# July 7, 2005 from a telecommunications perspective

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*Abstract: This document summarizes the events of the July 7, 2005 terrorist attack in London and its background, presents the British emergency procedures, with particular emphasis on communication, and examines the communication improvements implemented in the London Underground since then. This summary is based mainly on material available on the internet, largely from British newspapers and websites, supplemented by material found on Wikipedia, where I have checked the sources individually.*

## 1. Introduction

When I began writing this summary, I thought it would be enough to deal only with the London terrorist attack and the events surrounding emergency communications, but life, as we know, constantly overrides our previous decisions. This is what happened now, as on May 1, 2007, the British press reported exclusively on another terrorism trial related to the July 7 bombings. [1] [2] [3]

# 2. Background information

Figure 1. A MI5 photo (top) from 20042004 shows Shehzad Tanweer and Mohammad Sidique Khan, who participated in the 2005 bombings as suicide bombers. The bottom photo shows Khan working as a teaching assistant. [4]

In connection with the May 1 court case, it caused quite a stir that a photo taken by MI5 showed the future London attackers together. The photo was taken in 2004, more than a year before the attack, while Omar Khyam was under surveillance. Khyam is the leader of an Al-Qaeda terrorist cell who had been under constant surveillance by MI5 since 2003 and was sentenced to life imprisonment on May 1, 2007, for planning another attack. The estimated cost of the surveillance reached £50 million. MI5 was forced to issue an explanation regarding the case, which can be read on its official website. [5] [6]

# 3. Events of July 7, 2005, in chronological order [7]

1. Close antecedents – positive English events:
    a. A few days earlier, the Live 8 concert sent a powerful message to world leaders about the need for development in Africa.
    b. On July 6, London won the right to host the 2012 Olympic Games.
    c. On July 7, G8 leaders met in Gleneagles.

2. Based on closed-circuit television (CCTV) footage and eyewitness accounts, the following sequence of events was reconstructed (irrelevant details omitted from the original description):

03:58 A blue Nissan Micra rented by Shehzad Tanweer was recorded by a camera in Leeds.

05:07 A red Fiat Brava arrives at the Luton station car park. Jermaine Lindsay arrives alone and waits. (CCTV)

06:49 The Micra arrives in Luton (a suburb of London) and three people get out. They take four backpacks from the trunks of the Brava and Micra and continue on their way. (CCTV)

07:15 Lindsay, Hussain, Tanweer, and Khan enter Luton station (CCTV)

07:21 They get on a train heading to London King's Cross station (CCTV). Based on their behaviour, experts estimate the weight of their backpacks to be around 2-5 kg.

08:26 After the train arrives, they head towards the entrance to the London Underground system. (CCTV) The four terrorists then go their separate ways in four different directions.

08:50 Three terrorists execute suicide bombings on three different lines.

Tanweer bombing kills 8 and injures 171 at Liverpool Street station.

Khan kills 7 people and injures 163 others on Edgware Road

Lindsay's bombing on the Piccadilly Line causes the most casualties, as the train is packed with passengers. The death toll is 27, with more than 340 injured.

08:55 Hussein gets off the King's Cross line at Euston Road. He tries to call his colleagues from his cell phone, which is recorded by the control centre.

09:00 Hussein buys a 9V battery in one of the station's shops, presumably for the explosive device.

09:47 Hussein detonates his bomb on the number 30 bus at Tavistock Square.

The explosion kills 14 people and injures more than 110

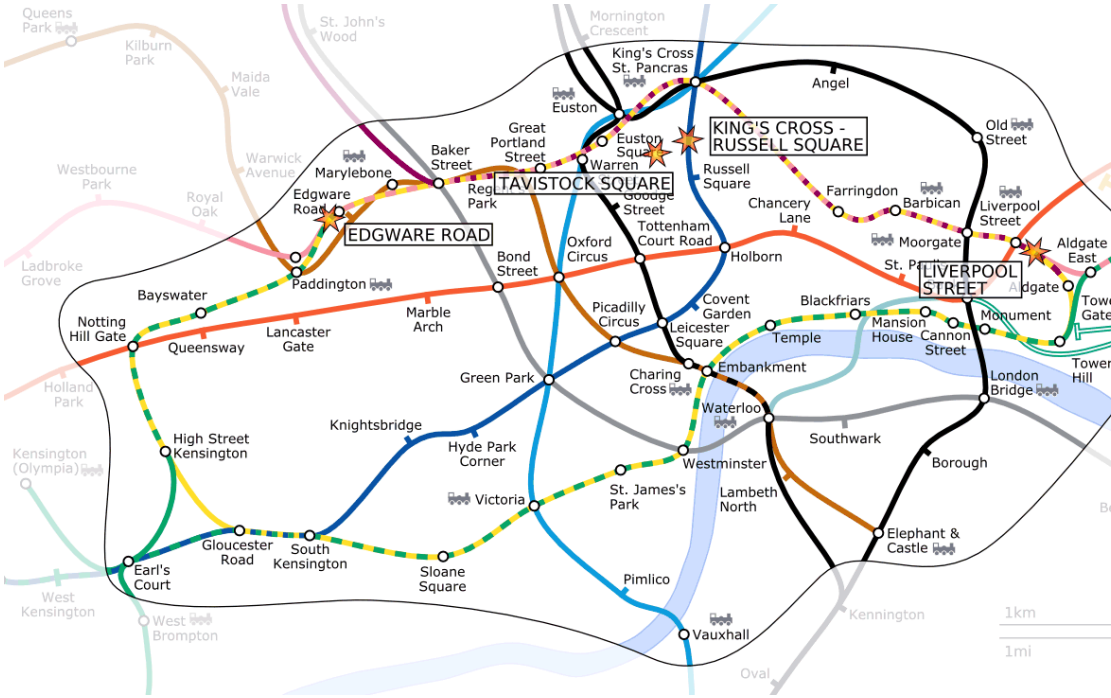


Figure 2. The sites of the explosions [8]

# 4. The English emergency communication system

Before analysing the events further, I will briefly summarize the specific information.

Many people think that emergency communication refers to communication between organizations involved in rescue operations during an emergency, but this is fundamentally incorrect; it is only part of the complex concept described above.

## 4.1 English classification of emergency communications

In the English system, emergency communications are structured as follows:

- communication between organizations involved in the rescue,
- exchange of information between injured persons, members of the public present at the scene of the disaster, and any coordinating or emergency response organization,

- communication between emergency services and a coordinating body,
- and finally, for ordinary people, information broadcast through the media.

In communication, on this basis, the following groups are classified:

- Organizations participating in the rescue:
  - London Ambulance Service
  - London Fire Brigade
  - Police (Metropolitan Police Service, City of London Police, British Transport Police)
  - Transport companies and their emergency services (London Underground's Network Control Centre, Transport for London, London Underground Emergency Response Unit)
- Organizations coordinating rescue operations
  - Headquarters of organizations participating in the emergency response
  - A superior group that brings them together, to which the organizations concerned delegate members (Gold Coordinating Group)
- Persons directly affected by the emergency
  - Injured
  - They are not physically injured (emotional injury is possible)
- Media
  - Official announcements
  - On-site reports

## 4.2 Major incident and command structure

A significant incident is any emergency situation that requires the intervention of one or more emergency services and directly or indirectly affects a large number of people. [9]

In the event of major incidents, the command structure is three-tiered. [9][10] Gold (Strategic) commanders work in a well-equipped office away from the scene and are made up of the senior leaders of the various organizations involved in the emergency response. Silver (Tactical) commanders work on site in a command center and are made up of senior officers present at the scene. Finally, Bronze (Operational) commanders work on site and directly control the use of their organization's resources.

Any emergency service can declare a major incident. If one service declares a major incident, the other services must automatically respond accordingly.

# 5. The first hour

In the following, I will rely on the report published by the London Assembly [11], referred to in short as the report, and will only indicate references that differ from it. In several cases, I will also include eyewitness accounts. These are not word-by-word citations but rather reflection of the emotions of eyewitnesses.

## 5.1 In general

Between 8:50 and 9:15, the overall picture was inevitably chaotic. Several, often contradictory, reports and news stories appeared. Numerous emergency calls (999) reported smoke coming from the underground. The London Underground's Network Control Centre's initial observation – a loss of power combined with a huge bang – led to the conclusion that an electrical surge had caused an explosion.

It was only at 9:15 that it became clear that explosions had occurred, but their exact location was unknown. The London Ambulance Service was called to seven different locations. This is why Sir Ian Blair, head of the Metropolitan Police Service, reported six explosions (including the bus bombing) at the first press conference.

In major emergencies, emergency services receive a significant number of emergency calls, which are then cross-referenced to determine exactly what has happened. As the first three explosions occurred underground, the number of calls was relatively low, making it difficult to ascertain what had actually happened.

In this regard, the report states that underground communication was not possible at all, although the problem of underground communication for emergency services is not new. Seventeen years before the bombings, an investigation following a fire at King's Cross station also raised the issue of the lack of underground communication. [12]

## 5.2 Aldgate tube station

Michael survivor:

„I saw an orange flash, followed by silver flashes, which I think were flying glass shards. This was followed by a growing sound. I didn't hear a bang, just a loud noise. The explosion spun me around and threw me to the ground. Halfway through the fall, it occurred to me that it was a bomb. I thought I was going to die. When I hit the ground, everything was so dark and quiet that I thought I was dead."

The first emergency call was received by the British Transport Police at 8:51 a.m. from a London Underground employee. The London Fire Brigade was called

to the scene at 8:56 a.m. The first firefighting unit arrived at the station at 9:00 a.m. and requested additional units due to thick smoke billowing from the tunnel. Two additional units and a senior officer then arrived, while another unit was dispatched to Liverpool Street. At 9:05 a.m., the fire department classified the incident as a major incident.

The first British Transport Police officer arrived at the scene at 8:55 a.m. The train's power supply had been cut off. At 9:01 a.m., the officer informed the London Ambulance Service (hereinafter referred to as the ambulance service) that 3-4 walking casualties had emerged from the tunnel. By 9:07 a.m., the number of injured had reached 25. At 9:08 a.m., the traffic police also classified the incident as a major incident. At 9:19 a.m., they officially requested assistance from the Metropolitan Police, whose first officer arrived at the scene at 9:20 a.m.

The first ambulance arrived at Liverpool Street at 9:03 a.m., and three minutes later, an emergency planning manager joined the operation. At 9:07 a.m., the manager informed the ambulance center to alert hospitals to be on standby for a major incident, designated a meeting point for a CBRN (Chemical, Biological, Radiation or Nuclear) hazard, and mobilized the emergency vehicles. At 9:14 a.m., the first ambulance arrived at Aldgate station and reported that the incident was an explosion and that there were five fatalities. At 9:24 a.m., 30 additional ambulances were requested to treat the injured.

In summary, the emergency services arrived at the scene quickly and it was soon established that an explosion had happened on the train. The three services independently declared the incident to be major at 9:15 a.m.

## 5.3 Edgware Road Underground Station

John survivor:

„The train had just left the station when there was a loud bang followed by two smaller ones, then an orange fireball. As the train's windows and doors shattered, I covered my head and eyes with my hands and arms. Shards of glass and pieces of glass rained down on me and the others. The train's sudden stop threw me forward. I thought I was going to die. There were shocking loud cries and screams, while the air was filled with smoke, soot, and the smell of chemicals. Large and small pieces of debris hit and covered me. A book got wedged between my shoulder and a piece of wall. A piece of metal hit my head and caused pain. The window behind me covered me with glass shards and pieces. My eyes were sensitive and dry from the fireball. No matter how much I rubbed them, it only got worse. Tiny pieces of glass pierced my face and head. I couldn't breathe because the dust and smoke were burning my lungs. I buried my head in the crook of my elbow, trying to get air. After that, a deathly silence fell over the train.”

At 8:58 a.m., the first call to the fire department came from nearby Praed Street. The fire department mobilized five units, but the first unit arriving at the scene at 9:04 a.m. turned back because they found nothing at the scene. At 9:07 a.m., another call came in, and four units were sent to the station, only one of which came from Praed Street. The other units were not redirected until 9:37 a.m. The first unit arrived at the scene at 9:18 a.m., and the fire department classified the incident as a major incident at 9:34 a.m.

The first rescue unit arrived at the station at 9:12 a.m., and at 9:14 a.m., the crew reported that there had been an explosion with a maximum of 1,000 casualties.

At 8:58 a.m., the traffic police received a call reporting that a person had been hit by a train and that a train had collided with the tunnel wall. The police were called by the fire department and arrived at the scene at 9:12 a.m. At 9:32 a.m., the police classified the event as a major incident.

In summary, the deployment of emergency services to the scene and the establishment of communication between them was much slower than at the previous site, even though underground workers had called them at 8:59 a.m. and the train was only 50 meters from the platform when the explosion happened. The police only classified the event as a major incident at 9:32 a.m., and the fire department did so two minutes later.

## 5.4 King's Cross/Russel Square

George survivor:

„The subway started moving. The doors closed and we began to enter the tunnel. This took about 12-15 seconds. ... A deafening bang. "What the hell was that?" I said. For a millisecond, there was a bright orange light in front of me. I was looking at the double doors with my back to the platform-side door. In that millisecond, the bright orange light disappeared. What the hell was that? Of course, I heard many people crying and praying. We now know that 25 people around me died instantly and another 25 were seriously injured. My first reaction—knowing my position in the car and knowing that I was in the first car—was to think, "We collided with a train." My first thought was, "We collided with a train and the driver is dead." I couldn't see anything. It's the meeting of demons; there's black smoke billowing, and I'm struggling to breathe. In those seconds, I thought, 'This is not good. This is not good, because if this is followed by fire or thick smoke, you're not going to get out of here, George. I literally wrote myself down; I felt this was the end. 'You're not getting out of here.' I couldn't see anything. I've never experienced anything like this before. I can't say anything about the other cars, but in the first car you couldn't see anything."

The explosion completely isolated the train between the two stations. Very few emergency calls were received, as mobile phones did not work underground. No

one on the train was able to communicate with the outside world until they left the carriage and walked down to the station.

The police were first alerted at 8:56 a.m. based on the station's surveillance camera. At 9:15 a.m., the police classified the event as a major incident.

Firefighters received their first call from the station at 9:02 a.m. The call reported smoke billowing from the tunnel. Three fire engines were sent to Euston Square and one to King's Cross. The first fire engine arrived at the station at 9:13 a.m. At 9:19 a.m. and 9:36 a.m., additional fire engines were requested at the scene. There is no information on whether these requested vehicles arrived or not.

The ambulance service received the first emergency call at 9:04 a.m. The rapid response unit arrived at the scene at 9:14 a.m., followed by the first ambulance at 9:19 a.m. At 9:21 a.m., the ambulance service classified the event as a major incident.

It is not clear exactly how the fire department was informed of the explosion. All that is known is that the fire department was hampered in its investigation of the events by the fact that handheld radios did not work between the platform and the top of the escalator, or between the top of the escalator and the area outside the station. For this reason, the fire brigade used runners who ran up and down the escalator to pass on information.

The first carriage of the train was facing Russell Square, so the seriously injured could be brought to the surface via Russell Square station as soon as the rescue teams arrived.

The first call to the ambulance service from Russell Square station was received at 9:18 a.m., 25 minutes after the explosion. One of the two train drivers guided the passengers to the station. The control center dispatched a rapid response unit to the scene at 9:24 a.m., which arrived at the station at 9:30 a.m. The incident was classified as a major incident at 9:38 a.m., 45 minutes after the explosion.

No separate information about the incident could be obtained from the police, as their records listed the two locations as a single incident.

In the absence of firefighters at Russell Square, the London Underground Emergency Response Unit secured the scene and, with the help of the two drivers, evacuated the passengers and transported the seriously injured from the first carriage to safety. The London Underground Emergency Response Unit is a small and little-known unit. Its task is to respond quickly to unexpected events on the Tube (suicides, derailments, and passenger emergencies). On July 7, the unit was present at all locations and played a significant role in averting danger. The unit has all the equipment and specialists necessary to rescue people and dismantle trains. The investigating committee was surprised to find that the unit does not have blue lights, is not authorized to use bus lanes, and has to pay road tolls for its vehicles.

In summary, the deployment of emergency services to the scene and the establishment of communication between them was chaotic, as the site of the explosion was one of the deepest points of the underground and the train was located almost halfway between the two stations.

## 5.5 Travistock Square

M survivor:

„We had just left Tavistock Square when there was a very loud noise. It wasn't a bang, it was more like a dull whistling sound, even though the bus was packed and I was at the front. As I was in a kind of shelter, I didn't hear it – I saw it, but I didn't actually hear it very loudly. Everyone fled from the bus as things fell to the floor and small pieces flew everywhere. The only thing I remember is the carnage and everything hitting the floor. I remember looking at the bus and initially thinking, "What is this sightseeing bus doing here?", because that's what it looked like. From the front, it didn't look like a London bus. Now I know why, but at the time I didn't realize it. It looked like the top had been removed. Until I saw the blood and smelled that smell, I thought it was really bad. What I'm saying sounds absurd, but it was so surreal that I can't express myself properly. I see things in my head, but I can't express them in words."

At Travistock Square, it was immediately obvious what had happened. The first emergency calls came in at 9:47 a.m., one minute after the explosion. By 9:56 a.m., twelve calls had been received. By then, the first medics were already on the scene, as the bus had exploded in the immediate vicinity of the British Medical Association headquarters and doctors and other trained first responders had rushed out immediately.

A member of the police force was also at the scene by this time. The first firefighter arrived at 9:50 a.m. and the first ambulance arrived at 9:57 a.m. The records do not indicate when the three organizations declared the incident as a major incident.

## 5.6 Summary of the report for the four locations

The 'first alert' system describes how communication between the control rooms of the emergency services takes place in the event of a major incident. The 'first alert' call is a conference call involving the emergency and transport organizations. The 'first alert' system was activated at 9.12 a.m. and the first conference call took place at 9.25 a.m. Based on the evidence, the investigation concluded that the 'first alert' system needs to be further improved, as, for example, the police did not officially receive a call to the Aldgate station until 9.19 a.m., 7 minutes after the 'first alert' system was activated, or because the

significant incident at Edgware Road was not identified before the conference call took place.

# 6. Communication problems

The Gold Command Group was originally convened at New Scotland Yard and held its first meeting at 10:30 a.m., at which it was decided to relocate the group to Hendon. The new location had been used before in similar cases and was well equipped, but it had one significant disadvantage: it was far from central London, where the headquarters of the emergency services are located.

## 6.1 Use of mobile and landline phones

The incident, by its very nature, caused significant problems in communication between emergency services. Throughout the morning and early afternoon, people continuously tried to call their friends and family members. The London telephone network handled an unprecedented volume of traffic. The number of calls on the Vodafone network increased to 250% of normal, while text messages doubled. British Telecom's traffic doubled. The number of wired and wireless calls to the Vodafone and O2 networks increased tenfold – 300,000 calls every 15 minutes, compared to 30,000 on a normal working day. O2 normally handles 7 million calls, but on July 7, it had to connect 11 million calls which represents a 60% increase.

Firefighters used mobile phones to stay in contact with their headquarters, which often caused problems. The police's TETRA radio system worked well as a backup system, but only the British Transport Police had such devices.

The ambulance service also primarily used mobile phones to communicate with the control centre. In reality, official vehicles are also equipped with radios, but problems arose with their use, as will be discussed later. The system was scrapped as outdated. Today, the ambulance service uses personal pagers as a backup system.

There is a system that allows only emergency services to use the mobile phone network within a specific area in the event of an emergency. This system is called Access Overload Control (ACCOLC).[13][14] The essence of ACCOLC is that mobile phone SIM cards contain a number in the range of 0-15. For ordinary users, this number is in the range 0-9, while for higher priority users, such as emergency services, this number is in the range of 10-15. In an emergency, mobile phones with SIM cards containing numbers between 0 and 9 receive a "service unavailable" signal, and only higher-priority devices can make calls within that cell. If the system is still overloaded, the operator can further increase the priority

level (11, 12, etc.). It has to be noted that ACCOLC was replaced by MTPAS (Mobile Telecommunication Privileged Access Scheme) in 2009. [15]

The ambulance service requested the introduction of ACCOLC in the Aldgate station area because they had ongoing communication problems. However, the Gold Coordinating Group did not approve the introduction of ACCOLC because they feared that it would cause panic among people in the cell and because it was unclear whether authorized persons had ACCOLC-enabled mobile phones.

Despite this, the City of London Police activated the ACCOLC system on the O2 network in a 1 km radius around Aldgate station between 12 noon and 4.45 p.m. During this period, O2 estimated that "hundreds of thousands, possibly over a million calls" were lost.

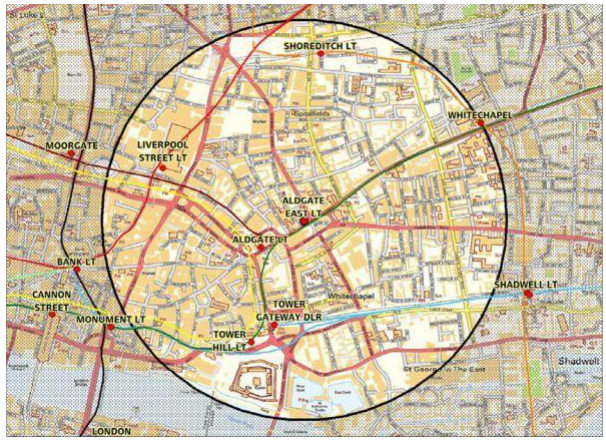


Figure 3. The area affected by ACCOLC

The report concludes that, based on the actual command and control structure, only the Gold Coordinating Group had the authority to order ACCOLC, and therefore the City of London Police would not have had the authority to implement it.

## 6.2 Communication between the Ambulance Service

The report concludes that the ambulance service personnel did everything possible under the extraordinary circumstances. All four sites were cleared within three

hours. During this time, approximately 200 vehicles and 400 employees and managers worked at the sites and 404 injured people were transported to hospital. The fact that the explosions occurred at four different points, three of which were underground, made it extremely complex and difficult to organise and implement the service's response.

The ambulance service used two separate radio systems. One was based on UHF radios and was used by control personnel to communicate with the scene, while the other was a VHF system used by emergency vehicles and key managers. The UHF communication system, which should have been used due to the unavailability of the mobile phone network, did not work. This was due to the simple fact that there were not enough devices.

The use of the VHF system was also disrupted:

a. Although two channels were used, route selection was carried out by a single operator.

b. The managers on site did not know which channel to use, as they normally receive the necessary instructions via mobile phone, but in this case the mobile system was not working.

c. The five different locations generated a very high volume of traffic, which the two channels were unable to cover.

These problems meant that personnel at the sites were often unable to communicate with headquarters. This resulted in situations where additional ambulances and equipment requested did not arrive at the scene, they were unable to contact other locations, and they were unable to receive information about which hospital to transport the injured to.

In the event of disasters and major incidents, one of the most important task is to ensure that there are enough hospital beds for the injured. The NHS (National Health Service) made 1,200 beds available within three hours. However, it is possible that alerting several hospitals located close to the scene but not equipped for acute care could have improved the standard of care. For example, Great Ormond Street Hospital was not alerted, even though it was closest to Russell Square station. Fortunately, the hospital staff still played a key role in the rescue efforts by setting up a mobile hospital. In the absence of adequate communication tools, medical students acted as couriers, carrying information back and forth.

## 6.3 Communication with persons involved in the incident

In such situations, with darkness and smoke, one of the most important considerations for passengers is to provide information as soon as possible. However, the drivers could only communicate with passengers in the first carriage, as most trains did not have internal communication devices that would

have allowed passengers and drivers to communicate, or if they did, they were damaged in the explosion. Furthermore, the explosions occurred in the second carriage, so the rear carriages were physically inaccessible to them.

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The report highlights the following shortcomings:

a. There are no emergency lights in the tunnels.
b. Lack of first aid kits in carriages and stations.
c. Lack of clearly visible safety instructions in carriages.

## 6.4 Recording details of injured and uninjured persons for subsequent communication purposes

In the event of a major incident, one important task is to record the details of those who are physically uninjured and those who are ambulatory and have already been treated, partly for the purposes of any subsequent psychiatric treatment and care, and partly to inform friends and relatives who may be looking for them. It is the responsibility of the fire brigade to transport injured and uninjured persons to a safe place. It is the responsibility of the police to record the personal details of injured persons after they have been treated and of uninjured persons at the scene. Overall, the tasks of the police are as follows:

a. providing information about what happened
b. advice on what to do
c. assistance in contacting loved ones
d. psychological assistance, if necessary
e. assistance and advice on getting home safely
f. information on where to seek help in the future
g. recording of personal data.

According to the report, the police were only able to partially meet the above requirements. For example, the first uninjured passengers left the scene immediately, and later several passengers reported that no one had attended to them. Furthermore, the London Emergency Services Procedures Manual does not specify who is responsible for setting up a reception area, and London Underground does not have information on which areas are designated for receiving passengers during the evacuation of individual stations.

A total of around 4,000 people were affected by the explosions. However, the police only have details of 946 people, meaning that more than three quarters of those affected are unknown

## 6.5 Communication to the public

During the first hour, the media received only the following official information: "go in, stay in, tune in" – loosely translated as "go home, stay at home and listen to the news". Sir Ian Blair did not hold the first press conference until 11.15 a.m., and until then only the above message was in effect.

At 9:30 a.m., a decision was made to set up an emergency hotline, and as a result, an 0870 number began operating at 1:30 p.m. Unfortunately, an incorrect connection delayed its effective operation until 4:00 p.m. In such cases, the line should be free of charge, but this number was put into operation with a charge of 10 pence per minute. The line handled 42,000 calls in the first hour. It was later decided that the income from this line would be used for charitable purposes.

In such situations, it is very important to take care of children of nursery and school age. However, schools did not receive any information about what to do in this case. Some schools decided to close and send the children home, saying that they would be safer there. There were schools that chose to extend their opening hours, as they thought that without transport, parents might not be able to pick up their children. At its first meeting at 10.30 a.m., the Gold Coordinating Group decided to advise schools to provide supervision for children until their parents could collect them. However, this recommendation only reached local schools at 1 p.m., which in many cases was too late.

Another important piece of information concerns the situation regarding public transport. On the afternoon of 7 July, several conflicting messages were released. On the one hand, the media continuously broadcast the already mentioned "go in, stay in, tune in" message, while on the other hand, the mayor stated that everything should return to normal as soon as possible.

At 10 a.m., the transport authority decided to suspend services passing through the city centre. This decision was made partly for safety reasons, as the police could not guarantee that there would be no further attacks, and partly because the road closures made it impossible to implement diversions. Bus services restarted on most routes by 5 p.m.

As a result of these events, traffic on other communication channels also skyrocketed. Visits to the official websites of emergency and transport services also increased significantly. The Transport for London website received more than 600,000 visits that day, six times its usual traffic. The company sent out more than 600,000 emails between 3 and 5 p.m. on 7 July to those who were registered in its email alert system, and more than half of these emails were read within an hour.

The police updated their website 27 times and had 1.5 million visitors during the day.

### 6.6 Following up and communication

Following the terrorist attack, the Resilience Mortuary was established as an independent organisational unit to identify the victims. It began operating at the Honourable Artillery Company in the City of Westminster (an inner city district of London). By January 2006, the operating costs of this organisation had reached £3 million. This was the first time such an organisation had been set up. The organisation began operating at 10 p.m. on 8 July, and within seven days, all of the deceased had been identified.

Those searching for their loved ones first had to go to the Casualty Bureau to officially report someone missing. To facilitate this work, the police set up a centre within the aforementioned office. The centre was named the Family Assistance Centre, which later caused several problems, as it was responsible for maintaining contact with all persons involved in the event, and several survivors concluded from the name that its only function was to search for loved ones.

The report highlights the need for post-traumatic stress treatment for both survivors and their family members. To this purpose, it would be essential to collect data on all those who may be affected. In this regard, it proposes the creation of a website where the above-mentioned persons can register and thus access treatment.

## 7. Summary and recommendations

In view of these tragic events, it has become clear which shortcomings need to be remedied as soon as possible.

### 7.1 Communication between the underground and the emergency services

O2 won the tender for the development of emergency service communications with its TETRA-based solution called Airwave.[16][17] The cost of developing Airwave was £2.9 billion, and it achieved 95% coverage in 2005. In December 2006, O2 sold the system to Guardian Digital Communications for £2 billion.

Back in 1999, an agreement was signed to build a network providing wireless communication (mobile, internet) throughout the entire underground system by 2010. The system, named CONNECT Project, also offers a TETRA-based

solution. The design, construction and maintenance costs will reach £2 billion over a 20-year period. The system will be able to serve both mobile phones and the Airwave system. The report specifically mentions accelerating the rollout of this system, with a deadline of the end of 2007. The system finally fully operates from November 2008. [18]

A report published by Transport for London in 2018 states that a new, more modern system could be installed to replace the London Underground's outdated TETRA system by mid-2030 at the earliest. Several refurbishment projects will need to be carried out to keep the Connect system stable and secure until mid-2030. These projects will involve upgrading the current hardware and software components. [19]

The report also states that the three data networks currently in operation must be replaced with a new data network called FON (Future Operational Network). This must be designed in such a way that it can safely serve the various operating services alongside the currently operating TETRA system. The introduction of FON requires capital investment that will enable its deployment within 2.5 years

## 7.2 Other recommendations

The communication shortcomings mentioned earlier — e.g. reviewing the privileges of the London Underground Emergency Response Unit, how to declare a major incident and activate ACCOLC, closer cooperation with the media, recording the details of those involved, etc. — necessitate a review of procedural protocols. The report contains a total of 54 recommendations for remedying minor and major errors in the future.

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