



Risk Reduction In Emergency Response

How emergency vehicle warning lights and sirens reduce the risk of accidents



What Are the Risks?

Risks to first responders and the public during emergency response



Physical Risks

Risk of injury or death due to vehicle accidents or delayed response



Financial Implications

Increased property damage when emergency vehicles are delayed, increased insurance premiums, and downtime for out of service emergency vehicles



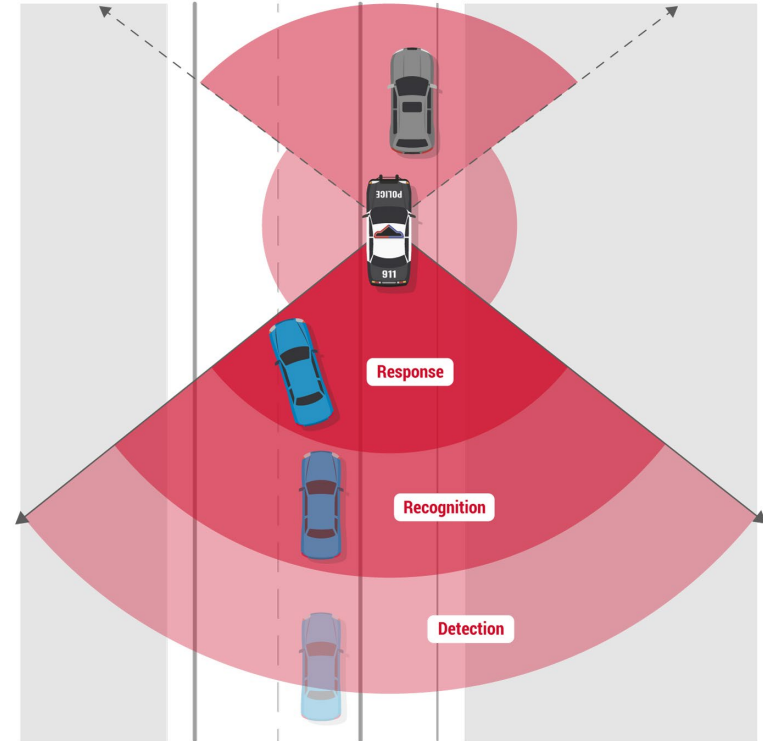
Legal Implications

Potential for lawsuits

Why Warning Matters

- **Detection**
The driver's initial awareness of a signal
- **Recognition**
The driver determines what the signal is and what it means
- **Response**
The driver modifies behavior

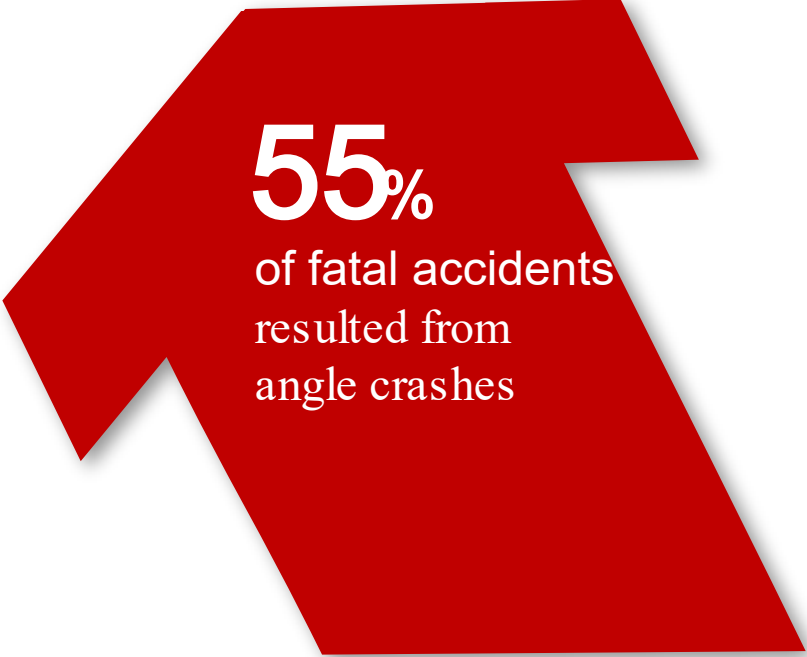
Detecting and recognizing emergency warning signals as early as possible is crucial to increasing motorist response time and reducing accident risk



Most Fatal Crashes Involved a Collision with Another Vehicle

In 53% of fatal crashes, the most harmful event was a collision with another motor vehicle

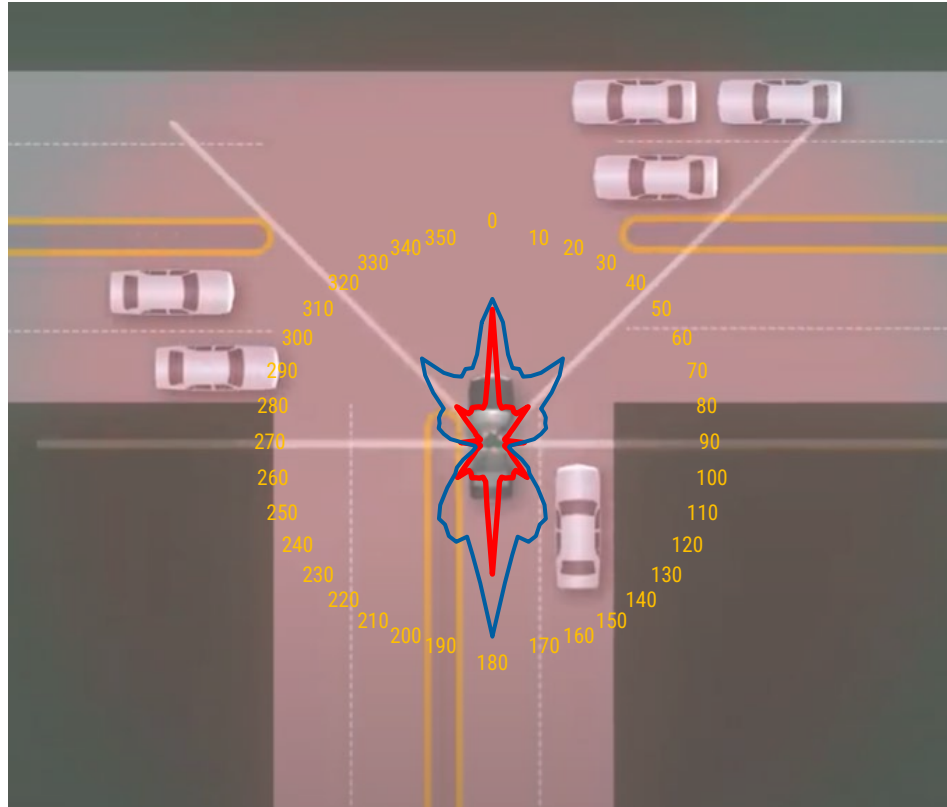
- 55% of these crashes were angle collisions
- 27% head-on
- 13% rear-end
- 5% side swipe



55%
of fatal accidents
resulted from
angle crashes

Off-Axis Performance

Blue – Non-Linear
Red – Linear



Biological Factors

Humans perceive light on a massive scale

- Brightness is the subjective visual sensation related to the intensity of light emitted from a point source
- The intensity of a light source must double (2x) for humans to perceive that the intensity has changed
- The intensity of a light source must increase (3x or 4x) for humans to perceive a significant intensity change



The scale of visual signal perception

On a dark night, humans can detect objects by star light. In broad daylight, humans can detect objects despite glaring light from the sun.

Ambient Sounds compete with Audible Warning Signals

Sound is measured using a term called decibel, or dB

- Charts from the National Institute for Occupational Safety and Hearing (NIOSH) or Occupational Safety Health Administration (OSHA) evaluate the sound level versus exposure time for your emergency responders
- The decibel scale differs from a standard ruler; each dB unit of measure increased logarithmically by a power of ten, from the threshold of hearing at 0 dB to a measure of 140 dB representing the threshold of pain
- The decibel scale is convenient because it compresses sound pressures important to human hearing into a measurable scale
- A small change in the number of decibels indicates a huge change in the amount of sound pressure

[Decibel Scale - Explanation, Working, Measurement, and FAQs \(vedantu.com\)](https://www.vedantu.com/decibel-scale-explanation-working-measurement-and-faqs);

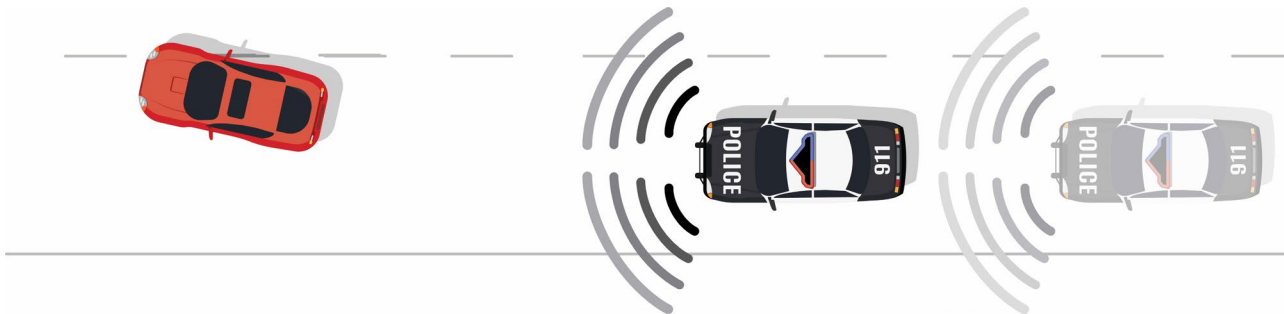
OSHA Technical Manual (OTM), Section III: Chapter 5 Noise



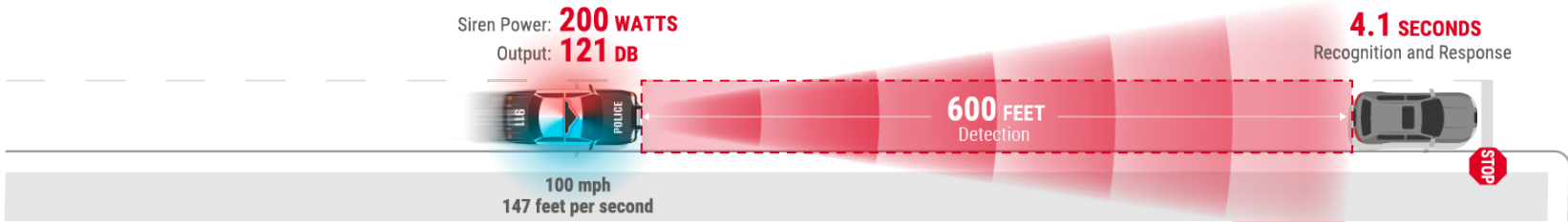
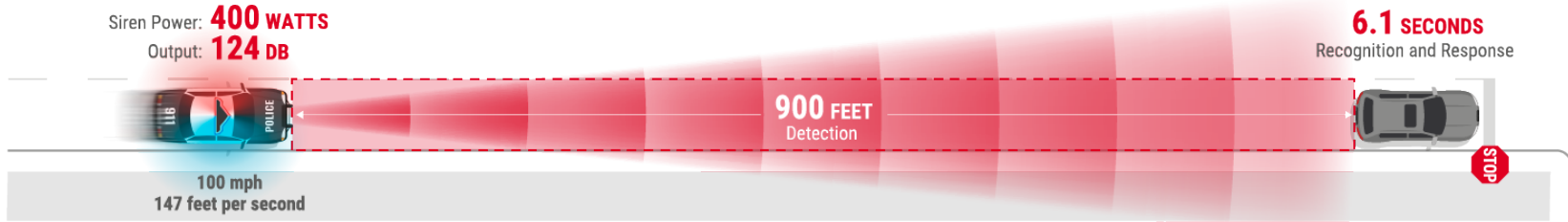
Consider DuaTone/DualSpeakers

Benefits

- A dual-tone/ dual-speaker system provides more than 3 dB vs. a single-tone/ single-speaker...
- This +3 dB increase provides a 50% increase in audible warning distance vs. a single-speaker/ single-tone system
- Multi-tone creates the perception of multi-vehicle emergency response



Relationship between Audible Warning, Speed, Distance, and Time



Risk Reduction: Siren Power & Warning Distance

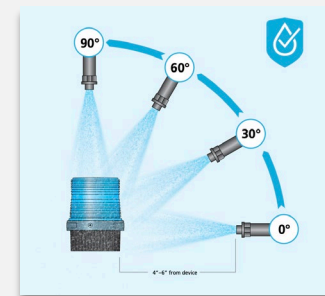


Use IP Ratings to Select Products for Your Application

Ingress Protection (IP) Rating System

The IP rating system is defined in international standard IEC 605029

IP ratings grade the resistance of an enclosure against the intrusion of dust or liquids



What is the highest IP rating?

IP69K is the highest standard on the Ingress Protection rating scale ideal for applications in which products are regularly exposed to high-pressure and high-temperature washdowns.



Ingress Protection Rating System



Solid Protection

Water Protection



Protected from high pressure and temperature water jets



Protected against the effects of continuous immersion of water



Protected against the effects of temporary immersion in water



Protected against water entry

Protection of electrical devices against solids and water

On-Scene SYNC Technology



Perimeter Breach Warning



What are the Benefits of Risk Reduction?



- Decreased risk of injury or death, to officers or civilians, during pursuit or response
- Quicker response or conveyance in situations that involve rapidly degrading medical conditions
- Decreased property damage when emergency vehicles are not delayed
- Decreased potential for lawsuits

Visual Warning and Audible Warning Work Together

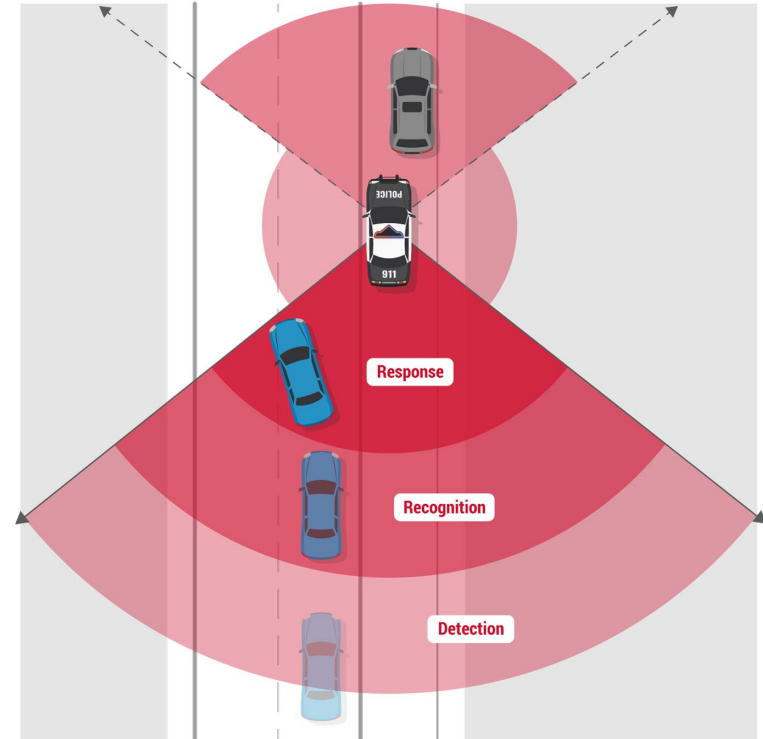
The benefits of a combined visual and audible warning system

- You cannot see around corners, but you can hear around them
- During the daytime, a siren/speaker system outperforms warning lights
- Warning lights outperform siren/speaker systems at night
- Audible warning helps counter the effects of visual workload
- Visual warning helps counter the effects of auditory masking in high-ambient noise conditions

Humans Process Signals in Three Phases

- **Detection**
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The driver modifies behavior

Detecting and recognizing emergency warning signals as early as possible is crucial to increasing motorist response time and reducing accident risk



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