Driverless vehicles – the road ahead

There has been much press coverage of the recent accident in Arizona in which an Uber vehicle, in driverless mode, although with a driver present, was involved in an accident in which a woman was killed. As I write, there are a number of conflicting theories of what actually happened, and I don't want to discuss the accident directly. However it seems to me that the amount of negative press coverage that the accident has received is very significant, and has led to calls for driverless autonomous vehicle trials to be suspended both in the USA and elsewhere. For example Christian Wolmar, a railway journalist and a former Labour party hopeful for the London Mayoral elections, has tweeted
More on Driverless car death. It will be a game changer and slow or halt this crazy rush to a technology no one asked for.
He has followed this up by an article in the Mail on Sunday entitled "Life-saving vehicles of the future or Uber's driverless death traps?" He is very forthright in his views and has drawn them together in a short provocative but highly entertaining book "Driverless Cars: On a Road to Nowhere". The book should be required reading for all those involved in the autonomous vehicle field, to counteract some of the hype that surrounds the developments.
Articles such as these and others have led me to consider what would be the level of accident risk for autonomous vehicles that would be acceptable to the public. Some would argue that the risk of autonomous vehicle accidents should be comparable with that from conventional road traffic (which leads to around 1700 fatalities and 175,000 injuries in the UK each year). The press coverage of the accident strongly suggests to me that this is not the case, and the public will expect safety levels more comparable to those that operate on the railway network (where the comparable figures are around 15 passenger fatalities and 11,000 serious injuries to passengers per year for the UK, mainly from trips and falls or platform edge incidents). These differences are stark, even allowing for the differences in the number of journeys by road and rail. The sociological reasons for this are complex and need to include considerations of personal control over risks versus giving that control away to others. Nonetheless if such high safety levels are to be expected, this is setting the bar very high indeed for autonomous vehicle safety systems. So high, I would suggest, that the time when autonomous vehicles can function in normal traffic environments is many decades away.
Having pondered this a little, I offer the following thoughts for consideration. Firstly, I don't want to be too negative about the future for autonomous vehicles. Current developments to provide a level of autonomy that helps drivers without increasing accident risk (up to around automation level 3) are to be much welcomed. Also I think the technology could be used for completely autonomous travel (automation level 5) for what I will call restricted networks – networks where autonomous vehicles of various types and modes are segregated from other traffic or pedestrians, or are operating at low speeds where any accidents will not be serious, and thus the risk of accidents involving conventional vehicles or pedestrian is minimized. For such systems the vehicle technology can be much simpler than some of the sensing technologies that are currently being developed by, for example, Uber and Google – for example the driverless autonomous ULTRA pods at Heathrow which run on restricted tracks, or the

concept outlined by John Miles of Cambridge University, where vehicles run on simple one carriageway roads, with a system that allows vehicles to follow sensors buried in the road. Indeed rail systems such as the DLR and Thameslink already have a high degree of automation and don't (at least for parts of their routes) require drivers. The important point is that the development of such networks would need to focus on infrastructure technology rather than vehicle technology.

So taking these thoughts further, let us consider some possibilities for the development of autonomous technology.

- Community restricted networks – towns or urban areas where the community decides that only autonomous vehicles should be allowed (together with cyclists and pedestrians of course), which would operate at low speeds, partly on reserved roads or tracks and partly in shared spaces. Hybrid vehicles that can operate in normal driving mode outside the area could be used, as well as specifically designed vehicles for shared spaces – such as for example the Milton Keynes pods.
- Inter-urban medium to high-speed networks – restricted lanes on roads or motorways (separated physically from conventional vehicle lanes) where cars, public transport vehicles and lorries could operate in autonomous mode. This would require, say, the fast lane on motorways to be restricted to such vehicles and would need some innovative thinking to design suitable junctions for vehicles to joining and leave the lanes. Such lanes could carry lorry platoons. I would not be as negative as Christian Wolmar is to this concept (a reading of his book shows he really, really doesn't like the idea), and I think there is probably a market for long distance journeys for lorries to and from ports and distribution centres. This would effectively be the rebirth of wagonload railway freight.
- Cheap, medium to high-speed busways, using the sort of technology described by John Miles, consisting of a single conventional carriageway with inbuilt sensors. Again, there would need to be strict segregation from other vehicles, but such systems could offer relatively cheap mass transit systems in urban areas, and could also (potentially) replace short railway branch lines with a more flexible provision that could run into towns and population centres not directly on the branch line. The GW south-western branches might be possible candidates for such schemes.
- Shared infrastructure with lightly used railways with autonomous public transit vehicles running on track formation with suitable modifications (wheel tracks to the side of the railway tracks), but able to leave it to access local population centres. An example of such an a network might be the Cambrian Coast line, where frequent, short, autonomous vehicles could provide the base service that would be able to serve stations on the line and provide, via restricted busways, links to other population centres (eg. from Porthmadog to Bangor or Barmouth to Dolgellau). Train services could still operate for through services to Shrewsbury or Birmingham and at peak times. Clearly work would be required to develop complementary train and vehicle control systems in such circumstances.

I make the last two suggestions with some nervousness as the replacement of train services by bus transport has an unhappy history. Nonetheless the use

of autonomous vehicles does, in principle, offer some prospect of improved services, with greater flexibility and some costs reductions. For any such schemes, It is in my view vital that the travel quality should not be reduced (i.e. the vehicles should offer the same level of comfort as trains with similar ride quality) and that the infrastructure for passengers waiting and boarding (i.e. stations) should also be of high quality, with waiting facilities, ticket machines etc.) and not merely a roadside bus stop.

No doubt there are other possibilities for the use of autonomous vehicles on restricted networks, with some more controversial than other. The challenge is to use the developing autonomous technologies to improve the overall transport network without compromising safety. And to repeat what I have already said, this will require that the focus for such developments should be on the infrastructure as much the vehicle.