# SUCCESS RATE AND ACCURACY OF THE INCIDENT INFORMATION IN RURAL AREAS

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## ABSTRACT

The aim of the study was to evaluate the current state of the incident information management in two provinces in Finland. An incident was defined as an unexpected event on a public road that disturbed traffic for more than half-an-hour. The information exchange chains were studied from the first emergency call to the time of the radio broadcast. Drivers had been informed on most of the incidents lasting over two hours. Information on incidents shorter than that had been given very seldomly. The more the incident disturbed traffic the better it was reported. However, drivers were informed on traffic incidents slowly.

## INTRODUCTION

Drivers certainly prefer to know that something is being done about the incidents that affect them. 40% of the drivers want to get information on congestions and incidents on their frequent journeys (1). It is especially important to receive information on alternative routes and the duration of the delays. The causes of the incidents are less important. However, when using for example RDS-TMC (RadioData System-Traffic Message Channel) service as information dissemination media, drivers prefer the order in which the cause is followed by the consequence (2).

In Finland authorities agreed on their roles in national traveller information in 1995. According to this agreement the police, the Finnish road administration (Finnra) and Finnish broadcasting company (YLE) have the active roles. Police and Finnra are responsible for collecting information as fast as possible on all incidents that affect traffic by endangering traffic safety, or creating delays or other inconveniences. Information should be delivered to Finnra's traffic management centre (TMC) where the information from different sources is combined and transmitted to YLE and possibly also to other media for further dissemination.

Finnra's current aim is to inform drivers if an incident is expected to last longer that 30 minutes and if it delays traffic more than 10 minutes or might cause secondary accidents. Finnra's traffic management policy (3) indicates that incident management is one of the most important traffic management functions. In their vision different quality criteria are defined for different road types and traffic environments. For example drivers should be informed on every incident on motorways or on main highways lasting more than 15 minutes in 10 minutes in daytime (6AM - 7PM) and in 30 minutes in night-time. In daytime the re-routing or the site clearance should be done in 20 minutes. Drivers should be informed about incidents on other roads lasting longer than 30 minutes in daytime in 20 minutes and in night-time in 40 minutes.

The current quality criteria had been a Nordic consensus, which was based on a common view about feasibility and acceptability of the incident management operations. However, the actual state of the Finnish incident management operations was unknown, so it had been very difficult to evaluate the real feasibility and appropriateness of the desired quality levels. Hence, the aim of this study specifically, was to evaluate the current state of the incident information. It was measured by the number of incidents in one year, by the number of the incidents that had been informed on, by the type of the incidents that had been informed on, and by the times how fast the TMC's received the incident information, and how fast the drivers were informed of incidents.

# METHOD

## DATA BASES

Information on traffic incidents is collected by many authorities and saved to different databases and records. Most of the emergency calls were made to the general emergency number 112, but phone calls were made also to the police's own number 10022. Information on these phone calls and the rescue services on the site is saved either to the fire department alarm database or to the police alarm database or to both in the case the both authorities were involved. In addition, the police has a database about its accident reports, traffic management centres have a database containing information on their traffic reports and Finnish broadcasting company collects information on their traffic reports.

The national database has information on every phone call that police receive. Data is coded so that events involving traffic can be identified. These cases are classified by traffic mode and by the severity of the accident or by the duties of the police. Every event is described as follows: time of the emergency call and the name and the phone number of the caller; alarm time, departure time, site arrival time, and operation time by unit; address and location of the event; short description of the event.

The national database has information on every event where the fire department has been involved. The events are classified by province and time, and also by the type, which make the selection of traffic related events possible. Every event is described as follows: time of the emergency call and the name of the caller, alarm time of the units, departure and site arrival times of the first unit, base arrival times of the units, address and location of the event, short description of the accident (not compulsory), and a description of the work of the units.

The police reports all traffic accidents that it has been informed of. These reports consist the time and the location of the accident and a free-form description of the accident. Finnra receives and saves these reports.

Finnra's TMCs have a common database for traffic related reports they receive and send. Operators study and sometimes discuss the reports with other authorities and create a traffic report for the media if the incident is assumed to last longer than 30 minutes. Normally two reports on one incident are done: the first announcement and the site clear announcement. Traffic reports include the following data: short description of the incident, location of the incident, description of the traffic control at the site, estimated duration (if available).

Finnish broadcasting company (YLE) has no responsibility for keeping record of its broadcasts. However, YLE saves most of the incident reports, which it receives from Finnra by fax. These papers have time stamp of the fax machine showing the arriving time to YLE. Usually, the radio journalists write on the papers the time, when the report is given in radio.

## FILTERING AND MATCHING THE DATA SOURCES

In this study, an incident was defined as an unexpected event on a public road that disturbed traffic for more than half-an-hour. The smallest public roads and urban streets were excluded. The studied period was one year (March 2001 - February 2002). Two provinces located in the southern Finland were chosen for this study: In both provinces the road network consists mostly on undivided rural highways on which the average daily traffic seldom exceeds 10 000 vehicles. Population in the both provinces is almost 0.5 million and is concentrated on one bigger and several smaller urban areas. However, the chosen provinces have also differences. Varsinais-Suomi is more dense populated and has more municipal centres. Its road network is smaller-scale. In Pirkanmaa, Finnra and the emergency call centre have co-operated for many years whereas Varsinais-Suomi has four emergency call centres and no co-operation agreements. Finally, although of little scientific value, the anecdotal cases had illustrated that the success rate and the accuracy of traveller information would have been lower in Varsinais-Suomi. Table 1 describes the main statistical differences of these areas.

Databases and sources were matched manually. The fire department database was the most extensive and was also in table format where as all police databases where in letter format. After a manual filtering it used as a basic database. Also other databases were searched manually and events in different databases were matched by using location and time information and event descriptions.

| Province | Varsinais-Suomi | Pirkanmaa |
|---|---|---|
| Population | 449 293 | 450 745 |
| Area [$km^2$] | 10 855 | 14 292 |
| Population in urban areas [%] | 79 | 81 |
| Length of public roads [km*] | 1 150 | 1 551 |
| Length of divided public roads [km] | 138 | 189 |
| Traffic performance [mill. veh. km /year] | 1 937 | 2 362 |
| Average daily traffic | 4 615 | 4 172 |
| Injury or fatal accidents [nr of accidents / year] | 217 | 222 |
| Accident density [nr of acc. / 100 road km] | 18,9 | 14,3 |
| Accident rate [nr of acc. / 100 mill. vehicle km] | 11,4 | 9,6 |
| Number of emergency call centres | 4 | 1 |

**Table 1. Characteristics of the two studied areas (road network included in this study).**

## CLASSIFICATION OF THE CASES

The cases were classified by their duration and severity. The following four duration classes were created: less than 1 hour, 1-2 hours, 2-4 hours, and more than 4 hours. According to the severity, cases were divided into two groups. In the first group the road had been closed for

traffic at least for some time, in some cases a detour had been organised, in the second group the traffic was able to pass the site along one lane at least.

# RESULTS

Altogether 237 incidents were found fulfilling the requirements set (Table 2). The number of the cases where the road had been closed for traffic was small. The share of the road closures was larger the longer lasting the incidents were. However, the number of total incidents was smaller the longer lasting the incidents were.

| Duration [h] | Road closure | Incidents in Pirkanmaa | Incidents in Varsinais-Suomi |
|---|---|---|---|
| More than 4 | Road closed | 6 | 3 |
| | Road not closed | 3 | 3 |
| | *in total* | *9* | *6* |
| 2-4 | Road closed | 9 | 8 |
| | Road not closed | 8 | 7 |
| | *in total* | *17* | *15* |
| 1-2 | Road closed | 7 | 4 |
| | Road not closed | 25 | 38 |
| | *in total* | *32* | *42* |
| ½-1 | Road closed | 4 | 4 |
| | Road not closed | 48 | 60 |
| | *in total* | *52* | *64* |
| *In total* | | *110* | *127* |

**Table 2. Incident numbers by duration and severity**.

Information on an incident was broadcasted better the longer lasting the incident had been (Table 3). Information was given on 87% of the incidents lasting more than 4 hours, but if the incident had lasted less than an hour the information percentage was only 11. Incidents that coused road closures seemed to be better informed on than others. Incidents in Pirkanmaa were more frequently (38%) announced about than those in Varsinais-Suomi (17%).

The TMCs had given traffic reports on most of the incidents they had received information on. In most of the cases of the missing traveler information the reason was that either police or fire department never informed the TMC on the incident.

Authorities were informed on the accidents mostly (86%) by private persons. In rest of the cases, the informant was either other authority or unknown. As most of the calls were done by mobile phones (according to the phone numbers) and the mobile phone penetration rate in Finland is around 90 per cent (4), it can be assumed that the first call had been given as soon as the incident happened or disturbed the first bypassing vehicle.

| Duration [h] | Road closure | Informed incidents in Pirkanmaa [%] | Informed incidents in Varsinais-Suomi [%] |
|---|---|---|---|
| More than 4 | Road closed | 100 | 67 |
| | Road not closed | 100 | 67 |
| | *in average* | *100* | *67* |
| 2-4 | Road closed | 89 | 63 |
| | Road not closed | 88 | 86 |
| | *in average* | *88* | *73* |
| 1-2 | Road closed | 56 | 50 |
| | Road not closed | 16 | 8 |
| | *in average* | *25* | *12* |
| ½-1 | Road closed | 100 | 25 |
| | Road not closed | 8 | 2 |
| | *in average* | *19* | *3* |

**Table 3. Percentage of incidents informed to travellers.**

Fire department's units received the information on an accident on the average 2 minutes after the emergency call and arrived to the site 10 minutes later. The police received the information on average in 4 minutes and arrived to the site 13 minutes later. However, it varied from case to case which authorities were present. On average, the first authority was at the site 13 minutes after the first emergency call and there were no differences between the provinces, neither according to the severity or the duration of the incident. (Table 4.)

| Operating times [min] | | | Fire dept. is alarmed | | Police is alarmed | | Fire dept.'s travelling time | | Police's travelling time | | 1st unit at the site after the call | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | P | V-S | P | V-S | P | V-S | P | V-S | P | V-S |
| Incident duration [h] | More than 4 | minimum | 1 | 1 | 1 | 2 | 12 | 7 | 4 | 13 | 11 | 9 |
| | | maximum | 9 | 4 | 4 | 5 | 21 | 12 | 26 | 23 | 34 | 21 |
| | | median | 2 | 3 | 2 | 3 | 16 | 12 | 11 | 18 | 21 | 16 |
| | 2-4 | minimum | 1 | 1 | 1 | 1 | 9 | 6 | 2 | 4 | 1 | 8 |
| | | maximum | 8 | 4 | 28 | 13 | 18 | 19 | 41 | 38 | 43 | 32 |
| | | median | 2 | 2 | 2 | 4 | 11 | 10 | 7 | 15 | 16 | 12 |
| | 1-2 | minimum | 1 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 4 | 4 |
| | | maximum | 8 | 28 | 20 | 33 | 12 | 30 | 148 | 64 | 156 | 69 |
| | | median | 2 | 2 | 3 | 4 | 8 | 12 | 12 | 15 | 13 | 14 |
| | ½-1 | minimum | | 1 | 1 | 2 | 3 | 2 | 1 | 1 | 2 | 3 |
| | | maximum | | 7 | 28 | 12 | 17 | 29 | 93 | 44 | 95 | 52 |
| | | median | | 2 | 3 | 4 | 9 | 7 | 14 | 13 | 13 | 11 |
| *median in total* | | | *2* | *2* | *3* | *4* | *9* | *10* | *12* | *14* | *14* | *13* |

**Table 4. Authorities operating times after the emergency calls (P = Pirkanmaa, V-S = Varsinais-Suomi).**

Figure 1 shows the information transmission times of some cases in which the information transmission was found at least to TMC. Authority alarmed is the time it took to inform the first, either police or fire, unit on the incident. Unit on the site shows the time it took before the first authority was on the incident site. Police's report is the delay from the first unit's

arrival until TMC received the information. TMC's report shows the time from receiving of information to TMC's report. Report to radio is time between the TMC's report is completed until it was received at YLE. Radio broadcast denotes the time took in YLE until the report was broadcasted.

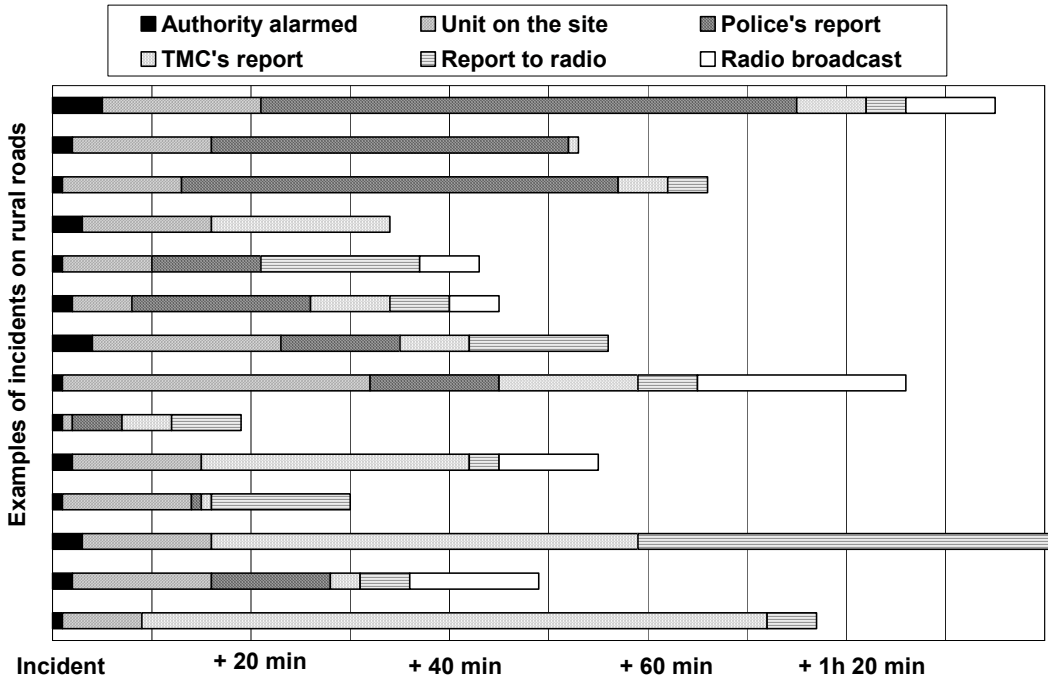


**Figure 1. Examples of authorities' alarming and travelling times to the site and information transmission times.**

The data showed that most of the incidents occurred on high-class roads (mostly undivided rural highways between the biggest cities), so according to the Finnra's vision the information on them should have given 20 minutes faster. The authorities came to the incident site on average in 13 minutes. However, already this time is longer than Finnra has set in its vision for the traveller information delay on high-class roads in daytime. In daytime the processes were faster than in nighttime and in Pirkanmaa faster than in Varsinais-Suomi. (Table 5.)

Out of those incidents, from which information was transmitted to drivers, approximately 2/3 was found in every database. On average (median), TMCs had completed the traffic reports 31 minutes after the emergency call and drivers were able to receive the information through radio in 43 minutes. However, the spread both in the duration and its components was large (Figure 1). The shortest transmission ranged from only couple of minutes to more than 80 minutes.

| | Current aim | Vision | Current state |
|---|---|---|---|
| Duration of an incident that should be informed to drivers | > 30 minutes | > 15 min (important areas)<br>> 30 min (others) | > 4 h (87 %)<br>2–4 h (81 %)<br>1–2 h (18 %)<br>0.5– 1 h (10 %) |
| Duration of the information delivery | | important areas:<br>Day 10 min, Night 30 min<br>others:<br>Day 20 min, Night 40 min | Pirkanmaa:<br>Day 30 min, Night 48 min<br>Varsinais-Suomi:<br>Day 50 min, Night 53 min |

**Table 5. The current state and the vision of incident information.**

# DISCUSSION

Today the drivers are informed on most of the long-lasting incidents and on the incidents that cause road closures. The short-lasting incidents are seldom informed. However, even if the long-lasting ones are informed about extensively they are seldom informed about fast enough.

The results showed that Finnra's vision is not feasible unless the incidents can be confirmed faster. Today the confirmation is done by an authority on the site. It is reasonable to assume that neither police nor fire department could reach the site faster than they do today because of the existing distances. However, in many cases TMC received the incident information really slowly even if authorities were present at the site. Information delivery should have been more effective in these cases. On the other hand, the information delivery chain is long and it takes time to transmit the information even without any avoidable delays.

Further research is needed how incident information could be given faster to drivers Databases used in this study did not explain the reasons of the delays. Automation of the data transmission should be considered as well as operators' education. The results showed also that even if the authorities have agreed on incident data exchange, incident information does not always reach the TMC. Organizations should carefully examine their working methods so that the practice would be as good as the agreements.

The results showed the current state of incident information in two areas in Finland. Differences between these two areas were obvious. In Varsinais-Suomi, traveller information was given slower and less frequently. Both geographical and organisational differences might explain it. Specifically, the number of emergency call centres in Varsinais-Suomi is going to be reduced from 4 to 1. This change might improve the situation as the number of incident calls, one centre receives, grows and operators became more familiar with traffic related incidents.

The aim of the incident management is to inform drivers about incidents. In Finland, there is no empirical evidence about the effects of incident information. It has been estimated that if 70% of the drivers would receive local information of the incidents at the correct time using e.g. vehicle terminals the annual benefit of incident reporting would be 1.2 million Euros (4). However, more research is needed on the incident information needs of drivers. In order for the TMCs to be able to give useful traffic reports, it should be important to know, what kind of information on incidents drivers need.

This study was conducted by combining data from multiple sources, out of which none was either exhaustive or fully reliable. The databases had some obvious faults: a database might have information on other authority's presence but its own database did not have any information on the case. Times in databases had some contradictions and some addresses were unknown. The disturbance caused to the traffic could not be reliably estimated from all of the incident descriptions. Because of the manual search of the databases, some cases might have been unobserved. More information about traveller information might also have been available at private broadcasting companies, whose data sources existence and quality are recommended to be taken into consideration in future studies. However, despite of all faults in the data it can be assumed that the results provide a relatively realistic picture of today's incident information in Finland.

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