(3) Telephone Communication Systems

Telephone communication systems were little affected, except for minor damage to management and operation buildings. In the city, most communication cables are directly buried in the ground, as shown in Photo 3.12.38, but it was said that damage, such as cutting of cables, did not occur. Telephone lines were congested over the entire area of Cairo for a few hours immediately after the earthquake shock, until late in the night. This occurred because automatic exchangers were temporarily interrupted by the signal transmission control system. It is said that there were two or three times the normal number of calls.

A precedence subscription telephone system had been studied, but it was not complete in time for this earthquake. Multiple circuit systems and earthquake-resisting systems have not been established.

3.12.3 Aswan Dam

Aswan High Dam, constructed between 1960 and 1971, is one of the largest rockfill dams in the world. Table 3.12.1 shows this dam, proud of its great scale: a crest 3,830 m long, 111 m high, a bottom width of 980 m, and Lake Nasser, 500 km in length [3]. Photos 3.12.39 through 3.12.46 show the outline of the dam. At present, the dam is administered together with the Aswan Dam by the Aswan Dam and High Dam Authority, belonging to the Ministry of Public Works and Water Resources. Aswan Dam is a dam with a total length of 2 km and a height of 50 m, constructed in 1902, 6 km downstream from the Aswan High Dam.

At Aswan Dam, 6 strong motion accelerographs (Model SMA-1) are installed, three at the gallery, one at the crest, and two at the berm. At an area 60 km away from the dam, one accelerograph is installed on the ground. Photo 3.12.47 shows the observation shed provided on the crest of dam and Photo 3.12.48 shows the strong motion accelerograph installed in the shed. These strong motion accelerographs are located at a remote area 900 km away from the focus and it was natural that the ground motions were not recorded on these accelerographs. However, up to the present time, none of the shocks have been recorded. The trigger level is set to the level of 10 gals now. If any records are obtained in a country such as Egypt where earthquake probability is very low, they will become very valuable data. Judging that the current locations will be interrupted little by noise, the trigger level can be lowered to the extreme limit possible. Strong motion accelerograhs are maintained by the National Research Institute of Astronomy and Geophysics, Ministry of Scientific Research and Technology but we were impressed there were no skilled technicians experienced in operation of strong motion seismographs. Training of personnel with sufficient skill and knowledge is an important issue. Aswan High Dam was not affected by the earthquake at all.

Reference:

1) General Organization for Greater Cairo Water Supply: *Rod El Farag Water Supply and El Marc Wells Plant*

2) Japan International Cooperation Agency: *Basic Design Investigation Report for West Omrania Water Supply and Sewage Systems Improvement Project*, Giza City, Giza Province, August 1988

3) Aswan Dam and High Dam Authority: *The High Dam, Ministry of Public Works and Water Resources*

Table 3.12.1 Parameters of Aswan High Dam

Length		3,830 m
Height		111 m
Width	Crest	40 m
	Bottom	980 m
Depth of Curtain Wall		170 m
Discharge Rate	Winter	0.9 to 1 million m^3/day
	Summer	2.4 million m^3/day
	Storage Capacity	16,2000 million m^3
Lake Nayaha	Reservoir Area	6,000 km^2
	Length	Approx 500 km

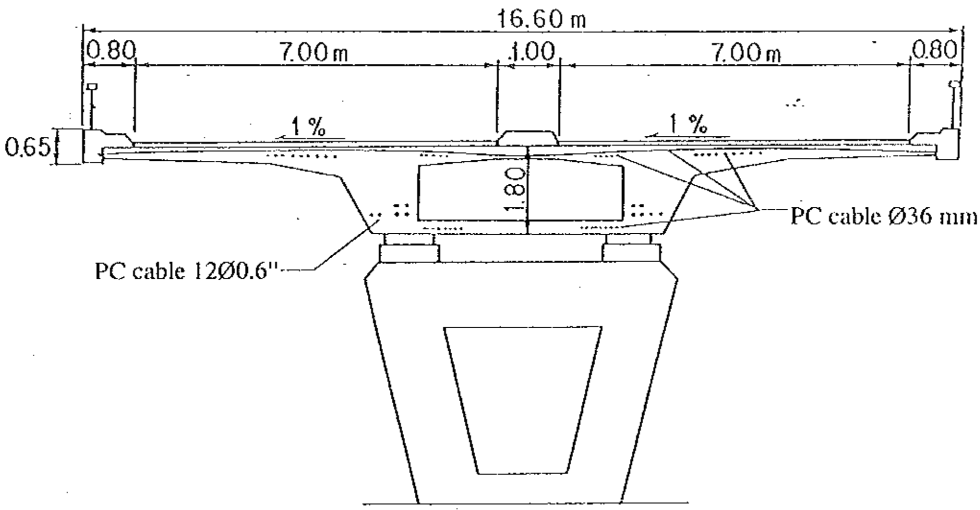

Fig. 3.12.1 Cross Section of Zamalek Elevated Bridge

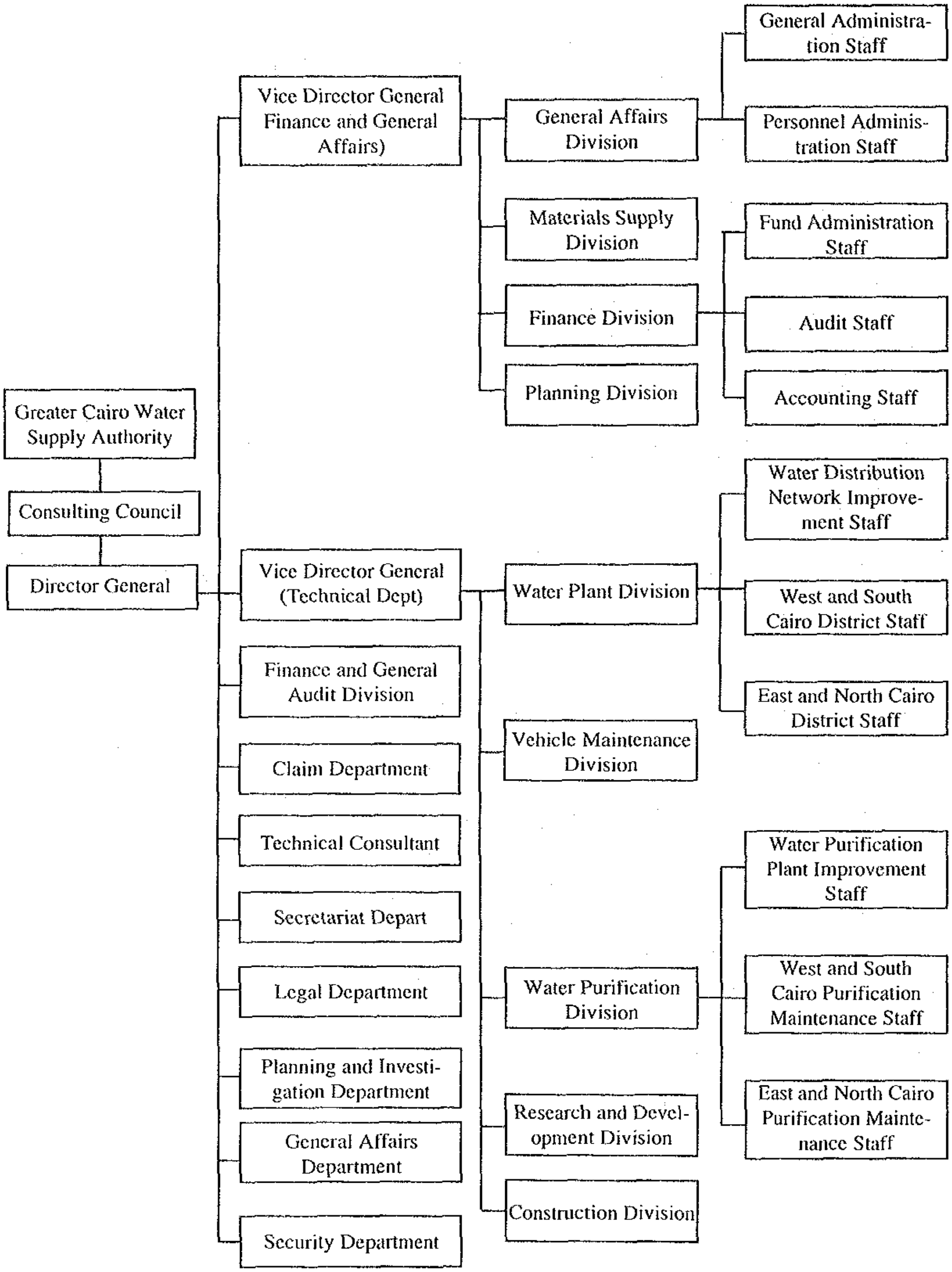

Fig. 3.12.2 Organization Chart of Greater Cairo Water Supply Authority

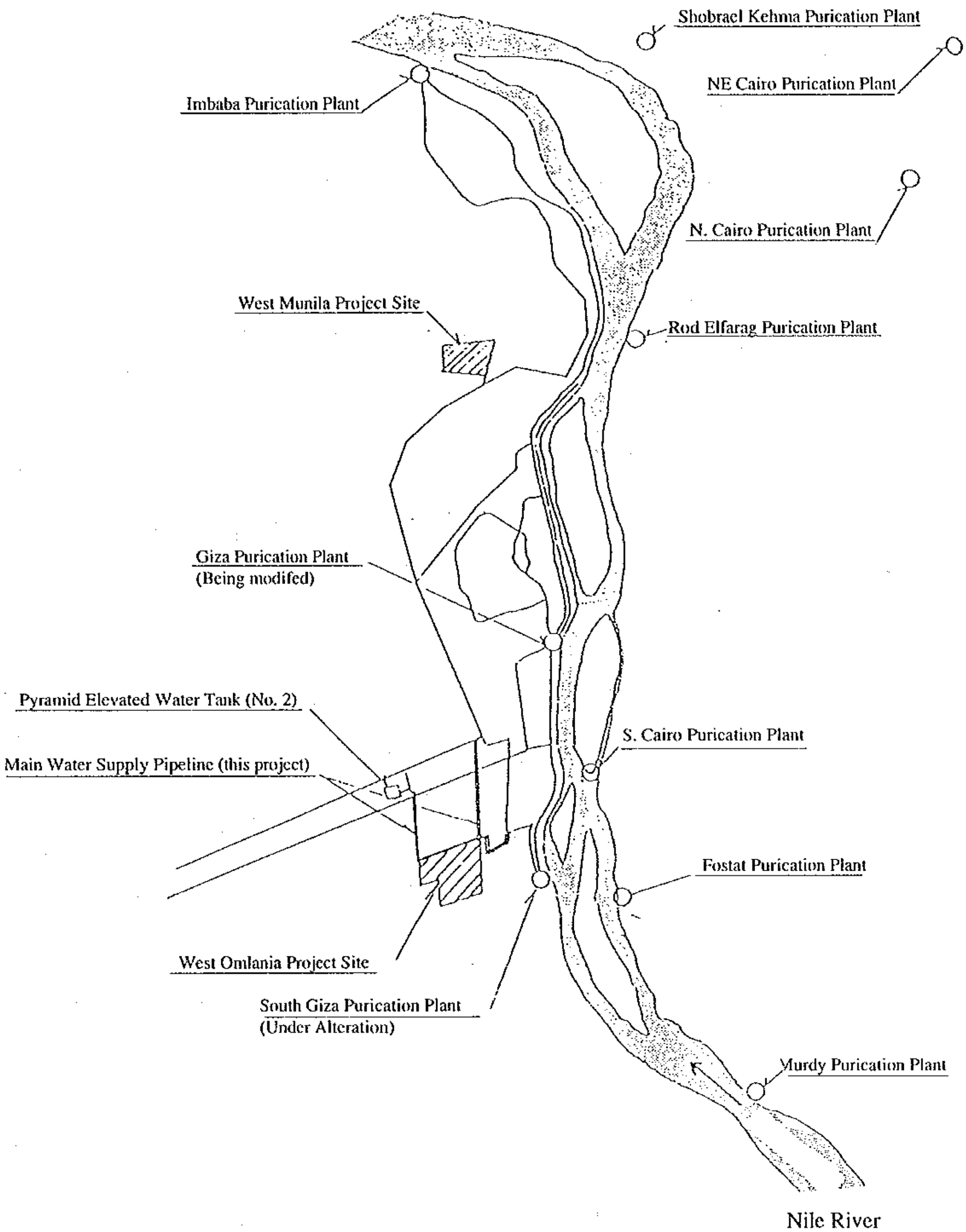

Fig. 3.12.3 Configuration of Water Purification Plants (Greater Cairo Water Supply Authority)

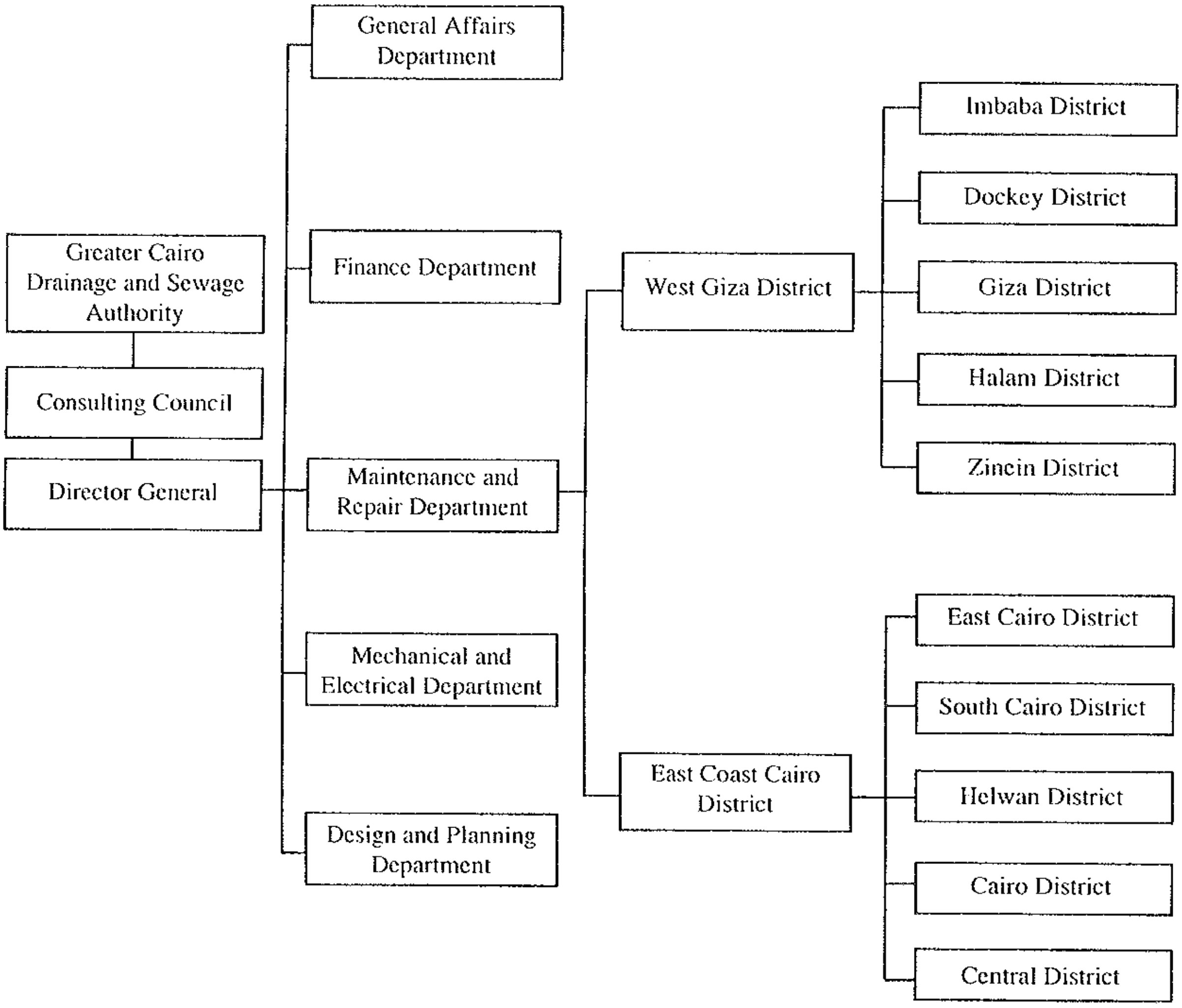

Fig. 3.12.4 Greater Cairo Drainage and Sewage Authority

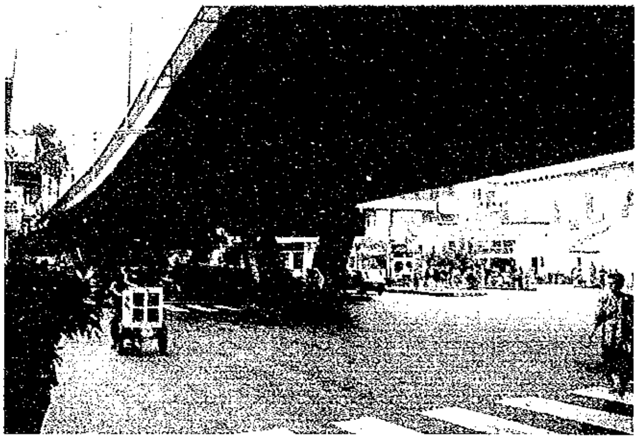

Photo 3.12.1 Zamalek Elevated Bridge

Photo 3.12.2 Bearing supports

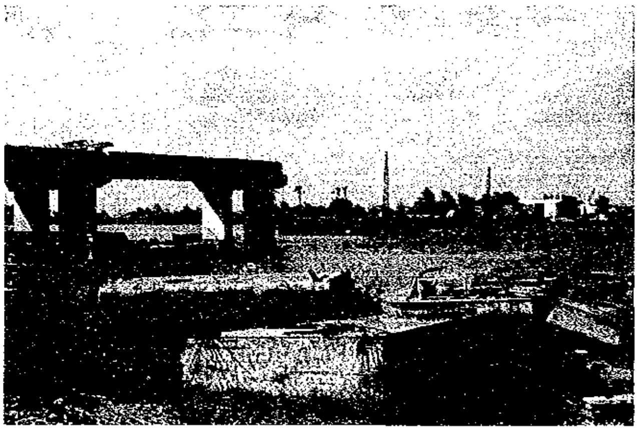

Photo 3.12.3 Faraskour Bridge (main structure being constructed in the river)

Photo 3.12.4 Piers and beams (the superstructure is prestressed concrete)

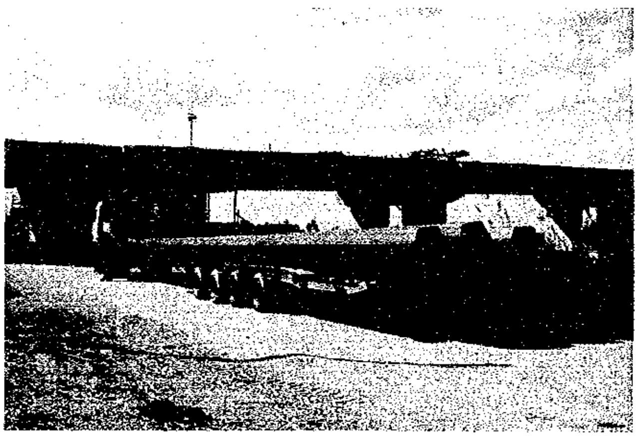

Photo 3.12.5 Steel sheet piles used for bridge construction (approx 30m long)

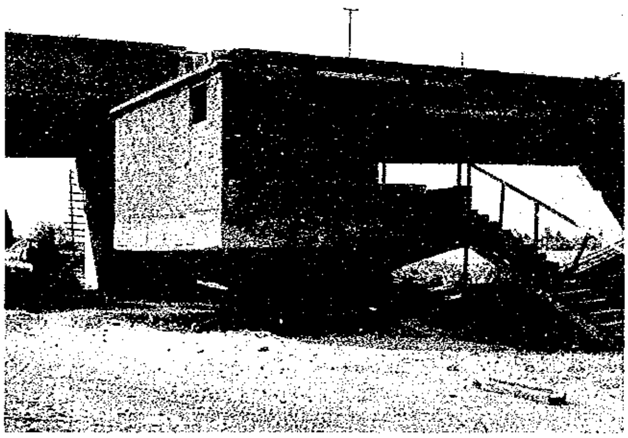

Photo 3.12.6 Piles subjected to load tests (tests were conducted with vertical load of 480 tf, 2 times the design load, applied. The test piles are used for supporting observatory station.)

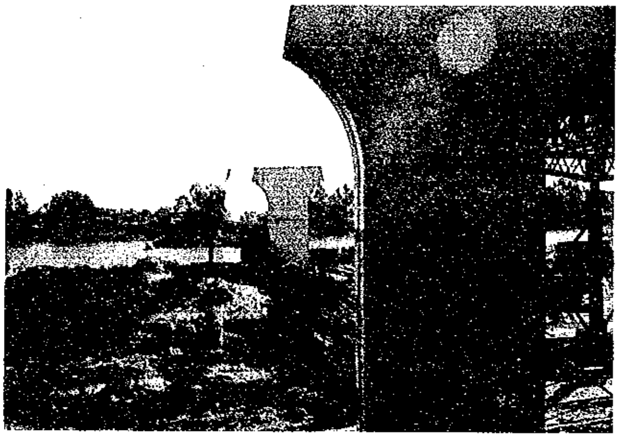

Photo 3.12.7 Mansula Bridge (under construction)

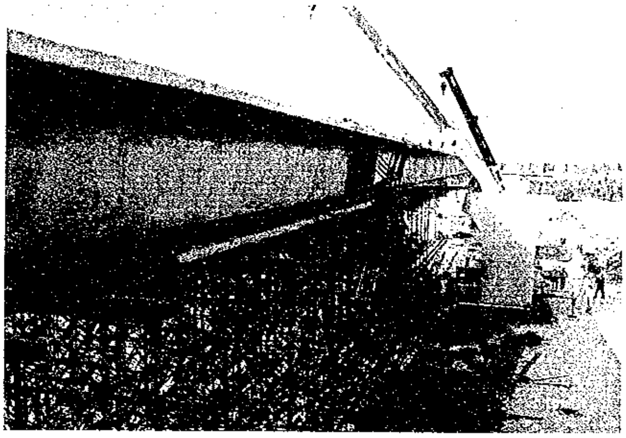

Photo 3.12.8 Mansula Bridge (cast-in-place PC)

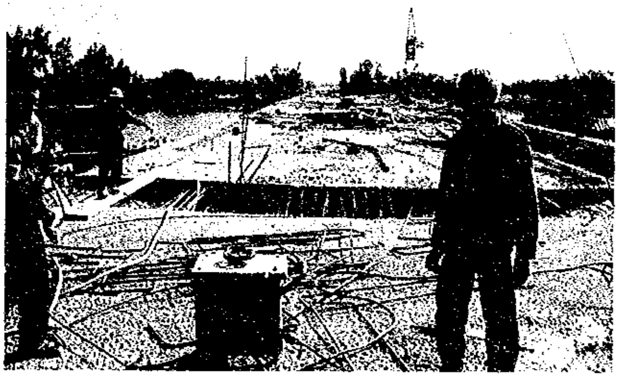

Photo 3.12.9 Beams under construction

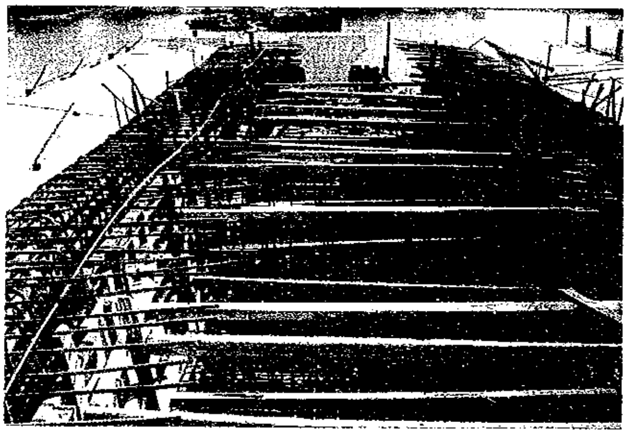

Photo 3.12.10 Beams and PC cables

Photo 3.12.11 Benisuef Bridge (in Benisuef City, approx 120km south of Cairo)

Photo 3.12.12 Benisuef Bridge

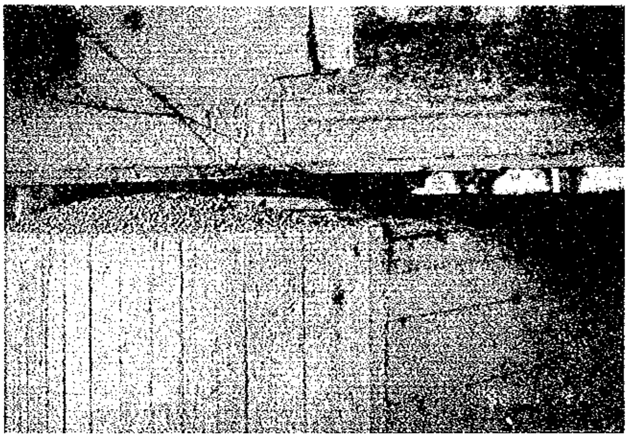

Photo 3.12.13 Bearing shoe

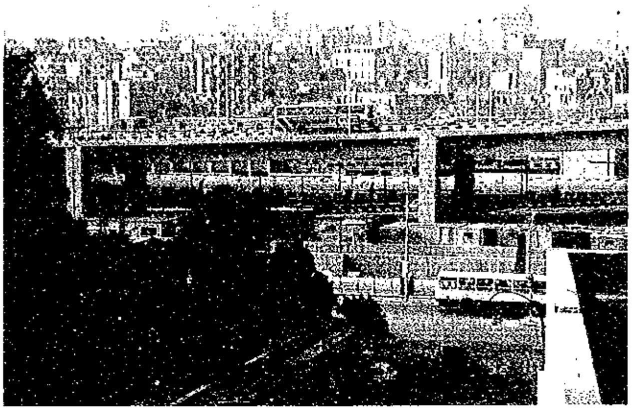

Photo 3.12.14 Elevated bridge in Cairo (rigid frame piers)

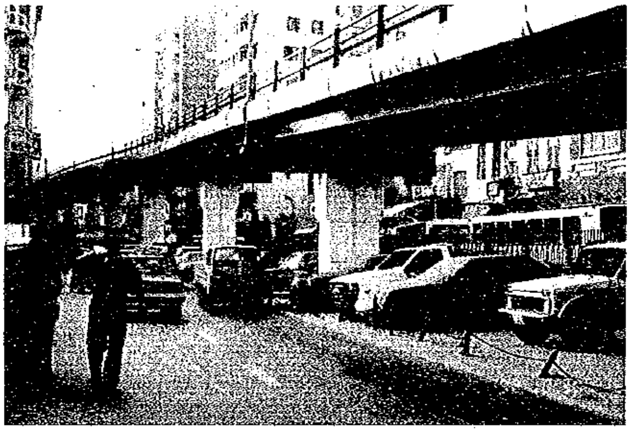

Photo 3.12.15 Elevated bridge in Cairo (piers are steel and fixed at the top)

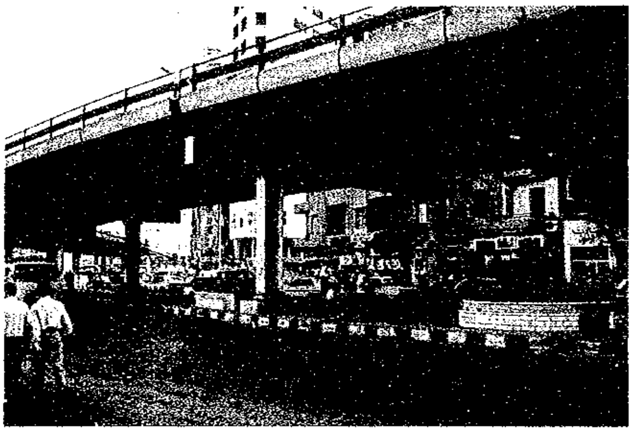

Photo 3.12.16 Elevated bridge in Cairo (steel piers and fixed piers are reinforced with bracing)

Photo 3.12.17 Elevated bridge in Cairo

Photo 3.12.18 Failure occurred in the connection

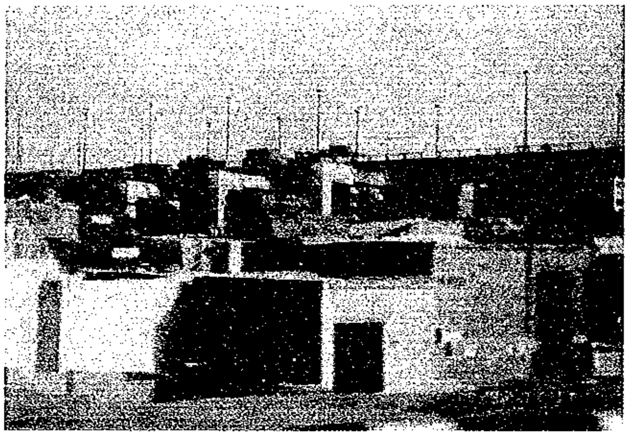

Photo 3.12.19 Elevated bridge in Cairo (rigid frame reinforced concrete piers. Cross beams of cantilever construction is not earthquake resistant.)

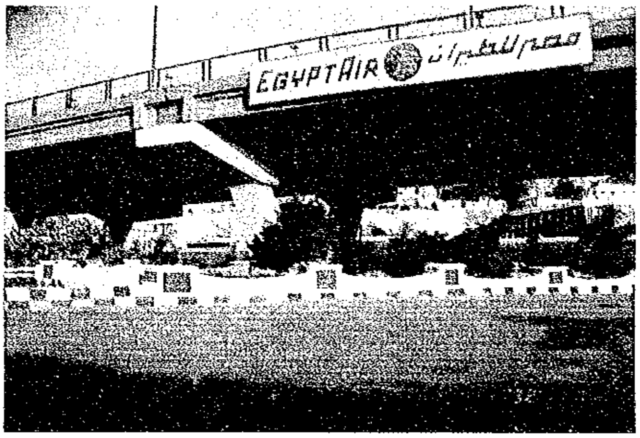

Photo 3.12.20 Elevated bridge in Cairo (streamlined rigid frame RC piers)

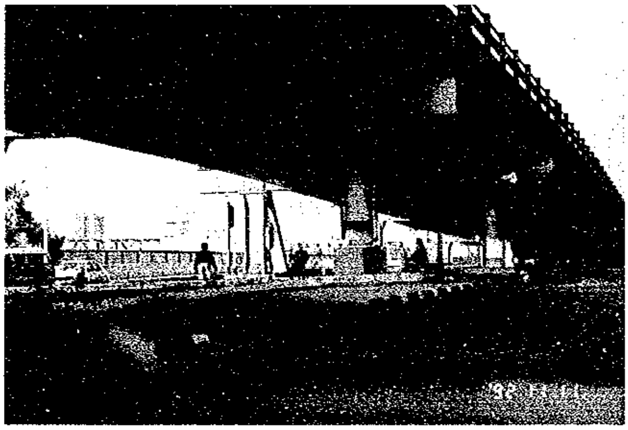

Photo 3.12.21 Elevated bridge in Cairo (steel piers: fixed piers and movable piers can clearly identified)

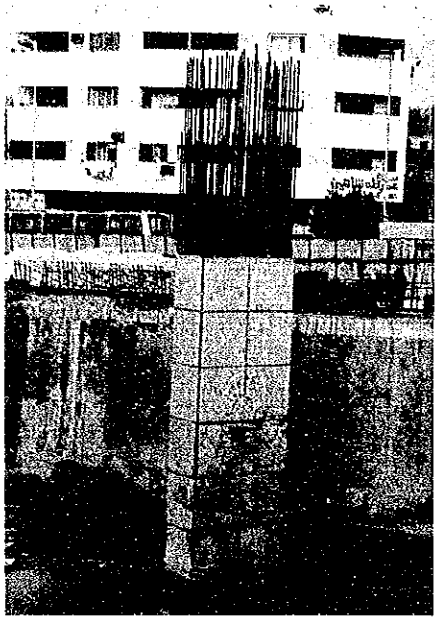

Photo 3.12.22 Bridge pier under construction (next to the July 26th Bridge in Cairo)

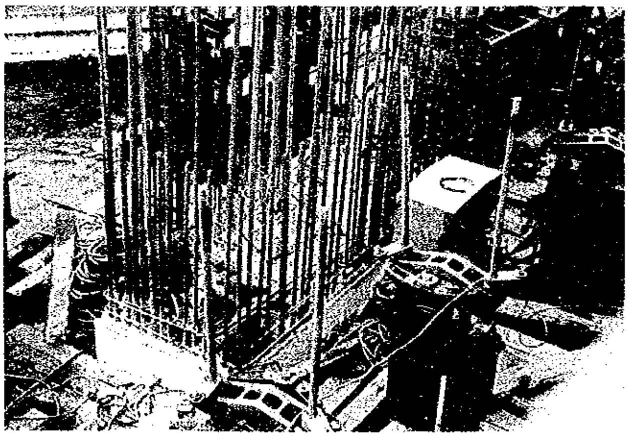

Photo 3.12.23 Arrangement of reinforcing bars (deformed bars are used and bars are properly tied with hoops)

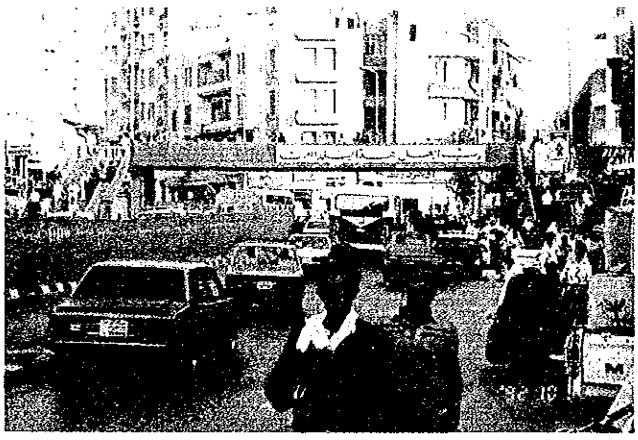

Photo 3.12.24 Pedestrain crossover bridge (steel)

Photo 3.12.25 Rotary bridge in the delta of the Nile (the bridge rotates for traveling ships. Similar bridges can be seen at a number of places.)

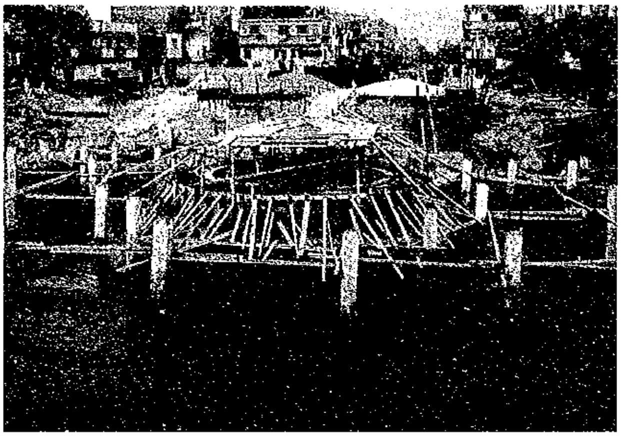

Photo 3.12.26 Rotary bridge under construction (the rotating table is being constructed)

Photo 3.12.27 Potable water faucet for public use (in Cairo)

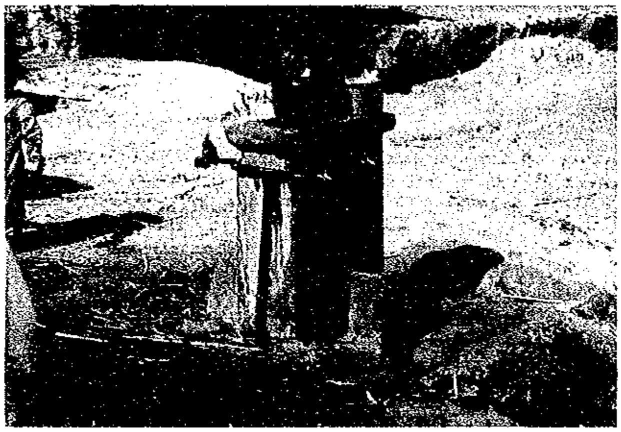

Photo 3.12.28 Potable water faucet for public use (Fayoum)

Photo 3.12.29 Rod El Farag Water Purification Plant

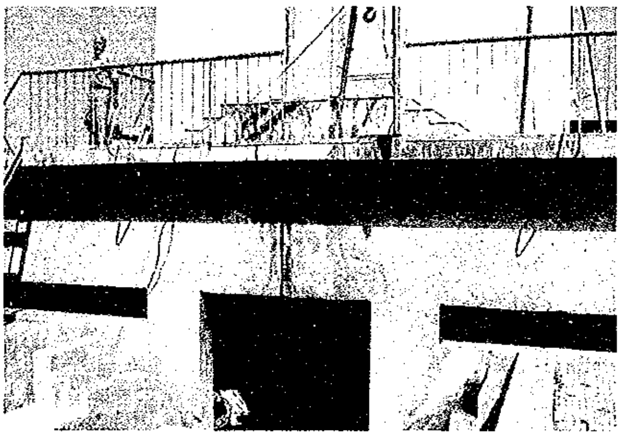

Photo 3.12.30 Water leakage seen in the distribution duct of sedimentation pond

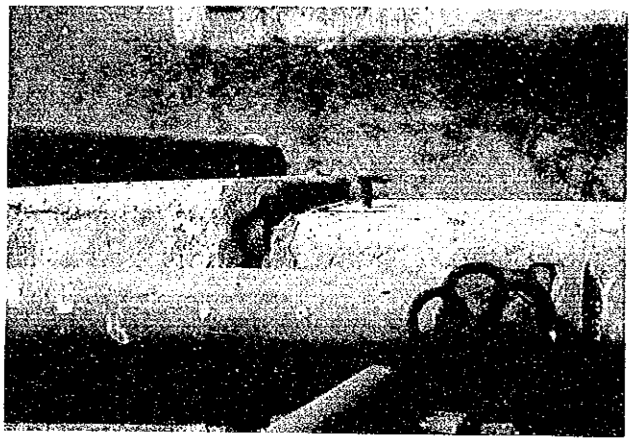

Photo 3.12.32 Slipped joint in concrete deck of water reservoir

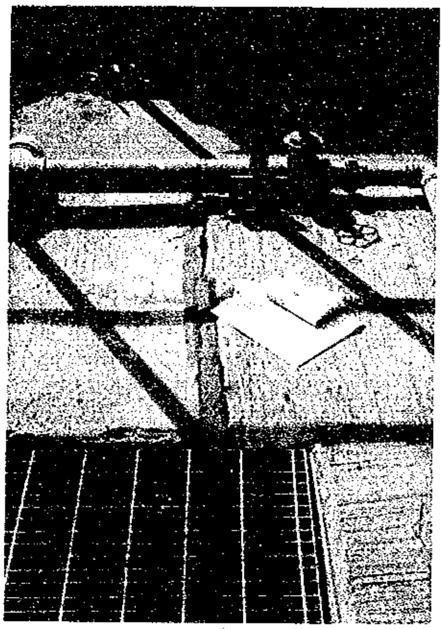

Photo 3.12.31 Slipped joint in concrete deck of water reservoir

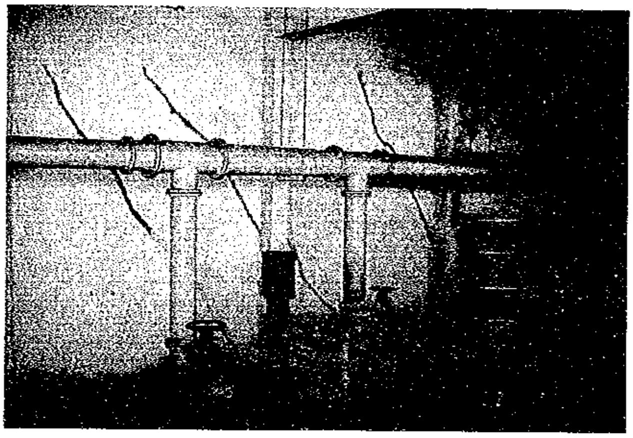

Photo 3.12.33 Cracks occurred on non-reinforced brick masonry wall (pump station)

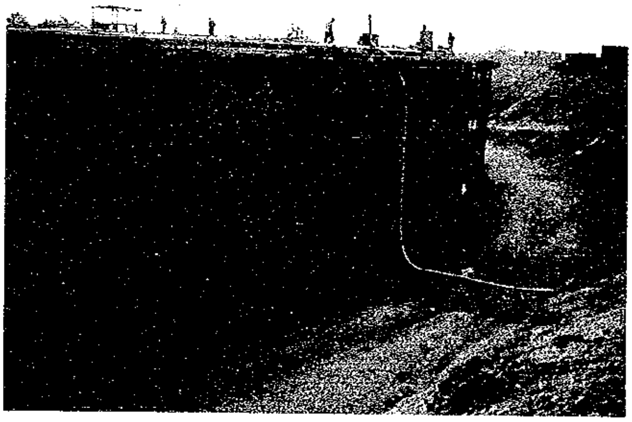

Photo 3.12.34 Derasa Water Reservoir Tank (RC, 80m dia. ×7m high, storage capacity of 30,000m^3, being constructed in Giza)

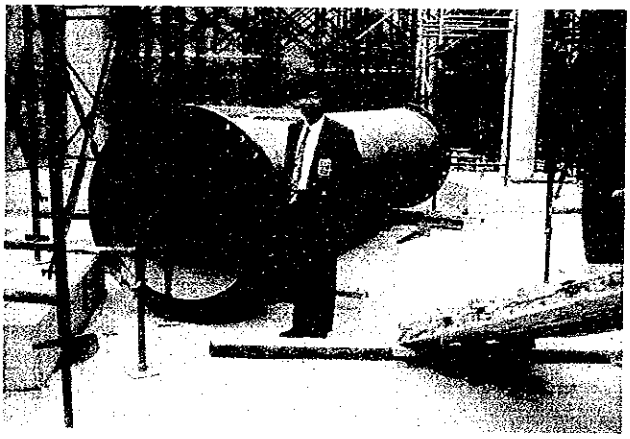

Photo 3.12.35 Ductile cast iron pipe used for water distribution and drainage

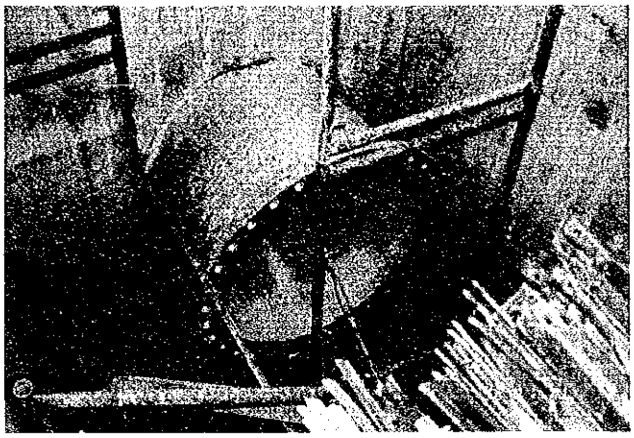

Photo 3.12.36 Ductile cast iron pipe rigidly connected to the structural wall

Photo 3.12.37 Connection between column and ceiling inside water reservoir tank (deformed bars are used and the end of column bars is properly bent at the ceiling slab. Re-bars for column are properly tied with hoops.)

Photo 3.12.38 Cables directly buried under the sidewalk

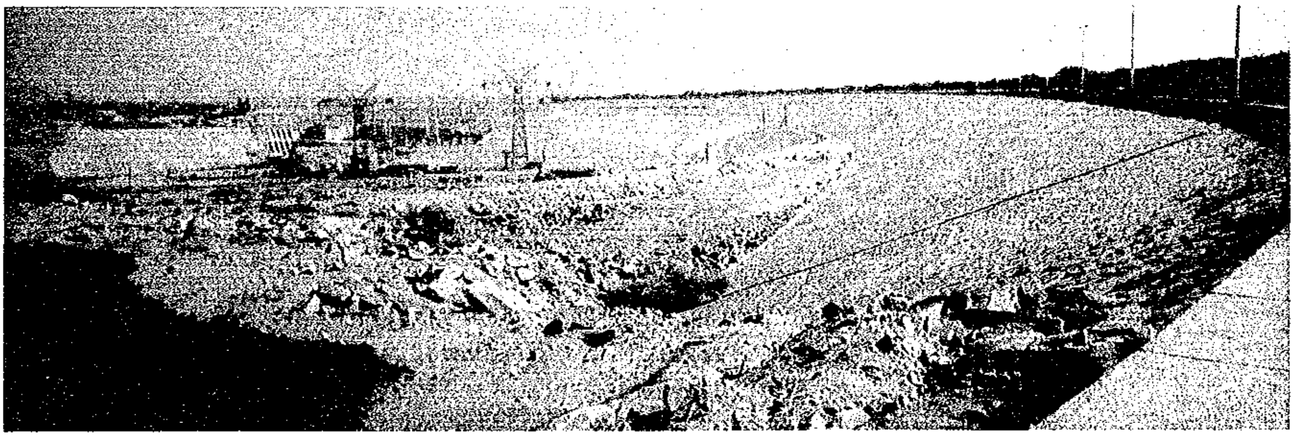

Photo 3.12.39 Overall view of Aswan High Dam (downstream area)

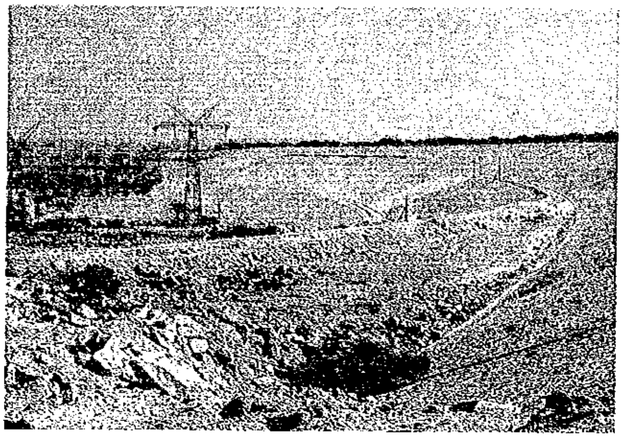

Photo 3.12.40 Overall view of Aswan High Dam (downstream area)

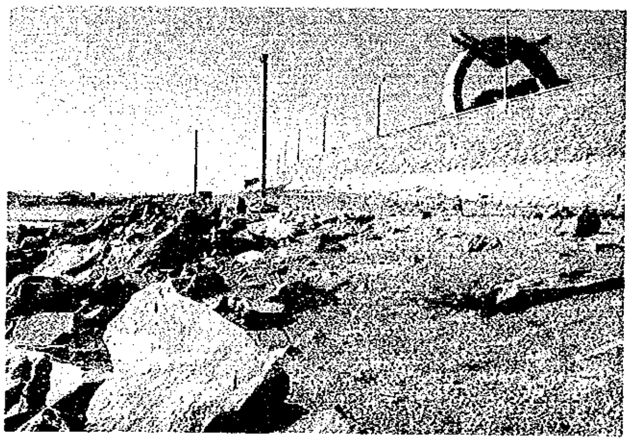

Photo 3.12.41 Aswan High Dam (upstream area)

Photo 3.12.42 Mass of large rocks

Photo 3.12.43 Part of the rock quarry (on the left bank downstream)

Photo 3.12.44 Lake Nasser

Photo 3.12.45 Water discharge downstream

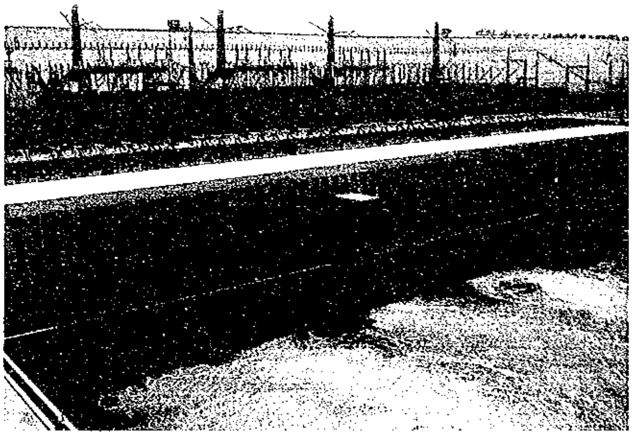

Photo 3.12.46 Generating plant (generating capacity of 2,100MW)

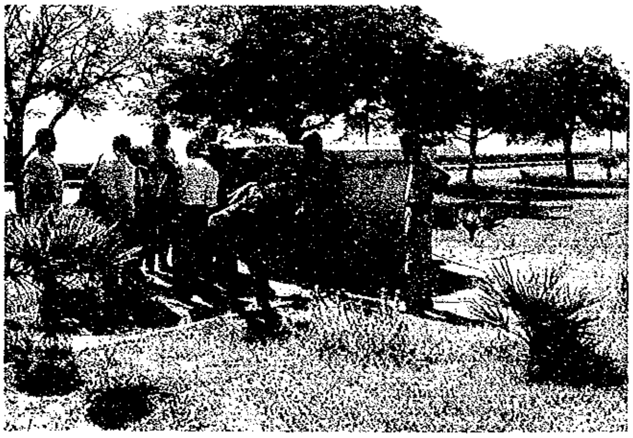

Photo 3.12.47 Strong motion seismograph shed constructed on the center of dam

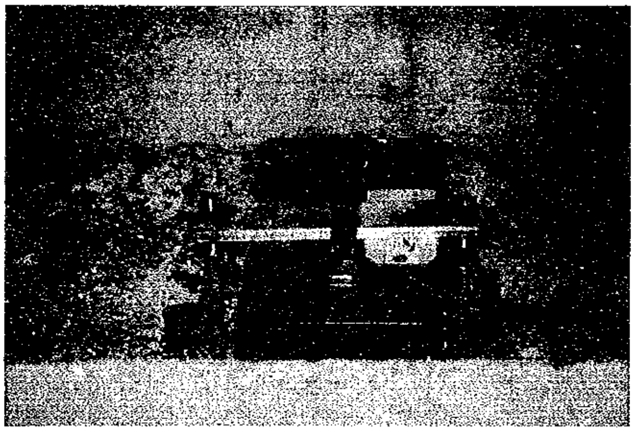

Photo 3.12.48 Strong motion seismograph (SMA-1)

3.13 Soil Liquefaction

The Capital Cairo is located on a soft alluvial fan deposit from the river bank terrace to the Nile River. Traces of soil liquefaction could not be noted in the city. The following soil conditions can be seen in the boring log obtained in Gezira Island located in the middle of the Nile, as shown in Fig. 3.13.1. The stratum to a depth of 13.7 m below the ground surface is composed of clayey soil and silty soil deposits with an underlayment of firm sand to a depth of 43.9 m and firm clay or silt from the depth of 43.9 m to a depth of 54.4 m. The strata below 54.4 m is composed of mixed deposits of firm sand, clay and silt. The stratum to a depth of 13.7 m below the ground surface is very firm, and this stratum could contribute greatly to the amplifications of the ground motion. Figure 3.13.2 shows the soil conditions for the area between Gezira and Tahria in the opposite side, with the Nile in the center. These conditions are consistent in composition with the conditions shown in Fig. 3.13.1. It can be seen that the ground in this area is composed of firm sandy deposits to depths from 10 to 15 m below the ground surface.

As seen in Fig. 3.13.3, it has been verified that the liquefaction was developed at Barmasht and El Aiyat along the Nile, 19 km from the focus. In addition to these areas, it can be presumed that liquefaction could occur over extensive areas in the Fayum district , but any traces of liquefaction could not be noted during the investigation conducted one month after the earthquake shock. In Barnasht, six large sand valves, 3 to 4 m in diameter, were found in crop fields as shown in Photos 3.13.1 through 3.13.4. Holes were 1 to 2 m deep and the surfaces were covered with clayey soil deposit of 1 m thick. Underneath the clayey soil deposit, sandy soil deposits were found. Soil samples taken from three locations in the area showed the grain size distribution curves, as shown in Fig. 3.13.4. The average D_{50} grain size ranged from 0.17 to 0.25 mm, uniform and fine or moderate sand, as shown in Table 3.13.1.

Their reliability is questionable, but according to eyewitnesses, sand and water continuously blew up to a height of 3 m for about 45 minutes. Such a large soil boiling was seen in Shariki Village, Akita Prefecture of Japan during the Nihon-kai chubu Earthquake of 1983, as shown in Photos 10 and 11. During the earthquake, cohesive soil deposits near the ground surface were compressed by excessive pore-water pressure and sand and water spewed up.

As a result of investigations made on soil liquefaction which occurred in the past earthquakes in Japan, it is known that soil liquefaction tends to develop in the area as [1]:

$$\log R = 0.77\,M - 3.6 \qquad (3.13.1)$$

Where,

R = area of liquefaction in radius (km)
M = magnitude of earthquake

Figure 3.13.5 shows this relationship. Since M = 5.4 during this earthquake, the area where soil liquefaction can occur in radius, R, will be only 4 km if estimated by Eq. (3.13.1). Conversely, the epicentral distance to Barnasht is 19 km. Therefore, it can be assumed that soil liquefaction could occur in more wide areas there than that estimated by Eq. (3.13.1). Loose sand deposits in Barnasht could be the major reason for the liquefaction.

Reference:

1) Kuribayashi, E., Tatsuoka, F., and Yoshida, S.: History of Soil Liquefaction in Japan since Meiji Era, Civil Engineering Journal, Public Works Research Institute, No. 30, December 1974

Table 3.13.1 Liquefied Sand Properties (Samples Taken from 3 Sand Boiling Pirs)

Property	Sample 1	Sample 2	Sample 3
Maximum grain size (mm)	0.85	2.0	2.0
Unit weight (gf/cm³)	2.76	2.72	2.71
50% grain size D_{50} (mm)	0.174	0.245	0.184

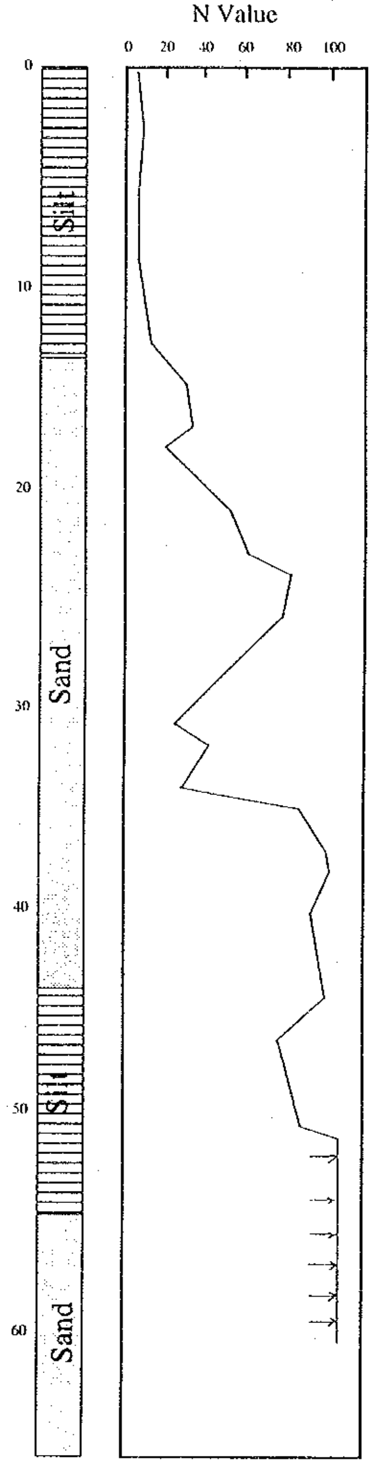

Fig. 3.13.1 Soil Profile (Gezira Island)

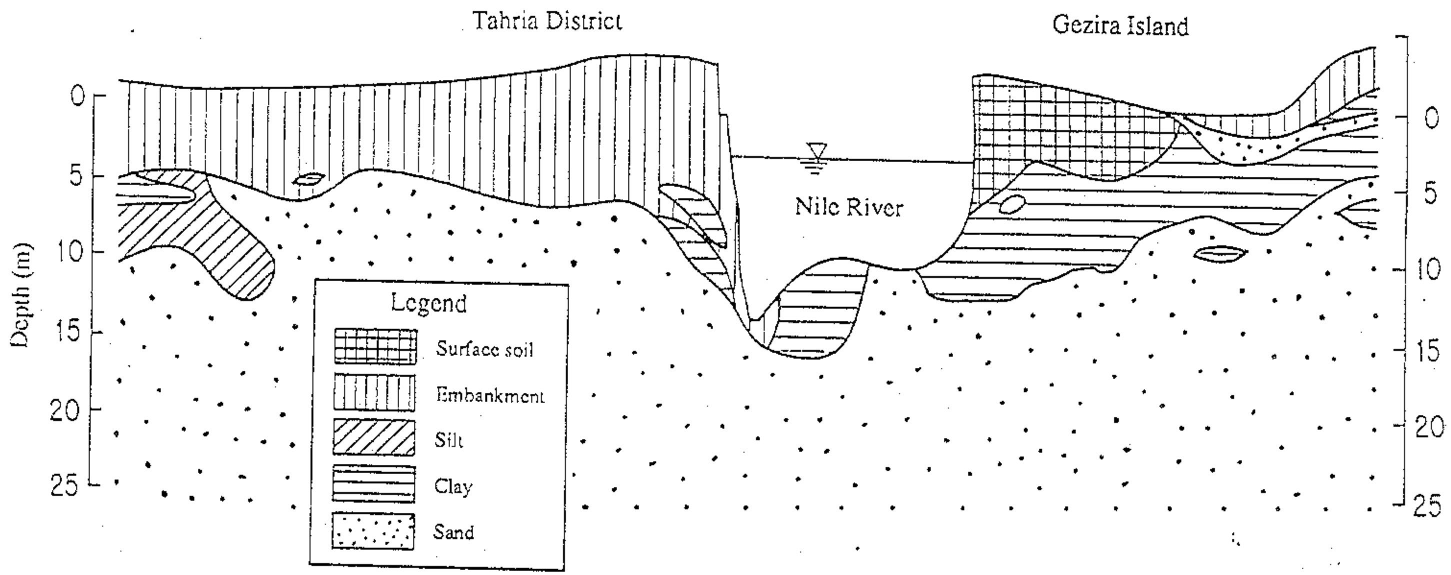

Fig. 3.13.2 Soil Profile from Tahria to Gezra

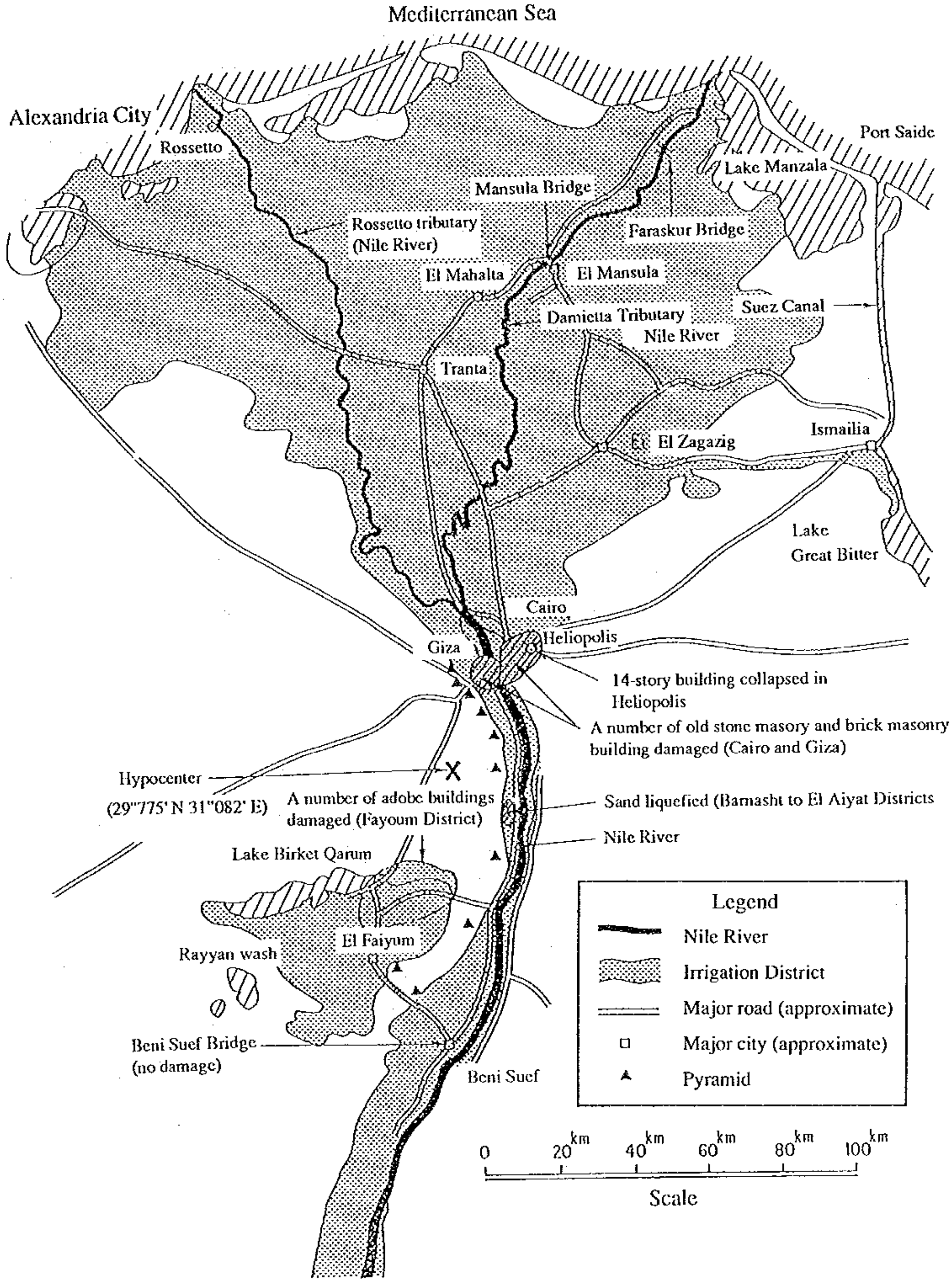

Fig. 3.13.3 Locations of Sand Liquefaction and Areas Seriously Damaged

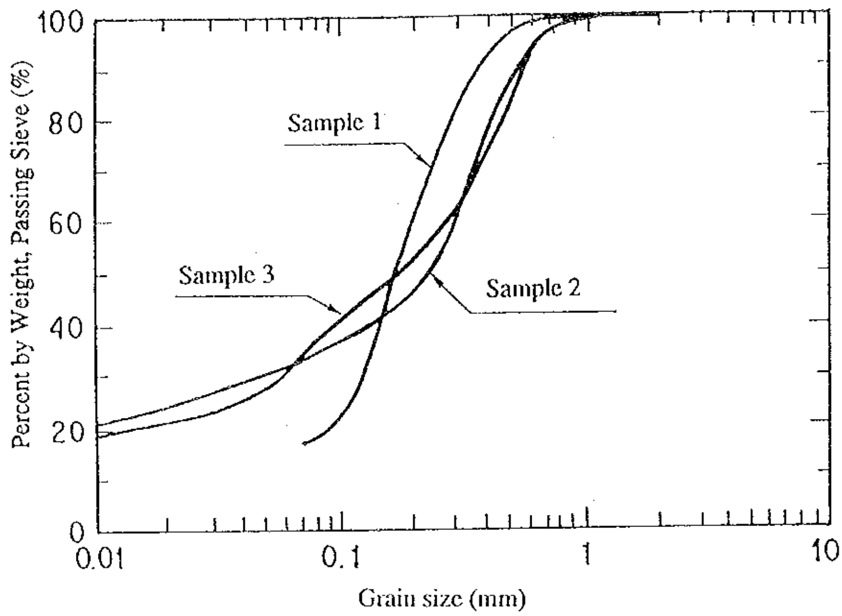

Fig. 3.13.4 Grain Size Accumulation Curve of Liquefied Sand (Taken from Three Pits)

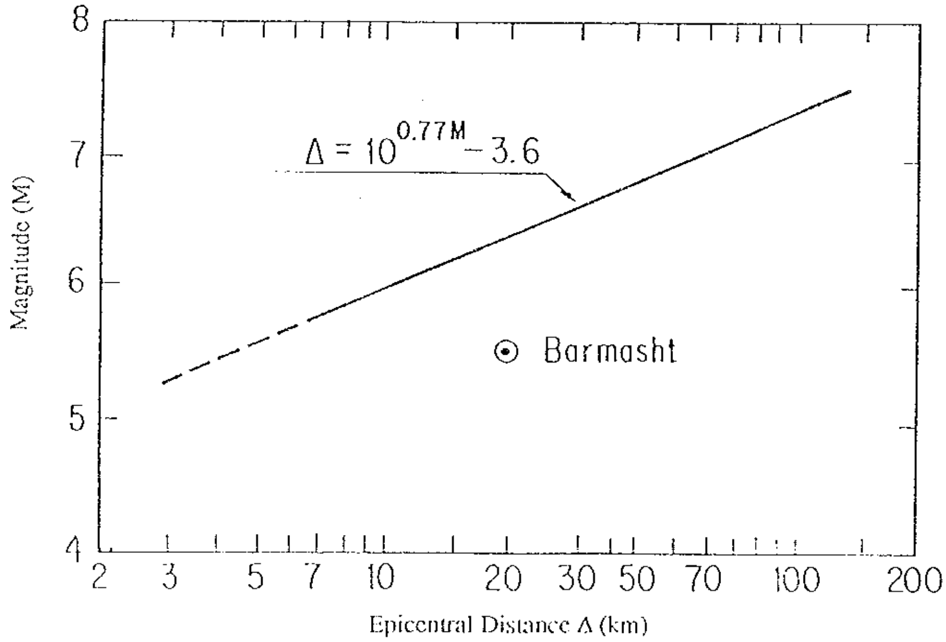

Fig. 3.13.5 Range Where Soil Liquefaction Can Occur

Photo 3.13.1 Largest sand valves generated from soil liquefaction (diameter of approximately 4m. Water and sand burst to a height of 2 to 3m. Barnasht district)

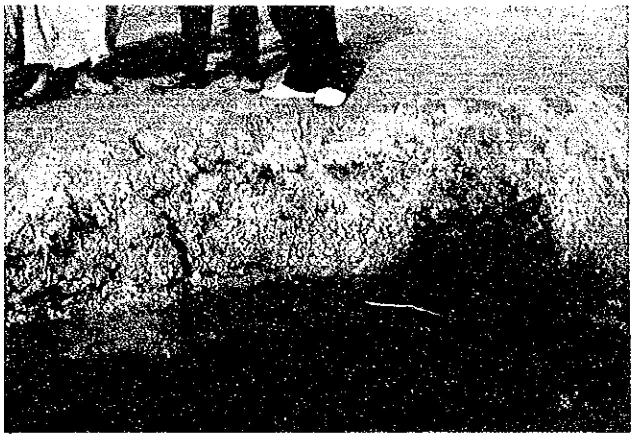

Photo 3.13.2 Close-up view of the valve shown in Photo 3.13.1 (Ground surfaces are covered with clayey soil. Sand layer is not taken in this photo.)

Photo 3.13.3 Sand valves of moderate size

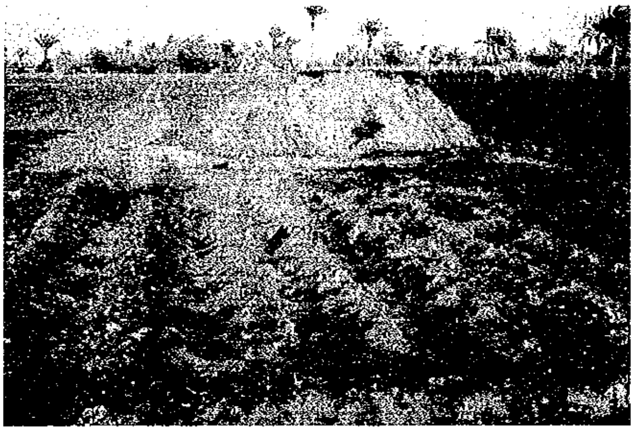

Photo 3.13.4 Deposit of boilded sand (It can be presumed that an extensive liquefaction occurred in this area because there were a number of these deposits. However, the disturbed areas were cleaned and any other disturbed areas could not be noted.)

3.14 Conveyance of Earthquake Information

The earthquake that occurred in Capital Cairo on October 12, after a lapse of 150 years, gave a serious mental shock to many Egyptians, in addition to the injuries, loss of life, and damage to property. Different from Japanese, who have unintentionally acquired a good knowledge on earthquakes through frequent shocks and training, it is natural that Egyptians, who have had little experience with earthquake shocks, were stricken by some sort of panic.

As long as aftershocks continue, the sensation of fear of greater shocks or possible approach of focuses to Cairo can increase. Mass communication media were vigorously agitating such a sense of uneasiness.

Under this situation, the earthquake expert team was dispatched to the site from Japan and met the Minister of Scientific Research and the press at the disaster site and answered various questions day after day. This provided the citizen with a chance for education and training on the science of earthquakes, and for a quick solution to the sense of uneasiness.

If an earthquake occurs, it is very important to quickly distribute accurate information for restoration of damage, to prevent secondary disasters, and to prevent panic from false rumors. The results of investigations conducted, from this point of view, on the conveyance of information directly after the mainshock, conveyance of aftershock information, and routine earthquake related activities in Cairo, will be described below. In addition, we will propose suggestions for the advertisement of earthquake information.

3.14.1 Conveyance of Mainshock Information

(1) Determination of Hypocenter by NRIAG

NRIAG, located at the Helwan Earthquake Observation Station and the sole earthquake observation agency in Egypt, determined the preliminary hypocenter one to two hours after the mainshock, based on the data obtained by WWSSN seismographs, that were the only available data after the mainshock. The mainshock occurred at 15:09 hours (local time) on October 12, 1992 in the area 20 km west of Helwan. This information was immediately transmitted to the Ministry of Scientific Research and Technology from NRIAG.

(2) Press Activities after Mainshock

Immediately after the mainshock, a number of TV, radio, and press reporters rushed into NRIAG in Helwan. Since it was the first time for the NRIAG staff to answer inquires of the media for detailed information on an earthquake, the research institute fell into confusion.

(3) Official Announcement of Mainshock

NRIAG controls the national earthquake observation network consisting of 9 stations including Helwan and Aswan. As these stations are not linked, the data obtained by each station were collected to Helwan station one after another immediately after the mainshock. As a result, several useful items of observation data were used for determining precise parameters of the hypocenter. The following parameters were obtained.

Time = 13:09:56.2 (GMT), 29.775° N, 131.082° E, 30 km deep

Magnitude, $M_D = 5.3$. This M_D was estimated from the lapse time of seismograms based on records gathered from the WWSSN seismograph at Helwan and the seismographs at Aswan. These data were officially advertised on October 14.

3.14.2 Information on Aftershocks

(1) Report of Aftershock Information by NRIAG

NRIAG started to install tentative earthquake observation stations the day after the mainshock. Within about 10 days after the mainshock, a local earthquake observation network, consisting of eight stations encircling the focus, was completed. Aftershocks were observed by these stations. NRIAG started to transmit the number of aftershocks twice a day at a fixed time via facsimile to the Ministry of Scientific Research and Technology. However, a great effort and a lot of time was required for the various processes such as: exchange of analog data recording paper, reading of seismograms, determination of focus and magnitude, and, preparation of aftershock distribution maps and aftershock frequency graphs.

(2) Announcement of Earthquake Information and Press Activities

Neither NRIAG nor the Ministry of Scientific Research and Technology are authorized to announce earthquake information. Therefore, NRIAG seismologists and staff were forced to answer various questions from the press and citizens. Citizens of Cairo were nervous about aftershocks and telephone inquiries were rushed from the citizens who are scared of another shock of magnitude 3 or above (the level of shocks that could be felt in Cairo and cause damaged buildings to collapse). In this connection, no aftershock over magnitude 3 had occurred since the last shock of 3.3 on October 27, until several aftershocks occurred in the night of November 5, including that of a magnitude of 4.0 during the stay of the Disaster Relief Team in Cairo. An aftershock occurred also during the press meeting of November 10. The shock was not strong, but some of the nearly 80 local pressmen stood up at the moment and created the sense of uneasiness. We took this as a rare chance to explain the basic concept of earthquakes, and told the participants the shock was a so-called aftershock and similar shocks could occur often in the near future.

(3) Prompt Announcement of Aftershocks

In the event an aftershock of magnitude 3 or more occurs, the staff of the Helwan station must immediately transmit the information to the Minister of Scientific Research. Therefore, two officials must be stationed on a six-hour working shift at the office of NRIAG to determine the magnitude of the aftershock, whether it is 3 or more. This is one of the emergency measures established at this time.

3.14.3 Information of Ordinary Seismic Activities

(1) Earthquake Information Announcement System in Egypt

Agencies that are authorized to announce earthquake information to the public have not been established by the Government of Egypt.

(2) Analytic Data of NRIAG and Their Applications

The office of NRIAG maintains large files of valuable data including new and historical data gathered by seismologists. Local seismologists ought to have the potential capability of creating earthquake information. This is one of the major purposes of the Disaster Relief Team. The evaluation of the Cairo Earthquake, the follow-up of aftershocks in particular, was successfully completed only because the large files of NRIAG on seismic activities in Egypt were made available.

Current earthquake observation systems and their capability in Egypt are very limited. Therefore, it is very difficult to properly cope with increasing demands for earthquake information once a great earthquake, similar to the last earthquake, occurs. In such a case, technology that simply indicates current seismic activities by quickly processing observation data will be become effective.

3.14.4 Recommendations

When a major earthquake occurs it is very important to provide accurate information quickly, not only to the administrative agencies but to the public for reducing earthquake damage. This is very important in order to relieve people from the fear of earthquakes that cannot properly be predicted at present, and to prevent false information. For this purpose, some of the following measures cannot be avoided.

(1) Increase the capability for tentatively determining the location of the epicenter.

(2) Construct seismic data processing systems for determining the time and location in order to identify variable seismic activities.

(3) Construct systems that can properly transmit and receive earthquake information between administrative agencies, the press, any other agencies that necessitate earthquake information, and the public.

(4) Assign specialists and establish necessary positions at agencies such as the Ministry of Scientific Research in order to provide earthquake information to the public.

(5) Provide education and training for nationals by earthquake specialists on general knowledge of earthquakes and on what to do during earthquakes. During this Cairo Earthquake a number of school children were crushed to death under collapsed school buildings. In order to eliminate such panic occurrences, it is important to continuously broadcast information on earthquakes and to educate the public by appropriate measures.

3.15 Training and Education in Earthquake Countermeasures

3.15.1 Disaster Countermeasures

The following is a summary of disaster countermeasures in Egypt, collated from a report by Mr.Muhammed Samy Amin of the Civil Defense Department of the Ministry of Internal Affairs published by the Egyptian Society for Earthquake Engineering in the "Fourth Egyptian Training Course on Earthquake Engineering" (Nov.12-14, 1990)[1], as well as first hand knowledge obtained at the Civil Defense Department of the Ministry of Internal Affairs. However, these are not designed specifically with earthquakes in mind, but are rather countermeasures against disasters in general.

(1) The system of disaster relief countermeasure activities

1) Egypt comprises 26 provinces, each of which has a fire-fighting and disaster prevention department under the overall jurisdiction of the Civil Defense Department of the Ministry of Internal Affairs in Cairo. The civil defense departments in each province have several branch stations set up at designated locations within their provinces.
2) Fire-fighting and rescue teams, equipped with the necessary materiel for disaster countermeasures, are formed in the head departments and in the provincial branch stations.
3) A system of mutual support between provinces has been set up, with an equivalent of 25% of each province's personnel and materiel reserved for support to neighbouring provinces. This personnel and materiel is mobilized, depending on the situation, at the command of the central government's Civil Defense Department.
4) When the mutual support between provinces is judged to be insufficient on its own due to the scale of the disaster, emergency rescue teams are dispatched. These teams are answerable directly to the Civil Defense Department, and are assigned to locations designated by the government. The teams are in effect deployed for support to neighbouring provinces.
5) When the scale of the disaster is very large and it is difficult to implement adequate disaster countermeasures even with the various means of emergency countermeasures mentioned above, the Civil Defense Authority may request that troops be dispatched.
6) A Central Civil Defense Command Headquarters within the Civil Defense Department maintains contacts with disaster prevention command headquarters in each province, and has the duty of enforcing disaster relief countermeasure operations. Furthermore, the Central Civil Defense Command Headquarters is in contact with all government organizations related to disaster prevention, and in the event of a disaster, duty personnel are dispatched from the relevant Ministry.

(2) The system of aid

1) A Supreme Civil Defense Council comprising the relevant Ministries formulates disaster countermeasure plans, and conducts surveys regarding the state of readiness of equipment and materiel necessary for disaster relief countermeasures.
2) The Ministry of Health is in charge of replenishing medicines and materiel for emergency medical treatment, allocating fully equipped ambulances, setting up emergency first aid centres in disaster-

stricken areas, assigning public places for the identification of bodies before burial, constructing mass graves as and when required, and so on.

3) The Social Ministry is in charge of drawing up evacuation and accommodation plans, securing food provisions and other forms of aid to local residents in disaster-stricken areas, and taking compensatory measures as required.

4) The Housing and Redevelopment Ministry is in charge of for preparing restoration and reconstruction plans in disaster-stricken areas, including reinforcing or demolishing damaged buildings, in cooperation with regional authorities.

5) Bodies affiliated to the Ministry of Internal Affairs take part in planning disaster relief countermeasure operations by taking responsibility for regulating traffic and transportation, so that rescue and evacuation efforts may be carried out smoothly. In addition, they devise the necessary legal measures to confirm the state of damage and to register the details of deaths or injuries.
The Ministry of Internal Affairs is also responsible for making efforts to secure the policing and safety of the disaster-stricken area, as well as carrying out emergency policing as and when required in order to prevent the incursion of unauthorized persons.

6) The Civil Defens Department and the respective branch stations in each province are supposed to prepare training and education plans and to make efforts to improve the capabilities of disaster prevention personnel in disaster relief countermeasure operations. In addition, the Civil Defense Department implements the allocation of necessary materiel.

(3) Materiel for disaster relief countermeasures

The state-of-the-art materiel which is allocated for disaster relief countermeasures is as follows.

1) Hydraulic jacks for lifting very heavy objects.
2) Motorized winches and similar machinery for traction and suspension.
3) Air cushions and lifting bags necessary for special rescue operations.
4) Sound detectors for use when searching for injured persons buried under fallen rubble.
5) Rescue equipment for emergency aid to rescued persons.
6) Electric saws and cutters, and other appliances for cutting wood and metal.
7) Hydraulic hammers to facilitate the crushing and transporting of heavy stones and lumps of concrete rubble.
8) Transportable power generators with lighting attachments fitted, to enable rescue operations to be continued throughout the night.
9) Hydraulic spreaders and shearing equipment used in rescuing victims from obstacles made of metal.
10) Research is currently underway on the possibility of using tracker dogs to search for the bodies of victims when major damage has been suffered.

3.15.2 Training and Education

As stated above, the Civil Defense Department of the Ministry of Internal Affairs is in charge of fire-fighting operations as well as rescuing people trapped in buildings which have collapsed as a result of an earthquake or other disaster. We were able to observe the training of rescue teams in the Ministry of Interior Affairs, and can say that at present all of the disaster relief equipment in the possession of the Civil Defense Department is maintained in extremely good condition. Furthermore, there is a very high morale among the relief personnel. It would appear that these rescue teams were very active everywhere after the earthquake, particularly in Heliopolis. Scenes of the training of rescue teams are shown in photos 3.15-1 and 3.15-2.

Apart from the training carried out by these rescue teams, classes and training are also provided for residents. Videos can be seen on a giant screen in the PR Room of the Training Centre, and it would appear that education for residents is also carried out here. Other than these, we are told that several PR rooms of this kind have been made available elsewhere.

Thus, education and training for residents on the subject of disasters also seems to have been carried out before the earthquake of October 12th with an emphasis on priority points.

Nevertheless, when this earthquake occurred children in several schools started to panic and tried to escape from the school buildings, leading to lamentable accidents in which many pupils were injured or died by being crushed by other pupils. In order to avoid the outbreak of this kind of panic, it is vital that the general level of such education and knowledge of the residents should be expanded, using suitable methods.

Since the impact of an earthquake extends over a wide area and the impact it has on the lives of the citizens is also diverse, there is a need for a readiness for earthquakes to be vigorously implemented not only by the central government but also by regional authorities, schools, and other relevant organizations.

For a long time after October 12th, the people of Egypt found themselves in a state of anxiety due to after-shocks. Furthermore, the questions we were asked by the media also concentrated on the subject of after-shocks. In order to ease this anxiety, appropriate information must be provided at appropriate times, in combination with the education of residents. In other words, while on the one hand there is a risk that panic will result if information is released in situations where education is inadequate, on the other hand we should not lose sight of the fact that if information is closed off, it could lead to an undue degree of anxiety amongst residents.

3.15.3 What to do during an Earthquake

In the "Fourth Egyptian Training Course on Earthquake Engineering" (Nov.12-14, 1990) mentioned above, Professor Sobaih of the Department of Structural Engineering in the Faculty of Engineering at Cairo University states:

"The panic and confusion of the mass coluld transform an ordinary seismic event to a catastrophe. Therfore, the training of the inhabitants on relief work and expecting the shock could raise the selfreliance of the mass and hence reduce the seismic effect."

Since there are differences between Egypt and Japan in the scale and frequency of earthquakes, as well as lifestyles and the structure of buildings, Japanese examples cannot necessarily be applied as they are. Therefore, on the precondition that such differences are given all due attention when referring to them, we introduce below some examples of education given to Japanese residents on action to be taken in the event of an earthquake in the case of Tokyo[2)].

What to do in the event of an earthquake

- Will you be ready to act if a major earthquake occurs? -

(1) If the earthquake comes while you are at home:

1) Safety starts at home! Take cover under something solid, like a table.
The main quake will last for about 1-2 minutes. The most important thing here is to move to a place that is safest for the situation you are in. First and foremost, you should take care to protect your head.

2) Deal with potential fire sources promptly! If a fire breaks out, put it out immediately!
Cultivate the habit of turning off gas and electricity even in small earthquakes, and help each other in dealing with fires as soon as they break out.
Before all else, turn off potential fire sources. If a fire breaks out, it's important to put it out while it is still small.

3) Don't rush outside in a hurry! The risks are great outside; you should wait for a good opportunity to escape.
Rushing around in a hurry leads to unexpected injuries.

4) Open doors and secure an exit! You should plan an escape route in the event of an emergency.
In high-rise apartments, you should remember to open doors and secure an exit, to avoid being trapped in the room.

(2) If the earthquake comes while you are in a busy street or office-block area

○ Protect your head when out of doors, and avoid dangerous objects!
You should be careful of falling objects or block walls.
The biggest danger in busy streets or office-block areas is from falling glass and signboards.

(3) If the earthquake comes while you are in a department store, a theatre, or an underground arcade

○ Follow the instructions of the local staff!
Don't panic, don't get carried away!
In places such as department stores or theatres where a lot of people gather, panic is the most dangerous thing of all. We should all take care not to stampede at exits or on stairways. Before all else, follow the instructions of the local staff.

(4) If the earthquake comes while you are in an office

○ Take cover under a desk to protect yourself!
Falling shelves and lockers are dangerous.
Should you feel a violent tremor, you should either take cover under a desk or evacuate to the corridor.

(5) If the earthquake comes while you are in an elevator

○ Check that it is safe, then evacuate quickly at the nearest floor!
Even if you are trapped in the lift, wait calmly for rescue.
Should an earthquake or fire break out, you should under no circumstances use the elevator. Should you feel an earthquake while you are in an elevator, you should press the buttons for all the floors on the control panel. When the lift stops, you should get out promptly, check that it is safe, then evacuate.

(6) If the earthquake comes while you are in the subway:

○ Don't panic, but look after your own protection!

Take hold of something solid to avoid falling with shock.

There may be a sudden strong impact, so you should take a firm hold of something solid inside the carriage, such as the side bar of the luggage rack or an upright pole, to avoid falling over. After this, you should follow the instructions that come over the public address system in the train. Arbitrary action leads to panic.

(7) If the earthquake comes while you are driving a car

○ Pull over to the left (traffic drives on the left in Japan) and stop your car; driving prohibited in restricted zones!

Arbitrary driving leads to confusion; take action as instructed by announcements on the car radio.

When there is a major earthquake, tyres tend to puncture, your steering wheel will go out of control, and it will become difficult for you to keep driving. While taking care of rear-end or head-on collisions, you should slowly bring your car to a halt. Then pull over to the left-hand kerb (in the case of Japan). Should evacuation be necessary, close the windows, leave your key in the ignition, and get out of your car, leaving the doors unlocked.

(8) If the earthquake comes while you are having a picnic or on a hike

○ Look out for landslides, land slip, or tidal waves!

Evacuate promptly from landslide, land slip, or tidal wave zones.

(9) Evacuation is the last resort

○ Evacuate on foot, carry as little as possible!

Once we have heard an evacuation order, we should all help each other to evacuate promptly.

It is incorrect to think that you should evacuate come what may, just because there has been an earthquake. Only evacuate when the head of the local authority has judged there to be a risk such as a major fire, tidal wave, or explosion of a hazardous substances resulting from the earthquake, and has issued an evacuation order,

(10) Correct information, correct action

○ Don't act on rumour!

Take correct action in line with information on the radio or from disaster prevention organizations.

When a major earthquake occurs, people become emotionally agitated. Allowing yourself to be carried away by wild rumours and false reports only leads to pointless confusion. In order to prevent panic, each and every one of us should before all else act calmly on the basis of correct information.

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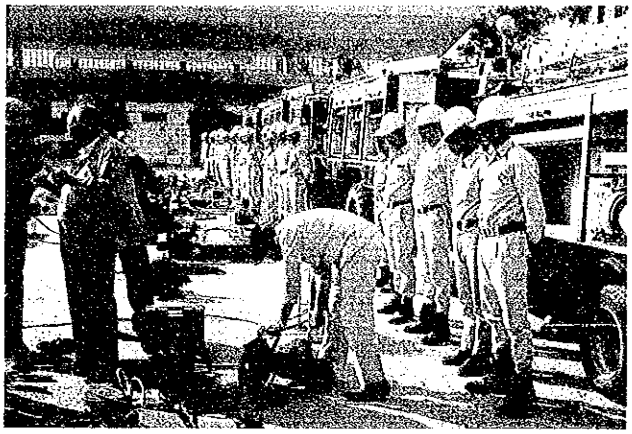

Photo 3.15.1 Training in the Ministry of Interior Affairs (1)

Photo 3.15.2 Training in the Ministry of Interior Affairs (2)

4. Conclusion

4. Conclusion

We have described the results of investigations on the Cairo Earthquake and have proposed several recommendations for future earthquake safety measures. To summarize the report, we have organized the 17-point proposal submitted directly to the government of Egypt on November 13th into the 11 items given below. At the same time we also present the memorandum on after-shock seismic activity issued on November 5th.

Summary of Proposals

(1) In order to properly locate hypocenters, more dense seismic observation network is necessary (presently only one station at Helwan for the metropolitan Cairo and its outskirts). An earthquake observation network equipped with three-component seismographs should be installed. Telemeter systems that can transmit and process data in real time are imperative. A few broad-band seismic stations are also necessary to be able to understand the fault mechanisms.

(2) It is necessary to install strong motion accelerographs for evaluating strong grand motion and structural response (none are installed at present).

(3) In order to deepen the knowledge of the earthquake of October 12 and of the crustal structure of the epicentral region, it is desirable that geological and geophysical surveys be facilitated.

(4) Geological survey of the faults suspected underneath the metropolitan Cairo should be conducted for the earthquake countermeasures of the city.

(5) Subsoil conditions such as the stratigraphy, distribution and thickness, and dynamic behaviors of the sediments should be studied in detail.

(6) It is necessary to reconsider the current earthquake-resisting design code for reinforced concrete buildings. It is also necessary to establish earthquake-resisting codes for various buildings and civil engineering structures.

(7) It is necessary to develop methods of evaluating the earthquake-resisting capability of existing buildings and the damage to buildings from earthquakes.

(8) Most of the old mosques were constructed of stone masonry and some of them were seriously damaged. Permanent repair is necessary. The most effective method for repair of cracks is the method of injecting epoxy resin grout. There are several details that should be modified for the roof and dome systems.

(9) Adobe houses should be repaired only after providing effective measures to prevent failures from this earthquake. It is desirable that new buildings be constructed of some materials other than adobe. For example, reinforced brick construction is recommendable if it is properly reinforced, because it is more resistant to earthquake shocks and can be constructed at a reasonable cost.

(10) In order to reduce damage from earthquakes, it is important to provide accurate information quickly, not only to administrative agencies, but to the public. For this purpose, it is necessary to provide measures as described below.

a) Establish systems that can quickly transmit and receive necessary information for administrative agencies, the press, various agencies, and the public.

b) Assign specialists and establish necessary positions at agencies such as the Ministry of Scientific Research and Technology in order to provide earthquake information to the public.

(11) Many school children panicked and were crushed to death under collapsed school buildings during the earthquake. In order to prevent such occurrences, it is important to continuously advertise information on earthquakes by appropriate media and to provide education and training for the public.

Memorandum on After-Shocks (November 5th)

Based upon the information of the decay of aftershocks number with time and the aftershocks area, which were provided by the National Research Institute of Astronomy and Geophysics, as well as the Japanese experiences on seismic activities, it seems that the major seismic activity of the October 12 Earthquake is almost coming to be ceased. However, there is still a possibility that minor aftershocks, which may not cause damage to structures, occur.

5. Acknowledgements

5. Acknowledgments

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