These human factors bulletins focus on how workers interact with their work environments. They are based on accident investigations that examine all the workplace factors that influence the decisions and actions of the workers involved in an accident. These factors help to identify the causes of an accident. Identifying these causes can help to prevent similar workplace accidents.

Safety approaches — person or system centered?

What happened?

A traffic control person (TCP) was directing vehicles on an alternating one-way flow. It was just after noon on a clear day, and the road was in a quiet rural area. The work zone was set up in accordance with the Ministry of Transportation *Traffic Control Manual for Work on Roadways* for Long Duration: Lane Closures with TCPs. The speed limit on the road was 50 km/h but signs were erected recommending reducing speed to 30 km/h through the work zone.

The TCP walked to his position to begin to stop the traffic in the westbound lane. He was wearing high-visibility apparel that met the required standard. A motorist approached the work zone, but failed to stop. The vehicle struck the TCP at a speed of approximately 30 km/h. The TCP was thrown in the air, hit the road and sustained fatal head injuries.

From a human factors perspective, why did it happen?

In this incident, the vehicle was within the lines of the westbound lane and was reportedly travelling at or below 30 km/h (less than the posted speed of 50 km/h). There was a turn in the road just before the TCP's position, and the vehicle may have been slowing for this turn. The relatively slow speed of the vehicle, and the probability that it was slowing down for the curve may have given the TCP the impression that the vehicle was going to stop. But by the time the TCP realized that it wasn't going to stop, it was too late to move out of the way.

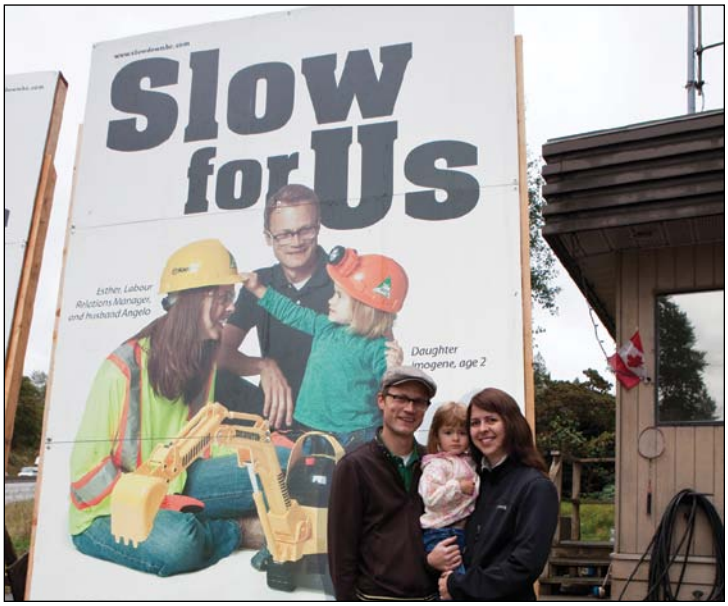
One way TCPs manage their safety is by continually assessing their environment. Most of the time, this is not done consciously. It's a sensory process in which a person picks up cues (features) from the environment, and then interprets them as to meaning and importance. In this incident, the early cues of the vehicle's approach did not likely indicate a hazardous situation to the TCP. However, as the vehicle came closer and the TCP realized that it wasn't going to stop, he no longer had time to react and get out of harm's way.

The time it takes to react is affected by how strong the cues are and if the event is expected. For example, it can take up to a full second[1] for a person to perceive, interpret, and respond to an unexpected event. Even at a speed of 30 km/h, a vehicle travels about 8 m in one second. This means that in many cases, such as this one, the reaction time of a TCP would not be quick enough to get away from the danger.

Often, it is difficult for TCPs to suddenly move out of the way. They wear apparel such as work boots and heavy clothing that limits their ability to move quickly. A TCP's ability to react quickly will also be reduced if it is cold or wet or if there is glare from headlights or sunshine.

Understanding human factors helps avoid workplace accidents

Presently, the most common method of controlling traffic is putting up signs that tell drivers of an upcoming work zone. These signs also play an important role in protecting TCPs. But signs are not always effective because drivers have to notice the signs, interpret what they mean, and then actually change their driving behaviour when approaching a work zone. Unfortunately, there is no guarantee that this will happen. If it doesn't, TCPs can be exposed to significant hazards. Signs are often accompanied by traffic cones to direct vehicles to single lane or alternate areas, but again, they are not always effective in actually stopping a vehicle.



If signs and cones are not effective in changing drivers' behaviours, the TCPs' last line of defense is their reaction time. Relying on behaviour as a control measure, such as drivers' behaviours in a work zone or the reaction time of TCPs, is called a "person centered approach" to safety. This approach also relies on TCPs to wear personal protective equipment, to always be alert, and to communicate with drivers clearly in order to control and manage their own safety.

In contrast, the "system centered approach" to safety gives a higher level of protection to TCPs. It recognizes that people are not always able to protect their own safety. So it uses more effective physical measures to control situations and does not rely on behavioural responses.

These measures includes things such as physically slowing the traffic (speed bumps), physically restricting traffic (concrete barriers), or closing the road so vehicles cannot enter the work zone. Vehicles can be used to escort traffic through the zone at a controlled speed. Temporary traffic lights can also be used to control the traffic so that TCPs are not directly exposed to the risk of moving vehicles.

This incident clearly shows that even on low-use roads, hazards to TCPs are still present, and the results can be severe. As well, from 2000 to 2009, 19% of all claims for TCPs came from being hit by vehicles or from trying to avoid being hit by vehicles. This statistic shows that relying on reaction time has a limited effect in protecting TCPs. Therefore, the risk assessment should consider a system centered approach to offer a higher level of protection for the TCPs rather than controls based on behaviour.

[1] Kroemer, K.H.E. and E. Grandjean (1997) *Fitting the Task to the Human*. 5th Ed. London, UK.