

DEMONSTRATED PROJECT FOR SEISMIC HAZARD PREVENTION AND REDUCTION IN MINNAN AREAS, SOUTH FUJIAN PROVINCE

Jinhai CHEN¹ And Yunlian DU²

SUMMARY

The demonstrated project for seismic hazard prevention and reduction in Minna Areas (MDA), South Fujian Province is a regional one, in the period of 1996~2000, sponsored and supported by the joint efforts of the China Seismological Bureau (CSB), the government of Fujian province and the municipal governments of Xiamen, Quanzhou and Zhangzhou. The project is a systematic one that has social and technological contents. It synthesizes advanced technology, relative regulations and effective administration.

MDA includes the cities of Xiamen, Quanzhou and Zhangzhou and their surrounding areas. Three demonstrated cities share great similarities in seismic threat, economy and culture. To establish demonstrated project here is to explore an approach in the realization of the country's decade goal for seismic hazard mitigation and also in improving the ability of the whole area to prevent and reduce the seismic hazards by means of mutual cooperation and unified programmed arrangement.

SOCIAL AND ECONOMIC SIGNIFICANCE

Fujian province locates in the north segment of southeastern coastal seismic belts, which is the most active part of the belt. MDA is situated in the southern segment of Changle—Zhao'an fault belt. It is an area in Fujian province where many earthquakes struck severely. The historical records show that 15 destructive earthquakes had occurred in the region since 1185. Two earthquakes of them has the magnitude $M_s=7.0\sim 7.5$ and three has the magnitude $M_s=6.0\sim 6.5$. In the middle of 1990's, earthquakes had been being active in the area and offshore. For example, on 16th Sept., 1994, an earthquake ($M_s=7.3$) occurred in the Taiwan Strait, southeast to Zhangzhou city. Another earthquake ($M_s=5.3$) took place in the southeast sea of Quanzhou city on 25th Feb., 1995. During recent years, MDA is under the national

intensified monitoring and surveillance. In the National Zoning Map, it belongs to degree VII and VIII in some parts. Thus, how to prevent and reduce the seismic hazard is an objective necessity.

Secondly, MDA covers an area of 250,000 square kilometers. With only 20 percent of the total territory of the Fujian province, one third of the total population, its GNP reaches 50 percent and has two-thirds of the total utilization of foreign investment.. What's more, **MDA** is the area with high population density and developed economy. Also, **MDA** is the famous habitat for overseas Chinese and Taiwanese. Therefore, to enhance the ability of seismic hazard mitigation and to reduce the loss is conducive to the development of social economy, social stability and improvement of investment environment.

Based on the factors above, the CSB and Fujian provincial government decides to establish the first comprehensive demonstrated area for seismic hazard prevention and reduction in China. Fujian provincial government has listed MDA as one of the six disasters prevention system in the period of 1996—2000.

¹ Seismological Bureau of Fujian Province, Fuzhou, China Email: Ap35@sdb.csdia.ac.cn

² Seismological Bureau of Fujian Province, Fuzhou, China Email: Ap35@sdb.csdia.ac.cn

OVERALL TARGET AND TECHNICAL THEME

According to the overall planning, it will take about five years to make MDA greatly improvement in earthquake monitoring, seismic hazard prevention, emergent response and disaster relief. To improve the public awareness of disaster prevention and mitigation. To enhance the control level of the coming disasters. To play an exemplary role in the realization of country's decade goal of seismic hazard prevention and reduction which is "To strengthen the capacity of the large and medium-sized cities and areas with high population density and developed economy to against earthquake of $M_s=6.0$."

MDA fully reflects the joint effects of government's functions and the latest achievements of earthquake science and technology. It consists of two parts: The first part is social measures, which includes the effective administrative organizations, the social plan for seismic hazard prevention and reduction, and the legislation and completion of relative regulations and laws. The second part is the coordinating system of enhanced technology related to four links, that is, earthquake monitoring, seismic hazard prevention, emergent response and disaster relief.

MDA is carried out on the principle of combining protective measures with rescue efforts while putting stress on the former shall be applied. While strengthening in the aspects of prediction and prevention, MDA tries to improve the level of quick-response to the earthquake emergencies, which is important to decision-makers and to carry out the emergent aid. For example, once the earthquake occurs, the Digital Seismic Network will fix the relative parameters of the earthquake within 8 minutes that could help the decision-makers to control the situation; the seismic hazard prediction system will give the estimated numbers of the economic loss and casualties according to three basic elements of earthquake, what's more, the system will offer the acsiliary-resuming plan of hazard reduction to the local government; the seismological consideration system will make a preliminary plan based on the trend of seismic hazard and then it will give the first judgement advice on the type within 2 or 3 hours after the event; seismic emergent pre-plans will be carried out to initiate the post-earthquake relief work; spot graphs and texts transmission system will deliver the latest and live information back to the Emergent Commanding Center. The whole system will remarkably improve the capacity of earthquake prevention and reduction and the ability of the quick response, as well as the efficiency of decision-making. It will win the time and reduce the loss of life and property.

MDA will carry out the principle of linking work at selected cities with that in entire areas. On the one hand, MDA makes complete investigations within the city proper of the cities of Xiamen, Zhangzhou and Quanzhou in the buildings and lifeline projects and establishes the seismic database of GIS, on the other hand, MDA sets up the earthquake modeling system and the database of GDP and population in cities and towns of all levels. It will give an estimated number of losses and casualties of possible earthquakes under different circumstance. As the granite stone houses are widely employed in MDA, they are the real threat to the local people once the earthquake occurs. Thus, the anti-earthquake demonstrative stone house is adapted after the specific vibration test. It is appropriate to local people. In the construction of MDA, the case of earthquake prevention in the three administrative units (central city, county, countryside) is implemented in three steps while trying to achieve the balance between the select and the commons.

BASIC FRAMEWORK AND MAIN TECHNICAL SYSTEM

MDA consists of five technical systems and four social disaster reduction systems. The project will integrate the technical achievement, functions of governments and the public anticipation. The main technical systems are as follows:

Digital seismic network

The digital seismic network in MDA is a composition of FJDSN. There are totally 12 substations in the mode of cable DDN and radio communication. It will monitor the earthquake of $M_s=2.0$ of the whole area and $M_s=1.5$ in some parts. The network center will make a prompt settlement to earthquake events. The basic parameters will be confined (in most cases) within eight minutes.

Earthquake precursor network

In MDA, there are originally 27 test sites that include crustal deformation network, underground fluid network and the electromagnetic network etc.. Due to the necessity of long-term and short-term prediction, the comprehensive and digital renovation will be implemented to adjust and optimize the network on these items to

improve the reliability of observation and the automatic level of the data's collection transportation and settlement.

Centered in Minnan Areas, the GPS network is deployed to monitor the crustal movement of the Changle—Zhao'an fault belt. Among ten stations in the whole province, there are eight in MDA. They supervise the crustal movements of southeast Fujian province and fault blocks of the Taiwan Strait with the stations in Taiwan simultaneously. Also, it supervises the deformation speed of the main faults and the characteristics of these changes. With the methods of gravity, water level and ground tilt, the network will provide the analytical data for medium-long-term prediction.

In the network, the single-functional test will be renovated into a comprehensive one to observe the geothermal heat, underground fluid movement, as well as water chemistry. Together with the network of electromagnetic and electromagnet, it will provide analytical data for short-term earthquake prediction.

Earthquake Data Communication Network

The Communication Network will make use of the on-line and radio transmission to ensure the communication and data transmission among the Emergent Commanding Center of the Seismological Bureau of Fujian province and, local seismological bureaus, three cities and other seismic stations. Spot graphs and texts transmission system was explored to solve the problem of the delay of the spot transmission. Combined with the technology of GPS, satellite communication, GSM communication and electronic maps, the system gains the satisfactory solution to the communication between the earthquake site and commanding center and the earthquake site and three cities. With these live information and latest data, the authenticity and accuracy of the commanding center and the government of three cities will be greatly improved.

seismic hazard prediction and disaster reduction countermeasures system

Seismic threat analysis, seismological micro-zoning, prediction of seismic hazards damage on the buildings and lifeline projects, prediction of the secondary disasters damage and loss appraisal will be carried out in the urban areas of three cities of Xiamen, Quanzhou and Zhangzhou. Adaptable decision will be made to meet the actual condition. The computer information management and assistant decision-making system for seismic hazard prevention and reduction by employing the GIS system as the platform is also under construction. The basic databases and countermeasures for disaster reduction of the three cities will be managed in a motive way.

GIS system not only serves directly for the seismic hazard prevention and disaster reduction, but provides basic information for city's construction and planning and for reasonable utilization of land and against other natural disasters.

Earthquake monitoring and emergent commanding system

The emergent commanding center includes the following parts: the local computer network, the basic seismic databases, the analysis and prediction system of seismic consideration, the appraisal system of seismic hazard and the emergent commanding system.

The network is connected with China Seismological Bureau, governments of provinces, cities, countries and seismological stations. It will have a quick response to the transmission of various monitoring information. The emergent commanding system is the basic infrastructure of comprehensive management for earthquake information. It will develop main-controlling blocks of emergent commanding center system on NOTES platform. By transferring the other subblocks, the system will directly display the latest information with multimedia technology by means of electronic bulletin board, which will improve the efficiency of earthquake consideration and the commanding during the disaster relief.

ORGANIZATION AND IMPLEMENTATION

Combined with science and society, MDA is not a mere technical work. In order to run smoothly the project, a working system headed by unified management of government is built. Clear and classified jobs are assigned to different working units that also have close coordination in between. China Seismological Bureau, concerned units of Fujian Provincial government and the top leaders of the three cities all take part in the work of organization unit. The unit has set up an office that belongs to the seismological Bureau of Fujian province. The

office is in charge of the everyday work. The project is implemented on the unified planning, step-by-step and top-to-down.

According to the overall framework, the project sets up five item units. Each unit divides the task into several subjects. In order to meet the needs of these subjects, the project is carried out by means of cooperating and exploring with the research institutes which are under the direct control of the China Seismological Bureau, universities and the software companies. The government of three cities of Xiamen, Quanzhou and Zhangzhou have launched their departments, units and resident committees to implement a complete investigations on the lifeline projects such as telecommunication, water supply, electricity supply and various buildings. The registration of the general investigation, also includes a series of numerous and jumbled data, such as property value, the number of people in various buildings in day and night. It is a complete and systematic investigation of basic information for seismic hazard prevention and reduction. It fully reflects the advantage of working system in MDA.

Three years have passed since the feasibility report of MDA passed in 1996. Apart from some digital equipment of ominous observation, the other technical systems will be roughly completed at the end of 1999.