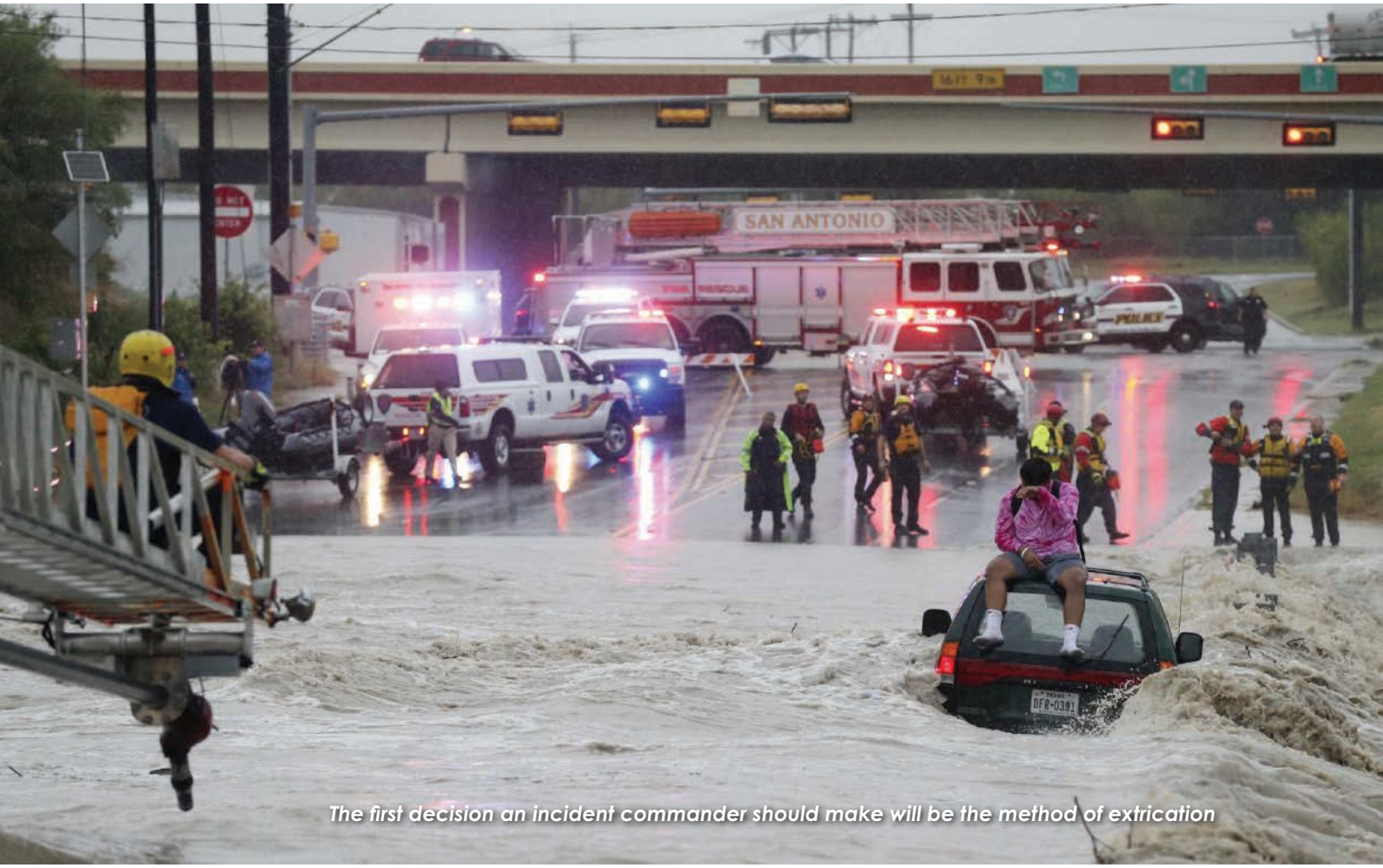
Rescue from submerged vehicles

By Colin Deiner, chief director, disaster management and fire brigade services, Western Cape Government



The first decision an incident commander should make will be the method of extrication

Most emergency rescue services respond to motor vehicle accidents with entrapments almost every day. Generally the affected vehicles end up on the road surface or in close proximity. Should the accidents occur off the road surface and end up in a different environment, the challenge becomes more problematic. Vehicles going over a mountainside or into an adjacent structure will require a more specialised approach, a greater deal of stabilisation and probably, heavier lifting tools. In all these cases and depending on the condition of your patients and level of entrapment, will require a careful approach. It can, however, be that a vehicle has come to rest in a body of water. In this case most of the rules will change. You might not have the time to address all safety precautions; you will only have limited time to remove the victims, which may require taking a 'life over limb' approach). Tragically, in many such incidents, you simply will not be able to reach the vehicle in time to make any difference. It is for this reason that we should do a thorough risk assessment of our response areas, ascertain the presence, nature and position of significant water bodies and develop effective response procedures for any possible incidents.

Risk: rivers

Vehicles ending up in water could present in a variety of ways and therefore provide a whole range of challenges for this very reason. The one we are probably the most familiar with in this country, are vehicles being swept away by flood waters. In such incidents vehicles can be partially submerged or the victims might be able to exit the vehicle and position themselves on the vehicle's roof. Depending on the velocity of the water stream, these victims might be able to be accessed relatively easily by land, boat or helicopter. However, they could be thrown free of their vehicles and get relocated a long distance from the location of the vehicle, which might require a protracted search along the banks of the river.

Accessing a vehicle in a moving stream will provide a number of hazards and challenges including:

- The possibility that the vehicle might become dislodged from its position while the extrication is in progress.

Most of your stabilisation will entail securing the wreck to a series of solid points

- Continuous water flow into the cab of the vehicle.
- Floating debris with a potential to cause serious injury to entrapped victims and rescuers.
- Compromised vehicle systems such as hybrids, undeployed airbags, vehicle batteries and floating escaped fuel and other hazardous fluids.

The command decision to enter the water will have to be well considered and the above risks will have to be taken into account. Rescuers entering the water cannot do so wearing structural fire fighting gear. Water rescue gear or specialised rescue suits that provide protection against mechanical damage (such as cutting and ripping) and hypothermia. Even in a warm climate, rapidly flowing water will be colder and working in it for a prolonged period of time, could induce hypothermia, thereby compromising your rescuers and placing them at risk unnecessarily.

Another primary safety consideration will be the stabilisation of the scene and the vehicle. Always work from a solid and safe territory; make sure that anyone entering the water has been secured by means of a safety line and ensure that the vehicle and any other unstable objects are secured. Do your research around personal flotation devices (PFDs). The situation will dictate what equipment you will require for this task. A number of years ago, the department I worked in attended to an incident where a medium delivery vehicle was swept off a bridge. The vehicle ended up on its side, partially submerged, a few metres below the bridge with the bottom facing upstream. In this case, the bottom of the truck formed an eddy, which allowed our rescue crews to work in a still space to remove the victim. The major concern was that the vehicle would be lifted by the stream and be swept down the river, taking the rescue crew along with it. We addressed this by parking a heavy rescue unit on the bridge (the water had subsided at this point) and securing the wreck to it by using two cables.

Any rescue service facing this possible risk, should take time to think about submerged vehicle stabilisation and how it can be achieved. Most of your stabilisation will entail securing the wreck to a series of solid points ie the big freakin' tree (BFT) and the big freakin' rock (BFR), which originated in the rope rescue fraternity. It will then become necessary to have a range of cables and related fastening equipment readily available. With the technology available to us nowadays, we have access to very accurate weather forecasting technologies, which allow us to identify high-risk areas and therefore we can prepare our crews and units to respond accordingly. A suitable early warning system can provide the necessary information to prompt the activation of additional water rescue resources and to stage them at certain high-risk areas. These teams need to be well equipped and highly mobile enabling them to rapidly respond from the staging area to any incidents within their operational sector. The service's command system must include these response teams within their operations sections with clear lines of communications to the task-level leader on the ground.

Risk: dams

It often happens that vehicles end up in large, still bodies of water such as dams, lakes, reservoirs etc. When a swift moving vehicle hits a static body of water, the deceleration will be severe causing serious injuries to vehicle occupants. The use of standard restraint systems will, in this case, have a dual role in preventing or minimising the initial impact shock and prevent the occupants from being thrown out of the vehicle. Seatbelts and undeployed airbags can of course present additional obstacles to rescuers intending to remove victims from a rapidly sinking vehicle.

Most passenger vehicles that land up in deep water will float on the surface for a short period of time ie from 30 seconds to several minutes. But, all vehicles will sink! If the water is deeper than the height of the vehicle body, it will submerge and disappear beneath the surface. Factors that effect the float time include closed, sealed and intact windows and weather seals, as well as the design, body style, construction quality and the condition and age of the vehicle. If the engine of the vehicle is located at the front, the vehicle will immediately assume an angled nose down position in the water.

Vehicles with open windows will submerge quicker as the water enters the vehicle. A closed vehicle will eventually lose its buoyancy and will sink rapidly at this point. It could be very difficult for entrapped occupants to open doors or break window glass from the inside of the vehicle and, for this reason, rescuers must carry tools for this purpose. Spring-loaded window

punches and seat belt cutters must be part of the first kit taken along by the rescuers entering the water. Window punches will not work on laminated windscreens and are only effective on tempered side-windows.

Should a victim be involved in a complex limb entrapment situation where prolonged extrication is required, this might exceed the ability of a rapid water/vehicle rescue squad. You have very few options here and it is for this reason that, in the absence of a heavy rescue unit, it would be a good idea to partner with a heavy vehicle recovery company and include a big recovery rig in your primary staging position. If it is possible to access the affected vehicle from the banks with such a rig, it can be temporarily lifted out of the water to such a point that will allow the extrication to be performed.

Fortunately, in most cases, there are not complex entrapments and squads should therefore train for a 'punch-and-go' evolution

- Punch the window out
- Cut the seatbelt
- Lift the victim out of the wreck
- Go!

Equipment

The initial safety equipment will be your standard swift-water rescue gear. Obviously, know you have to include the kind of equipment required for vehicle extrication. It is in marrying up all these resources that the challenge will come. Not all hydraulic rescue tools can work in a submerged or partially-submerged environment. Is this part of the specifications when we go to tender? Do we have the right forcible entry tools to break the windows of a submerged vehicle? Obviously the standard electrical tools are not an option.

At some point it might be necessary for the rescuers to spend time underwater while affecting the rescue. I am not talking dive rescue here, as that is a specialised discipline with a different set of rules and procedures, which is not the attention of this article. Planning must be done to enable rescuers to access submerged areas of a vehicle for short periods of time.

How is your equipment stowed on your rescue truck? Can you access it quickly and can you move it where you need it with minimum effort?

People who have located to the roofs of their vehicles may be able to be rescued by means of a throw rope

Invest in a good weather forecasting system

There are a number of inflatable platforms available that can be deployed as a 'floating staging area' or bases to move rescued victims onto.

Responding to the incident

As mentioned earlier in this article, your size-up will begin well before an incident takes place. Ensuring that all the necessary equipment is available and in good working order and that all rescuers have been trained to a very high level of proficiency in such a high-risk skill set, is the first step.

The second step would be investing in a good weather forecasting system. The South African Weather Services (SAWS) recently launched their 'Impact Based Forecasting System', which not only provides a severe weather warning functionality but also provides critical information on the impact of that weather on the area it will reach. Having this information available will allow you to deploy the necessary resources to pre-determined areas well beforehand and enable them to rapidly respond to any sudden emergencies. A great example of such a system was the swift-water rescue response plan of the Sandton Fire Department in the 1900s and early 2000s. A number of structures were identified along the banks of the Jukskei River in the Alexandra area and a flood monitoring device was placed under an upriver bridge. When the river reached a certain level, the swift-water rescue team would respond and rig their systems in anticipation of anyone becoming swept away. Many lives were saved through this practice. ▶

- Although the call for response to incidents where people are trapped in a fast current and moving swiftly downstream must be the priority, also ensure response to incidents where people are located in disabled vehicles in ankle-deep water that's barely moving. This situation could rapidly deteriorate and it is better to get them out of their vehicles and to safety at the first opportunity. These people might be traumatised, hypothermic or have suffered other injuries. Make sure that these people are constantly supported from the moment they leave the vehicle until they are handed over to rescue or EMS staff on dry land.

  In either a swift- or still water rescue, the first decision an incident commander should make will be the method of extrication. Once this strategy is decided upon, all resource and their tactics must be focussed on supporting it. If it's a helicopter-based rescue, there might be a need to clear debris in front of and around the victim location. Putting rescuers in the water should be the last option. If this is the decision, a huge effort must be made to provide for additional safety. Have a stand-by team on hand to carry out any rescue tasks if responders themselves get into trouble or if exhausted and/or hypothermic rescuers have to be replaced.

  People who have located to the roofs of their vehicles may be able to be rescued by means of a throw rope. Ensure that if the person is going to be removed by this method, that a) the victim is capable of holding on to the rope and b) there are no obstacles in the intended way of travel. It might be necessary to get a rescuer to the victim.

  If a heavy rescue unit or aerial apparatus is to be used, make sure that it is placed on stable ground before being put into use.

  Finally, safety officers should be strategically positioned upstream to monitor currents and floating debris that could pose a hazard to the rescuers.

Finally

This is an article. It is therefore not possible for me to explore all the aspects of responding to emergencies involving submerged or partially submerged vehicles. There is still a whole range of information and learnings to be obtained from response of heavy vehicles and large passenger vehicles involved in water-related incidents. It is up to you to identify these risks in your response area and spend time thinking, planning and training for such incidents.

The most important point I wish to leave with you is the potential of using weather technology to plan your emergency response and resource staging. During recent major fire incidents in my own province, we have made extensive use of technology to support our incident command system. We often see (or use) the term 'force multiplier'. Technology can do just that for you.