1. BACKGROUND

Traffic safety is a significant issue for emergency vehicles. According to the National Highway Traffic Safety Administration (NHTSA, 2014), every year in the United States there are on average:

- 4500 crashes involving ambulances, resulting in
- 33 fatalities, and
- 2600 injured persons.

Response time is also a problem for emergency vehicles. In Europe, there are approximately 151 million emergency calls per year. It is estimated that the societal cost of a one-minute delay in emergency response is €1180 (Jaldell, 2004). This means that if every emergency response is delayed by one minute or more, the societal cost is around €180 billion per year.

Emergency vehicles traditionally use lights and sirens to warn other road users that they are approaching, so that a clear path can be provided. However, research indicates three key issues with these warning systems:

1. Lights and sirens have limited range, and road users often don’t see or hear them until it is too late.

2. Vehicles are becoming more well insulated from the outside world, so sirens are less effective.

3. When drivers see or hear an emergency vehicle, they are often unsure about what to do.
2. SOLUTION

Emergency vehicles provide location information and vehicle status (e.g. sirens and lights operating, vehicle is moving or stopped) to their chosen service provider via cellular communications.

The service provider reviews this information. If the vehicle is travelling in emergency conditions, an anonymised message is sent to the C-ITS data exchange.

Target vehicle service provider receives information about vehicles that are travelling in emergency conditions.

The service provider filters the information and sends targeted warning messages to vehicles in the vicinity of an emergency vehicle.

An "emergency vehicle approaching" warning is provided in the target vehicle.

Monotch has used this approach to develop systems for approaching emergency vehicle warnings in the Netherlands and as part of the NordicWay 3 project. Both systems were deployed in Q2 2022. The systems are based on Monotch’s TLEX C-ITS platform, which enables harmonised delivery of a diverse range of C-ITS services in a secure, efficient and reliable environment.

3. PRIVACY AND SECURITY

Emergency vehicles have particular privacy and security requirements:

- The movements of police vehicles need to be kept private in order to maintain personnel safety and operational security.
- Privacy of ambulance patients and emergency services personnel needs to be respected.

C-ITS platforms use security methods such as encryption and user authentication to ensure that information can only be accessed by authorised parties.

Emergency vehicle service providers are able to anonymise information before it is sent to the C-ITS data exchange, so messages cannot be traced back to a specific vehicle. Each C-ITS message uses unique identifiers, so the messages cannot be matched in order to trace vehicle movement.

The messages are only relevant for a short period of time and are not retained.

Service providers that generate warning messages require the location of the emergency vehicle in order to filter messages and only send the warning to affected vehicles. The accuracy of the location of the emergency vehicle can be managed so that the exact location of the emergency vehicle is not shared.

Procedures for managing privacy and security of information are described in Data Processing Agreements, which must be signed by service providers before they able to receive data. This ensures that the requirements for maintaining confidentiality of private information are clearly defined in a legally binding contract covered by GDPR legislation.
4. **BENEFITS**

Several studies have been conducted that investigate driver behaviour when an emergency vehicle is approaching.

A study by Monash University (Lenné, 2008) showed that drivers generally don’t react until they have received two separate indications that an emergency vehicle is approaching. In-vehicle warnings can significantly improve driver reaction times:

A Swedish study (Lidestam, 2020) provided an in-vehicle warning of an approaching emergency vehicle in a simulated environment with the following results:
5. CONCLUSIONS

→ Traffic safety and response times are significant problems for emergency vehicles.

→ C-ITS technology enables in-vehicle warnings of approaching emergency vehicles.

→ This service can be provided as part of an integrated approach to C-ITS using a data exchange platform such as the Monotch TLEX environment. This method is being adopted by more and more countries and regions.

→ There are valid privacy and security concerns related to sharing emergency vehicle location information, but these can be addressed through well-established data protection practices.

→ Studies indicate that the use of in-vehicle warning systems can have a positive effect on driver behaviour, resulting in safer and faster emergency response.

References


