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## NOTES

### SELF-DRIVING CARS AND RURAL AREAS: THE POTENTIAL FOR A SYMBIOTIC RELATIONSHIP

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# NOTES

## SELF-DRIVING CARS AND RURAL AREAS: THE POTENTIAL FOR A SYMBIOTIC RELATIONSHIP

*Christiana Chmielewski\**

### INTRODUCTION

Imagine getting in the driver's seat of your car, setting your destination, and then sitting back and watching a movie, answering emails, or even taking a nap during the ride. While this is hardly a new concept for passengers, it is a new phenomenon for the person in the driver's seat. Now, imagine driving down a winding country road in the middle of the night when a white-tailed deer darts out in front of you. Your instinct is to slam on the brakes and jerk the wheel, an instinct that can often have devastating results for you, your car, and the deer. In a self-driving car human panic, and therefore human error, is eliminated.

During the past few years, car manufacturers have gradually introduced self-driving vehicles in various cities across the United States. Although self-driving vehicles are not yet available to the public, autonomous features are regularly introduced to the public, such as automatic forward-collision braking and automatic parking.<sup>1</sup> However, a major portion of the United States has been left out of the self-driving vehicle conversation—rural areas.

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<sup>1</sup> Doug DeMuro, *7 Self-Driving Car Features You Can Buy Now (and Some You May Already Have)*, AUTOTRADER (Nov. 2016), <https://www.autotrader.com/best-cars/7-self-driving-car-features-you-can-buy-now-and-so-259333>.

Rural areas compose over 97% of American territory.<sup>2</sup> However, due to the widely dispersed populations, the manufacturers of self-driving vehicles have excluded rural areas from their testing grounds. Traditionally isolated populations, especially the elderly, would benefit from having access to self-driving vehicles, and therefore, the community at large. The manufacturers of self-driving cars would benefit as well because the self-driving car would be exposed to the different terrains and obstacles that rural roads have to offer.

A self-driving car is a “vehicle capable of navigating . . . roadways and interpreting traffic-control devices without a driver actively operating any of the vehicle’s control systems.”<sup>3</sup> Human error accounts for 94% of serious accidents.<sup>4</sup> The concept of self-driving cars has existed nearly as long as cars themselves. Although experiments began as early as the 1920s, it was not until the late 2000s that self-driving cars began to gain ground in the United States.<sup>5</sup> As of 2016, there were 19 companies working to put self-driving cars on the road by 2021, including Tesla, Google, Toyota, BMW, and Volvo.<sup>6</sup>

The purpose of using self-driving cars is to greatly reduce human error thereby reducing car accidents and the resulting injuries.<sup>7</sup> In 2015, 35,092 people died in motor-vehicle related crashes in the United States.<sup>8</sup> Although

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<sup>2</sup> *New Census Data Show Differences Between Urban and Rural Populations*, U.S. CENSUS BUREAU (Dec. 8, 2016), <https://www.census.gov/newsroom/press-releases/2016/cb16-210.html> [hereinafter *New Census Data*].

<sup>3</sup> *Autonomous Vehicles: Self-Driving Vehicles Enacted Legislation*, NAT’L CONF. OF STATE LEGISLATURES (Aug. 27, 2018), <http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx> (summarizing 2012 DC B 19-0931) [hereinafter *Autonomous Vehicles*].

<sup>4</sup> *Automated Vehicles for Safety*, NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety> (last visited Mar. 6, 2018).

<sup>5</sup> Adrienne LaFrance, *Your Grandmother’s Driverless Car*, THE ATLANTIC (June 29, 2016), <https://www.theatlantic.com/technology/archive/2016/06/beep-beep/489029/>.

<sup>6</sup> Danielle Muoio, *19 companies racing to put self-driving cars on the road by 2021*, BUS. INSIDER (Oct. 17, 2016), <https://www.businessinsider.com/companies-making-driverless-cars-by-2020-2016-10>.

<sup>7</sup> *Driverless Cars and Eliminating Human Error*, INSURANCE QUOTES, <http://www.insurancequotes.org/auto/driverless-cars-and-eliminating-human-error/> (last visited Sept. 24, 2018).

<sup>8</sup> *Traffic Safety Facts: Summary of Motor Vehicle Crashes (Final Edition)*, NAT’L HIGHWAY TRAFFIC AND SAFETY ADMIN., <https://crashstats.nhtsa.dot.gov/Api/Public/Publication/812376> (Oct. 2017).

rural populations represent only 19% of the American population, rural fatalities accounted for 54% of all traffic fatalities in 2013.<sup>9</sup>

As of October 2018, fully self-driving cars are not available for the public to purchase; however, they are being tested on public roads under certain conditions.<sup>10</sup> For example, Uber, a ride-sharing service, is currently testing its self-driving cars in Pittsburgh, but the cars must be driven manually by a human driver at all times and the drivers are monitored in real time.<sup>11</sup> Self-driving cars are largely regulated by states.<sup>12</sup> Nearly half of states have passed legislation regarding self-driving cars.<sup>13</sup> Legislation is often vague, permitting self-driving cars on any public road.<sup>14</sup> In practice, self-driving cars are mostly tested in urban areas.<sup>15</sup> As of March 2018, there were 17 American cities either currently testing or that would soon be testing self-driving vehicles within their urban limits.<sup>16</sup> However, after a fatal car accident involving a self-driving car, Uber withdrew its fleet of self-driving cars from cities.<sup>17</sup> Since this withdrawal from urban areas, there has not been a shift towards testing in rural areas, a shift that I propose to be both necessary and appropriate for both the manufacturers of self-driving cars and those who live in rural, oftentimes isolated, areas.

By making self-driving vehicles available in rural areas, people who would otherwise be incapable of driving themselves, such as the elderly, might retain or regain a certain degree of independence by “driving” themselves. Additionally, it would be beneficial for the manufacturers of

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<sup>9</sup> *Traffic Safety Facts: Rural/Urban Comparison (2013 Data)*, NAT'L HIGHWAY TRAFFIC & SAFETY ADMIN., <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812181> (last visited Mar. 7, 2018).

<sup>10</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>11</sup> Kirsten Korosec, *Uber self-driving cars back on public roads, but in manual mode*, TECH CRUNCH (July 24, 2018), <https://techcrunch.com/2018/07/24/uber-self-driving-cars-back-on-public-roads-but-in-manual-mode/>.

<sup>12</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>13</sup> *Id.*

<sup>14</sup> *Id.*

<sup>15</sup> Adam Conner-Simons & Rachel Gordon, *Self-driving cars for country roads*, MIT NEWS (May 7, 2018), <http://news.mit.edu/2018/self-driving-cars-for-country-roads-mit-csail-0507>.

<sup>16</sup> *Is your city getting ready for AVs? This is a guide to who's doing what, where, and how.*, INITIATIVE ON CITIES AND AUTONOMOUS VEHICLES, <https://avsincities.bloomberg.org/> (last visited Mar. 6, 2018).

<sup>17</sup> Ian Wren, *Uber Suspends Self-Driving Tests After Pedestrian is Killed in Arizona*, NPR (Mar. 19, 2018), <https://www.npr.org/sections/thetwo-way/2018/03/19/594950197/uber-suspends-self-driving-tests-after-pedestrian-is-killed-in-arizona>.

self-driving cars to implement these cars in rural areas to provide new and different obstacles for the vehicle software to “learn” to accommodate.

Part I of this Note begins with a general background on self-driving vehicles and their development to date. Part II provides a description of rural areas, including the classification of rural areas and their demographics. Part III examines current state laws that address self-driving vehicles, focusing on Pennsylvania. Part IV discusses why self-driving vehicles should be introduced to rural areas for testing. Part V reviews car accident statistics in Allegheny County and its rural neighbor Butler County, then compares and discusses these statistics to demonstrate how self-driving cars could have an immediate beneficial effect on rural areas. Part VI addresses the basic logistics of choosing the rural area to test drive and proposes how to select test drivers. Finally, Part VII addresses potential counterarguments to the introduction of self-driving vehicles in rural areas.

## I. BACKGROUND ON SELF-DRIVING VEHICLES

### A. *What is a Self-Driving Vehicle?*

A self-driving car is “a vehicle capable of navigating . . . roadways and interpreting traffic-control devices without a driver actively operating any of the vehicle’s control systems.”<sup>18</sup> Such a car is always on alert and is unaffected by human limitations such as drowsiness or inattention.<sup>19</sup> Because human error accounts for 94% of car accidents, in a world where the roads are dominated by self-driving cars the demand on emergency response systems would be greatly reduced, as would the costs of both healthcare and auto insurance.<sup>20</sup>

According to the National Highway Traffic Safety Administration, there are six levels of automation.<sup>21</sup> Level zero, no automation, requires the driver to perform all driving tasks.<sup>22</sup> Level one, driver assistance, requires that the

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<sup>18</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>19</sup> Nancy Gupton, *The Science of Self-Driving Cars*, THE FRANKLIN INST., <https://www.fi.edu/science-of-selfdriving-cars> (last visited June 23, 2018).

<sup>20</sup> *Id.*

<sup>21</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>22</sup> *Id.*

driver controls the vehicle, but there are some driving assist features.<sup>23</sup> A level one vehicle must have at least one advanced driver-assistance feature, such as adaptive cruise control or lane-keeping technology.<sup>24</sup> Most modern passenger cars are a level one.<sup>25</sup> At level two, partial automation, the vehicle has automated functions but the driver must remain engaged at all times and monitor the environment.<sup>26</sup> A level two vehicle has two or more advanced driver assistance features, such as adaptive cruise control, lane-assist technology, and emergency braking, and uses these features in coordination with one another.<sup>27</sup> The newest models of cars are normally classified as level two.<sup>28</sup> At level three, conditional automation, the driver is not required to monitor the environment but must be prepared to take control of the vehicle at all times.<sup>29</sup> A level three vehicle is capable of driving on a highway without a human in control.<sup>30</sup> At level four, high automation, the vehicle is capable of performing all driving functions under certain conditions and the driver has the option to control the vehicle.<sup>31</sup> Although a level four vehicle is capable of completing an entire journey without human intervention, the vehicle may be limited to certain geographical areas or is prohibited from driving over a certain speed.<sup>32</sup> Finally, at level five, full automation, the vehicle is capable of performing all driving functions under all conditions, but the driver has the option to control the vehicle.<sup>33</sup> A level five self-driving car would be able to drive any road without even needing a human in the car.<sup>34</sup> Most cars on the road today range from a level zero to a level two, with

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<sup>23</sup> *Id.*

<sup>24</sup> Kyle Hyatt & Chris Paukert, *Self-driving cars: A level-by level explainer of autonomous vehicles*, CNET (Mar. 29, 2018), <https://www.cnet.com/roadshow/news/self-driving-car-guide-autonomous-explanation/>.

<sup>25</sup> *Id.*

<sup>26</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>27</sup> *Id.*

<sup>28</sup> Hyatt & Paukert, *supra* note 24.

<sup>29</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>30</sup> Hyatt & Paukert, *supra* note 24.

<sup>31</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>32</sup> Hyatt & Paukert, *supra* note 24.

<sup>33</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>34</sup> Tom Huddleston, *Move over Tesla, this self-driving car will let you sleep or watch a movie during your highway commute*, CNBC (June 26, 2018), <https://www.cnbc.com/2018/06/26/volvo-self-driving-car-sleep-watch-movie-on-commute-by-2021.html>.

limited numbers of level three vehicles.<sup>35</sup> Level three is the first level “where a human is not in primary control although a licensed driver must be prepared to take over if the system malfunctions.”<sup>36</sup> The ultimate goal of automobile manufacturers is to make level five vehicles available to the public.

Tesla, one of the companies at the forefront of self-driving vehicles, provides a basic outline of how car manufacturers are preparing vehicles to be self-driving. Tesla creates all of its vehicles with the necessary hardware for full self-driving capability, even though the car is not yet self-driving.<sup>37</sup> The software for self-driving cars is continuing to be developed today; therefore, as the software becomes available, Tesla implements it into their vehicles.<sup>38</sup> Tesla is currently working to achieve “Enhanced Autopilot,” which will enable a car to match its speed to traffic conditions, stay in a lane, automatically change lanes, exit an interstate, and self-park.<sup>39</sup> However, on its website, Tesla makes clear that even with enhanced autopilot the driver must remain alert and prepared to react at all times.<sup>40</sup> Thus, although self-driving cars are the ultimate goal of the vehicle manufacturers, it remains a work in progress.

### *B. Development of Self-Driving Vehicles*

The first modern car was built in 1886.<sup>41</sup> However, it was not until 1908 with the advent of the Ford Model T that cars began to be widely available to consumers in the United States.<sup>42</sup> Since the 1920s, car companies have conducted experiments involving self-driving cars; the interest has been driving dreamers for nearly as long as cars have existed.<sup>43</sup>

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<sup>35</sup> Hyatt & Paukert, *supra* note 24.

<sup>36</sup> Courtney Linder, *Federal government offers new guidance for self-driving cars with focus on safety*, PITT. POST-GAZETTE (Sept. 12, 2017), <http://www.post-gazette.com/business/tech-news/2017/09/12/Automated-Driving-Systems-cars-elaine-chao-self-driving-federal-guidelines-regulations/stories/201709120156>.

<sup>37</sup> *Full Self-Driving Hardware on All Cars*, TESLA, <https://www.tesla.com/autopilot> (last visited Sept. 1, 2018).

<sup>38</sup> *Id.*

<sup>39</sup> *Id.*

<sup>40</sup> *Id.*

<sup>41</sup> *Automobile History*, HIST. (2010), <https://www.history.com/topics/automobiles>.

<sup>42</sup> *Id.*

<sup>43</sup> LaFrance, *supra* note 5.

In 1925, Houdina Radio Control created a prototype of a self-driving car.<sup>44</sup> It was controlled by another car following closely behind using radio technology to control the driverless car; the driverless car was essentially a life-size remote-controlled car.<sup>45</sup>

Over the next few decades, self-driving technology continued to develop. By the 1950s electrical impulses rather than remote radio control, were used in self-driving cars.<sup>46</sup> These sensors could detect the location and speed of nearby vehicles and send this information to the self-driving car.<sup>47</sup> Although development continued through the 1960s, the electronic roadways needed for self-driving cars were not sufficiently widespread to allow for the general public to use self-driving cars.<sup>48</sup>

It was not until the late 1970s to 1980s that the first self-driving cars were equipped with the “necessary sensors, processors, and outputs to theoretically drive themselves through typical traffic without special external inputs.”<sup>49</sup> These were the first versions of the type of self-driving cars that are being tested today.<sup>50</sup> However, only in the past few years have self-driving cars made the transition from closed courses to public roads, albeit to a limited degree.

Ultimately, the creation of fully autonomous vehicles requires three technologies—sensors, connectivity, and software/control algorithms.<sup>51</sup> Many of the vehicles in today’s market have some degree of automation including blind-spot monitoring, lane-keep assistance, and forward collision warning.<sup>52</sup> As of October 2018, a fully self-driving car is not available to the public for purchase.<sup>53</sup> To create a self-driving car capable of the National Highway Traffic Safety Administration’s (NHTSA) level five automation,

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<sup>44</sup> Jenn U, *The Road to Driverless Cars: 1925–2025*, ENGINEERING.COM (July 15, 2016), <https://www.engineering.com/DesignerEdge/DesignerEdgeArticles/ArticleID/12665/The-Road-to-Driverless-Cars-1925--2025.aspx>.

<sup>45</sup> *Id.*

<sup>46</sup> *Id.*

<sup>47</sup> *Id.*

<sup>48</sup> *Id.*

<sup>49</sup> *Id.*

<sup>50</sup> *Id.*

<sup>51</sup> Gupton, *supra* note 19.

<sup>52</sup> *Id.*

<sup>53</sup> Tamara Chuang, *The first self-driving car will debut in three years, but will you want to buy one?*, THE DENVER POST (Mar. 26, 2017), <https://www.denverpost.com/2017/03/26/self-driving-car-debut/>.



detailed maps of the roads of the United States need to be created and maintained.<sup>54</sup> Self-driving vehicles require extremely detailed, three dimensional, constantly updated maps to both determine location and to reduce the amount of work the autonomous software must do to recognize its surroundings.<sup>55</sup> Additionally, algorithms need to be created to allow for driving in poor weather conditions.<sup>56</sup> Until these detailed maps and algorithms are created, car companies may not yet release a fully self-driving vehicle.<sup>57</sup>

Contrary to popular belief, vehicles will not gradually evolve through the six stages of automation. Although the autonomous features currently available such as emergency braking and lane warning were part of a gradual implementation plan, this same type of gradual implementation is not feasible with fully self-driving cars.<sup>58</sup> These limited autonomous features operate only for brief periods and in extremely limited settings.<sup>59</sup> In contrast, a fully self-driving car operates continuously and needs to be able to “cope with all short-term eventualities and crisis situations that may arise on the spot.”<sup>60</sup> There is no room for the self-driving car to learn by trial and error once it has been released to the public.<sup>61</sup>

Since August 2018, twenty-two states and Washington, D.C. have passed legislation related to self-driving cars.<sup>62</sup> Since March 2018, there were seventeen piloting cities in the United States either hosting self-driving vehicle tests or committed to testing in the near future.<sup>63</sup> There are an additional eighteen American cities that are “undertaking long-range surveys

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<sup>54</sup> *Top misconceptions of autonomous cars and self-driving vehicles*, *Driverless car mkt. watch*, [http://www.driverless-future.com/?page\\_id=774](http://www.driverless-future.com/?page_id=774) (last modified July 29, 2017) [hereinafter *Top Misconceptions*].

<sup>55</sup> Leslie Hook, *Driverless cars: mapping the trouble ahead*, *FINANCIAL TIMES* (Feb. 21, 2018), <https://www.ft.com/content/2a8941a4-1625-11e8-9e9c-25c814761640>.

<sup>56</sup> Chuang, *supra* note 53.

<sup>57</sup> *Id.*

<sup>58</sup> *Id.*

<sup>59</sup> *Id.*

<sup>60</sup> *Id.*

<sup>61</sup> *Id.*

<sup>62</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>63</sup> *Is your city getting ready for AVs? This is a guide to who's doing what, where, and how.*, INITIATIVE ON CITIES & AUTONOMOUS VEHICLES, <https://avsincities.bloomberg.org/> (last visited Mar. 6, 2018).

of the regulatory, planning, and governance issues” raised by self-driving vehicles, but have not started piloting yet.<sup>64</sup>

The ride-share giant Uber has received considerable media attention for implementing and using self-driving cars in cities. This paper will explore said self-driving cars because they are the best representation available for both the benefits and drawbacks of testing self-driving cars in cities rather than rural areas. The U.S. Department of Transportation selected Pittsburgh, Pennsylvania as one of ten “proving grounds” for self-driving vehicles in the United States.<sup>65</sup> Uber selected Pittsburgh as a testing site, in part, due to its unpredictable inclement weather, its myriad bridges, and its lack of a grid system.<sup>66</sup> Uber introduced self-driving cars in Pittsburgh in August 2016.<sup>67</sup> Ford is likewise using Pittsburgh as its testing grounds for its self-driving vehicle system, Argo.<sup>68</sup>

In March 2018, a self-driving Uber hit and killed a pedestrian in Tempe, Arizona.<sup>69</sup> This was the first instance of a pedestrian death caused by self-driving technology.<sup>70</sup> Furthermore, it was the first fatality involving a self-driving car with artificial intelligence in control.<sup>71</sup> In other words, it was the first self-driving vehicle accident that was not caused by human error.<sup>72</sup> Uber immediately suspended testing of its self-driving vehicles in Tempe, as well as in Pittsburgh, San Francisco, and Toronto.<sup>73</sup> In an April 2018 interview,

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<sup>64</sup> *Id.*

<sup>65</sup> Daniel Moore & Ed Blazina, *Ford investing \$1 billion in Pittsburgh autonomous research company*, PITT. POST-GAZETTE (Feb. 10, 2017), <http://www.post-gazette.com/business/tech-news/2017/02/10/Ford-launches-autonomous-research-in-Pittsburgh/stories/201702100237>.

<sup>66</sup> Courtney Linder, *Say goodbye to these Uber self-driving cars. But don't worry, there's a fresh fleet coming.*, PITT. POST-GAZETTE (Sept. 20, 2017), <http://www.post-gazette.com/business/tech-news/2017/09/20/uber-atg-pittsburgh-self-driving-autonomous-cars-volvo-travis-kalanick-ford-white-gray/stories/201709200162>.

<sup>67</sup> *Id.*

<sup>68</sup> *Id.*

<sup>69</sup> Daisuke Wakabayashi, *Self-Driving Uber Car Kills Pedestrian in Arizona, Where Robots Roam*, THE N.Y. TIMES (Mar. 19, 2018), <https://www.nytimes.com/2018/03/19/technology/uber-driverless-fatality.html>.

<sup>70</sup> *Id.*

<sup>71</sup> Leif Johnson & Michelle Fitzsimmons, *Uber self-driving cars: everything you need to know*, TECHRADAR (May 25, 2018, 5:30 PM), <https://www.techradar.com/news/uber-self-driving-cars>.

<sup>72</sup> *Id.*

<sup>73</sup> Wakabayashi, *supra* note 69.

Uber CEO Dara Khorsrowshahi, stated that Uber is “absolutely committed to self-driving cars.”<sup>74</sup>

In May 2018, Uber announced plans to resume operation of its self-driving cars in Pittsburgh.<sup>75</sup> However, Pittsburgh Mayor Bill Peduto stated that he has no intention of permitting Uber to return to the city until a full federal investigation regarding the Arizona crash is completed.<sup>76</sup> Additionally, should self-driving cars return to Pittsburgh, there would be stringent conditions placed on their operation, including a 25-mile-per-hour speed limit for self-driving cars regardless of the posted speed limit.<sup>77</sup>

Contrary to the mayor’s statement, Uber reintroduced a small number of its self-driving cars to Pittsburgh roads in late July 2018.<sup>78</sup> However, according to the head of Uber Advanced Technologies Group, the vehicles will be in “manual mode” rather than “self-driving mode” in order to help rebuild “trust and confidence in our commitment to safety.”<sup>79</sup> As of August 2018, Uber has not reintroduced self-driving cars in its other North American testing cities.<sup>80</sup>

The introduction of self-driving cars to the public in general remains a work in progress. While the manufacturers of self-driving cars have come a long way in the past decades, much work still must be done before such a vehicle is deemed safe enough to be released to consumers. This progress may be expedited by testing self-driving cars in rural areas.

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<sup>74</sup> Catherine Clifford, *Uber’s CEO: ‘We are absolutely committed to self-driving cars’*, CNBC (Apr. 13, 2018), <https://www.cnbc.com/2018/04/13/ceo-dara-khosrowshahi-uber-is-committed-to-self-driving-cars.html>.

<sup>75</sup> AJ Dellinger, *Uber Says It’s Bringing Self-Driving Cars Back to Pittsburgh, Mayor Does a Spit Take*, GIZMODO (May 24, 2018, 12:30 AM), <https://gizmodo.com/uber-says-its-bringing-self-driving-cars-back-to-pittsb-1826281896>.

<sup>76</sup> *Id.*

<sup>77</sup> *Id.*

<sup>78</sup> Courtney Linder, *Uber’s self-driving cars are back on the road, but hands must be on the wheel at all times*, PITT. POST-GAZETTE (July 24, 2018, 12:12 PM), <http://www.post-gazette.com/business/tech-news/2018/07/24/uber-self-driving-car-pittsburgh-manual-tempe-arizona-crash-peduto/stories/201807240012>.

<sup>79</sup> *Id.*

<sup>80</sup> *Id.*

## II. RURAL AREAS BACKGROUND

Rural areas account for 97.3% of the United States' land area, but contain only 19.3% of the population.<sup>81</sup> This translates to about 60 million people living in rural areas in the United States.<sup>82</sup> Determining whether an area is rural or urban is based upon population density.<sup>83</sup> In Pennsylvania there are 48 rural counties and 19 urban counties.<sup>84</sup>

In rural areas, public transportation is essentially nonexistent.<sup>85</sup> Due to the low population densities and long median travel distances, the implementation of ride-sharing companies, such as Lyft or Uber, is simply not feasible.<sup>86</sup> As such, testing self-driving cars through ride-sharing services would be impractical. Instead, self-driving vehicles would need to be driven by individuals for private purposes if they were to be tested in rural areas. Discussed in depth *infra*, a San Francisco startup created a device to put in a vehicle to map roads.<sup>87</sup> By putting these devices in the cars of rural drivers, self-driving cars could be implemented in rural areas relatively soon after.

In Pennsylvania, there are 2.2 million people age 65 or older, which amounts to 17.4% of Pennsylvania's population.<sup>88</sup> There is a sharp decrease in the number of Pennsylvania drivers after they reach age 75.<sup>89</sup> Without public transportation, this decrease represents a lower quality of life and an

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<sup>81</sup> *New Census Data*, *supra* note 2.

<sup>82</sup> *Id.*

<sup>83</sup> *Rural/Urban PA*, THE CTR. FOR RURAL PA., [http://www.rural.palegislature.us/rural\\_urban.html](http://www.rural.palegislature.us/rural_urban.html) (last visited Mar. 6, 2018).

<sup>84</sup> *Id.*

<sup>85</sup> *See Coordination and Integration of Rural Public Transportation Services in Pennsylvania*, THE CTR. FOR RURAL PA. (Sept. 2004), [http://www.rural.palegislature.us/rural\\_public\\_transportation.pdf](http://www.rural.palegislature.us/rural_public_transportation.pdf).

<sup>86</sup> Derek Pankratz, *Rethinking self-driving cars in rural areas*, INNOVATION IN MANUFACTURING (May 23, 2017), <https://www.linkedin.com/pulse/rethinking-self-driving-cars-rural-areas-derek-pankratzt/>.

<sup>87</sup> Steven Levy, *Your Next Gig: Map the Streets for Self-Driving Cars*, WIRED (Oct. 11, 2017, 7:00 AM), <https://www.wired.com/story/your-next-gig-map-the-streets-for-self-driving-cars/>.

<sup>88</sup> Jason Scott, *Aging in Pennsylvania: 65-plus population has grown 13.5 percent this decade*, CENT. PENN. BUS. J. (Dec. 1, 2017, 9:35 AM), <http://www.cpbj.com/article/20171201/CPBJ01/171209988/aging-in-pennsylvania-65plus-population-has-grown-by-135-percent-this-decade>.

<sup>89</sup> *Highway Statistics 2000*, FED. HIGHWAY ADMIN., <https://www.fhwa.dot.gov/ohim/hs00/d122.htm> (last visited Sept. 1, 2018).

increased level of isolation.<sup>90</sup> On average, rural Pennsylvania residents are older than urban residents.<sup>91</sup> In rural areas, approximately 18% of the population is age 65 or older.<sup>92</sup> In comparison, about 16% of the urban population is over the age of 65.<sup>93</sup> By 2040, it is estimated that 25% of the rural Pennsylvania population will be 65 years or older.<sup>94</sup>

Rural areas present an enormous opportunity for the manufacturers of self-driving cars to test their vehicles in a lower risk environment. Testing in rural areas would provide the manufacturers a far greater range of scenarios and may ultimately lead to a shorter timeline for the release of self-driving cars to the general public. However, although current state legislation does not specify that self-driving cars are limited to testing in cities, this has become the practice.

### III. CURRENT STATE LAWS REGARDING SELF-DRIVING VEHICLES

The NHTSA is the federal agency charged with regulating highway safety.<sup>95</sup> The National Traffic and Motor Vehicle Safety Act was passed in 1966 with its purpose to “reduce traffic accidents and deaths and injuries resulting from traffic accidents.”<sup>96</sup> The NHTSA has promulgated over 60 Federal Motor Vehicle Safety Standards (FMVSSs), which set the minimum standards that automobile manufacturers must meet.<sup>97</sup> The NHTSA has left the regulation of self-driving vehicles largely to individual states. State laws regarding self-driving cars tend to be written broadly but in practice focus on cities.

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<sup>90</sup> *Waiting for a Ride: Transit Access and America's Aging Population*, AARP 1, 2, <https://www.aarp.org/content/dam/aarp/livable-communities/learn/transportation/waiting-for-a-ride-transit-access-and-americas-aging-population-aarp.pdf> (last visited Sept. 1, 2018).

<sup>91</sup> *Demographics: Quick Facts*, THE CTR. FOR RURAL PA., [http://www.rural.palegislature.us/demographics\\_about\\_rural\\_pa.html](http://www.rural.palegislature.us/demographics_about_rural_pa.html) (last visited Mar. 7, 2018).

<sup>92</sup> *Id.*

<sup>93</sup> *Id.*

<sup>94</sup> *Id.*

<sup>95</sup> *About NHTSA*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., <https://www.nhtsa.gov/about-nhtsa> (last visited Mar. 7, 2018).

<sup>96</sup> Daniel A. Crane, Kyle D. Logue & Bryce C. Pilz, *A Survey of Legal Issues Arising from the Deployment of Autonomous and Connected Vehicles*, 23 MICH. TELECOMM. TECH. L. REV. 191, 205 (Spring 2017).

<sup>97</sup> *Id.*

The CEO of NuTonomy, the first company to test self-driving cars in public trials in Singapore, stated that the most significant legal question for driverless car makers in the United States is whether they can “win approval to test our vehicles in the range of *urban* environments that are required in order to develop a safe, efficient, fully autonomous mobility-on demand transportation service.”<sup>98</sup> Tesla is focused on urban areas; its webpage states, “your Tesla will figure out the optimal route, navigate *urban* streets . . . , manage complex intersections with traffic lights, stop signs and roundabouts, and handle densely packed freeways with cars moving at high speed . . . .”<sup>99</sup> Both of these statements emphasize testing self-driving vehicles in urban areas, wholly leaving out rural areas as potential testing grounds without providing the reason for this omission.

In September 2017, the Federal Department of Transportation released a voluntary guidance titled, “Automated Driving Systems (ADS): A Vision for Safety 2.0,” which consists of “suggestions for states and industry that are intended to encourage, not hamper, autonomous vehicle development.”<sup>100</sup> The guidance outlines the roles of the federal and state governments in regulating automated driving systems.<sup>101</sup> While NHTSA is responsible for regulating “safety design, performance aspects and equipment in motor vehicles,” states regulate the human driver and licensing.<sup>102</sup> While those involved with self-driving cars are “encouraged to regularly submit safety self-assessments,” they are not required to by the new guidance.<sup>103</sup>

Over the past six years, there has been a great increase in the number of states introducing legislation relating to self-driving vehicles.<sup>104</sup> As of October 2018, 29 states have passed legislation relating to self-driving cars, but much of this legislation simply allows the testing of self-driving cars on public roads.<sup>105</sup> Most state laws do not specifically state that self-driving cars

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<sup>98</sup> *The Road Ahead for Driverless Cars: Karl Iagnemma, nuTonomy*, ELEC. COM. & L. REP. (Feb. 15, 2017), <https://www.bloomberglaw.com/product/tech/document/X18EQHDS000000> (emphasis added).

<sup>99</sup> *Full Self-Driving Hardware on All Cars*, *supra* note 37 (emphasis added).

<sup>100</sup> Linder, *supra* note 36.

<sup>101</sup> *Id.*

<sup>102</sup> *Id.*

<sup>103</sup> *Id.*

<sup>104</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>105</sup> *Id.*; *see, e.g.*, TRANSPORTATION CODE, 74 PA. CONS. STAT. § 9511 (2016).

are limited to city streets.<sup>106</sup> A 2016 Pennsylvania statute created standards for testing self-driving vehicles on public roads, allowing the use of allocated funds for “intelligent transportation system applications, such as autonomous and connected vehicle-related technology.”<sup>107</sup> Pennsylvania Senate Bill 427 establishes an application and permitting process for those wishing to test self-driving vehicles, as well as general safety requirements for the vehicles.<sup>108</sup> Additionally, SB 427 would consider the test operator of the self-driving vehicle the driver, thus the driver would be held liable should an accident occur.<sup>109</sup> The Bill was referred to Transportation in February 2017 and is still there as of October 2018.<sup>110</sup>

Following the March 2018 fatal car accident in Tempe, Arizona, discussed *supra*, the Pennsylvania Department of Transportation (PennDOT) released “voluntary interim guidelines to step up oversight of automated vehicles in the state.”<sup>111</sup> These guidelines ask that companies halt all operation of their self-driving vehicle technology that is under federal investigation.<sup>112</sup> PennDOT additionally recommended self-driving car companies submit a voluntary “notice of testing” to PennDOT that provides basic information from the company, including:

[V]erification that the [self-driving vehicles] meet federal and state safety standards as well as policies adopted by PennDOT; proof of a driver or operator training program, with the strong suggestion that these individuals have a clean driving record; a list of all vehicles involved in the program; names of approved drivers and their valid driver’s license numbers; routes and geographic locations for testing; and proof of insurance.<sup>113</sup>

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<sup>106</sup> *Autonomous Vehicles*, *supra* note 3.

<sup>107</sup> TRANSPORTATION CODE, 74 PA. CONS. STAT. § 9511 (2016).

<sup>108</sup> Nick Malawsky, *Pa. Legislature introduces autonomous vehicle testing bill*, PENN LIVE (Feb. 24, 2017), [http://www.pennlive.com/news/2017/02/pa\\_legislature\\_introduces\\_auto.html](http://www.pennlive.com/news/2017/02/pa_legislature_introduces_auto.html); see S. 427, Pa. Gen. Assemb. 2017 Sess. (Pa. 2017).

<sup>109</sup> *Id.*

<sup>110</sup> S. 427, Pa. Gen. Assemb. 2017 Sess. (Pa. 2017).

<sup>111</sup> Courtney Linder, *PennDOT issues voluntary guidelines for self-driving cars on public roads*, PITT. POST-GAZETTE (Apr. 9, 2018), <http://www.post-gazette.com/business/tech-news/2018/04/09/PennDOT-voluntary-guidelines-leslie-richards-autonomous-vehicles-summit-pennsylvania/stories/201804090105>.

<sup>112</sup> *Id.*

<sup>113</sup> *Id.*

Furthermore, PennDOT requested that companies with vehicles that share hardware or software that is part of a National Transportation Safety Board investigation immediately halt all testing on such vehicles.<sup>114</sup>

As of June 2018, self-driving vehicle regulation has largely been left to the states. However, H.R. 3388, otherwise known as the “SELF DRIVE Act,” would preempt any conflicting state laws regarding the “design, construction, or performance” of self-driving or otherwise highly automated vehicles or automated driving systems unless those state laws are identical to the federal ones.<sup>115</sup> The bill “establishes the federal role in ensuring the safety of highly automated vehicles by encouraging the testing and deployment of such vehicles.”<sup>116</sup> The bill passed in the House of Representatives in late summer 2017.<sup>117</sup> In September 2017, the Senate received the bill and referred it to the Committee on Commerce, Science, and Transportation, but no further action has been taken as of September 2018.<sup>118</sup> Until this bill or a similar one passes the Senate and is signed by the President, self-driving vehicles will remain largely regulated by the states.

Legislation on both a state and federal level is working towards self-driving cars as the societal norm. However, the legislation, much like the development of the self-driving cars themselves, is a process measured by years rather than months. Although the legislation does not specify that testing must occur in cities, those testing self-driving cars have chosen cities as their focus trial grounds.

#### IV. STATE LEGISLATION NEEDS TO FOCUS ON TESTING SELF-DRIVING VEHICLES IN RURAL AREAS

The purpose of self-driving cars is, in part, to reduce the risk of human error, which is the leading cause of serious accidents.<sup>119</sup> By implementing self-driving cars in rural areas, the amount of car accidents caused by human error would be greatly reduced.

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<sup>114</sup> *Id.*

<sup>115</sup> SELF DRIVE Act, H.R. 3388, 115th Cong. (2017).

<sup>116</sup> *Id.*

<sup>117</sup> *Id.*

<sup>118</sup> *Id.*

<sup>119</sup> *Automated Vehicles for Safety*, *supra* note 4.



Rural areas have their own mobility-related difficulties that could be remedied by the introduction of self-driving cars.<sup>120</sup> Rural areas offer a different terrain where manufacturers of self-driving cars can test their vehicles.<sup>121</sup> In cities, self-driving cars essentially just need to be capable of avoiding other vehicles and people.<sup>122</sup> Rural areas offer a greater variety of obstacles to help the cars better learn to adapt to changing situations.<sup>123</sup> Rural areas offer curvilinear backroads, higher speeds, unplowed or unsalted winter roads, and there is a lower chance of hitting a pedestrian or another car should the self-driving car err.<sup>124</sup> Additionally, rural roads provide unique obstacles, such as animal crossings and slow-moving vehicles.<sup>125</sup> It is these unsafe rural road conditions that often deter people, particularly the elderly, from driving.<sup>126</sup>

It is not just the physical environment that provides incentive for testing self-driving cars in rural areas—the drivers themselves, and their human ineptitudes are further reason. As stated *supra*, human error is the overwhelming cause of car accidents.<sup>127</sup> Driving on a rural road with a monotonous landscape may cause “highway hypnosis,” in a regular car driver, resulting in driving in a “dulled, drowsy, trance-like state,” creating further risk of car accidents.<sup>128</sup> As discussed throughout this paper, public transportation is essentially nonexistent in most rural areas.<sup>129</sup> This results in drunk and fatigued individuals, who do not have an alternative method of transportation driving in an unsafe manner, thus making the rural roads more unsafe.<sup>130</sup> Self-driving cars would remove the risk of lack of concentration and poor judgment from rural roads.

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<sup>120</sup> Pankratz, *supra* note 86.

<sup>121</sup> *Id.*

<sup>122</sup> *Id.*

<sup>123</sup> *Id.*

<sup>124</sup> *Id.*

<sup>125</sup> *Id.*

<sup>126</sup> *Id.*

<sup>127</sup> *Automated Vehicles for Safety*, *supra* note 4.

<sup>128</sup> *Rural Driving*, DRIVERSED.COM, <https://driversed.com/driving-information/city-rural-and-freeway-driving/rural-driving.aspx> (last visited Aug. 14, 2018).

<sup>129</sup> *Id.*

<sup>130</sup> *10 Unique Dangers to Driving on Rural Roads*, DRIVE-SAFELY, <https://www.drive-safely.net/driving-on-rural-roads/> (last visited Sept. 1, 2018).

Self-driving cars in rural areas could help improve self-driving cars in cities.<sup>131</sup> Self-driving cars rely on machine learning and pattern recognition, which is derived from artificial intelligence.<sup>132</sup> The software is exposed to a series of images, through which it learns how to classify a wide array of objects.<sup>133</sup> The process repeats itself over and over again, increasing its ability to correctly identify a variety of objects.<sup>134</sup> A similar process is used in teaching self-driving cars actions and evaluations.<sup>135</sup>

Exposure to rural areas and its obstacles would teach self-driving cars about potential obstacles and how to properly react to problems that may never arise in urban driving.<sup>136</sup> Rural areas often lack basic infrastructure, such as curbs, barriers, and signage, that the computer software uses as reference points.<sup>137</sup>

The more time an individual spends in his or her car, the higher the incentive to drive a fully autonomous vehicle.<sup>138</sup> On average, those living in rural areas drive ten more miles per day than their urban counterparts.<sup>139</sup> Furthermore, rural residents travel approximately 33% more miles than their urban counterparts.<sup>140</sup>

As discussed *supra*, detailed road maps need to be created and maintained before fully self-driving cars can be released for the public to purchase.<sup>141</sup> If self-driving cars, even those with limited self-driving abilities such as a level 3 or 4 on the NHTSA scale, were used in rural areas, the road mapping could occur simultaneously with the vehicle learning how to

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<sup>131</sup> Pankratz, *supra* note 86.

<sup>132</sup> *Top misconceptions*, *supra* note 54.

<sup>133</sup> *Id.*

<sup>134</sup> *Id.*

<sup>135</sup> *Id.*

<sup>136</sup> *Id.*

<sup>137</sup> Tracey Lindeman, *MIT Invented a Tool That Allows Driverless Cars to Navigate Rural Roads Without a Map*, MOTHERBOARD (May 7, 2018), [https://motherboard.vice.com/en\\_us/article/43bk8j/mit-lidar-allows-driverless-autonomous-cars-to-navigate-rural-roads-without-map](https://motherboard.vice.com/en_us/article/43bk8j/mit-lidar-allows-driverless-autonomous-cars-to-navigate-rural-roads-without-map).

<sup>138</sup> *Top misconceptions*, *supra* note 54.

<sup>139</sup> *Fact #759: December 24, 2012 Rural vs. Urban Driving Differences*, OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, <https://www.energy.gov/eere/vehicles/fact-759-december-24-2012-rural-vs-urban-driving-differences> (last visited Oct. 2, 2018).

<sup>140</sup> Todd Litman, *Public Transportation's Impact on Rural and Small Towns: A Vital Mobility Link*, THE AM. PUB. TRANSP. ASS'N 14 (2017), <https://www.apta.com/resources/reportsandpublications/Documents/APTA-Rural-Transit-2017.pdf>.

<sup>141</sup> *Top misconceptions*, *supra* note 54.

counteract typically rural obstacles. A San Francisco startup created a device that would be installed in traditional, non-self-driving vehicles.<sup>142</sup> The device maps out the streets as the car drives.<sup>143</sup> In rural areas, this device may be essential before self-driving cars can be tested on the myriad of backroads that compose the majority of Pennsylvania driving surfaces. Self-driving vehicle manufacturers currently map roads by employing their own fleet of vehicles.<sup>144</sup> Drivers that use the startup's device would receive compensation—paid more for driving a specific, requested route, and less when the device is in passive mode and the driver is going about his or her normal day.<sup>145</sup> In both of these situations, the device collects data and maps the roads traveled.<sup>146</sup>

Cities, including Pittsburgh, typically provide various means of transportation where people do not have to drive themselves. For example, public transit in Pittsburgh includes an extensive bus system, light rail, incline, and paratransit services.<sup>147</sup> Older adults in rural areas who are unable to drive themselves may be forced to remain at home, isolated from their community due to limited, if any, public transportation.<sup>148</sup> In part due to this lack of transportation, rural elderly adults tend to be more socially isolated than their urban counterparts.<sup>149</sup> Introducing self-driving vehicles may reduce this isolation.

In 2015, both rural and urban Pennsylvania had a poverty rate of 13%.<sup>150</sup> Technological innovations tend to lead to new sources of employment and economic growth.<sup>151</sup> Cities should not be the only area to reap an economical benefit from a new technology.

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<sup>142</sup> Levy, *supra* note 87.

<sup>143</sup> *Id.*

<sup>144</sup> *Id.*

<sup>145</sup> *Id.*

<sup>146</sup> *Id.*

<sup>147</sup> *Public Transportation*, VISIT PITT., <https://www.visitpittsburgh.com/plan-your-trip/transportation/public-transportation/> (last visited Mar. 7, 2018).

<sup>148</sup> Marianne Baernholdt, Guofen Yan, Ivora Hinton, Karen Rose & Meghan Mattos, *Quality of Life in Rural and Urban Adults 65 Years and Older: Findings from the National Health and Nutrition Examination Survey*, 28(4) J. RURAL HEALTH 339, 344 (2012).

<sup>149</sup> *Id.*

<sup>150</sup> THE CENTER FOR RURAL PA., *supra* note 91.

<sup>151</sup> VICTOR MULAS ET AL., BOOSTING TECH INNOVATION ECOSYSTEMS IN CITIES: A FRAMEWORK FOR GROWTH AND SUSTAINABILITY OF URBAN TECH INNOVATION ECOSYSTEMS, THE WORLD BANK 11 (2015).

Discussed *supra*, Uber withdrew its self-driving vehicles from its test cities after a fatal accident in March 2018.<sup>152</sup> In late July 2018, Uber reintroduced a small fleet of its self-driving cars in Pittsburgh, but not in the other previous test cities.<sup>153</sup> Rather than working to reintroduce the self-driving cars in cities, the focus should shift to their immediate implementation in rural areas. In these areas, the risk of a fatal accident as occurred in Arizona is greatly reduced due to the lower and more widely dispersed population. In general, rural counties experience far fewer pedestrian fatalities and injuries than urban counties.<sup>154</sup> Thus, the risk of a self-driving car hitting a pedestrian in a rural area is greatly reduced.

By testing self-driving cars in rural areas, the manufacturers of these vehicles would immediately benefit as the vehicles would face a greater variety of obstacles to “learn” how to appropriately react. The long-term benefit of self-driving cars in rural areas would allow previously isolated populations greater access to their community. As such, both legislation and the practices of self-driving vehicle manufacturers should shift to testing self-driving cars in rural areas.

#### V. COMPARISON OF CAR ACCIDENT STATISTICS IN URBAN AND RURAL PENNSYLVANIA

Nineteen percent of the American population lives in rural areas.<sup>155</sup> However, car crash fatalities in rural areas accounted for 54% of all traffic fatalities in 2013.<sup>156</sup> Thus, the threat of fatal car accidents is far greater in rural areas. Although Butler County is not one of the most rural counties in Pennsylvania, it is much more rural than its neighbor, Allegheny County, an urban county home to Pittsburgh. While Butler County is part of the larger Pittsburgh metropolitan area, it still provides a glimpse into the differences in car accident statistics between urban and rural areas. By comparing the

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<sup>152</sup> Wren, *supra* note 17.

<sup>153</sup> Linder, *supra* note 78.

<sup>154</sup> TOM WOLF & LESLIE S. RICHARDS, 2016 PENNSYLVANIA CRASH FACTS & STATISTICS, PA. DEP'T OF TRANSP. 62 (2016), [http://www.penndot.gov/TravelInPA/Safety/Documents/2016\\_CFB\\_linked.pdf](http://www.penndot.gov/TravelInPA/Safety/Documents/2016_CFB_linked.pdf).

<sup>155</sup> NAT'L HIGHWAY TRAFFIC AND SAFETY ADMIN., *Traffic Safety Facts: Rural/Urban Comparison* (2013 Data) 1 (2015), <https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812181>.

<sup>156</sup> *Id.*

crash statistics of two neighboring counties, regional differences such as weather and road conditions, are greatly reduced.

Allegheny County has an estimated population of 1.2 million as of 2017.<sup>157</sup> The land area of Allegheny County is 730.08 square miles, resulting in a population density of 1,675.6 persons per square mile.<sup>158</sup> Butler County's estimated 2017 population is 183,000.<sup>159</sup> While Butler County has a similar land area to Allegheny County—788.6 square miles, its population density is far lower—233.1.<sup>160</sup> The differences in population density effect the raw number of car accidents that occur in these neighboring counties.

Of the 129,377 crashes that occurred in Pennsylvania in 2016, 83,882 of them occurred on non-interstate state highways (i.e. state-maintained roads that are not designated as interstates).<sup>161</sup> Of the 82,965 persons injured in 2016 Pennsylvania car accidents, 55,908 of them were injured on these non-interstate state highways.<sup>162</sup> Out of 209,837 car crashes, 20,863 were caused by persons over the age of 65.<sup>163</sup> Thus, drivers over the age of 65 represented 19.9% of car accidents in Pennsylvania in 2016.<sup>164</sup> In 2016, 4,018 of Pennsylvania crashes were caused by hitting a deer, which amounts to 3.1% of the total car crashes in the state that year.<sup>165</sup> Because urban counties have higher populations, a greater number of vehicles, and vehicle-miles of travel, these counties tend to have a higher total number of crashes.<sup>166</sup> Fifty-seven percent of the total traffic crashes in Pennsylvania in 2016 occurred in 11 of its 67 counties—either urban counties or those neighboring urban

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<sup>157</sup> U.S. CENSUS BUREAU, *Quick Facts: Allegheny County, Pennsylvania*, <https://www.census.gov/quickfacts/fact/table/alleghenycountypennsylvania/PST040217> (last visited June 26, 2018).

<sup>158</sup> *Id.*

<sup>159</sup> U.S. CENSUS BUREAU, *Quick Facts: Butler County, Pennsylvania*, <https://www.census.gov/quickfacts/fact/table/butlercountypennsylvania/BZA210216> (last visited June 26, 2018).

<sup>160</sup> *Id.*

<sup>161</sup> WOLF & RICHARDS, *supra* note 154, at 16.

<sup>162</sup> *Id.*

<sup>163</sup> *Id.* at 10.

<sup>164</sup> *Id.* (combined the percentages of both male and female drivers over the age of 65 to reach this number).

<sup>165</sup> *Id.* at 156.

<sup>166</sup> *Id.*

counties.<sup>167</sup> Thus, even though rural counties only account for 27% of the population in Pennsylvania, they account for 43% of total traffic crashes.<sup>168</sup>

In 2016, Allegheny County accounted for 9.9% of the total car accidents in Pennsylvania.<sup>169</sup> In comparison, Butler County only accounted for 1.4% of the total car accidents for that year.<sup>170</sup> However, Allegheny County represents 9.6% of the total population of Pennsylvania while Butler is only 1.5% of the total population.<sup>171</sup>

Between 2012 and 2016, there were 317 traffic fatalities in Allegheny County.<sup>172</sup> In Butler County during the same five years, there were 117 traffic fatalities.<sup>173</sup> In other words, Butler County had 63.93 traffic fatalities per 100,000 persons while Allegheny County had 24.42 deaths per 100,000 between 2012 and 2016.<sup>174</sup> While Allegheny County had more fatal traffic accidents as a whole during this five year period, it is important to remember that Butler County's population is substantially smaller than that of Allegheny County, thus, a greater proportion of the Butler County population died during this period than the Allegheny County population.

Breaking down the traffic fatalities further, between 2012 and 2016, there were 63 pedestrian deaths from car accidents in Allegheny County.<sup>175</sup> However, in that same time period, there were only 6 pedestrian deaths in Butler County.<sup>176</sup> Thus, Butler County has a smaller rate of pedestrian deaths in consideration of its population than Allegheny County. Furthermore, in 2016, 401 pedestrians were injured in car accidents in Allegheny County, compared to 10 in Butler County.<sup>177</sup> This equates to 33.42 pedestrian injuries in car accidents in Allegheny County per 100,000, whereas Butler County

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<sup>167</sup> *Id.*

<sup>168</sup> *Id.* at 66; *see also* THE CTR. FOR RURAL PA., *Rural Pennsylvania and the 2010 Census 2* (2011), [http://www.rural.palegislature.us/documents/factsheets/Rural\\_PA\\_and\\_2010\\_Census.pdf](http://www.rural.palegislature.us/documents/factsheets/Rural_PA_and_2010_Census.pdf).

<sup>169</sup> *Id.* at 59.

<sup>170</sup> *Id.*

<sup>171</sup> *Id.*

<sup>172</sup> *Id.* at 61.

<sup>173</sup> *Id.*

<sup>174</sup> The author extrapolated these numbers by dividing the total number of traffic fatalities for the county by the total population of that county, then multiplying the quotient by 100,000 to determine the deaths per 100,000.

<sup>175</sup> *Id.* at 65.

<sup>176</sup> *Id.*

<sup>177</sup> *Id.*

had 5.46 pedestrian injuries per 100,000.<sup>178</sup> These pedestrian statistics demonstrate that the risk of testing self-driving cars in rural areas is far lower than in urban counterparts.

From this breakdown of 2016 Pennsylvania statistics, there are more accidents in urban areas than rural. However, as rural areas represent a substantially smaller population, the data indicates that, based on population, there is a greater rate of accident, injury, and death in rural areas. Because of this greater proportional chance of accidents, self-driving cars are necessary in rural areas to reduce this risk of traffic accidents.

## VI. HOW TO DISTRIBUTE THE SELF-DRIVING VEHICLES IN RURAL COMMUNITIES

### *A. Selecting the Rural Area*

Factors to consider in choosing an appropriate rural area are: roads (curviness, physical condition); climate (snowy, rainy); wildlife (frequency of cars hitting wildlife); and additional obstacles (slow moving vehicles, such as horse and buggies or farm machinery). An appropriate rural area would have most, if not all, of these conditions, as it would provide the most material for a self-driving vehicle to learn from.

A 2018 study compiled the 31 municipalities with the most animal-related crashes in 2017. Butler County came in second, behind Allegheny.<sup>179</sup> While Butler County had about half as many animal related accidents as Allegheny County, Butler County's population is substantially smaller than that of Allegheny County; therefore, the chances of a Butler County driver hitting a deer are far higher than that of an Allegheny County driver. Butler County is the rural area in Pennsylvania that experiences the most animal related accidents, providing plenty of dynamic obstacles for self-driving cars to avoid.<sup>180</sup>

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<sup>178</sup> The author extrapolated these numbers by dividing the total number of pedestrian injuries caused by car accidents for the county by the total population of that county, then multiplying the quotient by 100,000 to determine the pedestrian injuries per 100,000.

<sup>179</sup> Rudy Miller, *Where in Pa. are you most likely to hit a deer? The top 31 towns Bambi should avoid*, LEHIGH VALLEY LIVE (July 23, 2018), [https://www.lehighvalleylive.com/news/index.ssf/2018/07/oh\\_deer\\_the\\_31\\_pa\\_towns\\_where.html](https://www.lehighvalleylive.com/news/index.ssf/2018/07/oh_deer_the_31_pa_towns_where.html).

<sup>180</sup> *Id.*

Butler County has 129,000 acres of farm land, which represents one quarter of the total land area of Butler County.<sup>181</sup> In contrast, 38,000 acres in Allegheny County is farm land, which equates to just over 8% of Allegheny County's total land area.<sup>182</sup> As discussed *supra*, Butler and Allegheny County have similar total land areas.<sup>183</sup> From this data, it can be inferred that there is a greater number of farm equipment driven on roads in Butler County than Allegheny County.<sup>184</sup>

Thus, with both the abundance of animal-related traffic accidents, as well as the farm land and its farm equipment on the roads, Butler County would provide an adequate testing ground for self-driving cars.

### *B. Selecting the Test Drivers*

Although the long-term goal of putting self-driving cars in rural areas is to increase the mobility and independence of the elderly population, it would be inadvisable to have the elderly serve as the test drivers of self-driving cars in rural areas. As younger adults are more inclined to try new technology than seniors, a younger demographic should be used to test self-driving cars in rural areas.<sup>185</sup> Additionally, fatal crash rates increase after the age of 75.<sup>186</sup> This is due to an increased susceptibility to injury and medical complications.<sup>187</sup> Although the number of car accidents with self-driving vehicles is relatively low, because of the greater risk of serious injury or death for elderly persons involved in a car accident, the elderly population should not be testing self-driving cars in rural areas in the early stages. Lastly, the

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<sup>181</sup> *Pennsylvania: Farm Numbers, Land in Farms, Average Size and Land Area, 2009*, U.S. DEP'T OF AGRIC., [https://www.nass.usda.gov/Statistics\\_by\\_State/Pennsylvania/Publications/Annual\\_Statistical\\_Bulletin/2009\\_2010/farm\\_number%20and%20land%20in.pdf](https://www.nass.usda.gov/Statistics_by_State/Pennsylvania/Publications/Annual_Statistical_Bulletin/2009_2010/farm_number%20and%20land%20in.pdf) (last visited Oct. 2, 2018).

<sup>182</sup> *Id.*

<sup>183</sup> U.S. CENSUS BUREAU, *supra* notes 157 and 159.

<sup>184</sup> The author is originally from Butler County and can personally attest to the abundance of farm tractors and other farm vehicles being driven on roads.

<sup>185</sup> Brian Kennedy & Cary Funk, *28% of Americans are 'strong' early adopters of technology*, PEW RES. CTR. (July 12, 2016), <http://www.pewresearch.org/fact-tank/2016/07/12/28-of-americans-are-strong-early-adopters-of-technology/>.

<sup>186</sup> *Facts and Research*, AAA, <https://seniordriving.aaa.com/resources-family-friends/conversations-about-driving/facts-research/> (last visited Oct. 22, 2018).

<sup>187</sup> *Motor Vehicle Safety: Older Adult Drivers*, CTRS. FOR DISEASE CONTROL & PREVENTION, [https://www.cdc.gov/motorvehiclesafety/older\\_adult\\_drivers/index.html](https://www.cdc.gov/motorvehiclesafety/older_adult_drivers/index.html) (last updated Nov. 30, 2017).



self-driving cars should be provided to capable drivers with clean driving records who regularly travel on backroads in various weather conditions.

#### VII. COUNTER-ARGUMENTS TO TESTING SELF-DRIVING VEHICLES IN RURAL AREAS

Some may counter this proposal by arguing that cities should remain the testing ground for self-driving cars, that it is too early in the development process to test self-driving vehicles in rural areas. Indeed, cities are now emerging as the new centers of technological innovation.<sup>188</sup> However, as testing self-driving cars in cities has been halted in all but one city, I propose that rural areas should serve as the testing grounds in the interim. Currently, it is more attractive to test drive self-driving vehicles in urban areas *because* of the lower speeds, and therefore, lower risk of serious accidents.<sup>189</sup> However, self-driving vehicles have been tested within cities for a substantial amount of time with an extremely limited number of accidents.<sup>190</sup> In other words, the technology in self-driving vehicles is sufficient to be expanded to rural areas without a great risk of accidents.

Another argument against testing self-driving cars in rural areas is the relatively low populations; because of the high number of rural backroads that are driven by relatively few people, how can a self-driving car ever learn these roads simply by introducing these cars to rural drivers? As discussed *supra*, a device has been created for the average driver to use that maps roads.<sup>191</sup> If this device were introduced in rural areas in the period leading up to the introduction of self-driving cars, these cars would already have a good sense of the area before their arrival. This device incentivizes drivers to travel on roads they would not normally by compensating them for the services rendered.<sup>192</sup>

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<sup>188</sup> MULAS ET AL., *supra* note 151.

<sup>189</sup> *Id.*

<sup>190</sup> See Kia Kokalitcheva, *Humans cause most self-driving car accidents*, AXIOS (Aug. 3, 2017), <https://www.axios.com/humans-cause-most-self-driving-car-accidents-1513304490-02cdf3d-551f-46e6-ad98-637e6ef2c0b9.html> (most accidents that have occurred with self-driving vehicles have been caused by humans in low-speed incidents.).

<sup>191</sup> Levy, *supra* note 87.

<sup>192</sup> *Id.*

### CONCLUSION

The manufacturers of self-driving cars should expand their focus to include rural areas as testing grounds, especially while this is still a relatively new technology. While legislation does not specifically prohibit self-driving cars from being tested in rural areas, in practice, the manufacturers of self-driving cars have focused their tests in cities. State legislation should more actively push for the testing of self-driving vehicles in rural areas. In creating specific legislation for self-driving cars in rural areas, both the inhabitants of rural communities and the manufacturers of self-driving cars will experience long-term benefits.