

2.3. New remote services

2.3.4 Ways of using mobile telephones by people with dementia

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Dementia conditions

Dementia is the name of a number of symptoms of malfunctions in the brain. There are several forms of dementia; the most frequent is Alzheimer's disease. Other causes of dementia are blood clots and brain haemorrhages, Parkinson's disease, alcohol abuse, etc.

Some forms of dementia can be cured, medicine can delay the development of certain forms, but in the majority of cases, the illness worsens during the course of a few years.

Dementia shows itself primarily with failing memory and reduced ability to function in day-to-day life. Problems with concentration, arithmetical skills, sense of locality and language appear as well. Dementia develops gradually into serious problems of managing daily life. In the concluding phase, the majority of dementia sufferers will completely lose the ability to live in their own homes and must live in a nursing home.

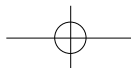
In Western Europe and North America the number of people with dementia is expected to increase due to the rising life expectancy. The older you are, the greater the risk of developing dementia.

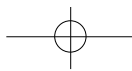
In Denmark, which has a population of approx. 5.5 million, there are approx. 40 000 persons with medium to severe dementia. The annual costs today of dementia in Denmark are estimated to be approx. 2.3 billion euro.

Due to the population's rising life expectancy, it is expected that society's costs for dementia will increase markedly in coming years.

Mobile technologies

At the moment, there are a number of mobile technologies that are relevant in relation to being able to offer solutions that can help people with early-stage dementia to live longer in their own homes in a dignified manner:





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1. Mobile communication with the help of GSM has the affect that the user with aphasia outside the home can come into contact with relatives and care personnel and vice versa, either via verbal communication or by text or symbol communication.
2. Positioning with the help of GPS positioning equipment can inform the user, the relative or care personnel about the user's position.
3. Various applications are realised on an SMS server which the user, relatives or care personnel have access to and which offers various services.

A number of the solutions which are used today in connection with people with dementia are also used by the transport and security sector and by ordinary consumers. This entails that the prices of equipment and services are often favourable.

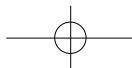
What problems can be solved or limited by using mobile technologies?

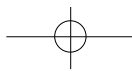
With the help of mobile technologies, different solutions and services are developed which are relevant in relation to providing help to the user with dementia to function more independently and with greater safety:

1. *Help to structure daily life for people with dementia:*
(daily plan, reminder, feedback)
2. *Help to find his/her way around*
3. *Remote vocal communication when the need arises*
4. *Finding and tracking a user*
5. *Alarm/reminder when a specific geographic area is vacated*
6. *Combinations of points 1 - 5.*

The users' needs

1. Many users with early-stage dementia need help and support to live a good and dignified life in their own residences. With the right support it will be possible to extend the time the user can remain living in his/her own residence.
2. Spouses and relatives need relief and to reduce their uncertainty and nervousness due to the family member with dementia.





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3. Personnel at nursing homes need a tool, which, with a minimum amount of effort, makes them able to ensure that the demented patient does not disappear or have an accident.

Examples of solutions and products

1. Thought, structure and memory support

Comai (www.comai.se) is a new product developed in Sweden that can function on Symbian-based mobile telephones. The system helps the user structure his everyday life by giving the user a reminder about things that must be done (take medicine, get up, do shopping, etc.). The reminder is shown on the mobile telephone with a picture, text and sound. It can be individually set if the user must acknowledge after the activity has been completed or begun, and an alarm can be sent to relatives if the system does not receive the acknowledgement.

Via a website, the user can alone or together with a relative, organise activities in the system's calendar which is placed on an SMS server.

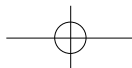
In technical terms, the system comprises an SMS server which communicates with the connected mobile telephones. The messages are managed between the SMS server connected to the Internet via a computer and the mobile telephone in a two-way communication.

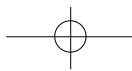
The mobile telephone can at any time be used in the usual manner.

2. Help to find the way

X-road Navigator (www.x-road.com) is a user-friendly GPS navigation system, which functions on hand-held units (PDA or navigation unit) in combination with the unit's integrated GPS receiver or an external cable, Compact Flash, SD or Bluetooth GPS receiver. The unit with X-road Navigator can be fitted in the car for navigation whilst driving, but it can also be used outside of the car as a digital map or as a hand-held navigator. If one is a pedestrian or a cyclist, the system takes pedestrian and one-way streets into account and shows the nearest pedestrian and bicycle routes.

Furthermore, X-road Navigator provides the option of receiving a position from another person via a text message. The function is only available if you have a PPCPE unit (Pocket PC Phone Edition).





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To be able to transmit a position, the sender must also have a PPCPE unit, which runs X-road Navigator. The text message will contain a position to which you can navigate.

Beforehand, the user or a relative can code in the address of the place the user is to visit. With the help of the map and directions on this as well as synthetic vocals it can guide the user to the destination. A new address can be sent via the navigator.

3. Vocal communication when the need arises

Many persons with early-stage dementia will feel secure by having the possibility of talking with relatives and possibly asking for help when they are outside of the home. The relatives will be given better opportunity to support the user and at the same time be able to carry out the daily tasks unhindered.

Many people with dementia in the early stages of the illness can benefit well from normal mobile telephones.

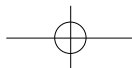
Many will gradually have difficulty in managing and operating ordinary mobile telephones.

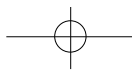
Soneco CC (www.soneco.fi) is a specially designed GSM mobile telephone, which is very simple to operate for persons who have reduced cognitive functions, including people with dementia.

The user interface of the telephone comprises only one button and three lamps with different colours. The three lamps represent three pre-programmed numbers which the user can remember with the help of the colour. Calls and the answering of calls are done by pushing the button.

Another option is to use Philiphone 4 (www.bertlandpihl.se), which is fitted with only 4 large buttons that can be marked with either a name or a picture of the person who has the pre-programmed number. Calls to the telephone are answered by pushing one of the 4 buttons.

The telephone comprises an ordinary standard telephone of the type Sony Ericsson T290, Sony Ericsson K300i as well as some older Sony Ericsson models which are fitted into a special cover and connected to the 4 buttons.





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4. Find and track user

Today there are a number of units from various manufacturers that are able to track and find the position of a person carrying the equipment concerned. There is a GSM modem and a GPS receiver built into the unit.

The equipment's position can, at any time, be notified by sending an enquiry – from a mobile telephone – about the equipment's position via a special SMS server. After a few seconds, the equipment's exact position, street name, house number, etc. is received or the distance and direction from the nearest address.

The position can also be notified by connecting to the system's website and enquiring on the position of a given unit. After a few seconds, a section of a map is shown with information about position and appurtenant address.

Furthermore, the equipment can be supplied with an emergency button. If the button is activated, relatives or personnel will immediately be informed and notified of the equipment's position and address.

Micro-Tracker (www.safelink.dk) is an example of such equipment.

Some of the equipment can combine the tracking function with two-way GSM communication.

Over and above a pre-programmed emergency number, Safelink s-911 (www.safelink.dk) has two call-up buttons for pre-programmed numbers.

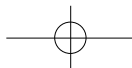
There is also equipment that contains automatic alarm functions which entails an alarm being sent if the equipment is positioned horizontally for a longer period. In this way, a fall for example can be registered so that the situation can be dealt with immediately.

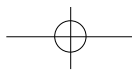
Lommy (www.lommy.com) is an example of such equipment.

5. Alarm/reminder when a specific geographic area is vacated

It is often appropriate if the user can freely move about within a given area. This could be a nursing home and its surroundings or a local area known to the user (neighbourhood). If the user leaves this area, it is necessary for an alarm to be sent to the nursing home personnel or relatives.

The SMS server from Safelink (www.safelink.dk) contains the option of setting up a "fence" on a selected map in the system. If the user of a given unit moves outside the specified "fence", an alarm is set off.





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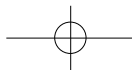
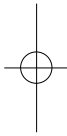
Research

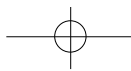
The utilisation of mobile technologies to help people with dementia is relatively new. This means that only very few validations have been conducted of the utilisation value of the new solution.

However, experience that has been gained until now shows that the users, the relatives and nursing home personnel are very satisfied with the new possibilities that are made available and the utilisation is gaining ground.

It will however, be necessary – through further research – to clarify in more detail how the new solutions must be used and how they have the greatest value in relation to alternative solutions. In this way a greater certainty is achieved that the solutions suit the users' needs, are ethically responsible and have a reasonable economy in relation to alternative solutions.

It is expected that in line with the development of new generations of mobile services and terminals with strongly increased data transmissions and data processing capacity, it will be possible to develop new equipment and services that can further support people with dementia in living a good life and reducing the costs for care in the future.





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2.3.5 Implementation of an SMS-based emergency service in Finland

*FICORA-Working group for emergency communications
Drawn from report, published by FICORA*

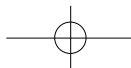
This section is drawn from the FICORA Working Group report for emergency communications, a full version of which can be found at [FICORA, 2005]. It describes a system where the universal emergency number 112 is easily and reliably accessible also by means of a text message within the technical restrictions of the service. The system is intended for users with a disability (such as people with a hearing impairment), but it may be useful for anyone in an emergency situation. In this system all 112 emergency text messages are routed to one centralised answering point. The centralised answering point sends an acknowledgement message and locates the mobile telephone by means of the positioning system for emergency calls. The emergency response centre appointed as the centralised answering point may deliver the 112 emergency text message or corresponding information to the nearest emergency response centre on the basis of the location data.

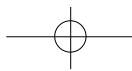
2.3.5.1. Foreword

The directives on electronic communications, which in Finland have been implemented through the Communications Market Act, include a requirement that people with a disability must have access to emergency services equivalent to that enjoyed by other users. This is also one of the key topics of the European Union's INCOM¹ working group. The Finnish strategy for accessible communications, which has been through public consultation, contains several recommendations, one of which was to adopt an SMS-based service for the emergency number 112 by the end of 2005.

An SMS-based service for 112 is not a new issue as it has already been one of the targets of the Ministry of the Interior for the last decade. Until now, deaf and hard of hearing people have been able to make emergency calls by means of text telephones and by sending text messages to separate mobile telephones placed with the individual emergency response centres. The numbers for these mobile telephones were only given to those requiring the service among users with a disability. From 2002, the Emergency Response Centre Administration has prepared the transition to a national emergency response service based on text messages. In this system, planned to be introduced in 2007, the general emergency

¹ INCOM stands for Inclusive Communications.





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number 112 is easily and reliably accessible also by text messages. The service is expected to help all people in emergency situations, not only users with a disability.

The 112 short message number was reserved for emergency purposes in the short message numbering scheme of the Finnish Communications Regulatory Authority (FICORA) some time ago. Also, barring of calls to the general emergency number 112 is prohibited through FICORA's regulations. SMS to 112 required some adjustments to the regulations.

2.3.5.2. SMS-based emergency services elsewhere in Europe and the development of standards

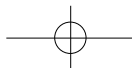
There are no European standards for emergency text messages. The propositions of this report are based on the normal SMS-based service. For solutions exceeding the presented basic solution it is important to follow corresponding projects in other countries as well as the development of standards.

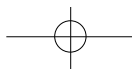
Since 2003 the National Post and Telecom Agency in Sweden (Post- och telestyrelsen, PTS) and the operator of the emergency service in Sweden (SOS Alarm Sverige) have evaluated emergency alarms to 112 via SMS in a study and trial project. Since October 2006 the possibility to send SMS to the emergency number 112 has been launched as a service during a two year period and it is available for people with disabilities.

2.3.5.3. Practical implementation of a SMS-based emergency service in Finland

Basic solution

If emergency text messages were always routed directly to the nearest emergency response centre, short message service centres and possibly also other network elements would require additional functionalities. Therefore, direct routing does not seem to be a technically and economically feasible solution. Instead, it seems that the best way to handle 112 emergency text messages is to route all messages to one specified answering point where the calling mobile telephone is located by means of the positioning system for emergency calls. The emergency response centre, which is to be determined later as being the answering point, then submits the emergency text message or corresponding information to the emergency response centre nearest to the sender on the basis of location data.





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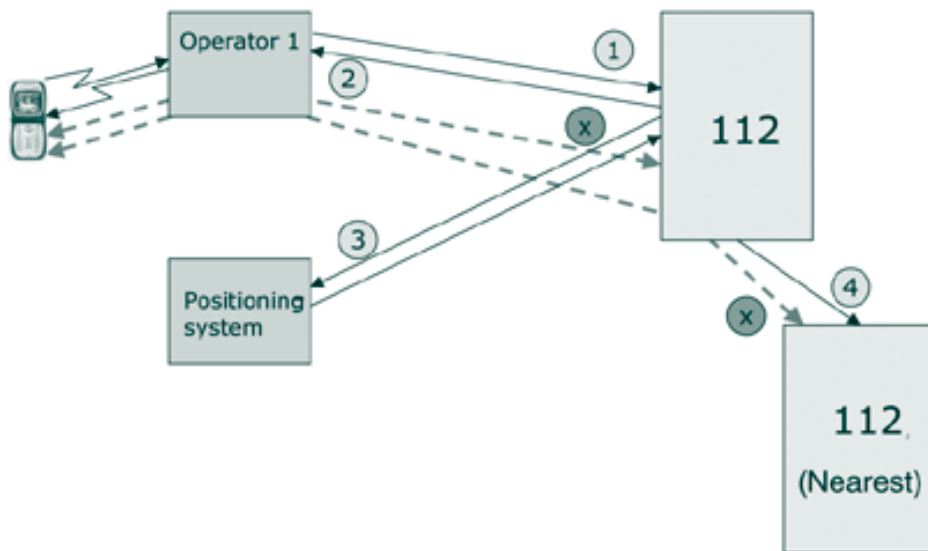
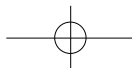
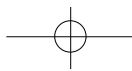


Figure 2.31. Basic solution for the SMS-based emergency service

1. Transfer of the 112 emergency text message to the centralised answering point.
 2. Acknowledgement message from the answering point.
 3. Location of the sender.
 4. Transmission of data to the emergency response centre nearest to the sender.
- x. Possible text message conversation between the emergency response centre and the sender (may take place in two phases).

The Emergency Response Centre Administration will designate the centralised answering point. This centralised model may be adopted, provided that the answering delay will not be too long. It is possible to keep the answering delay at a moderate level, when the first acknowledgement message is sent from the centralised answering point as soon as the sender of the emergency message is located. The new positioning system for emergency calls adopted at the beginning of 2005 will enable the location to be identified. To keep the delays short, it is appropriate to integrate the reception of 112 emergency messages and other related activities into the general emergency centre system. The situation can be further clarified through a text message conversation between the centralised answering point and the person needing emergency help. From the centralised answering point the emergency text message or related information can be transmitted to the emergency response centre nearest to the person needing emergency help. For the conversation between the nearest emergency response





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centre the person needing emergency help, some other number than 112 must be transmitted in the answering message from the nearest emergency response centre.

Restrictions in the SMS-based emergency service

Common restrictions or problems that may occur in the SMS-based emergency service are described below.

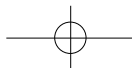
The normal SMS-based service may be unreliable and slow:

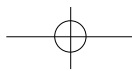
- *Text messages are transmitted via the network rather reliably, operators estimate that reliability exceeds 99%*
- *Also when a message is not transmitted to the receiver, the reason for this is usually found in the terminal equipment*
- *Operators estimate that the average delay for text messages is 2 seconds, thus problems may occur in some special situations, such as mass voting.*

Text messages to 112 are barred in the cases described below:

- *Barring of All Outgoing Calls (BAOC) is activated. It bars not only calls but also text messages. The subscriber can activate this function on his or her telephone*
- *Barring of All Incoming Calls (BAIC) is activated. It bars not only calls but also text messages (this means that it is not possible to receive the acknowledgement message from the centralised answering point). The subscriber can activate this function on his or her telephone*
- *Operator Determined Barring of Outgoing Calls (OBO) is activated. It bars also text messages. The service operator may activate this function, for instance, when the limit for the call balance is reached²*
- *The limit for the prepaid account balance is reached (note: some operators support free-of-charge SMS services, which means that also the SMS-based emergency service may be free and the service may be used although there is no balance for the prepaid account)*
- *The SIM card is missing*
- *The caller is in a shadow region of his or her own operator's network*

² FICORA Regulation number 35 on barring categories in telecommunications contains the following point: "Traffic to the general emergency number 112, emergency number for the police 10022 and the operator's number for fault reports shall not be barred with any category". This applies also to text messages.





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- All radio channels are busy in connection with mass events.

Foreign roaming customers cannot use the service as text messages are routed to the short message service centre of these customers' home network.

Malicious messages are possible.

Tracing malicious messages becomes easier as the emergency response centre can see the number of the sending mobile telephone and locate the mobile telephone of the person needing emergency help.

Malicious messages are, however, not regarded as a serious problem for the emergency response centre when they are sent via the Internet, anonymously or with a fault calling line number, as such sending is only possible towards a mobile telephone.

Working group's proposal for solution

The working group suggests that the SMS-based 112 emergency service be implemented according to figure 2.32. If the text message conversation is also implemented between the sender of the emergency text message and the nearest emergency response centre, the implementation takes place according to figure 2.33.

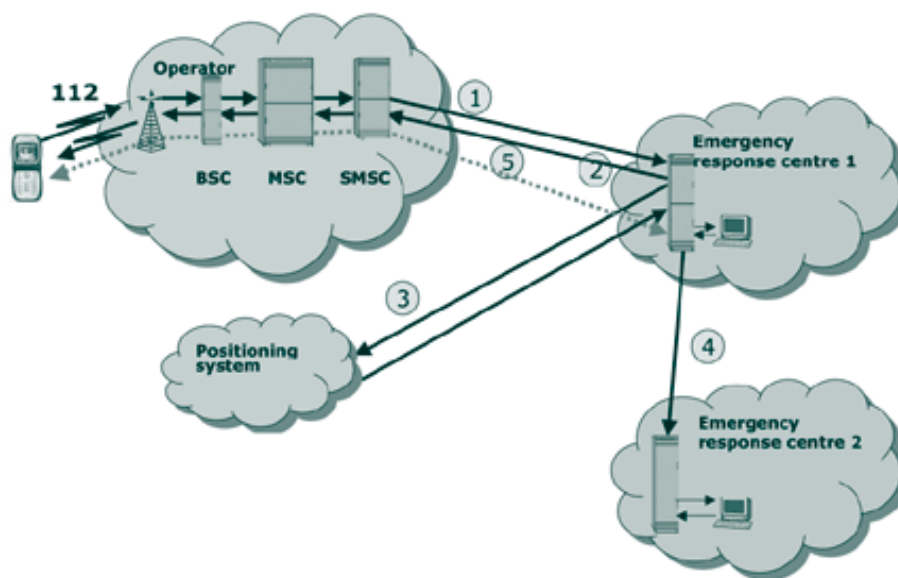
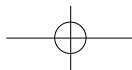
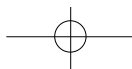


Figure 2.32. Implementation of the SMS-based 112 emergency service (possible text message conversation only from the centralised answering point).





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1. Transfer of the 112 message to the centralised answering point.
2. Acknowledgement message from the answering point.
3. Location of sender.
4. Transmission of data to the emergency response centre nearest to sender.
5. Possible text message conversation between the duty officer at the answering point and the sender.

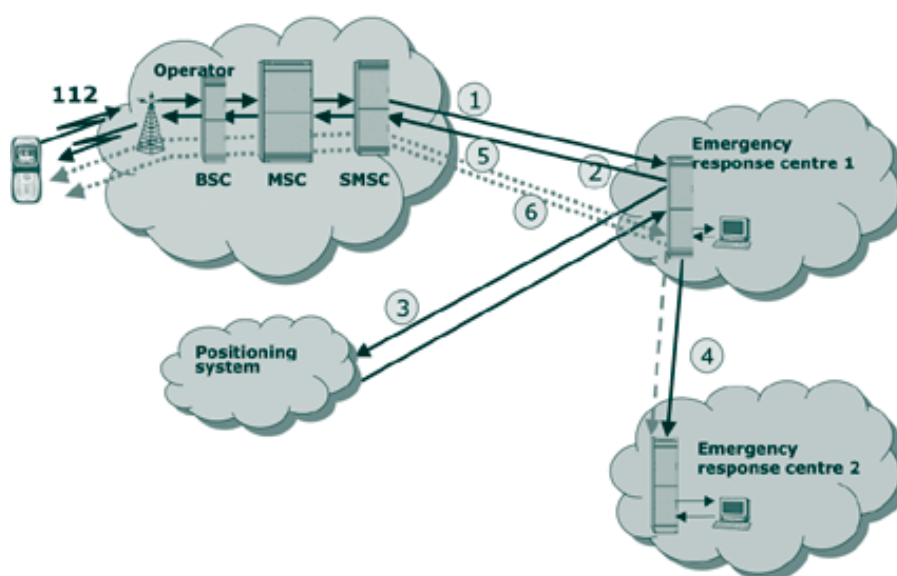
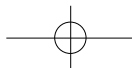
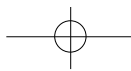


Figure 2.33. Implementation of the SMS-based 112 emergency service (possible text message conversation also from the nearest emergency response centre).

1. Transfer of the 112 text message to the centralised answering point.
2. Acknowledgement message from the answering point.
3. Location of sender.
4. Transmission of data to the emergency response centre nearest to sender.
5. Possible text message conversation between the duty officer at the answering point and the sender.
6. Possible text message conversation between the nearest emergency response centre and the sender.





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2.3.5.4 Costs for the provision of emergency text messages and call itemization

Users can send emergency text messages to 112 free of charge and text messages to 112 must not be included in the call itemization of a bill. These requirements are based on section 55 of the Communications Market Act (393/2003), which states that users must be able to access the universal emergency call number 112 free of charge. According to the preamble to the Act, this means calling an emergency number or, for instance, sending a text message to an emergency number, if it is technically possible, or some other technical way to connect an emergency number which may be provided in the future. According to section 24 of the Act on the Protection of Privacy in Electronic Communications (516/2004), a call itemization for a subscriber connection may not contain identification data for services for which no fee is charged.

The acknowledgement message of an emergency text message can be compared to call back, which in some cases is used in connection with a normal emergency call. This call-back is a normal call for which a fee is charged, and therefore also the acknowledgement message is a normal chargeable text message.

In a text message conversation, messages sent to 112xx by the person needing help are also emergency text messages for which no fee is charged. In a text message conversation, the emergency response centre's messages to a normal subscriber number are text messages for which a normal fee is charged.

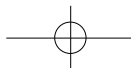
According to FICORA's interpretation, the emergency response centre does not pay compensation to operators for those 112-calls which are cost-free for users. The same principle applies to 112 emergency text messages.

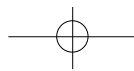
The emergency text messages are routed from each operator's short message service centre directly to the emergency response centres' centralised answering point, which means that there will be no inter-operator text message fees. If, however, such costs should occur, the operators must mutually agree upon them.

2.3.5.5 Implementation and maintenance costs

Costs for the implementation and maintenance of the SMS-based emergency service are mainly composed of four parts:

- 1. changes that operators must make for routing 112 text messages to short message service centres – the working group sees that these costs form a part of the normal operation costs and do not cause any additional costs*





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2. *transmission connections from short message service centres to the centralised answering point. The aim is to use existing (IP) connections between the emergency response centres and the operators, but costs may occur for VPN specifications; if there are no usable connections they must be acquired*

3. *acquisition and maintenance of receiving interface and/or adaptor at the emergency response centre (update as necessary, probably not very frequently)*

4. *personnel costs at the emergency response centres (training, etc.).*

Items 1 and 2 involve costs which may be compensated to operators. As stated above, item 1 does not cause any costs. Item 2 causes some costs which, however, can be defined more precisely

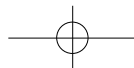
after the Emergency Response Centre Administration decides which transmission connections are adopted and selects the centralised answering point.

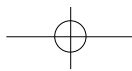
Costs incurred of items 3 and 4 are emergency response centres' own costs and the Emergency Response Centre Administration is the most aware of these costs. Costs for item 3 depend on the solution decided by the Emergency Response Centre Administration (interface software as part of the emergency response centres' own system / separate adaptor).

2.3.5.6 Implementation schedule

The first phase includes: transmission of the 112 emergency text message to the centralised answering point, acknowledgement of the emergency text message, location of the mobile telephone, and transfer of information to the nearest emergency response centre, where necessary. For text message conversation, the schedule is open and a more precise schedule can be done only after the first phase has been put into practice.

From the operators' point of view, the implementation in this time frame was regarded as realistic at the time this report was published. Question about the interface/adaptor implementation requires fast decision-making on the technical details at the Emergency Response Centre Administration.





2.3. New remote services

2.3.5.7 Further development

The first-phase implementation contains some restrictions and problems, but some of them may be abolished in the longer term. Some of the restrictions and problems require that amendments are made to international standards or other international agreements. FICORA's working group for emergency communications follows the international development both in standardisation and in other countries' solutions (e.g. Sweden) and contributes to international development as necessary.

The following list contains those restrictions and problems that have been discovered for the first phase:

- *reliability and delays of 112 text messages*
- *effect of barrings on 112 text messages*
- *other reasons that prevent the sending of 112 text messages.*

routing of 112 text messages in special cases (foreign roaming customers in Finland – the messages are routed to short message service centres of these customers' home networks; Finnish roaming customers abroad – the messages are routed to short message service centres of these customers' home networks and from there to the centralised answering point in case of those operators that take part in the SMS-based emergency service);

service operators who provide short message services to Finnish customers but whose short message service centre is located abroad and who do not want to join the system (such cases are not known for the time being, but may occur in the future) dimensioning/expansion of the system in case of a dramatic increase in the use.

2.3.5.8 References

FICORA, (2005). Implementation of an SMS-Based emergency service in Finland ficora.fi/englanti/document/WGReport022005.pdf.

