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Technical Report on Telecommunications and Disaster Mitigation

Focus Group Technical Report

2.5 Earthquakes in Turkey2

2.5.1 The Kocaeli-Golcuk Earthquake of August 17, 1999

2.5.1.1 Preparation before the incident

Scientists had been repeating making statements in the media about the imminent danger of a devastating earthquake in the Marmara Region since mid-1998. The Turkish Amateur Radio Society (TRAC) took these statements seriously and visited the National Earthquake Monitoring and Research Centre (Bogazici University Kandilli Observatory) in Istanbul to get more detailed information from the head of the "Earthquake Engineering Department", Prof. Mustafa Erdik, PhD (now general director of the centre). This contact was facilitated by TRAC's existing contacts with this institute since 1992 at the time of the Erzincan Earthquake.

Prof. Erdik explained the situation to TRAC, presenting 2 possible scenarios that included details such as the risks concerning roads and harbours. One scenario assumed the epicentre to be in the east and the other assumed it would be in the western part of the Marmara-Graben. TRAC prepared a simple checklist for determining what could happen if this threat occurred and all public communication facilities would break down, making information gathering via the usual public channels impossible. This checklist was based on the expected damages in the various areas. TRAC's plan would be to ask the police about information related to incoming damage reports in

2 The material for this section was kindly provided by Aziz Sasa, President of TRAC, the Turkish Amateur Radio Society (member of IARU), and, in particular, represents TRAC's perspective.

order to make the determination of the epicentre possible. The police radio communication system was regarded as the only reliable source of information.
The other initiative, among several others made by TRAC, was to bring the "Communication Service Group" mechanism onto the agenda. This Service Group is one of nine different service groups, which are intended to handle various planning aspects of emergency management prior to emergencies together with the operational aspects during and after emergencies. It is lead by Turk Telekom and all GSM-providers, satellite service providers, the maritime communication service provider, law enforcement agencies, Turkish Radio TV (TRT), and other agencies with a strong radio communication structure are members. TRAC is the only voluntary organisation that is member of this group. The main idea of this structure is to enhance co-operation among all communication providers, aiming at mutual aid in order to provide emergency communication and quick network recovery in the aftermath of emergencies. The "Communication Service Group" has to be established in every province in accordance with Decree 88/12777, based on the Law No: 7269 ("Law of Disaster Management in Provinces").
Due to the insistence of TRAC this mechanism became operational (most probably for the first time since its creation in 1988) in Istanbul with a meeting being held in April 1999. The head of this service group, the regional director of Turk Telekom in Istanbul, advised all participants to liaise with TRAC, stating that the Amateur Service, coordinated by TRAC, will be most likely the only remaining means of communication if the earthquake occurs.
TRAC applied to TRT (Turkish Radio Television) to get free access to their mountaintop locations in order to install our repeaters but this application was denied. Requests to install a facility in a university campus in an area of Istanbul where a military heliport and the biggest hospitals are located and to convert a military museum ship to a EOC for Izmit almost 6 months before the incident were also denied.
Further steps in terms of preparation were efforts to liaise with the authorities. Attempts to liaise with the Office of the Prime Minister were not successful but liaison was established with the Governor of Istanbul and the Istanbul Fire Brigade and TRAC conducted an exercise with these agencies one month before the earthquake occurred. Liaison with the Civil Defence and the Istanbul Ambulance Unit already existed.

2.5.1.2 Operations

The earthquake (Mw=7.6) happened on August 17, 1999, at 00:02 UTC. It was widely felt.
Electrical power was cut off in large areas of the country seconds later. Telephones (GSM and wired) remained operational for about one minute before they were affected although some GSM networks continued to operate for about an hour in the severely affected areas before they become congested or power was lost.
It took about an hour to overcome the shock, arranging care for elderly family members and getting ready for action. Before getting ready for action it was necessary to determine the epicentre of the earthquake. The police station in the near vicinity was visited, where first reports of damage were arriving through the police radio network. Damage in only one part of Istanbul was reported – in a section of Istanbul already identified as the most risky area in the city by scientists. No damage was reported from other parts of the city. This was clearly fitting into the scenario that had been evaluated with the Kandilli Observatory in the stage of preparations. It meant that the epicentre was in the east, most likely around Izmit (Kocaeli). If the epicentre had been in the west, almost all coastal areas of Istanbul would have experienced severe damage.
At this stage, media sources were unusable for gathering reliable information, as they were passing only rumours and unconfirmed statements. It would take almost one day more to get substantial observations and news from them.

The next step was to start to communicate. As all equipment was installed in a car, there was no problem with electrical power. When the predetermined net frequency on HF (40 Meters Amateur Radio Band) was accessed it was clear that stations from all over the country were already on the air. One of them was in the HQ of Civil Defence in Ankara (HQ), operated by TRAC members in liaison with the Ministry of Interior. All stations were supplied by emergency power - either generators or car batteries. HQ was informed about the situation and the next step of the operation was that the TRAC team would move towards Izmit, avoiding the motorway where the risk of bridges collapsing was imminent and reporting observations from cities along the route.
A second TRAC team was also formed which was deployed to the Government of Istanbul in order to serve there as communicators and install a station. Liaison with this team was obtained by either simplex radio communication or via our only remaining repeater with emergency power.
First observations were relayed from Gebze (Province of Kocaeli, half way to Izmit) where the TRAC team met the Chief of the local Civil Defence and passed his report to Ankara. He urged us to move towards Izmit where he expected the most severe damage. Approaching Izmit the dimension of damage grew constantly. Roughly 2 hours after the incident the team observed that the state of shock had changed to one of panic. The traffic on the road became extremely dense, because thousands of people were trying to get through to their relatives living around Izmit.
A police patrol escorted the TRAC team to the Government Building in Izmit. The team arrived at the Governor's office at 03:30 UTC (06:30 Local Time) and met the Vice Governor in charge, an official with whom TRAC had cooperated on several occasions in the past and who knew about their capabilities, and the Governor. The TRAC team conveyed the Governor's messages to Ankara

via HF Radio, assisted by other stations within the network, which relayed the messages if propagation conditions changed. There was no problem of passing the messages back and forth.
Shortly afterwards, a team from TRAC in Sakarya (Adapazari) started to relay the messages of the Governor of Sakarya (the other city severely damaged) via VHF to the team in Izmit. One member, residing in a village on a high location, relayed the incoming messages from Adapazari to the TRAC team on VHF simplex with his handheld radio. This traffic was then relayed to Ankara via HF. He reported that one bridge on the Istanbul-Ankara Motorway had collapsed, making the road unusable and burying one bus and several cars under it. This information, confirming the scenario of the Observatory, was instantly passed to HQ in order to warn their SAR-deployment that was supposed to start for Izmit from Ankara. All TRAC stations along the route of this Civil Defence Team were urged to call them on the VHF Civil Defence channel, warning and guiding them to alternative routes. This information was also passed to other provinces from where aid was expected to come. TRAC were later praised by Civil Defence for this action, as otherwise their deployment would have experienced severe difficulties.
In a few hours an HF Radio was deployed in Adapazari which then allowed the traffic to be passed to Ankara directly. At around 03:30 UTC, the TRAC station in the Istanbul Emergency Operation Center (EOC) became operational and it then passed messages from there to Ankara on HF. Part of the Istanbul team was deployed to the severely damaged township of Avcilar (in the western part of Istanbul) in order to set up tactical communication between the agencies in the field and/or with the EOC.
Aid from other provinces was being sent to the disaster area and most of these deployments were accompanied by TRAC members who acted as communicators of the convoys. Communication with the Ankara-Civil Defence SAR-Deployment in Izmit was accomplished by simplex VHF. 24 hours after the incident, TRAC had installed a repeater in a TRT mountaintop location in the vicinity of Izmit that enabled the entire disaster area to be covered with simple VHF radios, thus enhancing communication capabilities significantly.

A TRAC team member was deployed to a water-bottling facility near Adapazari to organize the drinking water supply by radio communication with the Emergency Operation Centres where TRAC members were stationed. After the arrival of more members to take over the duties in the Emergency Operation Centres, the TRAC mobile station was released for other tasks. It was moved to a problematic area according to orders from HQ and used to convey messages to or from these problematic zones where no other means of communication was available.
Co-ordination between the large number of incoming foreign SAR-Units and the local Emergency Operation Centres (EOC) appeared to be one major problem because no communication structure for this purpose was available. As a result, an unnecessary accumulation of SAR-Units on one site did occur, while on others where survivors were reported to be buried, no SAR-Unit was present.
The TRAC team therefore focussed on the task of establishing communication between the SARUnits and the EOC. As the affected area was large and no official knew the distribution or location of the operational SAR-units, it was impossible to track all units and get an overview of the situation. This was accomplished in only one area (Yalova) at least partly, because the local authorities had concentrated the camps of the SAR-Units in one particular place, and it was therefore possible to contact the logistics personnel of the units to obtain information about their communication facilities. It turned out that the larger SAR-Units had amateur radio operators in their ranks. This made co-ordination with them very easy as frequency compatibility was no problem.
The entire communication of the Interior Ministry and the Ministry of Housing and Infrastructure with the disaster area was accomplished using the TRAC-Network. The operation lasted for 10 days and 170 TRAC members were engaged in the disaster area.

2.5.1.3 Impact on public networks

As mentioned before, GSM and fixed lines communications were not operational. There was no connection between Istanbul and Ankara as the fibre-optic cable had multiple ruptures near Adapazari. Additionally, a major switch in the Adapazari Region was destroyed completely. A bypass between Istanbul and Ankara was established by utilizing military satellite infrastructure approximately 24 hours after the incident. With this, the east-west connection was restored, but Adapazari and Izmit (the most problematic areas) could not be connected. The east-west fibre-optic connection was restored (by an operation lasting 36 hours) approximately 48 hours after the earthquake. However, due to the destruction of the switch near Adapazari, phone lines (fixed and mobile) in a large portion of the disaster area could not be completely restored within 10 days. In the areas where the lines were restored, the assignment of subscribers took additional time.
The deployment of mobile GSM utilities in the immediate aftermath of the disaster became a problem due to congestion on the motorways. Transport was directed through alternative routes but stopped at police roadblocks and not allowed to pass through. And as the transport crews had no communication with the EOC, they could not contact any official to obtain permission to pass through. Their arrival at the incident area was thereby delayed for almost 24 hours.

2.5.1.4 Learning from the disaster

After the earthquake TRAC was invited by the Secretary of State at the Prime Ministry to sign a MoU with the Prime Ministry. Free access to TRT locations was obtained and MoU's were also signed with the International Federation of Red Cross and Red Crescent Societies and the Turkish Red Crescent.
The TRAC stations in the Istanbul EOC and the EOC's of Izmit and Adapazari became operational permanently. The repeater installed near Izmit was equipped with better antennas which increased its performance. This repeater, working in the amateur radio band, became the main source of tactical communication for the field hospitals for a 3 month period. This rather unusual situation was made possible by a temporary frequency assignment by the Turkish Regulatory Body.

2.5.1.5 Summary

This was a typical “if everything else fails - amateur radio will work” case. It also demonstrated the complexity and difficulty of recovering public network services. TRAC’s success in ensuring service in the most critical hours was based on efforts in the pre-disaster preparation period and also demonstrated the necessity of a multidisciplinary approach (obtaining risk analyses) and tight cooperation among stakeholders (an example being the military-civil cooperation to bridge the damaged east-west fibre-optic cable in this particular case).

It thereby indicates the importance of the “Communication Service Group” mechanism.

2.5.2 The Duzce-Kaynasli Earthquake of 12 November, 1999

2.5.2.1 Preparation before the incident

In this case the post-disaster period of the 17 August 1999 disaster can be regarded as the preparation for the disaster of November 12 that devastated the eastern neighbours of Sakarya and Kocaeli.

The biggest improvements in comparison with the previous disaster were the installation of permanent EOC’s in Kocaeli and Sakarya with the participation of TRAC and the raising of awareness of the role of TRAC among the administration.

To sum up: many lessons having been learned from the 17 August disaster made a better preparation possible.

2.5.2.2 Operations

The earthquake happened at 16:57 UTC (18:57 LT) and had a magnitude Mw=7.2. When it happened, all TRAC stations in the EOC’s were manned and active. GSM and phone lines became almost instantly nonoperational in the affected area and also in areas where the earthquake was strongly felt.

Communication between the affected area and the neighbouring areas could easily and instantly be accomplished via VHF repeater near Izmit. HF was the second communication resource.

One member of the TRAC Sakarya-branch, living near Duzce, drove to Duzce and met the Governor there 15 minutes after the incident. He reported via the TRAC network that the most urgent need was support to fight fires. This information was instantly delivered to the Sakarya and Istanbul EOC’s. Starting with Sakarya, the very next city to the affected area, fire brigades were deployed to Duzce, followed by fire brigades from Izmit and Istanbul.

A TRAC member from Bolu, the neighbouring district of the affected area to the east, reported damage from Bolu. He also reported that the main road to Duzce (the Ankara-Istanbul Highway) was disrupted due a landslide and advised all aid convoys heading to Duzce from Ankara to contact him by radio to be guided to alternative roads. He also organized military-civil communication (by operating side by side with an officer who took over communication with the military).

30 minutes after the incident the Minister for Interior Affairs arrived at the Istanbul EOC and received his first briefing from the TRAC team on duty there.

Members of the TRAC branches in Izmit (Kocaeli) and Sakarya were deployed to Duzce and Kaynasli (a severely damaged township of Duzce), to take communication duty in the provisional EOC’s that had been installed. They were assisted by a TRAC member in a village near Duzce who acted as a control station of the TRAC HF Radio Network.

As it appeared that no further immediate deployment from Istanbul was needed at this stage, the team in Istanbul decided to take care of the foreign SAR and aid groups being deployed from various countries to Istanbul and expected to be assigned to different sites in the disaster area. As a first step liaison was established with the delegations of the Ministry of Foreign Affairs and OCHA already present at the airport.

A proposal by TRAC that all incoming foreign groups complete a questionnaire before being deployed to the disaster area was accepted. This questionnaire required essential information about their communication equipment (type, amount and frequency) together with information about the qualification of the communicators (amateur radio operator, possibility of programming the radios to other frequencies). An information leaflet for the groups stating the frequencies predefined for infield communication with the local EOC's was also prepared. No group was deployed to the disaster area without having filled in the questionnaire and received the frequency information leaflet. As it was possible that some of the groups would have no information about the frequencies of their radios, appropriate measurement equipment (frequency counter) was deployed to Istanbul Airport as a precaution.

38 different groups with a total of 384 personnel were registered. The most experienced groups in large-scale international operations (among them THW from Germany and the Swiss Rescue Dog Team) had amateur radio operators in their ranks.

The information collected from the questionnaires was relayed to the EOC's in the affected area by the TRAC radio network. With this information being available, the TRAC operators in the EOC's could move to the frequency of any foreign group, guiding them by radio communication in the disaster area.

Our communicators in these EOC's were assisted by voluntary translators in order to overcome possible language problems.

As a result of this operation, no problems in the coordination of the foreign groups were encountered this time unlike following the earthquake of August 17, 1999. This operation was much praised by foreign groups. For example, the British Civil Defence (BCD) stated that "this perfect communication structure was the very first of its kind ever experienced in 30 years of international disaster operations" in its debriefing report. BCD also recommended it to become an international standard.

After the arrival of all the foreign teams, the Istanbul TRAC team left the airport and went to the disaster area to take over duties from the first shift.

The governor of a city in southeast Turkey deployed a UHF portable repeater and some handheld radios in the area. TRAC assisted with the installation of the repeater. The radios were distributed to the government agencies in order to provide them with a common command channel.

2.5.2.3 Impact on public networks

GSM and fixed line services were knocked out instantly. Their recovery in those areas not directly affected, such as Istanbul, was accomplished within a few hours whereas recovery in the disaster area took 72 hours. The deployment of mobile GSM units was not a problem this time as the roads from the western direction were clear.

2.5.2.4 Summary

As this disaster happened relative shortly after the August 17 earthquake and in its adjacent vicinity, with experienced and skilled personnel still present in Adapazari and Izmit, initiating the first response was greatly facilitated.

Therefore TRAC was able to focus on the serious problem of coordinating the numerous incoming foreign groups. The statement of BCD showed that in-site coordination was a general problem, also being encountered during other large-scale disasters in other parts of the world. TRAC demonstrated that this kind of problem, common to all disasters, can easily be solved by the engagement of amateur radio.

2.5.3 The Van Earthquake on 23 October, 2011-10:41 UTC, Mw=7.2

2.5.3.1 Preparation before the incident

Being informed of the seismic risks in the area, TRAC had already formed a branch in Van, headed by a communication technician of the Ministry of Health. HF Radio and a VHF repeater were available.

2.5.3.2 Operations

Having been alerted by media, TRAC checked its Automatic Position Reporting System (APRS) network to obtain observation data. Then as many stations as possible from various parts of the country were made operational on a predetermined emergency alerting frequency in the 40-Meters HF Amateur Radio band. Additionally, the chief communicator of the voluntary SAR-Group AKUT in Istanbul, an amateur radio operator and member of TRAC, was contacted. They were getting ready for deployment to the disaster area and a “modus operandi” was determined with him.
The TRAC representative in Van appeared on the predetermined HF-channel about 2 hours later, reporting on the situation in the region (the GSM-Network remained operational, for example) and coordinating communication with the Ministry of Health (MoH) command centre. The TRAC HFnetwork stood by on the channel of MoH, relaying messages when direct communication between Van and Ankara was not possible.
A member of the TRAC Trabzon branch, employed as a chief technician of the major GSM service provider, reported periodically about the condition of the network, in order to be ready for possible outages in the GSM network, and the deployment of mobile GSM-Stations to the area. As on-site radio communication for coordination between the agencies became a major problem it was decided to deploy a well-equipped and experienced member from the nearest possible location (Gaziantep in this case). He went to the area with a Turkish Red Crescent (TRC) convoy and organized the on-site coordination between all agencies, setting up a station in the local TRC Command Centre.

2.5.3.3 Observations

As the local switch of Turk Telekom remained intact and all GSM providers had their local infrastructure in the same location, the GSM network remained operational. Another ameliorating factor was the low number of inhabitants in the affected area. The network reached its limits only when an extensive number of media and VIP visitors arrived in the area, significantly raising the traffic volume. Relatively quick and numerous deployment of mobile GSM infrastructure solved that problem “just in time”.
It was reported by the official of a GSM provider in a Communication Service Group meeting at a later date that a lack of coordination among the agencies again caused the delayed arrival of mobile GSM units (as was also experienced during the 17 August 1999 incident). One convoy was misguided and forced to stop for almost 24 hours on the way to the incident area at a control post. Determining and reaching the key person responsible for solving this problem by GSM became a major and time-consuming matter. With the availability of a well-organized interagency radio communication network, this problem could have been solved in a matter of minutes.
Because the operational GSM infrastructure remained operational the local authorities believed that all communication problems were solved. They were not aware that the interagency communication was not existent at all. This indicates a severe and apparently typical deficit in terms of situation assessment. This was a key factor causing TRAC’s delayed intervention regarding the interagency radio communication network in this particular case.

2.5.3.4 Conclusion

This incident showed that the availability of public networks does not mean that all communication duties can be fulfilled properly. It showed also, that the availability of public networks can cause a deficit in terms of situation assessment which results in chaotic conditions in the field where extremely critical duties such as search and rescue have to be supported by a well-working interagency radio communication. TRAC decided to organize immediate deployments to remote incident areas, regardless of inquiries from government agencies, with the primary task of organising the interagency radio communication structure.