

Examining the Development History and Future Vision of Taiwan's Disaster Rescue System on the Local Government Level – Showcasing the Taipei City Government

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Abstract

The Taipei city is located at the earthquake belt of Pan-Pacific Ocean and the area of the west Pacific Ocean monsoon, year to year faces the attack of earthquake, torrential rain and typhoon. Therefore, long-time exertion to hazard mitigation works is indispensable. The Chi-Chi earthquake and Nari typhoon flooding over 200-year return period in 2001 caused serious loss to the whole Taiwan areas. The Taipei city also reexamines from the disaster mitigation experience, adjusts and revises each item to guard against the related disaster topics, had constructed a complete and integrated operating mechanism of disaster rescuing system. The Taipei government had set up “Rules for natural hazard mitigation and recovery of Taipei” in 1975 to be a harbinger in hazard mitigation works in Taiwan. The Executive Yuan proclaimed the “Disaster prevention program” in 1994 to enforce the function of hazard mitigation, and presently “Disaster Prevention Law” in 19th Aug, 2001 to build up a complete framework in central and local governments. In order to strengthen hazard mitigation combination between technology and practice, Taipei City Government and the National Science Council (NSC) of the central government had proposed an integrated and joint system about hazard mitigation, expecting to build up a model for other areas. With an advanced and macroscopic point of view, the essay aims at exploring foresight of hazard mitigation works in Taipei city. (*Ann Disaster Med.* 2004;3:27-37)

Key words: Disaster; Rescue; EMT; DMAT

Introduction

As a political, economic and cultural hub, Taipei City thrives in commerce and industry and its cityscape is increasingly marked by towering high rises and a rapidly surging population thanks to a swift economic and social development over the recent years, where as the land utilization in downtown areas gradually

saturates, many residential areas are spreading to the outskirts of the city and along the slopes. With the constantly expanding city limits, the variety of potential disasters is also diversifying; for instance, the recent incidents of the September 21 Chi Chi earthquake,¹ typhoon Rammusun, the March 31 quake, typhoon Nari, SARS (severe acute respiratory syndrome)

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epidemic,^{2,3} have not only come to mar the public with indelible pain and enormous social costs but also come to test the city administration's wits in disaster prevention and rescue capabilities.

Taipei City's Disaster Rescue System and Its Operating Mechanism

Disaster prevention and rescue system

Taiwan's disaster prevention and rescue system, as defined by the Disaster Prevention and Rescue Act, has the system divided into three tiers – the central government level, the central-ruled municipality and county municipality level, and the local government level of townships, villages and municipalities. Though the Disaster Prevention and Rescue Act has not enlisted administrative districts on a separate level, the Taipei City Government has had its municipal disaster prevention and rescue system divided into a two-tier scheme, comprising of the municipal and district levels (see Annex 1), in light that the city's disaster response is subjected to relevant laws, such as the "Local Government System Law",⁴ the "Taipei City Natural Disaster Prevention, Rescue and Post-disaster Response Measure", and the "Taipei City Major Natural Disaster Emergency Response Measure", and as per years of experience through actual implementations. The municipal rescue body is manned by the mayor, who double as the commander, with members comprising of officials from city government bureaus and divisions; the district rescue body has district magistrate manning the organization as commander, with members comprising of personnel dispatched from police stations and district halls, where specific tasks are assigned

according to the nature and responsibilities of the administrative units.

At normal times, the organization of Taipei City's disaster prevention and rescue system is comprised of the Taipei City Disaster Prevention Joint Mission, the Taipei City Disaster Prevention and Rescue Commission, the Taipei City Government Disaster Prevention and Rescue Expert Consulting Committee and so forth. In the event that Taipei City is at risk of major disasters, the emergency response body would be turned into corresponding organizations, which primarily comprised of the municipal and district disaster response centers, with an emergency response task force set up within various administration bureaus and divisions, in addition to field command center installed at the disaster sites, and the Taipei Rescue Squad.⁵ In post-disaster rebuilding, there is the Post-disaster Rebuilding Promotional Committee; a logistical diagram depicting how the units work together is as shown in Annex II.

Disaster prevention and rescue operating mechanism

In a move to quickly mobilize rescue units and personnel coming from relevant administration bureaus and divisions in the event that the city should be at risk or under major disasters to excel an integrated disaster rescue yield, an "Emergency disaster reporting system" has been installed at the Bureau of Fire Administration's disaster rescue care duty dispatch/command center, which encompasses a rapid command reporting system, fax transmission system, handset short-messaging reporting system, handset priority voice communication system, wire telephone system, exclusive disaster alert telephone and so forth that can

be used to activate the emergency reporting system in the event of a disaster and notify relevant disaster rescue personnel to report to the disaster response center or dispatch rescuers to disaster-hit areas to provide emergency rescue work.

At the onset of a disaster, the ability to grasp the magnitude of a disaster can infinitely help disaster response commanding center commander come to disaster rescue decisions. In light of which, a comprehensive disaster intelligence gathering system has emerged as very important. Presently, the Taipei City Government's disaster intelligence gathering system encompasses the disaster computerized transmission system, exclusive disaster fax transmission devices, exclusive disaster prevention and rescue e-mail transmission system, exclusive disaster announcement broadcast station, wireless PDA disaster intelligence surveillance and reporting system, wireless telephone system, and internal disaster intelligence transmission information system and so forth.

To facilitate conducting emergency field rescue work in major incident and disaster sites, a forward command center is set up depending on the state of a disaster site that would facilitate dispatch and command in close vicinity, where a district magistrate would head the mission as field disaster commander. In the case of the collapsed Dong Hsing Building in Taipei City following the Sept. 21 earthquake in 1999, the Taipei City Government had swiftly set up a forward command center at the disaster site for 10 days; in the case of a collapsed private residence building along section 3 of Chen Der Road following the March 31, 2002 earthquake and at the Taipei Financial Building site where a construction crane was snapped and fallen

down, the Taipei City Government had all set up a "Forward command center" at the disaster sites, with the district magistrates heading the site as commanders, in charge of commanding field crews to carry out rescue related undertakings in life rescuing, traffic control, peripheral security surveillance, emergency care response and so forth.⁶

Taken into account the grave casualties following every natural disaster that could go beyond the means and resources that a disaster-hit municipal or county government is capable of handling, in search of swift response, and to grapple the opportune timing for emergency rescue, the Taipei City Government not only files support from the central government as stipulated by the Disaster Prevention and Rescue Act but also works with six county/municipal governments of the Taipei County Government, the Keelung City Government, the Taoyuan County Government, the Hsinchu County Government, the Kinmen County Government and the Lienjiang County Government, as well as the Ministry of Transportation and Communication's Bureau of Rail Administration through a regional joint defense and mutual support protocols that would allow enlisting outside help when the city's disaster response capabilities should fall short of supporting a particular disaster scenario.

Select Disaster Reviews

The Sept. 21 earthquake

As major earthquakes, measuring 7.3 on the Richter scale, broke out in Chi-Chi of central Taiwan at 1:47am, September 21, 1999, which though quite a distance away from Taipei City, it nevertheless dealt a major blow to the city as the Dong Hsing Building, located along sec-

tion 4 of Ba Her Road, had collapsed as a result of the tremors, leaving 73 dead, 14 missing, 138 injured in a catastrophic incident, with disaster scenarios as recapped below, marking it the worst natural disaster in Taipei history since it was first founded in 1884.^{1,7-9}

Following the quakes, Taipei city suffered major power outage as the city was besieged in complete darkness, at which point a large volume of incident phone calls began to reach Taipei city Government bureau of fire administration's 119 duty dispatch center, and response centers at various government levels had been set up immediately after, where all disaster rescue personnel had voluntarily reported to duty without notice. The municipal disaster response center, manned by deputy mayor Bai and secretary general, swiftly took control at the site of the collapsed Dong Hsing Building, and quickly set up a "Forward command center", run by deputy mayor Oou, in charge of commanding and dispatching disaster rescuing resources, comprising of the administration's various disaster rescue units, armed forces, private rescue organizations and the like, ensuring an expeditious execution of various coordination and rescue efforts.

In response to the quake rescue mission, a united effort had been sought by all rescue units sharing a sense of compassion and upholding what the mayor had instructed of "Never to give up, never to rest but to continue with the rescuing mission", "Never to abandon rescuing unless coming to an absolute dead end". To ensure a smooth execution of various crucial rescue efforts, a three-tier zone control had been set up at the site that helped to segregate disaster rescuers, logistical staff, disaster-hit family members, the press and such, with an

effective integration of rescue efforts from private rescue organizations. On day three following the quake disaster, orders were given to begin excavating the site, coordinated with voluminous sprinkling and manual digging, that aimed to screen for any life sign, layer by layer, which had led to the rescue of the Sung brothers on day still, a factual proof that the city administration's rescue efforts were on track.

Compared with previous disasters that the city had to wrestle with, damages arisen from the quake were not only unprecedented, but the incident stood as a major challenge to the city government's disaster prevention and rescue system. In spite of acclaimed recognition from all sections of the society, the administration, driven by a stepped-up disaster prevention awareness following the grave incident, had begun reviewing the administration's disaster prevention system and disaster rescue equipment capacity, together with appointing 64 administration personnel to receive emergency rescue training in the United States. In conjunction to which, an island-first UN-certified "Taipei City Search Squad" has since 2000 been launched, aiming to save lives utilizing hi-tech equipment and search canines, and the squad has been proven effective in many subsequent local and foreign rescue missions, i.e. the Salvatore quake in 2001, the typhoon Toraji's gale disaster in 2002, the March 31 quake in Taipei City in 2002, the Iran quake disaster in 2003 and so forth, spreading the warmth and care for all mankind and a boundary-free rescue effort.

Statistics on Taipei City's Sept. 21 quake damages is depicted in Table 1.

Typhoon Nari's gale disaster

With typhoon Nari declared to invade the city on Sept. 16, 2001, to effectively response to relevant disasters, the Taipei City Disaster Response Center was formally set up at 8:30 am, Sept. 15 in a move to aggressively set up disaster prevention mobilization work. Yet little than expected that as typhoon Nari stalled and

hovered over Taiwan extendedly, notwithstanding packing ample of precipitations, it not only broke the city's 105 years of meteorological records but the unrelenting torrential rains, which far exceeded the flood prevention criteria devised for the city, had led to devastating results, as floodwaters gushed through the

Table 1. Statistics on Taipei City's September 21 quake damages

Type	Incident Count	Footnote
Human casualty	74 persons (including one suffering from cardiac arrest prior to arriving at the hospital)	1. The emergency rescue mission deployed a total manpower of 77,770 person/missions.
Declared missing	14 persons	
Number injured and sent for medical treatment	138 persons	2. In power supply, rotation power supply through main power lines resumed at 19:30 on Sept. 21, except that for the Nankang and Neihu districts), and 98% of city-wide power supply had resumed to normalcy by 11:00am, Sept. 24.
Toppled buildings	3 cases	
Hazardous buildings	23 buildings assessed as hazardous	3. In traffic signage, 98% of citywide traffic signage had been resumed to normalcy by October 1.
Building found with crack lines	199 buildings	
Gas leak	213 cases	4. The gas leak incidents included 29 cases lodged in at the municipal disaster response center.
Persons trapped in Elevators	29 cases	
Power outage	98% power restoration	5. The case count on buildings reporting of crack lines only pertained to those lodged in at the municipal disaster response center.
Traffic signage	98% restored to normal operations city-wide	
Fire	3 incidents	
Generator short	7 cases	
Other services	43 cases	

embankment and inundated and disabled the pumping stations, causing mudslides, landslides, landfalls and severe damages to the mass rapid transit system, and threatening the lifeline of the entire city.

The disaster had caused devastating damages, leaving 27 casualties, 3 declared missing, 16 severely injured, besides unaccountable loss of property damages among others; relevant disasters are recapped as shown in Table 2.

Left behind by the gale disasters were floodwaters that inundated many of the building basements, and mounds and mounds of debris and garbage that the residents of Taipei had cleared out of their flooded homes, while water and power outages continued to hamper the citizens from conducting normal day-to-day functions. To ensure a smooth execution of various rebuilding work, the administration had allocated available manpower and equipment, combining the strength of the armed forces and

private resources requisitions and soliciting the help of the central government and other municipalities, to embark on the rebuilding efforts. At the united efforts of the entire rescue personnel, the city was eventually restored to its former glory, and the lives of its residents returned to normalcy.

Following the passing of typhoon Nari, to review future strategy and to ensure a rightful execution of the rebuilding work, the Taipei City Government had instilled a “Taipei City Government Typhoon Nari Post-disaster Rebuilding Committee”, headed by Executive Yuan vice speaker Mr. Liu Chao-shuen as commissioner, to assist the administration examine the cause of the disaster, review relevant disaster prevention, rescue and aids work, and the city’s postdisaster recovery system, as well as drafting tangible improvement recommendation and providing consultation for input in moving forward rebuilding related undertakings. In conjunction to which, committee recommendations

Table 2. Statistics on Taipei City’s Nari typhoon damages

Type	Disaster Recap
Slope disasters	Devastations following typhoon Nari find the city suffered over 100 landfalls of varied magnitudes, 40 disaster spots along some 26 roadways, 25 preservation zones, and around 30 endangered dwellings, with varied landfalls along hazardous side slopes.
Collapsed roadways	232 disaster spots.
Embankment damages	230 meters, including those along the Shertze Dao and Shia Bashien areas.
Damaged pumping station equipment	35 equipment units located in eight stations
Shelters for disaster-hit residents	Number of disaster-hit sought shelter totaled to 2,053 persons.
MRT damages	Severe damages are reported at some of the stations along the Nankang line, Tamsui line and Pannan line.

were forwarded to relevant administration bureaus and division that would poise to improve and strength the city's disaster prevention system; with ongoing review efforts and infrastructure improvements, substantial progresses had been made to Taipei City's relevant disaster prevention system, bracing toward the objective of recreating the city into a disaster resistant one.

Future Visions

To instill a full-time disaster prevention and rescue body

To excel its disaster prevention and rescue system, strengthen its disaster prevention and rescue function, and enforce the promotion of disaster rescue work, the Taipei City Government has since instilled a disaster prevention and rescue system review task force, aiming to review and develop an innovative and visionary disaster prevention and rescue system most suited for Taipei city, mirroring some of the existing foreign disaster prevention and rescue systems, in search of building a city that is disaster proof and disaster resistant.

To launch a comprehensive round-the-clock response center

To fully grasp and utilize a host of disaster rescue information, communication, and to integrate the disaster prevention mechanism of various administrative units, which would help to discern and grapple the state of various disaster, notify relevant units and convey disaster intelligence, and to excel the center's command, monitoring, coordination and response functions that are crucial for completing the disaster rescue work and minimize disaster damages, the city administration has plans to launch a Taipei

City Disaster Response Center at the fifth subsection of Hsin Yi Road, which would be custom-tailored to support a multipurpose and round-the-clock operating mode.

To induct a disaster response backup center

In lieu of an effective system as some of the fire brigades in the central region had collapsed at the onset of the Sept. 21 Chi Chi earthquake that occurred in 1999, to curtail the city's existing disaster command system from being disabled in the event of a major disaster and kept from carrying out its intended purposes, being that both the disaster rescue command center and disaster response center are situated on the third floor of the Bureau of Fire Administration, allocations have been made to install a second disaster response center and disaster rescue command center at the new construction site of the bureau's Yen Ping brigade, located along Cheng Zhou Road in western Taipei.

To strengthen a district-based disaster prevention and rescue organization and efficiency

Following the relentless onslaught of the Sept. 21 earthquake, Taipei mayor Ma Ying-Jeou is more keenly reminded of the fact that a singular rescue body from the city government may fall short of supporting the emergency aid for the 2.3 million Taipei residents in the event of a major disaster, for the comprehensiveness and broad-based coverage. Taken into account the fact that the district office is more familiar with the local geology and a close-knit community tie, making it most suitable to assume the front-line role in disaster prevention and rescue efforts, active efforts have been made to enlist

the district offices as part of the city's disaster prevention and rescue system by pushing the program to brace toward a "Regional oriented command system".

To draft a disaster command system's standard ICS operating procedure

By mirroring the concept and principles of the U.S. incident command system, and taken into account the state of the existing command and emergency rescue work, a set of standard disaster incident command system operating procedures are to be set up in anticipation of effectively integrate various disaster rescue manpower and resources, instill the city administration team with maximum combat readiness, and excel the rescue efficiency at disaster scenes.

To instill a multipurpose disaster prevention park

As a densely populated metropolis that Taipei City is, the interim placement of disaster-hit residents in the event of a major disastrous incident would emerge as a significant problem. In light of which, the Taipei City Government has plans allocate twelve park reserves for appointing a disaster park for every administrative district, taken into account the characteristics of regional environment and population structure, where it could serve as a recreational venue to the residents at normal times and for storing essential survival rations and equipment, and be turned into an emergency shelter for disaster-hit residents at the time of a disaster.

To instill an intelligent fire rescue dispatch system

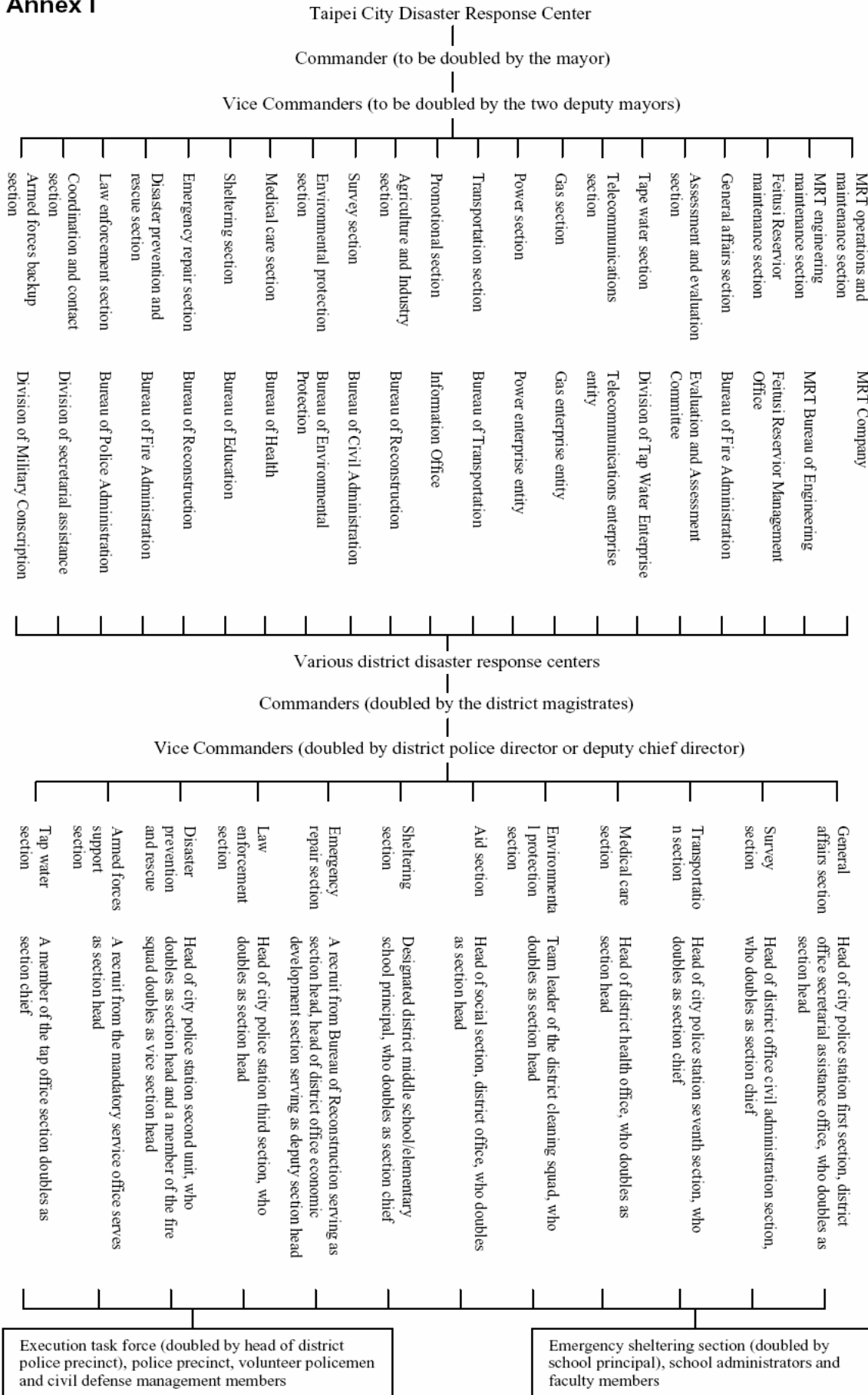
As the administration's 119 duty dispatch center remains manually dispatched following its

upgrade from a fire brigade in 1995, the administration has plans to integrate the currently leased ANI/ALI (an incoming call and address prompting system) 119 case reporting system to its existing information management system, anticipating to provide real-time computerized command and dispatch that would help to dispatch adequate manpower, equipment and devices to a disaster site for emergency rescue within the shortest time possible.

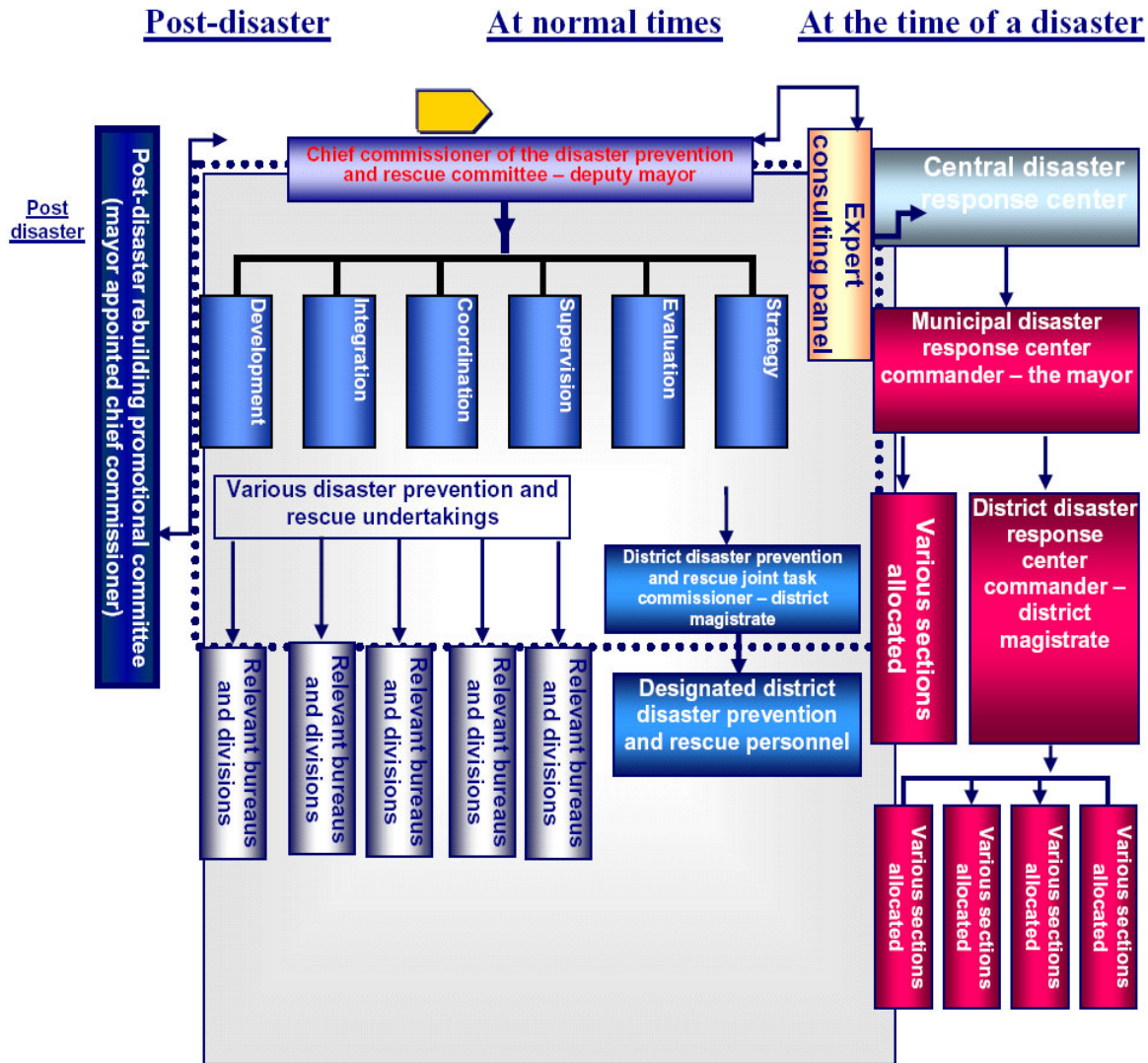
Recapitulation

In pursuit of a sustainable yield in disaster prevention and rescue efforts, the Taipei City administration is committed to integrating the ISO quality control concept and in promoting various standardized fire service tasks by mirroring the past disasters and vying to excel, under its existing disaster prevention and rescue framework, its administration with globalized efficiency, scientific approach, standardized implementation and rational enforcement. In conjunction to which, the city administration is committed to instill an ICS emergency incident command system, rated by various types of disasters and various stages in disaster rescue, in anticipation of developing Taipei City into a metropolis that is disaster-proof and disaster resistant.

Annex I



Annex II



References

1. The 43rd report from the Central Weather Bureau, Ministry of Transport and Communication, Republic of China. Available at http://www.cwb.gov.tw/V2.0/frames_html/cwb1.html. Accessed May 31, 2004
2. Wang TL, Jang TN, Huang CH, et al. Establishing a clinical decision rule of severe acute respiratory syndrome at the emergency department. *Ann Emerg Med* 2004; 43:17-22
3. World Health Organization. Cumulative number of reported probable cases of severe acute respiratory syndrome (SARS). Available at: http://www.who.int/cst/sars/country/2003_09_30. Accessed May 31, 2004
4. Local Government System Law. Available at <http://law.moj.gov.tw/> Accessed May 31, 2004
5. The rules concerning fire prevention/rescue and disaster response in Taipei City. Available at <http://www.tfd.gov.tw/law/law.php> Accessed May 31, 2004

6. Related articles. Available at http://tpeusar.tfd.gov.tw/index_main.htm Accessed May 31, 2004
7. Liao YH, Hwang LC, Chang CC, et al. Building collapse and human deaths resulting from the Chi-Chi Earthquake in Taiwan, September 1999. *Arch Environ Health*. 2003;58:572-8
8. Hsu EB, Ma M, Lin FY, VanRooyen MJ, Burkle FM Jr. Emergency medical assistance team response following Taiwan Chi-Chi earthquake. *Prehospital Disaster Med*. 2002;17:17-22
9. Wu JY, Lindell MK. Housing reconstruction after two major earthquakes: the 1994 Northridge earthquake in the United States and the 1999 Chi-Chi earthquake in Taiwan. *Disasters*. 2004;28:63-81