A PLAN FOR STRONG EARTHQUAKE ALARM SYSTEM 10 SECONDS BEFORE IT ATTACKS THE CITY OF TOKYO

by

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OBJECTIVES OF THE SYSTEM

The system was derived to decrease the losses of human lives and facilities by means of catching an occurrence of a strong earthquake before it attacks Tokyo area. In future, we hope this system will cover whole area of Japan Islands.

PRINCIPLES OF THE SYSTEM

In Jpapn, the epicenters of the severe earthquake experienced in the past exist almost inside a limited area. Concerning especially the city of Tokyo, the area of epicenter can be considered to be a zone 60~100 km away from the city center. It takes 15~25 sec. for S-wave to arrive at Tokyo city, when an earthquake occurs in this area. If a network of seismometers is placed over this epicenter area, the control center on-line connected to this network can make many emergency controls utilizing the travelling time of the earthquake wave. (Fig. 1)

Fig. 2 indicates the epicenters of the past experienced severe earthquakes which have been felt in Tokyo severer than V in JMA scale. It is recognized from this figure that the epicenter area are two, the one is the belt zone 45 NNS 60 100 km away from Tokyo city and another is the zone almost just beneath the city.

The severer earthquakes took place in the distant belt zone rather than beneath the Tokyo city.

The proposed emergency system by authors will be available for the future earthouakes in the belt zone of the sea near the Tokyo city.

Location of Seismometers

Seismometers to detect the occurrence of an earthquake should be distributed as densely as possible covering the expected area of the

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future earthquake, since the epicenter of the future earthquake is not deterministic. If the seismometers are installed as indicated in Fig. 3, sixteen pick-ups are necesiated.

Judgement Center

An on-line computer connected with the installed seismometers in the judgement center has to judge a strong earthquake which would give damages on the Tokyo city from many small magnitude earthquakes which one or two seismometers feel strong vibration due to short distance to an epicenter.

The following two criteria to judge the strong earthquake are considered.

A) When P or S-wave level (displacement or acceleration) at one observation point exceeds a certain level, in this case, a necessary time to judge is short, however, it is possible to misunderstand the small scale earthquake as a large scale one.

Therefore, in this stage the occurence of an earthquake should not be informed to the citizens, and only the important facilities such as atomic power plants should be stopped by the on-line computer in the judgement center.

B) When acceleration of two or three seismometers exceeds a certain level. A necessary time is longer than for A) criterion, but, there is almost no possibility to misunderstand a small regional earthquake to be a severe one.

In this case, the judgement center can give the earthquake alarm to anywhere.

A) and B) criteria are not independent, but, they are continuous and B) criterion will be adopted a few seconds after A) criterion.

Judgement Center consists of mainly a computer and every information from the seismometers network always comes to this computer.

The computer can make the rapid performance for the emergency control without any delay and confusion from terror in case of a strong motion earthquake.

Advantage of this On-line System

1) An important characteristics of this system is an emergency control on the facilities which are expected to be dangerous to others at time of earthquake by the computer without man hand as belows.

a) Operation for stopping the super express train.
   Making red all signals of highways,
b) Operation of emergency valve of high pressure gas and oil pipe line,
c) Stop of nuclear power plant,
d) Application to many chemical industries.

At present, most of the above facilities have emergency devices

which act immediately after the earthquake shock, however, those devices might not act at time of a severe shock, because of the cut-off of electric power to them and severe vibration of themselves.

2) Alarm to city residents

Each home of the city is informed a quake shock around 10 seconds before it attacks, by any means such as pocket-bell, TV, Radio, etc, according to B) criterion.

Losses of citizen's lives in Tokyo due to earthquakes were and would be caused mainly by the big fire after the earthquake, hence, the alarm of 10 seconds before the earthquake give the people enough time to put out many kinds of fire origin.

In case of many moderate earthquakes which make the mind of people unquiet, people can be quiet because of no information from the system.

Problems Left to be Solved

There is almost no problem about the seismometer to be installed at the sea bottom and delivery system of earthquake information.

A problem is how to judge a severe large earthquake from many regional earthquakes within very few seconds without any mistake, however, this will be solved in a few years because we have many data about this problem.

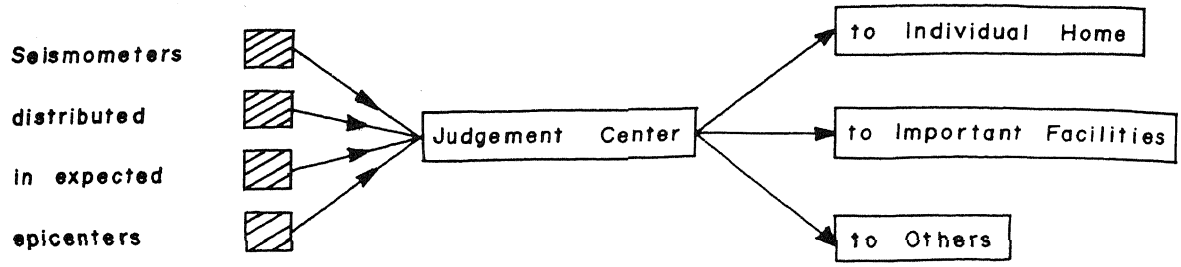

Fig. 1 Diagram of Earthquake Alarm System

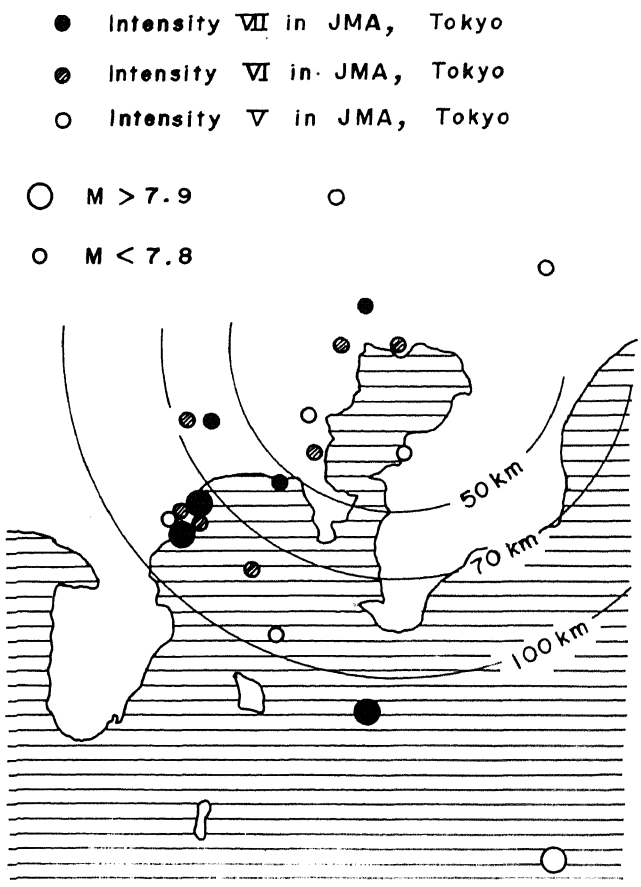

Fig. 2 Epicenters of Strong Earthquakes which are felt more than Intensity V

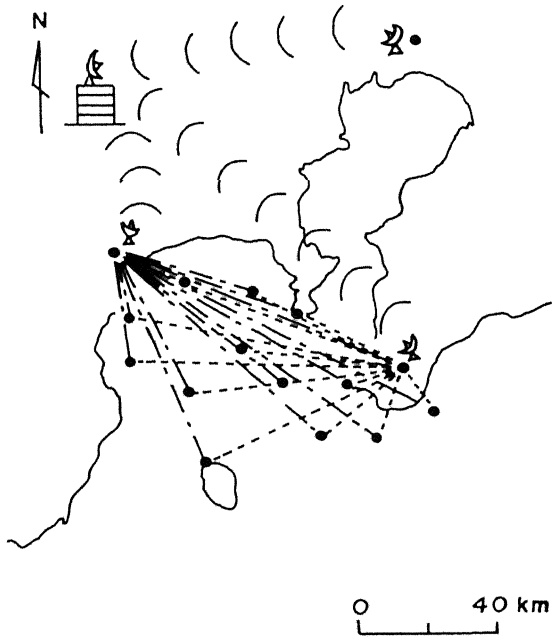

Fig. 3 Distribution of Seismometers