



# SES personnel's experiences of driving in floodwater

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Statement of purpose: The Research into Practice Brief series provides concise summaries of research findings for end-users and practitioners. This brief provides an overview of aggregated findings from surveys conducted with State Emergency Services (SES) in four jurisdictions. The surveys explore the experiences of SES personnel encountering floodwater in SES vehicles.

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## BACKGROUND

A recent study in Australia found that over 50 per cent of the 150 Australian floodwater fatalities between 2004 and 2015 were people attempting to drive through floodwaters (Australian Water Safety Council, 2016). Many drivers are rescued from vehicles annually, and across Australia these rescues are commonly performed by members of the State Emergency Service (SES).

As an occupational group, SES personnel are exposed to floodwater risks and perform duties that may exert real or perceived pressures on them to drive through floodwater, e.g. to get to a rescue location. In some jurisdictions there are workplace policies that strongly discourage driving through floodwater. In addition to the workplace health and safety considerations, driving through floodwater can result in vehicle damage and have potential impacts on professional reputation, e.g. if SES personnel are seen driving through floodwater when the core message to the public is "if it's flooded, forget it".

The aims of this study were to explore the experiences of SES personnel encountering floodwater in SES vehicles, to describe the contexts and conditions in which they have entered floodwater, and to investigate the factors that influenced decisions to enter floodwater. This Research into Practice Brief summarises top-level findings from surveys conducted with SES personnel from four jurisdictions. Further analysis for each jurisdiction separately is underway and will be fed back directly.

## RESPONDENTS

In total 1,251 SES personnel completed the survey. The median age range of respondents was 45-54 years of age (24 per cent), and the sample overall comprised 71 per cent male (n=862) and 28 per cent female (n=334) respondents. A large majority (88 per cent) were volunteer members, 7 per cent were salaried members, and 5 per cent were both salaried and volunteer members.

Most respondents (90 per cent) had approval to drive SES vehicles and 81 per cent were deployed in floods and storms. Under half (43 per cent) had received 4WD training and 13 per cent had received advanced level flood rescue training.

## EXPERIENCES OF DRIVING INTO FLOODWATER

A definition of floodwater on the road was developed with the assistance of SES end-users.

**Floodwater on the road was defined as an environment with:**

- **water across the road surface**
- **little to no visibility of the road surface markings under the water (i.e. uncertain of road quality/integrity and possibly depth)**
- **water on normally dry land - flowing or still**



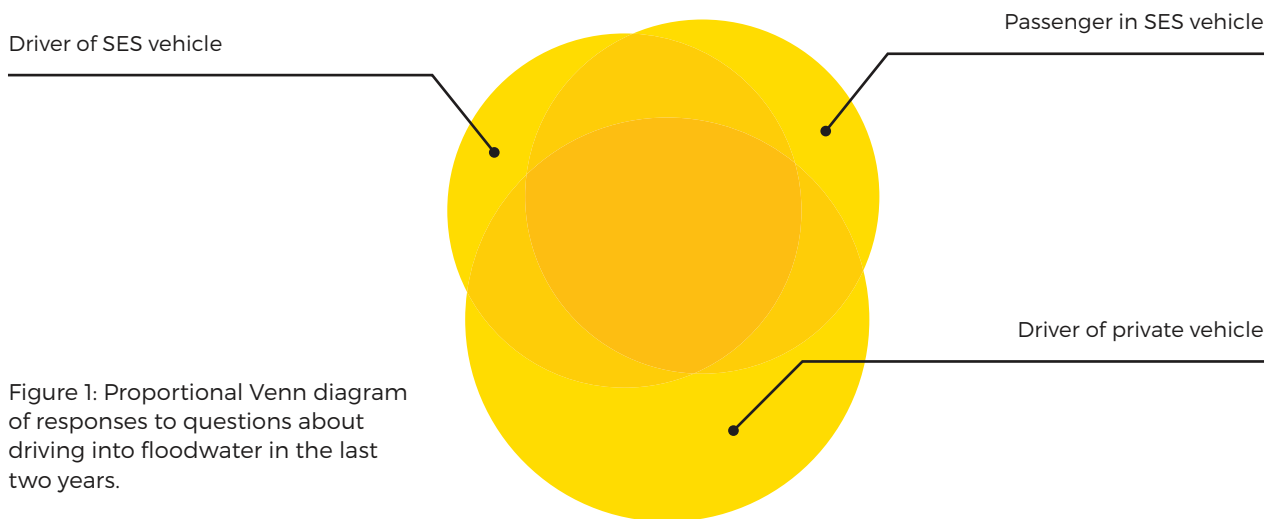


Figure 1: Proportional Venn diagram of responses to questions about driving into floodwater in the last two years.

Based on this definition, respondents were asked three questions; whether they had entered floodwater in the last two years as the driver of an SES vehicle, as a passenger in an SES vehicle, and as the driver of a private vehicle.

- 37 per cent (n=463) reported they had driven into floodwater in an SES vehicle as the driver,
- 39 per cent (n=488) reported they had been driven into floodwater in an SES vehicle as a passenger, and
- 52 per cent (n=650) reported they had driven into floodwater in their own private vehicle.

Figure 1, above, presents the responses to these three questions showing, proportionally, the overall size of each subsample and the degree of overlap of the responses.

More than a third of respondents have driven into floodwater in an SES vehicle and more than half have driven into floodwater in their own private vehicles. This suggests that, in general, the act of entering floodwater in a vehicle is fairly common practice. Data presented in the Venn diagram indicate that a large proportion of those who entered floodwater in an SES vehicle as a driver, also report being driven through as a passenger. It is not possible to say whether this high degree of association is due to exposure, i.e. this reflects a group of people who encountered floodwater frequently and hence have a greater opportunity both to drive, and be driven, through it; or whether it reflects a risk normalisation process, i.e. if you are driven through floodwater as a passenger in a work vehicle you are more likely to drive through yourself as a driver as part of a greater acceptance of the practice.

## CONDITIONS AND CONTEXTS OF ENTERING FLOODWATER IN AN SES VEHICLE

Respondents who had driven through floodwater were asked to recall a recent or memorable experience of entering floodwater in the last few years, with a request to preference an example in an SES vehicle if they could recall one.

In total, 506 respondents (40 per cent) recalled a recent event where they had entered floodwater in an SES vehicle either as a driver OR as a passenger. Respondents then provided detailed information about the context and conditions in which this event occurred and the factors that influenced their decisions to drive into floodwater.

### Road and location characteristics

Respondents were asked about the location and the road on which the event took place. As shown in Figure 2, page 3, most events took place in rural areas (41 per cent), on a normal stretch of road (76 per cent) and on minor/residential roads (54 per cent).

### Water characteristics and vehicle type

Respondents were asked to estimate the depth (Figure 3, page 3) and flow (Figure 4, page 3) of the water that they entered. Respondents were shown an image, similar to that in Figure 4 (page 3), with depth in centimetres shown against it, to provide a consistent reference against a familiar vehicle type for respondents to estimate the depth of the floodwater on the road that they drove, or were driven, into.



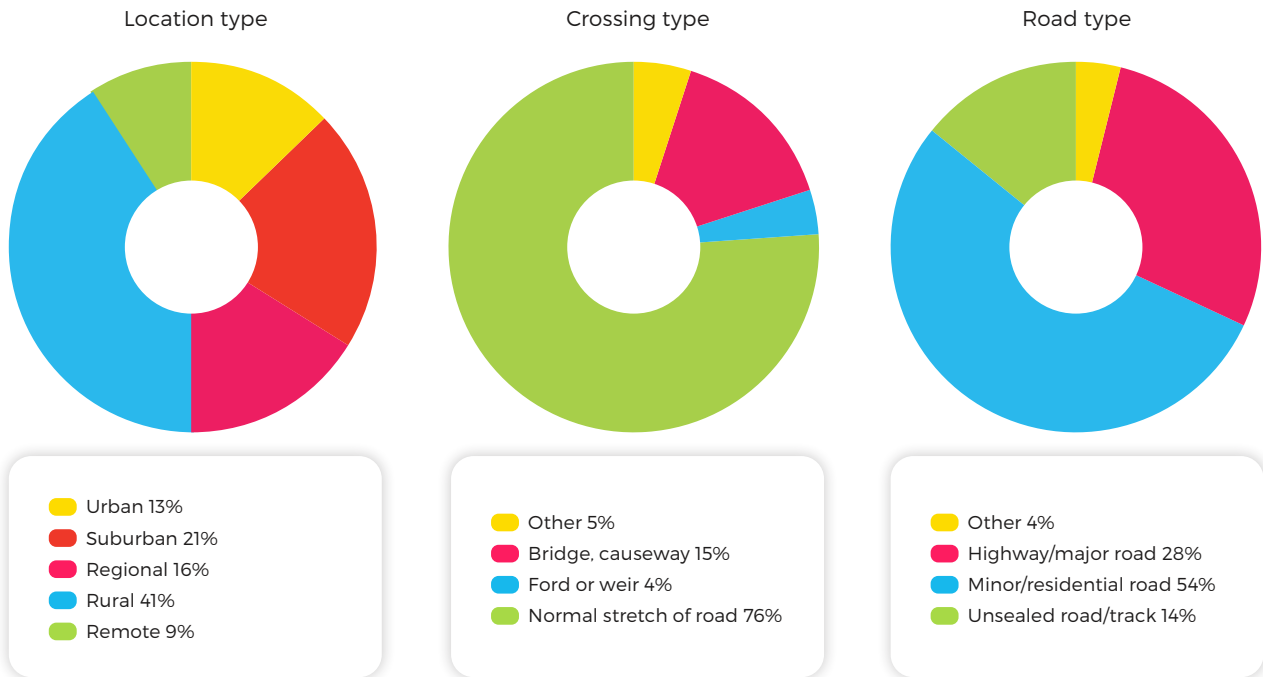


Figure 2: Location and road details where SES personnel entered floodwater (n=506).

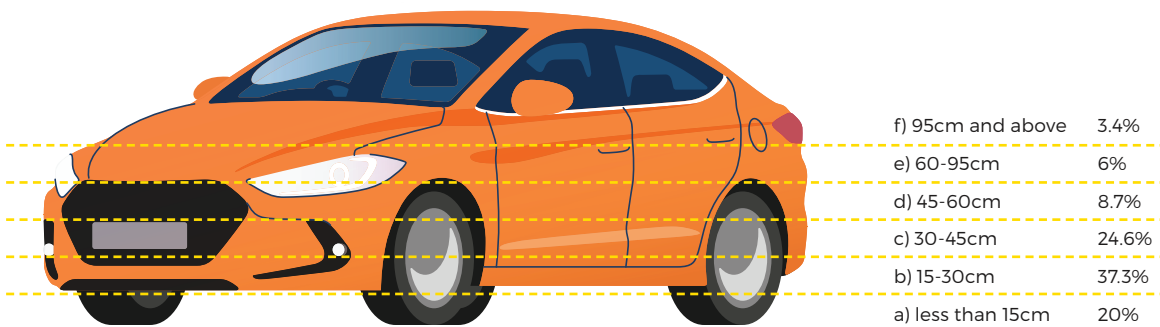


Figure 3: Estimated water depth entered by respondents (n=506).

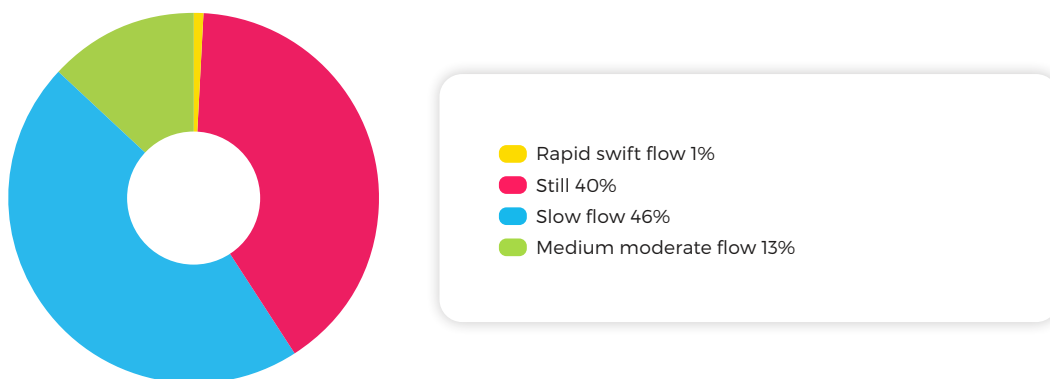


Figure 4: Water flow (n=506).



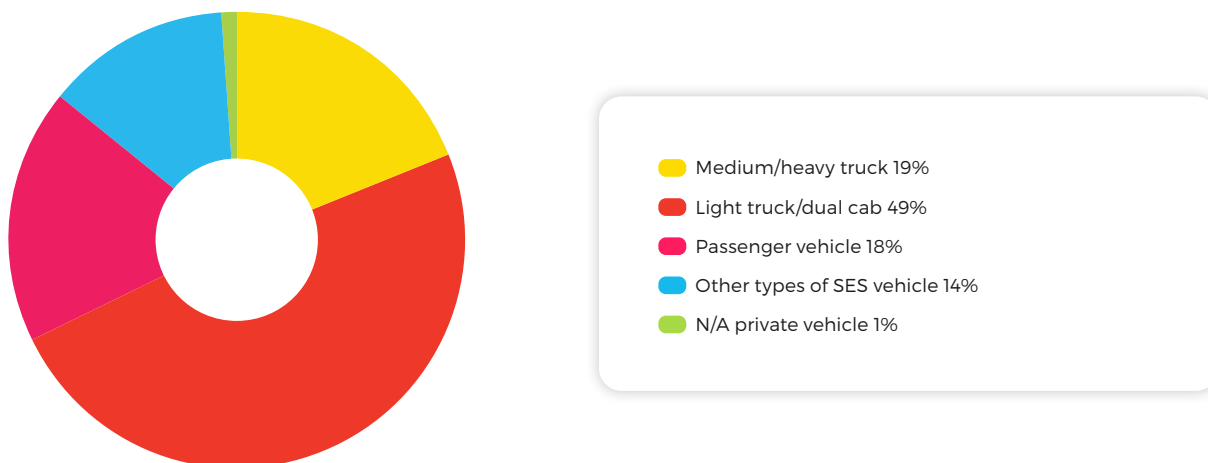


Figure 5: Type of vehicle that entered floodwater (n=506).

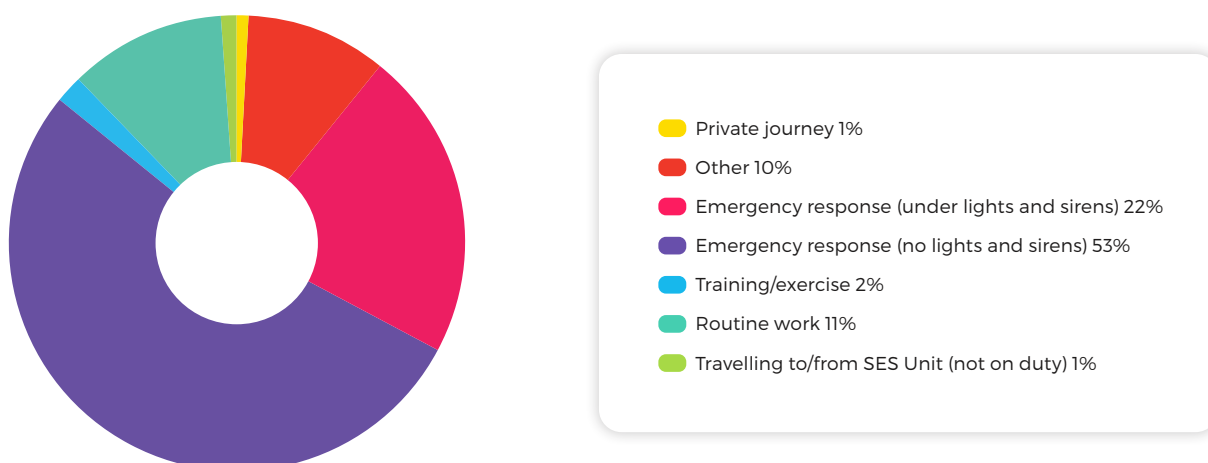


Figure 6: Activity being undertaken at the time of entering floodwater (n=506).

In terms of water characteristics, just over half of the events reported (57 per cent) involved driving through water that was estimated to be 30 centimetres or less. However, just under a fifth of events (18 per cent) involved entering water more than 45 centimetres deep (9 per cent 45-60 centimetres and 9 per cent more than 60 centimetres). Water flow (Figure 3, page 3) was mostly slow or still (86 per cent).

Respondents provided details of the type of vehicle they were in (Figure 5, above). Whilst around half (49 per cent) were in light trucks/dual cab vehicles, similar proportions were in smaller/lighter SES passenger vehicles (18 per cent) or in medium/heavy trucks (19 per cent).

In summary, most frequently SES personnel entered floodwater in shallower water (less than 30 centimetres) and water with slow or no flow, and in typically larger/heavier vehicles. Although this is a

generally positive finding, suggesting that personnel were less likely to be swept away in these events, it should be noted that the surface underneath the water could not be seen and heavier vehicles could potentially have a greater impact on an unstable road structure or surface. So although these events may in general represent lower risk, they do reflect a degree of potential risk.

### FACTORS INFLUENCING DRIVING INTO FLOODWATER

Understanding the activities that were being undertaken and the factors that influenced decisions to drive into floodwaters is explored and reported in the following section. This includes consideration of the activities that were being undertaken at the time of the event, the characteristics of the driver,



factors that influenced the decision to drive through floodwater, and the role of passengers in the decision making. As the last three areas relate specifically to the driver (the controller/commander of the vehicle) a subset of drivers-only is included in those sections.

### Activities being undertaken

Figure 6, page 4, depicts the activities SES personnel were undertaking at the time of entering floodwater. In around half of events (53 per cent) respondents reported they were on emergency response (without lights or sirens) and in just under a quarter of events (22 per cent) they were on emergency response (under lights and sirens).

## DRIVER CHARACTERISTICS

In the 506 events described to this point, 317 (63 per cent) were reported by the driver of the SES vehicle. The remaining data reported in this Brief refer to the responses of these 317 drivers only.

Simple statistical tests were used to compare respondents who had driven through floodwater in an SES vehicle to the rest of the sample (Chi Square and post hoc tests to investigate differences). Demographic and driving characteristics associated

with an increased/decreased likelihood of having driven into floodwater in an SES vehicle are summarised in Table 1, below.

As can be seen from the results in Table 1, below, a number of factors that relate to 'opportunity' appear to link to entering floodwater in SES vehicles. Specifically more hours spent driving generally, driving SES vehicles more frequently, being deployed in flood events, and encountering floodwater more often. Interestingly, age was not a significant variable in this analysis.

### Factors that influenced the decision to drive into floodwater

Respondents were asked to consider 'the extent to which' a list of 18 factors may have influenced the decision to drive into floodwater in the reported event. These factors related to the journey (e.g. urgency, lack of alternative route), their ability and experience (e.g. SES training), the influence of others (e.g. other road users, vehicle occupants), and work-related pressures (e.g. desire to complete duty). Respondents were asked to indicate the extent to which each influenced their decision using a rating scale from 1 ('not at all') to 7 ('a great deal'). Figure 7, page 6, summarises the mean ratings drivers of SES vehicles give to each factor.

VARIABLE	MORE LIKELY TO HAVE DRIVEN INTO FLOODWATER	LESS LIKELY TO HAVE DRIVEN INTO FLOODWATER
Gender	Males	Females
Employee type	Volunteer members	Salaried members
Length of service	Volunteer members >6 years length of service	Volunteer members <6 years
Current flood rescue qualification	Yes	No
Duration of holding full licence	>6 years	<3 years
Hours driven per week (generally)	>7 hours per week	<7 hours per week
Duration of approval to drive SES vehicles	>6 years	<2 years
Frequency of driving SES vehicles	Often/Daily	Rarely/Never
Frequency of encountering floodwater	Frequently/Occasionally (>3 times per year)	Never/Rarely (<3 times per year)
Deployed in floods	Yes	No

Table 1: Characteristics of those more/less likely to have driven through floodwater in an SES vehicle in the last 2 years; 317 drivers vs rest of sample (n=934).



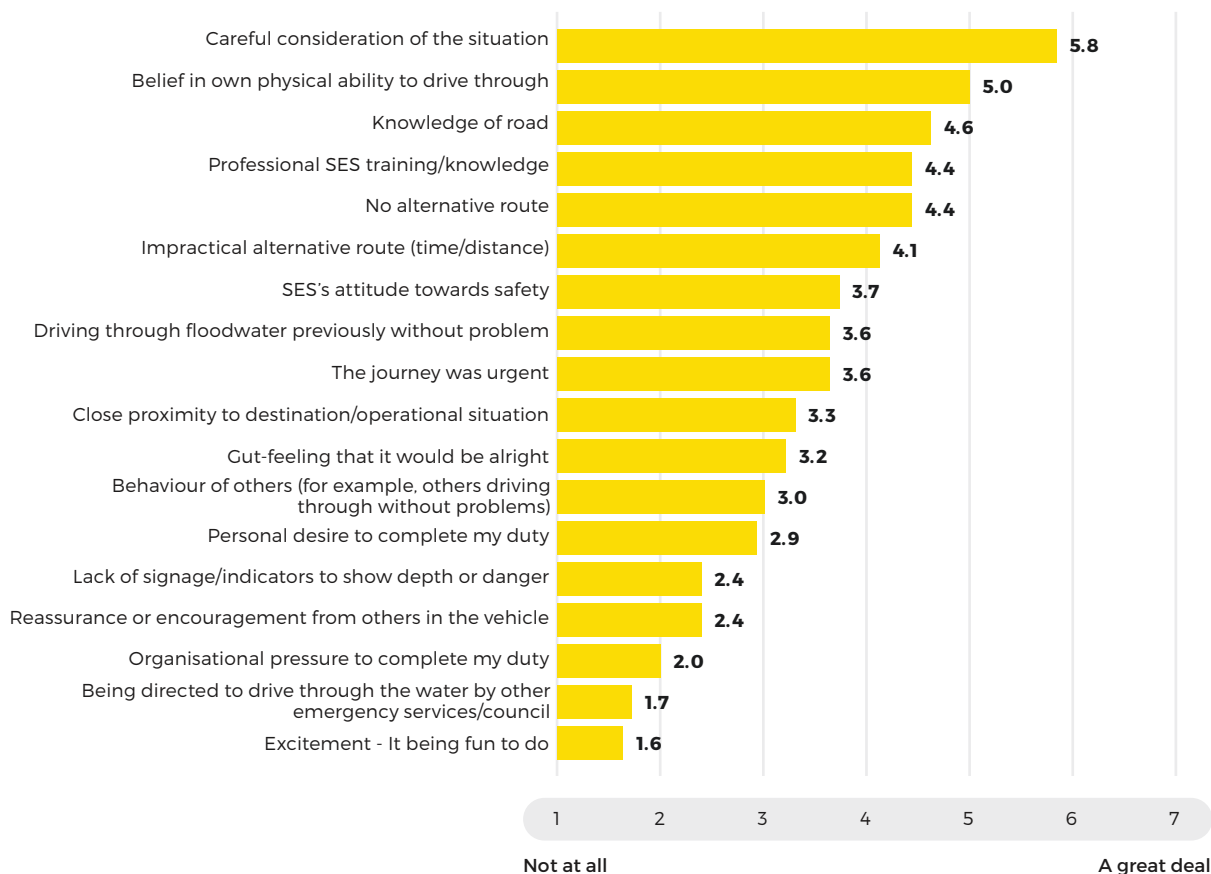


Figure 7: The extent to which a range of factors influenced driver's decision to enter floodwater (n=317).

Figure 7, above, provides a good overall picture of the ranking of factors that influenced drivers' decisions to enter floodwater. Many of the top influences relate to feelings of confidence and self-efficacy, such as belief in ability, knowledge, and professional competence. Situational and journey-related factors, such as urgency and lack of alternative, or practical alternative route and proximity to destination feature in the mid- section, and external factors, such as influence of others and organisational factors appear towards the bottom of the list. Most interesting is the top influence which was careful consideration of the situation. This certainly indicates that entry into floodwater was not an automatic or surprise event in most instances, and also suggests that SES personnel felt the decision to enter floodwater was a considered one.

### SOCIAL INFLUENCES

In this section we review drivers' perceptions of the influence that passengers inside the vehicle, and other emergency services outside the vehicle, had on their decision to drive into floodwater. Again, this

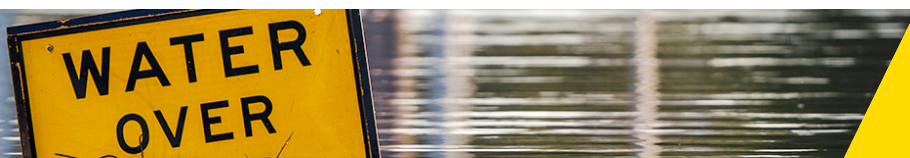
section relates only to the 317 events that the drivers of SES vehicles reported.

As noted in Figure 7, above, encouragement to enter floodwater from passengers in the vehicle was not felt to be particularly influential in the decision to enter floodwater, however this area was investigated separately in the survey in a little more detail.

Overall, 75 per cent of events of driving into floodwater (n=238) took place with passengers in the vehicle, and most of the time the passengers were other SES colleagues. Passengers were reported to have influenced the decision to drive into floodwater in around a quarter of those events.

Respondents were provided with the opportunity to comment on how they felt passengers and others influenced their decision to drive into floodwater. A total of 65 respondents provided text comments, and these were thematically coded to look at the overall balance of issues that were being noted. The results of the coding are presented in Table 2 below.

Consensus, resulting from discussion among vehicle occupants, emerged as the most reoccurring theme. This suggests that passengers were more



Themes	N	Example
Reached a consensus: agreed / discussed / decided together	25	"We discussed whether to travel through the water. Unanimously agreed that it was safe..."
Waded first: walked through, conducted risk assessment	20	"Got out and helped assess water level and cross flow. Check crossing integrity."
Pressure / urgency of situation	8	"It was a multi-agency rescue of persons trapped by flood water and in danger..."
Experience / knowledge / direction of others	8	"...I listened to them because they were more experienced than me and had been with the Unit for longer."
Observation of other vehicles	4	"...We also waited and observed trucks driving through the water."

Table 2: Thematic analysis of the influence of passengers and other people in the decision to enter floodwater.

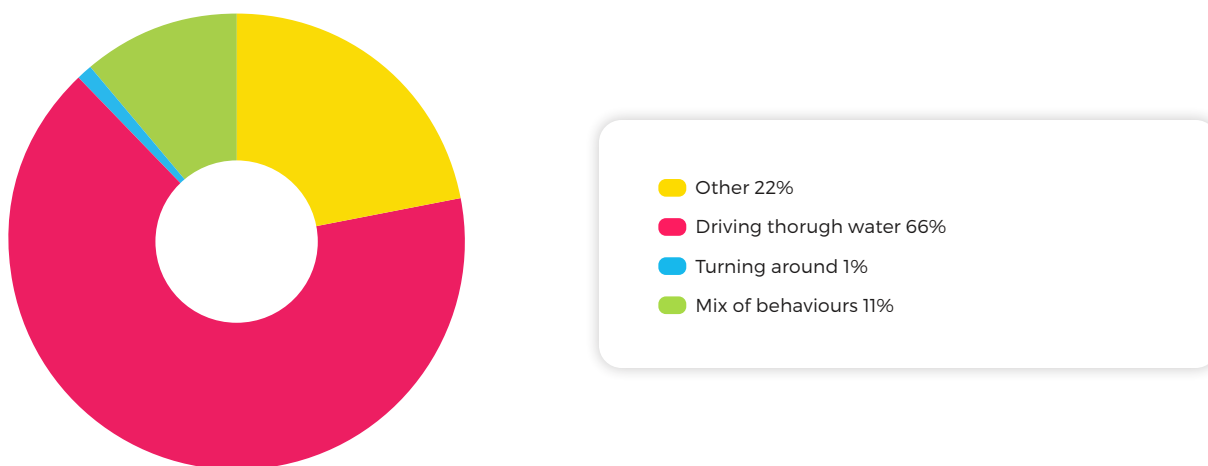


Figure 8: The actions of other emergency services personnel in vehicles – only for occasions when they were present (n=117).

likely to be used as a resource for risk assessment and decision making, rather than being a source of encouragement to enter floodwater (as partially implied in the influence on decision making question reported previously, Figure 7, page 6 - "reassurance or encouragement from others in the vehicle").

Finally, respondents were asked about the actions of other emergency services at the time they drove into the floodwater. Respondents indicated that other emergency services personnel in vehicles were present in only just over a third of the events reported (37 per cent, n=117). These responses are summarised in Figure 8 above. As shown, when other emergency service vehicles were present, they were also driving through the water. This suggests that there was a

degree of pressure to do the same, but also that the driver could observe this action being successful/safe.

### STRENGTHS AND LIMITATIONS

The study is one of the first investigating the experiences of emergency service personnel driving through floodwater and the overall sample size is large and adequate for further statistical modelling and analysis. However, the number of respondents only represents a small proportion of the workforce in these organisations and should be treated with caution. Also data presented here reflect the combined responses from personnel across four different state SES agencies with different organisational responsibilities, duties, policies and





practices. As such, this provides just a general snapshot of driving through floodwater practices in a group of emergency service workers, but specific single agency data are likely to be more useful for end users with regard to potential utilisation of the findings.

## IMPLICATIONS

The findings were discussed as they were presented, and suggest that driving through floodwater in work vehicles is a generally common/accepted but still potentially risky workplace practice. Although in the majority of events reported, personnel typically drove through shallow water with slow/no flow and in larger/heavier vehicles there was some risk associated with these actions when the road surface underneath the water is obscured with its integrity unknown. When asked about activities, influences and the role of others in the decision to drive through floodwater, more events occurred during emergency responses (although not all), and the decision to enter floodwater appears to have been as the result of careful consideration, with passengers in the vehicle being more of a resource for risk assessment/consensus, rather than encouraging risky driving per se.

The study findings can be used in a number of ways, including

- informing risk assessment strategies for emergency workers, helping to build a picture of 'typical' floodwater entry and creating an opportunity for further discussion of scenarios that would be useful for training and safety
- targeting interventions to those personnel more 'at risk' of driving through floodwater
- for individual agencies, guiding the development of policy, and larger agencies can use these data as a benchmark against which to assess changes in safety practice over time.

Overall, it is hoped that the data collected as part of this project - with both SES personnel and the mirrored data gathered from the Australian general public, see Research into Practice Brief 4 - will enable more informed and nuanced discussions around the risks involved in driving into floodwater and the elements that influence decision making. The findings provide insights for internal communication of risk as well as public education and risk communication. They can also assist in the development of training for SES personnel, specifically regarding the role and advocacy of passengers in in-vehicle risk assessment, and there is potential for use in community engagement more broadly.

## FURTHER READING

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## FLOOD RISK COMMUNICATION

This research is funded by the Bushfire and Natural Hazards CRC and is led by Dr Mel Taylor. This project will develop an understanding of the motivations, beliefs, decision making processes and information needs of at-risk groups for flood fatalities.

For more information, please see: [www.bnhrcr.com.au/research/floodriskcomms](http://www.bnhrcr.com.au/research/floodriskcomms)

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