Automated vehicles (AVs) will crash less frequently than human-driven vehicles, but they will still crash. These crashes will sometimes create victims, and these victims will justifiably demand compensation. Our legal system is well-equipped to handle non-automated vehicle crashes, but AVs will challenge our existing doctrine. It is not yet clear how liability will be assigned when an AV crashes.

Each part of this four-part brief series considers one of four possible defendants—AV manufacturers, operators, fleet owners, and dispatchers—in a lawsuit following an AV crash. This brief (Part One) explores the liability and insurance outlook for AV manufacturers.
1 Background

This four-part series explores questions around AV liability and insurance. Our purpose is to highlight areas where the emergence of AVs will pose a challenge to existing legal doctrine. Uncertainty in liability is a major barrier to deployment of any new technology, especially one with such wide-ranging effects as AVs. A predictable, fair, and science-based approach to creating liability rules would assist in facilitating the rapid deployment of the safest AV business models.

Each part of this brief series considers the liability burdens that a particular party to an AV crash could bear. This brief—Part One of the series—explores the liability and insurance outlook for AV manufacturers.

An AV manufacturer, for the purpose of this brief, is a company that manufactures both the vehicle itself and the vehicle's self-driving system. It is conceivable that the vehicle manufacturer and the system manufacturer could be separate parties, but for simplicity we here assume they are one and the same.

The brief makes three additional simplifying assumptions:

- AVs are individually owned (i.e., they are not part of fleets).
- AV insurance, like conventional auto insurance, is available to manufacturers in a competitive market with different insurance products available.
- Parties choose to purchase insurance when it is economically rational for them to do so.

This brief is structured as follows. Section 2 describes challenges to determining liability for and insuring AV manufacturers. Section 3 presents three possible liability and insurance frameworks for AV manufacturer insurance and notes the advantages and drawbacks of each. Section 4 outlines anticipated outcomes of each framework at different levels of vehicle automation. Section 5 concludes.

2 Challenges

2.1 Manufacturer liability

Most automobile accidents are evaluated under either a negligence or products liability framework. Typically, courts evaluate unintentional human errors under the negligence standard and unintentional manufacturing errors under products liability. Suppose a human-driven vehicle drives through a red light at an intersection. If the vehicle drove through the red light because the driver was inattentive, courts will evaluate whether or not the driver's inattention constituted negligence. If the vehicle drove through the red light because its brakes failed, courts will evaluate whether or not the manufacturer sold defective brakes. These two lines of inquiry are usually separate. Human drivers are liable for their negligence but not for manufacturing deficiencies, and the manufacturer is liable for selling defective products but not for human driving error.

AVs will complicate this basic evaluative framework. The process of automating driving tasks—that is, giving tasks over to the ability and judgment of a computer—blurs the line between human error and manufacturing defect. For example, reconsidering our previous hypothetical, suppose an AV drives through a red light at an intersection. If the vehicle drove through the red light because the driver was inattentive, courts will evaluate whether or not the driver's inattention constituted negligence. If the vehicle drove through the red light because its brakes failed, courts will evaluate whether or not the manufacturer sold defective brakes. These two lines of inquiry are usually separate. Human drivers are liable for their negligence but not for manufacturing deficiencies, and the manufacturer is liable for selling defective products but not for human driving error.

Products liability is a “strict” liability standard, meaning a plaintiff need not demonstrate that the defendant acted negligently in any way. In other words, a manufacturer is liable for product deficiencies even if the manufacturer
exercises reasonable care at every step of the manufacturing process. All that matters is whether the product deficiency caused injury.

Products liability has been the default standard for suing a vehicle manufacturer. Since the introduction of the automobile, there have been numerous products liability lawsuits brought against automakers. Products liability doctrine is robust and courts are familiar with products liability analyses. However, it is possible that courts or legislatures could craft or repurpose a different liability standard—either more or less burdensome to manufacturers than traditional products liability—depending on societal goals. If society’s priority is to streamline adoption of AV technology, a negligence standard would be less burdensome for manufacturers. Such a standard would mean that manufacturers would only be liable for injuries caused by AVs they produce if it can be shown that the manufacturer did not exercise reasonable care to prevent that particular AV crash. This would significantly reduce the manufacturer’s legal burden, making entrance into (or expansion within) the AV market a much more attractive prospect for manufacturers.

If society’s priority is to maximize victim compensation via a zero-tolerance approach to AV accidents, absolute liability would be an even stricter standard than products liability. Here, a manufacturer would not only be strictly liable for injuries caused by AVs they produce, but would additionally bear the burden of proof in court. Instead of the plaintiff having to prove the AV caused the injury, the manufacturer would have to prove it did not cause the injury. Products liability cases are often expensive for plaintiffs because of legal costs associated with proving the nature of the defect. Absolute liability could shift much of those costs to the defendant manufacturer.

Regardless of how liability is assigned, the level of automation present in a given vehicle will be highly relevant. Although a vehicle capable of full self-driving and a vehicle that requires constant human monitoring are both AVs, they suggest a fundamentally different conception of both the manufacturer and the human driver’s levels of responsibility. Human control and manufacturer liability are inversely proportional. The more control the human driver has, the less likely that the manufacturer will bear liability (and vice versa). The Society of Automotive Engineers (SAE) has developed a widely used system for classifying vehicle-automation levels (Table 1).

**Table 1. SAE classification system for automated vehicles**

<table>
<thead>
<tr>
<th>SAE level</th>
<th>SAE name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No automation</td>
<td>All aspects of driving are fully human and manually controlled.</td>
</tr>
<tr>
<td>1</td>
<td>Driver assistance</td>
<td>Automation assists with only one aspect of driving (e.g., steering, speed,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>or braking control).</td>
</tr>
<tr>
<td>2</td>
<td>Partial automation</td>
<td>Automation assists with multiple aspects of driving, allowing for limited</td>
</tr>
<tr>
<td></td>
<td></td>
<td>self-driving. Driver must monitor and be ready to take control of the vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>at all times.</td>
</tr>
<tr>
<td>3</td>
<td>Conditional automation</td>
<td>Lowest-tiered system classified as automated driving. Automation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>controls routine driving, but manual override is required in challenging</td>
</tr>
<tr>
<td></td>
<td></td>
<td>situations. Driver must monitor and be ready to take control of the vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>at all times.</td>
</tr>
<tr>
<td>4</td>
<td>High automation</td>
<td>Automation controls all driving in most conditions. Manual override is</td>
</tr>
<tr>
<td></td>
<td></td>
<td>possible but only required in very challenging situations.</td>
</tr>
<tr>
<td>5</td>
<td>Full automation</td>
<td>Automation controls all driving in all situations. Manual override is not</td>
</tr>
<tr>
<td></td>
<td></td>
<td>necessary and may not even be possible.</td>
</tr>
</tbody>
</table>

If the human driver has significant control over the vehicle and driving tasks, it is likely that courts will apply a

---

1 Among the most notable of these cases are MacPherson v. Buick Motor Co, 217 N.Y. 382 (N.Y. 1916) and Henningsen v. Bloomfield Motors, Inc., 32 N.J. 358 (N.J. 1960). In both cases, the courts found that victims of automobile manufacturing defects are entitled to compensation for their injuries.
traditional negligent driving inquiry. Hence the driver (rather than the manufacturer) of an SAE Level One AV will be more likely to bear liability for negligent driving, since she or he enters the vehicle’s driver seat accepting the responsibility for being largely in control of the vehicle. On the other hand, the operator of an SAE Level Five AV has little or no control over the vehicle or driving tasks. Some prototypes for such vehicles do not even have a manual steering wheel or brakes, meaning the “driver” of the vehicle cannot logically be the human. Here, liability will likely revert to the manufacturer since there is little or no room for the driver to commit a driving error. At SAE Levels Two, Three, and Four, liability determination is less clear. Inquiries will likely be incident-specific and based on the relative amounts of control maintained by the driver and the vehicle system. Across all levels, the use of data collected by an AV’s sensors, cameras, and other data-generating devices will aid in the process of determining which party was “at fault” for a crash.

2.2 Manufacturer insurance

Insurance can help stabilize the manufacturer’s expected legal costs, but in order for manufacturers to know how to insure, they need to know the likelihood that they will be assigned liability. If manufacturers do not know how courts will assign liability, they will not know if they need to carry insurance, or what type. Finding an appropriate insurance policy based on unknown risks will be difficult.

Clarifying liability will also help determine the types of insurance products needed. Under a scenario in which AV manufacturers will likely be liable for injuries caused by the AVs they produce, they may need an insurance product similar to the commercial fleet insurance widely offered for non-automated vehicles by large insurers such as Geico, Allied, and State Farm. These insurers, as well as new market entrants, could adapt such policies for AV manufacturers. Indeed, Munich RE, one of the world’s largest reinsurers, recently introduced the world’s first liability insurance policy specifically for AV testers and developers.²

After identifying the types of insurance products needed, insurance actuaries and underwriters must determine how these products should be structured and priced. The novelty of AVs presents a challenge in this regard. In the United States, automobile fatalities occur at a rate of roughly 1 fatality per 80 million vehicle miles traveled (VMT).³ This means that large insurance companies work with datasets of approximately 100 billion VMT to accurately model human-driver risk. Accurately assessing AV risk will require datasets just as large—or perhaps even larger, since AVs will likely be far safer than non-automated vehicles. The Rand Corporation estimates that data on at least 275 million failure-free miles are needed just to prove with 95% confidence that AVs cause the same number of fatalities as human drivers.⁴ But as of September 2018, AV industry leader Waymo has logged just 9 million self-driven miles on public roads, and the worldwide total of highly automated VMT on public roads is likely under 20 million. Even if an insurer somehow had access to the entire dataset of all the world’s highly automated VMT (and they likely will not unless some sharing is mandated, as this data is essentially a trade secret), it is too small to use for even relatively simple forecasting.

Given this uncertainty, it is possible that traditional insurers will either overestimate or underestimate the probability and cost of AV accidents, and therefore overprice or underprice their insurance policies. There will be great market demand for specialists, likely former employees of major AV companies or academics and researchers, who have particularized knowledge of AV technology and software risks. These specialists may join existing insurance firms or may launch boutique firms that focus exclusively on AVs or even a particular manufacturer’s line of vehicles.

² Munich RE. Autonomous Vehicles.
³ Insurance Institute for Highway Safety, General Statistics.
3 Possible liability and insurance frameworks

3.1 Products liability

At present, manufacturers are most likely to be held liable for AV accidents under a products liability approach because it is their default legal standard. A products liability lawsuit requires a defective product, which means the plaintiff must prove to the court’s satisfaction that the product is in fact defective. There are three well-established subclasses of product defects:

- **Design defects** occur when a product’s design makes the product inherently and unreasonably dangerous to use. For example, a manufacturer could sell an AV incapable of distinguishing flying insects from pedestrians. If an AV injures its occupant because it slams on the brakes to avoid hitting a gnat, a plaintiff could sue under a design defect theory.

- **Manufacturing defects** occur when a product is made or assembled incorrectly or when a quality-control error occurs. For example, a manufacturer could accidentally sell a particular AV with inoperative sensors. If a sensor flaw causes a crash, a plaintiff could sue under a manufacturing defect theory.

- **Warning defects** occur when the consumer does not receive adequate warning about a product’s inherent dangers. For example, a manufacturer could sell an AV with no warning that an AV might crash in certain situations, or it could advertise that “our AVs will never crash.” If the AV does eventually crash, a plaintiff could sue under a warning defect theory.

Each of these theories has proven viable for non-AVs in different circumstances, and each could be viable for AVs as well. The design defect theory is particularly noteworthy with regard to AVs. A zealous court could hold that any AV that crashes is ipso facto defective under a design defect theory, since AVs are supposed to be designed to not crash. A more moderate court could hold that some—but not all—AV crashes indicate the existence of a product defect. We do not know how courts will interpret the concept of “defective” for AVs. But unless the legislative or executive branches of government provide clarification on what constitutes a product deficiency for an AV, individual judicial interpretations will create the rules.

If courts analyze AV crashes like they analyze non-AV crashes, design defect litigation will probably turn on whether the court feels that a particular AV’s software design makes using that AV “inherently and unreasonably dangerous.” Common sense suggests that there must be a minimum threshold where an AV could be so incompetent as to be unreasonably dangerous—for example, if it could not recognize street signs or it frequently failed to identify pedestrians in a roadway. However, if courts create a minimum threshold that is impractically high, any crash scenario could be deemed unreasonably dangerous. This could create an unlimited liability burden on AV manufacturers that would stunt the nascent AV industry.

Clarity on what constitutes a design defect for an AV is especially important given that litigating a case involving an AV crash under a design defect theory is already likely to be difficult in practice for several reasons. First, it will be hard for a plaintiff to find people with deep enough knowledge of a particular company’s proprietary driving software to serve as expert witnesses, particularly while AVs remain novel. Second, even those with technical expertise will find it challenging not only to identify defects in software coding or machine-learning algorithms that led a particular AV to crash, but to clearly explain the error to a jury or judge with no special technical knowledge. Third, until judicial precedent crystallizes, courts may reach vastly different conclusions about whether or not certain software and algorithmic errors render AVs “inherently and unreasonably dangerous,” which could lead to inconsistent legal precedent across different jurisdictions. In short, design defect is likely the most viable products liability theory under which to sue an AV manufacturer. But a design-defect lawsuit will likely also be a very difficult

---

case for the average plaintiff to bring.

It is also important to recognize that products liability lawsuits are expensive for manufacturers as well as plaintiffs. Even the threat of a products liability lawsuit can result in legal costs that exceed damages sought. The prospect of frequently facing such lawsuits may discourage new companies from entering the AV sector. Again, improved clarity regarding what constitutes AV design defect can mitigate much of the problem. If manufacturers know they may be liable under design-defect theories for most or all of their vehicles’ crashes, they can insure accordingly and/or settle early with plaintiffs to achieve the goal of victim compensation more efficiently than protracted litigation.

3.2 Absolute liability

An alternative strict-liability framework that could be applied to AV manufacturers is absolute liability when at fault (ALWAF). Borrowed from the Federal Safety Appliance Act, ALWAF is an even more plaintiff-friendly standard than strict liability because of its unique burden-shifting approach. In most tort liability frameworks, including products liability, the defendant is presumed not guilty until the plaintiff proves otherwise. Under ALWAF, by contrast, the defendant is presumed guilty and bears the burden of proof to show that they are completely without fault.

An ALWAF framework for AVs would presume the vehicle manufacturer to be completely liable for any harm that one of its AVs causes. In case of an incident, the manufacturer would need to rebut this presumption by proving its vehicle was precisely 0% at fault for associated harm. If the judge or jury found the manufacturer even 1% responsible, the manufacturer would need to fully compensate the victim, even if the victim or another party bore 99% of the responsibility.

The argument in favor of an ALWAF framework is that it would maximize victim compensation because it will be so difficult for manufacturers to prove they are 0% responsible for a crash. The downside is that this massive potential liability burden could discourage manufacturers from entering the AV market, depriving society of the safety and other benefits that AVs can offer. Insurance may play a role in assuaging manufacturer reluctance. The insurance outlook under ALWAF is similar to products liability in that drivers likely will not purchase liability insurance, but manufacturers almost certainly will. The underwriting and pricing challenges described in Section 2 will still apply. Manufacturers will want insurance, but insurers—at least initially—will have very little information with which to assess risk. Cooperation and data-sharing between manufacturers and insurers will be essential to creating a fair rate.

Consumers could also benefit from insurer-manufacturer cooperation if it results in manufacturer insurance rates that accurately reflect the risk of vehicles produced by the manufacturer and if these rates are made public. Consumers may struggle to understand a highly technical safety report, but they can readily understand that lower insurance rates generally indicate a safer product. Fair insurance rates hence provide a useful market signal.

3.3 Negligence and “The Reasonable Computer Driver”

While the ALWAF framework would more frequently impose liability on manufacturers and allow individual plaintiffs to recover more easily, it may ultimately be counterproductive for improving overall public safety.

We assume, as most experts do, that AVs will cause proportionally fewer accidents than human drivers. Given that society bears a massive cost from lost lives and productivity associated with car crashes, there is a strong argument to be made for encouraging proliferation of AVs. However, if AV manufacturers will face massive liability burdens (and thus massive insurance burdens), companies will be less likely to enter or expand their presence in

---

the AV sector. The result will be a delayed transition from conventional to automated vehicles, and hence delayed realization of the safety benefits that AVs can offer.

An alternative to a strict liability scheme is a negligence scheme, the standard commonly applied in non-AV crashes. Negligence is defined as “the breach of a duty of reasonable care.” In simpler terms, negligence is when one unintentionally injures another because the injurer failed to take appropriate precaution. A “duty of reasonable care” exists in a scenario when one is legally obligated to take reasonable precautions. Driving a car is one such scenario.

It is legally established that human drivers owe a general duty of reasonable care to others (both drivers and pedestrians) on the road. In practice, this means that drivers have a duty to drive safely and avoid accidents whenever possible. Some elements of this safety duty are created by statute—for instance, laws compel drivers to obey traffic signals and speed limits, so a failure to obey a traffic signal is treated as a failure to take reasonable precaution. Other elements of the safety duty are not explicitly spelled out in statute but are expected of all drivers as an exercise in reasonable common sense. For example, driving a vehicle while blindfolded may not be specifically prohibited by a statute, but courts will nevertheless find that driving while blindfolded is a failure to take reasonable precaution. In non-statutory cases, courts apply the “reasonable person test.” Here the court simply asks whether a hypothetical “reasonable person” (meaning a person who acts prudently, legally, and with society-average skill and judgment) would have acted as the defendant did. In an automobile negligence lawsuit, the defendant may be found to have breached the duty to drive safely if a reasonable, average driver would have acted differently.

While computer drivers do not suffer from the same afflictions that typically cause humans to crash (e.g., inattention, lapses of judgment, non-sobriety), deficiencies in computer systems may yield similar results. If a vehicle drives through a red light and hits a pedestrian in the crosswalk, it is of little import to the pedestrian whether the injury was caused by a human driver’s inattention or a computer driver’s sensor error. The pedestrian’s injury is the same in either scenario, and courts should be equally well-equipped to analyze a human driver and a computer driver by reference to what a reasonable, non-negligent driver would have done in that scenario.

Negligence would be an easier standard for AV manufacturers because unlike either products liability or ALWAF, a manufacturer could avoid liability by demonstrating that their AV acted like the “reasonable driver” would have done in the same the situation. This would require that AVs perform at least as well as a “reasonable” human driver, meaning that vehicle must obey all traffic laws, make rational judgments about when to change lanes and make turns, and drive with at least human-average skill.

In addition to encouraging AV proliferation, negligence lawsuits are generally less time-consuming, and therefore cheaper for the parties, than products liability lawsuits tend to be. A “reasonable driver” analysis would likely be easier for both judges and juries to resolve than an analysis of highly technical evidence about programming algorithms. This means less time litigating and less money paid in attorneys’ fees.

The downside of applying a negligence framework is that when manufacturers can win on a claim, injured plaintiffs will lose. However, vindication by the courts is not the only route to plaintiff recovery. Health insurance held by the plaintiff and any auto insurance policies held on the AV can help compensate victims. Pre-trial settlement is possible as well: even if negligence lawsuits are cheaper than products liability lawsuits, they may still be more expensive for the manufacturer than offering the plaintiff a settlement before trial.

A negligence framework may also discourage AV manufacturers from striving for the highest possible safety performance, since manufacturers will only be legally responsible for ensuring that their vehicles drive as well as—but not necessarily better than—human drivers. Competition may still spur manufacturers to emphasize safety.
4 Anticipated outcomes of framework application

In this section, we discuss how each of the three liability and insurance frameworks presented above would likely affect manufacturers of AVs at the different SAE vehicle-automation levels. We note that while we ground our assessment in real-world evidence to the extent possible, the novelty of AVs and the dearth of established examples means that much of this section is necessarily speculative.

4.1 Products liability

If legislatures do not impose new rules, fault for AV accidents is likely to be assigned to AV manufacturers under a products liability framework. We anticipate the following outcomes, summarized in Table 2:

- **In SAE Level One and Two** vehicles, human drivers retain considerable control over the vehicle. Accidents involving these vehicles will likely be viewed as analogous to accidents involving non-AVs, which means applying a negligence inquiry for human driving errors and a products liability inquiry for demonstrated manufacturing errors. Drivers will continue to purchase insurance.

- **An SAE Level Three** vehicle can frequently drive autonomously but may signal the driver with a “request to intervene.” This is the most challenging level to examine under a products liability framework. Negligence will likely apply when a human driver fails to respond to the vehicle’s intervention request; products liability will apply for an accident caused when insufficient warning signals are given. The vehicle’s failure to warn—either a complete failure to give any warning or a warning that is insufficient for the human driver to react appropriately—could be argued as a manufacturing defect if the vehicle fails to give a warning or as a warning defect if the manufacturer doesn’t communicate to the driver how to interpret and respond to the warning. Both drivers and manufacturers will likely purchase insurance given the liability uncertainty that this class of vehicle will pose.

- **An SAE Level Four** vehicle can autonomously handle most normal driving tasks, requiring human intervention in only specific conditions such as inclement weather. As with Level Three, Level Four vehicles will likely be subject to a mix of negligence and products liability. Negligence will be less common, likely only applying if the driver fails to take control under unusual circumstances in which the vehicle requests intervention. Otherwise, products liability will apply. Humans will probably not purchase insurance given the relatively low chance of being found negligent.

- **An SAE Level Five** vehicle is fully automated and can handle any driving task. Human intervention is not possible, so human error is precluded. Only products liability can logically apply, so manufacturers will be the only party likely to purchase insurance.

<table>
<thead>
<tr>
<th>SAE level</th>
<th>Liability</th>
<th>Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Traditional, driver-borne negligence for human error. Products liability only for manufacturing errors.</td>
<td>Traditional, driver-held insurance.</td>
</tr>
<tr>
<td>2</td>
<td>Traditional, driver-borne negligence for human error. Products liability only for manufacturing errors.</td>
<td>Traditional, driver-held insurance.</td>
</tr>
<tr>
<td>3</td>
<td>Traditional, driver-borne negligence if the driver fails to respond to a vehicle’s “request to intervene;” products liability if no request is given.</td>
<td>Held by both drivers and manufacturers.</td>
</tr>
<tr>
<td>4</td>
<td>Products liability except in unusual circumstances</td>
<td>Likely held only by manufacturers.</td>
</tr>
<tr>
<td>5</td>
<td>Products liability.</td>
<td>Held by manufacturers.</td>
</tr>
</tbody>
</table>
4.2 Absolute liability when at fault (ALWAF)

Here, we assume that a legislature (either state or federal) imposes absolute liability when at fault (ALWAF) on manufacturers of vehicles achieving a certain level of automation, as described in Section 3.2. We anticipate the following outcomes:

- **At SAE Levels One and Two**, humans retain significant control over their vehicles. Since SAE Level One vehicles are very much like human-driven vehicles outside of their automated components, human negligence is likely to be the dominant liability standard. Since SAE Level Two vehicles demand continuous human monitoring, accidents caused in the limited self-driving mode will likely be evaluated by reference to the human’s level of monitoring. This calls for a human negligence liability standard. Because human drivers are likely to bear liability, ALWAF will not apply to vehicle manufacturers and humans will continue to purchase insurance.

- **At SAE Level Three**, either ALWAF or negligence could apply. ALWAF could apply to a program like Tesla’s Autopilot if the software causes an unexpected crash despite proper human monitoring. If the system requests intervention but the driver ignores it, or if the driver is using the autonomous driving features in situations for which the features are not designed, human negligence would be more likely to apply. Both manufacturers and drivers will likely purchase insurance.

- **At SAE Level Four**, ALWAF would apply in all circumstances except when the driver ignores a request for intervention in the rare conditions where autonomous driving fails. Hence drivers may bear liability in unusual cases, but manufacturer liability will be more common. Manufacturers will purchase insurance to cover their highly likely liability. Drivers will probably not purchase insurance because the manufacturer will be much more likely to bear liability.

- **At SAE Level Five**, ALWAF would apply in all circumstances, meaning that manufacturers always bear liability. Manufacturers will purchase insurance.

<table>
<thead>
<tr>
<th>SAE level</th>
<th>Liability</th>
<th>Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Driver negligence.</td>
<td>Traditional, driver-held insurance.</td>
</tr>
<tr>
<td>2</td>
<td>Driver negligence or ALWAF.</td>
<td>Likely held by drivers and manufacturers.</td>
</tr>
<tr>
<td>3</td>
<td>Driver negligence or ALWAF.</td>
<td>Likely held by drivers and manufacturers.</td>
</tr>
<tr>
<td>4</td>
<td>ALWAF</td>
<td>Held by manufacturers.</td>
</tr>
<tr>
<td>5</td>
<td>ALWAF</td>
<td>Held by manufacturers.</td>
</tr>
</tbody>
</table>

4.3 Manufacturer-borne negligence

Here, we assume that a legislature imposes a negligence standard on AV manufacturers, as described in Section 3.3. We anticipate the following outcomes:

- **At SAE Levels One and Two**, humans retain significant control over their vehicles. The same negligence rules that currently apply to human-driven vehicles will likely apply to Level One and Level Two vehicles as well. Drivers will continue to purchase insurance.

- **At SAE Level Three**, negligence may be borne by either the manufacturer or the driver, depending on the particulars of a crash. Computer negligence may be established by showing both that (1) the vehicle did not request driver intervention, and (2) the vehicle breached a duty of reasonable care. Courts will ask whether or not a reasonable human driver would have acted differently than the computer driver. Human negligence may be established by showing that the driver failed to heed a request for
intervention, or by establishing that the human was in control of the driving function at the time of the crash. Both manufacturers and drivers will likely purchase insurance, given that either could be liable.

- At SAE Levels Four and Five, computer negligence will dominate because the human is either completely or usually not in control of the vehicle. Human negligence may still apply in the unique situations where a SAE Level Four vehicle requests intervention, such as in a snowstorm. Manufacturers will purchase insurance for the situations in which their vehicle compares unfavorably to the “reasonable human driver.” Prudent human drivers/operators will likely purchase insurance as well for the so-called “corner cases” where the computer driver caused a crash but did not act negligently. An example might include a “choice of evils” scenario where the AV swerves to avoid a child in the road and hits a parked, unoccupied car instead.

**Table 4. Anticipated outcomes under a manufacturer-borne negligence framework**

<table>
<thead>
<tr>
<th>SAE level</th>
<th>Liability</th>
<th>Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Traditional, driver-borne negligence for human error.</td>
<td>Traditional, driver-held insurance.</td>
</tr>
<tr>
<td>2</td>
<td>Traditional, driver-borne negligence for human error.</td>
<td>Traditional, driver-held insurance.</td>
</tr>
<tr>
<td>3</td>
<td>Driver- and computer-borne negligence.</td>
<td>Held by drivers and manufacturers.</td>
</tr>
<tr>
<td>4</td>
<td>Computer-borne negligence dominates. Driver-borne negligence only in unusual circumstances.</td>
<td>Held by drivers and manufacturers.</td>
</tr>
<tr>
<td>5</td>
<td>Computer-borne negligence dominates. Driver-borne negligence only in unusual circumstances.</td>
<td>Held by drivers and manufacturers.</td>
</tr>
</tbody>
</table>

5 Conclusion

The AV revolution will challenge the tort liability scheme, but some existing legal rules and doctrines may prove sufficiently flexible to address the unique features of AV manufacturing. Legal policymakers should consider both the benefits and shortcomings of AVs to strike the appropriate balance between innovation and victim compensation. Regardless of the scheme policymakers adopt, liability assignment must be clear. If all parties have a clear understanding of if, when, and how they may be liable, they will be better informed and will make better choices about using (and insuring their use of) AVs.

If policymakers choose to assign liability to AV manufacturers, the critical questions that must be resolved are:

- What will be the market impact of holding AV manufacturers liable? Will assigning liability in this way disincentivize market entry?
- Should we evaluate a manufacturer under negligence, strict liability, or a different form of liability? Does (or should) the standard change at different SAE Levels?
- Is a lawsuit against a manufacturer under the chosen liability standard a plausible proposition for the average plaintiff? Is it economically efficient?
- Should we grant a quasi-human status to AV computer drivers for liability purposes?
- Are there other forms of state or federal AV governance that will complement this liability standard?

To answer these questions, policymakers should collaborate with legal experts who are doing important research in this field. This brief only touches on a few of many liability concepts that legal academia is currently debating. Legal experts can support good policy development by providing useful historical insight and practical analysis to help guide policymakers through the conceptual challenges of liability reform. This type of collaboration will ensure that manufacturers and consumers can realize the safety goals of AV technology.