

3M Transcript for the following interview: Ep-45 Connected Roads

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Welcome to the 3M Science of Safety podcast presented by 3M Australia and New Zealand Personal Safety Division. This is a podcast that is curious about the signs and systems of all things work, health and safety, that keep workers safe and protect their health. I am Mark Reggers, an occupational hygienist, who likes to ask the questions Why, How, and Please Explain. Whether you are a safety professional, occupational hygienist, or someone with any level of WHS responsibility in the workplace, maybe you are a user of safety products or maybe you are a bit of a safety nerd who finds this stuff really interesting, then this is a podcast for you.

(R) Today we're talking about connected roads with Kosta. Welcome back, Kosta.

(K) Good morning, Mark.

(R) Fantastic to have you back. So, for those who haven't listened to our previous chat, can you please introduce yourself? Who are you and where are you from?

(K) I'm Kosta Karagiannopoulos. I work for 3M at the Transportation Safety division and I'm an Application Engineering Specialist.

(R) So, you get involved with traffic signs, anything traffic safety, road markings, delineators. That's your world?

(K) Correct and I'm also involved in the 3M Connected Roads program.

(R) Interesting, which is why we got you in today to have a chat because I know I've been hearing about connected roads generally on social media and it seems to be this big thing but when we talk about connected roads, what are we actually referring to? I've got a vision that comes in my mind, but I'm sure there's more of a precise definition that I hope you can help us out with.

(K) So, in the early days, the concept of having a fully autonomous vehicle was a great idea and everyone thought that all you have to do is jump into your car and just tell it where you need to go, and it will take you there.

(R) Sounds like the dream. I'm looking forward to that day.

(K) Well, we're all looking forward to that day but reality kicks in at some point and we realise that we can put a lot of sensors on a vehicle to make it able to see where it is, have what we call the special awareness.

(R) Or scanning the immediate environment.

(K) Exactly and think of where it needs to go and how it's going to go there. But the problem is that the sensors are expensive, so we can make such a vehicle very viable if you like, but it's going to be probably expensive for anyone but the richest of people to purchase and utilise. And at the same time, we'd have to load the vehicle with lots and lots of sensors. So, the solution to that, if you like, to be able to make the vehicle see better and see easier on the roads is to create a type of infrastructure that caters for that type of vehicle and that is what we refer to as connected roads, so a type of infrastructure that the vehicle can read and perhaps

even communicate with and stream live information back and to the vehicle from the environment.

(R) So, it can sense or be told there's a stop sign coming up, or there's a speed limit. Is that what you mean by signs communicating?

(K) Not just that. This type of interaction can already happen from the vehicle itself. We want to take you to a step further so say for example there's a work zone ahead. How could an autonomous vehicle interact with a work zone? Will it be able to see it because it's not a standard signage? It's a temporary signage. It wasn't there yesterday. It's there today. It may not be there in a couple of hours. Will it see it? Will it see it properly? What's the action that it's supposed to take? What if there's an accident two kilometres down the road? We want the vehicle to know about these sorts of things and take proper action. For example, in the accident, if there's still debris on the road, all the vehicles that travel in that direction will be notified about that accident and they can slow down, change lanes if necessary or stop, come to a full stop and therefore save everyone's lives and prevent any more incidents.

(R) So, definitely a future that sounds pretty exciting. And I'm asking your crystal ball here because I mean you see Google and Tesla and Uber all working on these autonomous vehicles and now these connected roads. I mean, is there a date or a window to get to that point because it's not just a case of let's just make a vehicle that can see and sense everything. There's probably steps along the way. How long is this likely to take?

(K) That's a very good question and there's a lot of crystal balling here because with everything technology, it's advancing so quickly that no one can quite put the finger and say, "This is when it's going to happen," but the general consensus and I agree with that; my opinion is that we're probably maybe 20 to 30 years away from

seeing something that's very close to a fully autonomous vehicle, but I think human drivers will share the roads with connected automated vehicles for at least another 20, 30 years. So, maybe for a fully automated vehicle, fully autonomous vehicle, we're looking at something maybe in the 40 to 50 years' time, which I know sounds very far away, but that's just a prediction. It may come a lot quicker than what we think.

(R) Technologies flies. Its speed; just when you think it's zigging and then it starts to zag. It depends on where it goes. So, 50 years is a fair way away. What are the steps to get to that particular point?

(K) The Society of Automotive Engineers, they've come up with six levels of automation, so we start with a level zero vehicle, which means it has absolutely no automation and goes up to level five, which is considered to be a fully automated vehicle.

(R) That's that end goal. That's many years down the track, whenever that it is.

(K) That's the dream. So, the next level up from level zero, which is no automation, would be level one, which is driver assisted system, such as your ABS and your lane departure warning systems.

(R) That's where we are today in a roundabout way, depending on how new your vehicle is. But that's where we are, level one.

(K) Yes, more or less and we actually have a level two vehicle, such as the Teslas with partial automation. Next up you have your level threes, conditional automation, level fours, high automation and then the dream, level five, where you just walk into your vehicle. There may not even be a steering wheel inside and you just ask it to take you where you need to go, and it will take you there.

(R) There's a lot of steps there in each one of those, I'd imagine. That's another big jump forward in technology and trust and reliability but you've got to have a pathway of what we're aiming for.

(K) Exactly but what's interesting is that whilst these levels were defined, and this was a concept that the industry would work around and try to implement, these days we find more and more studies are happening and it looks like we may be skipping levels two to four and try to go to something like level five. The reason behind this is what exactly you said earlier with the Teslas where the ... and I'm just bringing Teslas in as an example. It's not just the Teslas but any non-fully automated vehicle or any vehicle with partial automation still needs the driver's input and assistance but human nature is that drivers go behind the wheel and they think they hear 'autopilot' or 'automated' and what it is they'll completely ignore the driver's skills and responsibilities. So, they start doing something else, focus on their pad or the phone doing messaging, and this is why we have these accidents. So, studies have shown that we either have to have the human element firmly behind the wheel, steering, even with partial automation or not have it at all. So, level two, three and four may actually be counterproductive because people will focus on doing other daily tasks and not actually pay attention on the road while they should still be doing that and it's quite clear by the vehicle manufacturers but it's just human nature.

(R) I get it. I'm either driving or I'm not driving. It's either one of the two. Either I've got full control, or I can focus on something else, whatever it may be. So yeah, I can see where that would make sense, but I guess that's the understanding, what are the impacts of these types of technologies and what's going to be safe, what's going to make sense and not cause an accident every time an autonomous vehicle goes for a spin down the road. So, you mentioned before about the infrastructure. Now, talking about signs, connecting, it just becomes part of our society in

everywhere we go. That's going to be huge. I mean, what are some of the technologies that I guess ... well, we're crystal balling a little bit again ... that will come into play because that's a huge thing to have all this connectivity between signs and changing conditions and the challenges that come along with those technologies.

(K) So, at 3M we're working on our core strengths in the business to try to improve the infrastructure ... for example, the traffic signs. We're trying to make them machine readable. They're already readable by humans but we're trying to make them foolproof if you like, because right now, what the camera systems are trying to use is some sort of OCR, optical character recognition or shape or graphic recognition to understand what it is and interpret that sign in an analogue level. But what we're trying to do is convert those signs into a form of binary or digital if you like.

(R) Digital, yep.

(K) Yes. On the pavement marking, where you have things, what we're trying to do is make the pavement markings again more visible to the machines, to the cameras and we're trying to improve on that for situations where the road marking could be completely invisible, for example. What happens if there's snow on the road? You certainly don't expect human drivers to be able to see the road markings because the road is fully covered by snow, so we're trying to come up with solutions that will make those road markings visible to perhaps some sort of radar or sonar if you like to the vehicle.

(R) They're definitely real-world situations that I had not thought about until you just mentioned them before, because I don't live in an environment where there is snow, but it makes sense. If it's not snow, or other kind of debris or whatever on

the ground, you still want to have that reliability. So, what are the challenges going forward for some of these things that we're trying to work on?

(K) Well, I think the biggest challenge is to convince people that first of all they need to improve the infrastructure and bring that infrastructure for the vehicles out there. Some people think the vehicles should do all the work, the vehicle manufacturers should do all the work; improve the cameras, improve the algorithms but the reality is, they can do so much, and we have to do our bit on the other end as traffic engineers and help those vehicles build that redundancy to be able to navigate properly. One of the biggest challenges with the optical systems in connected automated vehicles is that each vehicle manufacturer is different, so they're using different optical systems, different software algorithms, so what one vehicle may see in a sign and they may be able to read it properly very easily may not be what the next vehicle sees from another manufacturer.

(R) Can you have a vehicle to the cloud? Now, I'm only just talking, brainstorming here. I love my cloud accounts and I can access stuff. Would that type of play work in this space, where it's always connected to a cloud that's feeding it information?

(K) Most definitely and this is the type of the connected roads that we envisage for the future, but each vehicle will upload in real time data onto perhaps a road agency's cloud and feed that data back to the relevant vehicles, if we go back to the accident example that I brought up earlier. So, let's say an accident happens right where your vehicle is located, and your vehicle picks that up, then it can transmit that information up to the cloud, so now it can be transmitted to all the relevant vehicles that are approaching the area or they're scheduled to drive past that area and perhaps take a different route.

(R) This is a safety podcast, work health and safety. So, what are the health and safety, worker benefits that you see coming out of this connected roads, autonomous vehicle area because I'm sure there must be some in there.

(K) There most definitely is. The biggest benefits that people who work in work zones will see is that the vehicles, as they approach a work zone, ideally you will set the speed down to a low ... let's say in Australia 40 kilometre per hour speed and change lanes and pay respect to the road rules that apply to that section of the road. We see a lot of the drivers these days, the human drivers, to just race past. They see traffic signs and roadwork signs and 40, down from an 80 kilometre per hour speed limit and they just don't ...

(R) Just ignore it. We've all seen it, yeah, literally ignore it. It's just the speed zone if it wasn't a work zone.

(K) Yes. And worst of all, people still drive, and they play with their mobile phones which is really, really bad because it's not just the speed. If they're not paying attention, they're not looking at where they're going, they may end up ... and quite often they do ... inside where people are actually working. This is where you have the accidents, so you have the speed and then you have the people driving in the zones where they're not supposed to. But you would expect the fully autonomous vehicle to completely bypass all that and adhere to the rules and perhaps as soon as they clear the work zone, they can give control back to the driver and then the driver can speed off again back to where they need to.

(R) I could imagine from driver fatigue, that aspect would be quite beneficial from a worker health point of view, and the fully autonomous vehicle end of the spectrum where you can get the vehicle and maybe have a nap, depending how long your drive is or where you've got to get to.

(K) It certainly helps there as well, especially with the truck drivers. There have been quite a lot of incidents lately in Australia with truck drivers being very tired, working overtime, working long hours, not getting enough sleep and it will certainly help there, where the vehicle won't have to tell them to take a break any longer, but it can take over and keep going and when the driver is rested enough, they can wake up and take over and just continue the journey without having to stop.

(R) I'm sure there's plenty more we haven't covered. Just having a quick think about it, there certainly are some big benefits from the health and safety side, not just from a society impact point of view. So, going forward from this point, what needs to happen to have this ideal future as a future reality?

(K) So, there are two things that need to happen really. The OEMS, the vehicle manufacturers need to keep working on their vehicles, improving their technologies and bringing the cost down because there's no point in creating a technology that works well, but no one can purchase.

(R) We can get to the moon, but everyone doesn't have a rocket, so it's got to be affordable in a very weird analogy way there.

(K) That's a very good analogy, actually. I like it. So, that's one leg. The other leg would be to invest in building that connected roads infrastructure and that's build in a digital future where we allow the vehicles and the infrastructure to communicate. We have that vehicle to infrastructure and backwards communication. The key is redundancy, how vehicles and autonomous vehicles and the brain of a computer if you like operates and thinks is way different to how a human driver thinks and operates, so we have to have those redundancy systems, check systems in there to provide a safe solution and keep implementing the advanced driver assisted systems like we do these days. I mean, look, who knows the future holds? This is where we're aiming at now and I believe we have to be

aiming at a certain future. All the road agencies and the government and everyone is working towards that. They keep preaching that towards a zero mantra and I think that's one way of achieving it. Statistically it's been shown that most accidents are related to human drivers, human driver error so the obvious choice is to remove the element of the human driver from the equation to try and bring those accidents and incidents down. Who knows where we're going to here? Things might change. I mean, we keep hearing about flying vehicles now and vertical take-off vehicles and that might change in the future as well. Who knows but yeah, we have something solid, something that we can achieve relatively easy with current technology. It's not some sort of space technology that we have to invent 30 years from now. It's just that it has to come down slowly and drip-fed into our society.

(R) Certainly, an interesting topic. Not one that I usually think about in my normal day-to-day activities, but really appreciate you coming in, Kosta and yeah, helping us have a chat about this.

(K) Thank you, Mark.

(R) Well, thanks for listening everyone. If you have any questions, comments, suggestions for future topics or guests you think would be great to get into the studio, you can shoot us an email to scienceofsafetyanz@mmm.com. You can also contact us via that email if you need any information around connected roads or what 3M are doing in the future as well as the safety products and equipment we usually talk about. 3M are certainly here to help. You can also visit our website, 3m.com.au/sospodcast which has a transcript of our conversation that Kosta and I have had today as well as links to other resources. Be sure to subscribe to the podcasts through Apple Podcasts, Spotify or Google Podcasts or wherever you get this podcast from so you don't miss any future episodes and if you enjoyed the podcast or found it informative, we really would appreciate it if you can take a few

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