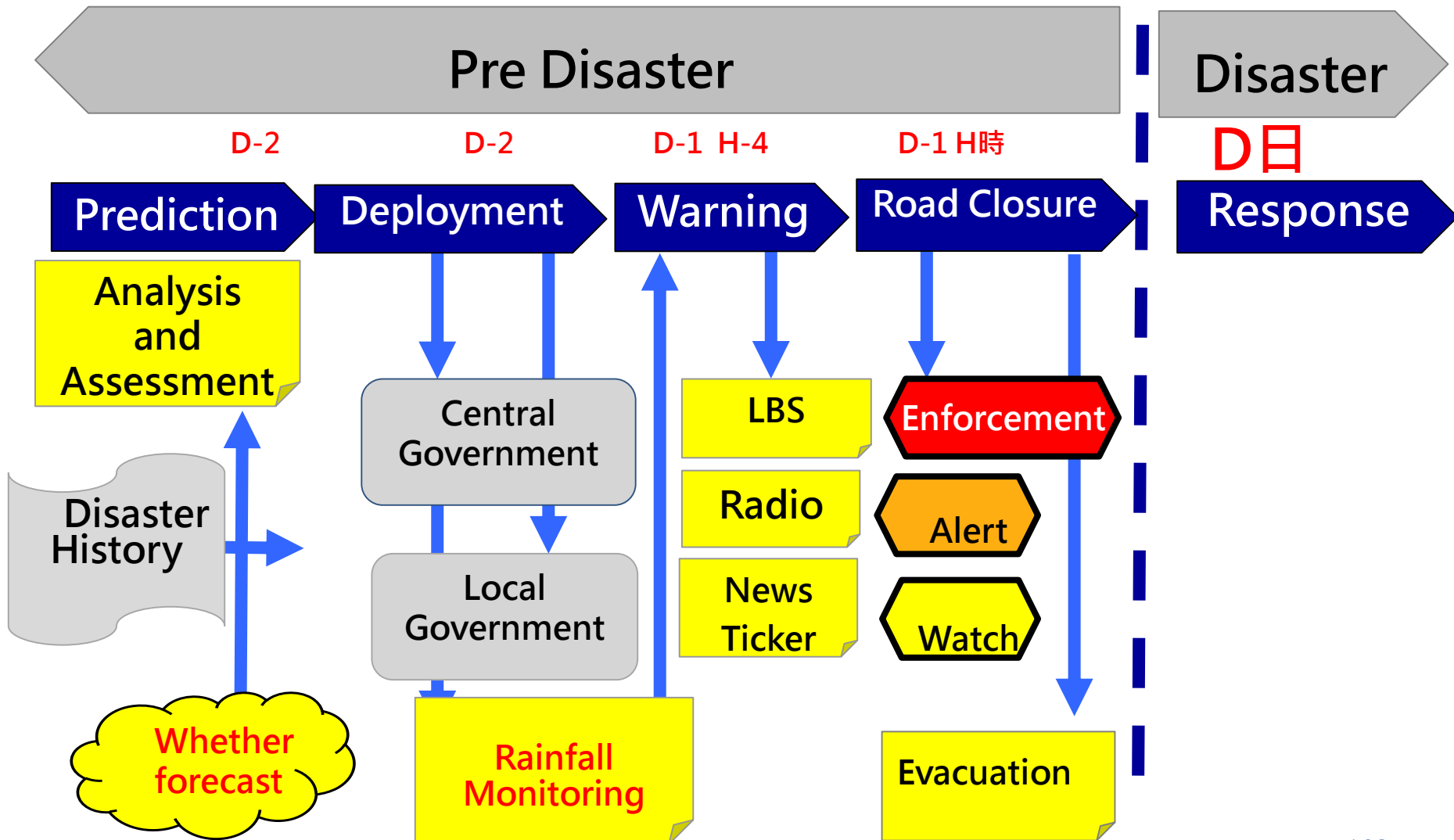


0

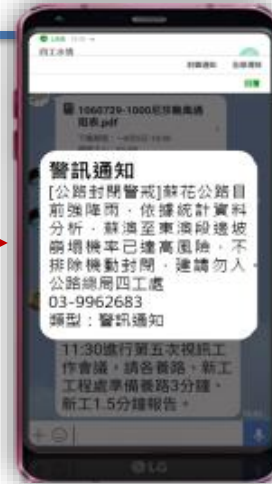
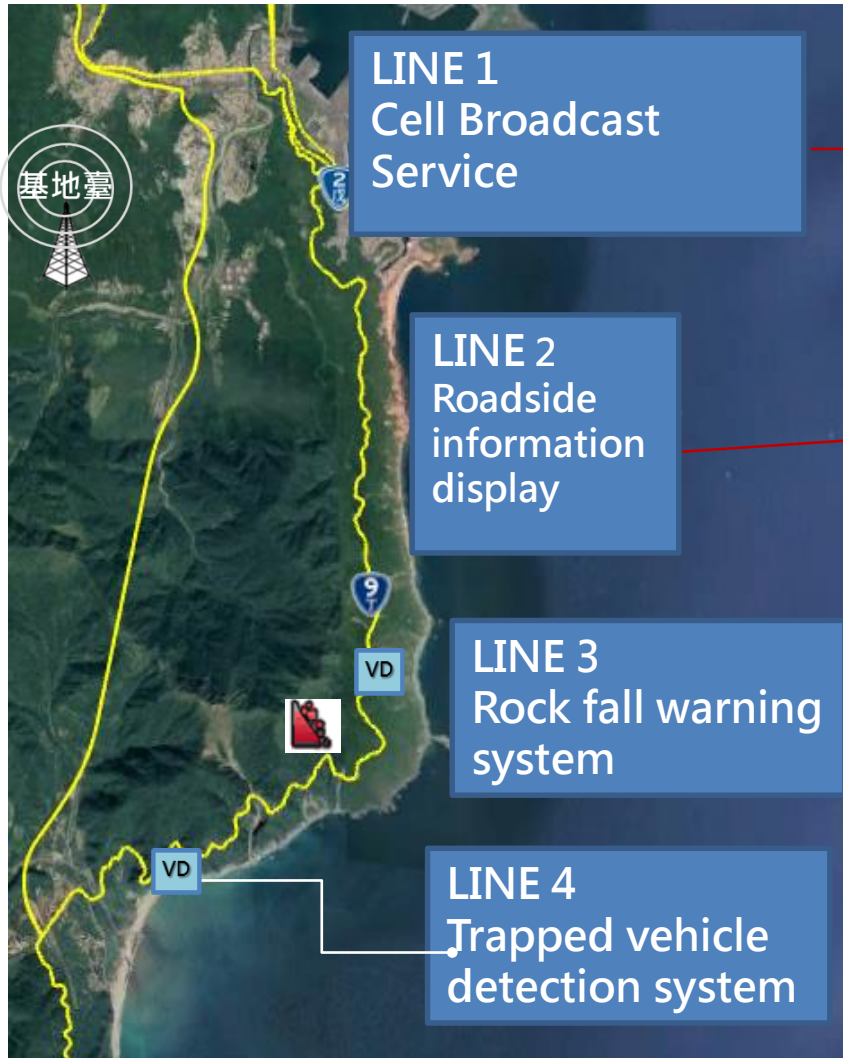


1

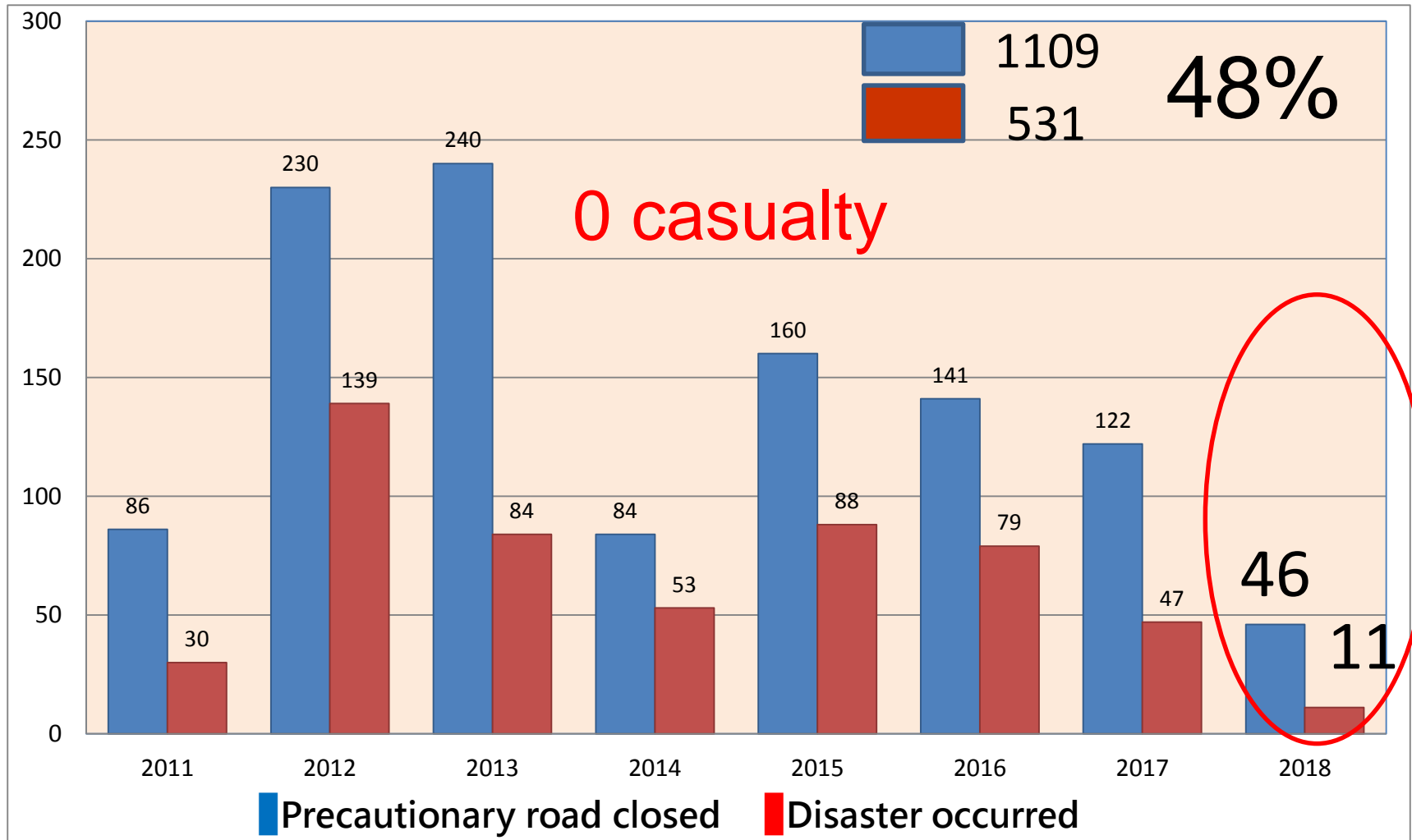
Concept of (HDEWM)



Tools of Earning Warning System



Comparison of (HDEWM)

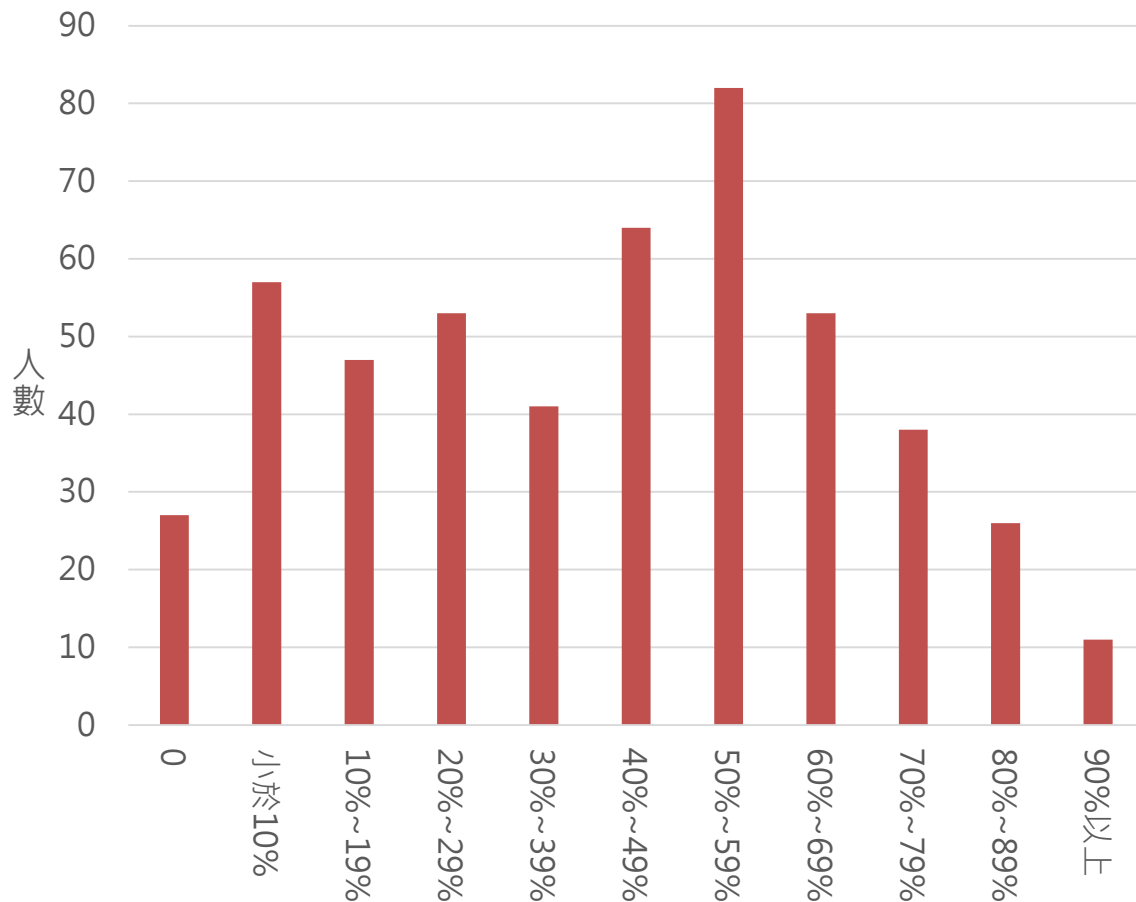


6. Water park corn powder explosion

- 27 June 2015 in New Taipei city, Taiwan
- International assistance: Euro Skin Bank, Japan, USA, Israel, Singapore
- Lessons learned from legal frame work, Mass Burn Casualty response, emergency hospital coordination.



Total Burn Surface area (TBSA)



Total burn	499
Average TBSA	42.0%
TBSA \geq 40%	274 (56.7%)
TBSA \geq 80%	37 (7.6%)
Dead/Mortality rate	15 / 3.0%
Survivor/Survival rate	484 / 97.0%

TBSA 90%+ Amputation





八仙塵爆 / 差一點離開人世！八仙塵爆截肢重傷者 花6年讀完大學

2017-06-12 13:05聯合網 記者馮靖惠 / 即時報導



Prosthetic limb





Facing the future with hope



Experience Sharing

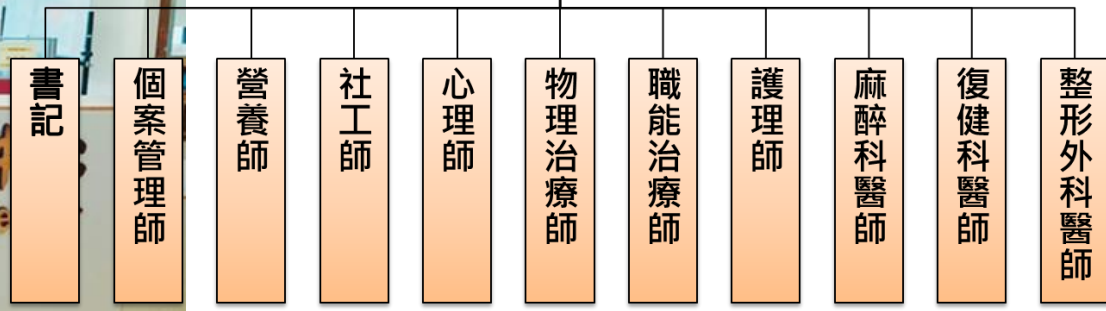
- ◆ 25 May 2016, European Medical Corps workshop on “Dealing with Mass Burn Casualty disaster”
- ◆ 3 doctors was invited by DG ECHO
- ◆ Astonished by mortality rate 3% in Taiwan (usually < 20% normally)



Burn Rehabilitation and Post Acute Care Center



燒燙傷急性後期照護中心主任



7. Integrated recovery and relocation approach

- **Communication:** persuade tribal people to relocate
- **Cooperation:** Central and Local Government (land use)
- **Contribution :** Disaster Relief group and Tzu-Chi Foundation (budget and construction)

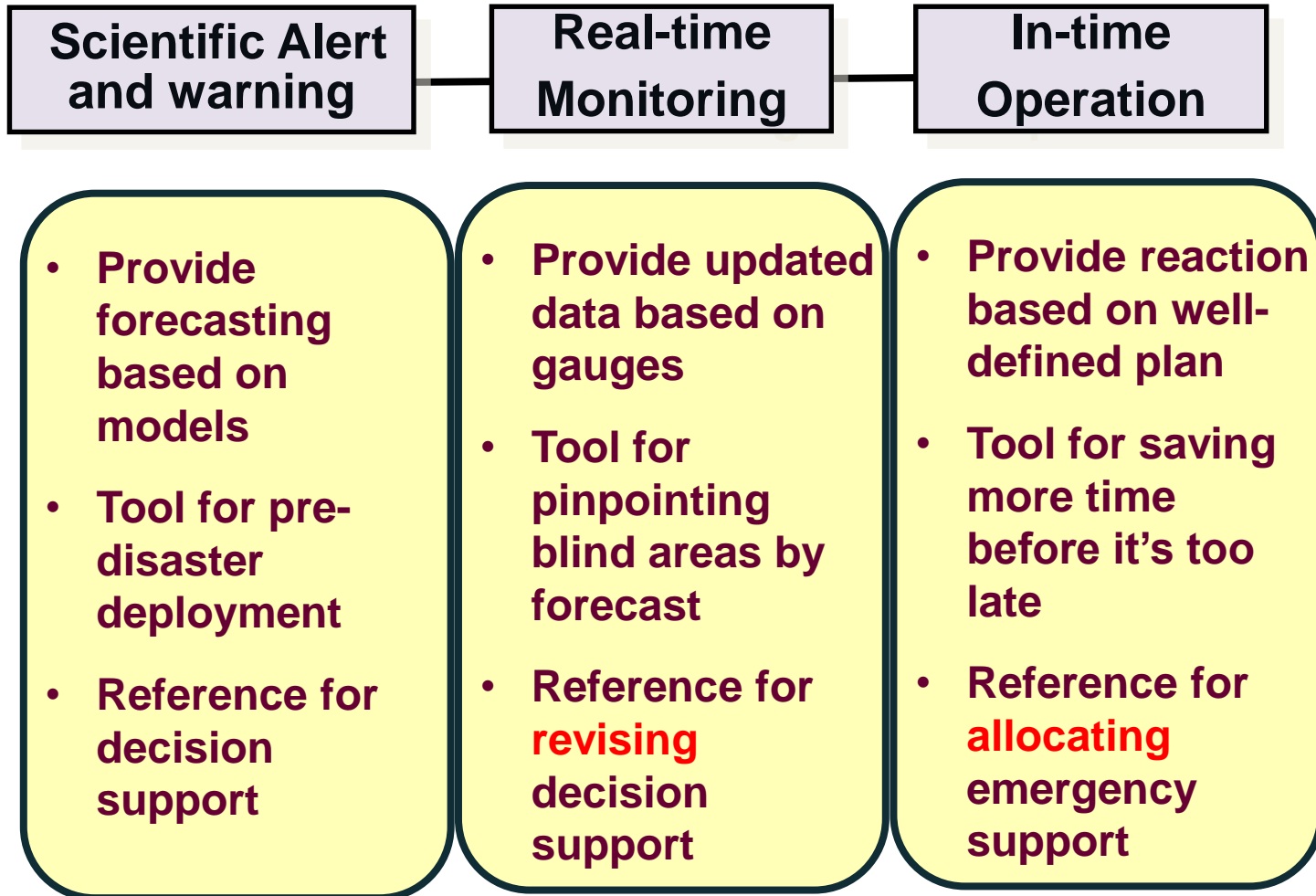
Build Back Better (3B)

- To plan, build and relocate two indigenous tribes in just 18 months.
- A good example for disaster response and recovery function.



Conclusion

Three elements to succeed emergency response





Thanks!