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2016 will earn its place in history as perhaps one of the most tumultuous years ever. Those in the camp of ‘it will never happen’ were surprised by Brexit, the Trump victory, the ‘no’ vote to the Italian referendum, the return of Russia, the drop in oil prices, the rapid development of technology like artificial intelligence (AI), vehicle autonomy, and so many other changes.

It seems 2016 was truly an inflection point, making 2017 a year when so much of what we’ve been talking about actually has taken hold. As consumers, homes, devices, vehicles, and more have become increasingly connected, it is changing the way that consumers interact with everything. The growing number of digital connections means greater access to information. This information will bring even greater understanding into your customers, their preferences, and behaviors; it will also create operational transparency and insights into new risks that insurers may decide to underwrite.

In this issue of Crash Course, we will look at how rapidly changing technology is driving change for the consumer, the vehicle, the insurer, and the repairer. Each play a key role in the automotive insurance and collision repair businesses, and each is responding to technology in unique ways, driving change throughout the automotive ecosystem.

It is not enough for the industry to just keep doing the same things faster – i.e. ramp up speed. We must challenge ourselves to think differently, embrace innovation and take advantage of the digital and technological advancements underway. IT’S HAPPENING. We owe it to our customers, stakeholders, organizations, and ourselves to get involved.
The consumer is the new center. Shifting consumer demographics, behaviors, preferences, and technology use over the last several years has brought us to today — where nearly every company thinks differently about how it operates, develops products and services, and takes them to market. For the automotive space - inclusive of insurance carriers, collision repairers, original equipment manufacturers (OEMs), and all of those that support or contribute to the auto ecosystem, this changing consumer dynamic is very real.

It’s happening all around us.

Shifts in the U.S. demography are painting a different picture of our population. We’re seeing significant changes in where people are living, and the make-up of our country, including age, gender, and race. Our environment is also changing, with climate change a growing concern, particularly as the severity of storms continues to increase, and disproportionately hit the areas where more people are moving. These factors play an important role in future trends for personal mobility, and the automotive insurance and collision repair industries.

Technology has also changed the way that humans interact with one another and their surroundings, and how they choose who to do business with.

Transportation is not just about concrete and steel. It’s about how people want to live.

U.S. Transportation Secretary Anthony Foxx

"Transportation is not just about concrete and steel. It’s about how people want to live. ”

" — U.S. Transportation Secretary Anthony Foxx

05
So, Who Is Moving, Where?

According to the U.S. Census Bureau, the overall population of the U.S. grew by 0.7 percent to 323.1 million during the period July 1, 2015 to July 1, 2016. Since CY 1980 there has been a steady migration of U.S. residents to the South and the West census regions, which saw their population grow between 1980-2016 by 4.5 percentage points and 4.6 percentage points respectively. During that same period the Northeast lost 4.2 percentage points of overall share of U.S. resident population, and the Midwest lost 4.9 percentage points. By 2016, the U.S. Census Bureau estimates that the South census region accounted for nearly 40 percent of the overall U.S. resident population - an area which includes states that have seen strong growth even in the last three years (2014-2016) such as Florida (+5.6%), Texas (+3.4%), and South Carolina (+2.7%).

In the West region, the resident population of Nevada grew by 3.8 percent, and Utah grew by 3.7 percent (see Figure 1). West Virginia and Illinois were the only two states that lost population between 2014 and 2016. With more people moving to areas of the South and West, more homes and cars are in areas that have seen some of the most severe weather over the last year. A quick review of the top 10 most extreme weather events of 2016, reveals seven occurred in states with strong population growth (see Figure 2):

- Hurricane Matthew hit the southeastern coast of the U.S. late September/early October with strong winds, ocean surges, and flooding, killing 49 people and resulting in economic losses of $4 to $6 billion.
- In mid-August, Louisiana experienced torrential rainfall – three times as much rain as in Louisiana during Hurricane Katrina, with flood damage to 60,000 homes, over 100,000 vehicles, and multi-billion dollar losses. Scientists at the National Oceanic Atmospheric Administration (NOAA) concluded after their rapid-response study of the event that climate change made this rainfall event at least 40 percent more likely today than in 1900. They also concluded that 1-in 30 year events have become 10 percent more intense since preindustrial times. Significant drought in the Southeast from central Mississippi to western North Carolina helped feed numerous wildfires throughout the region, with the worst devastating Gatlinburg, TN in late November, killing 14 people, destroying over 2400 structures, and resulting in damage of more than $500 million.

Digital devices have become an ingrained part of everyone's lives, with 92 percent of U.S. adults owning a cell phone (includes smartphones); 73 percent owning a desktop/laptop computer; 68 percent owning a smartphone, and 45 percent owning a tablet as of 2015. Subsequently it has become ever more critical for businesses to understand how to interact and engage their customers, how technology is changing consumer actions and expectations, how the use of technology differs among the various generations, and how each generation has been impacted by broader economic forces such as the Great Recession.
“Snowzilla” slammed into the East Coast January 22-24, 2016, dumping up to three feet of snow from northern Virginia to southeast New York resulting in 55 fatalities, and economic losses between $500 million and $3 billion. According to NOAA, the snowstorm was the fourth most powerful to hit the Northeast in at least 66 years, affecting 102.8 million people and covering about 434,000 square miles in 26 states.16

Significant flooding in Ellict City, MD in July was also labeled a 1 in 1000-year event.16

And finally, Texas was clobbered with numerous hail storms in March and April, with resulting losses totaling more than $7 billion. More than 110,000 vehicles and thousands of homes were hit by large hail shaped like jagged rocks on April 12th, resulting in the costliest hailstorm in Texas history.16

In total, catastrophe events for 2016 resulted in $175 billion in overall losses, including $50 billion in insured losses. Insured losses were $5 billion more than the ten-year average between CY 2006-2015, and $16 billion higher than the thirty-year average from 1986-2015.17 Texas alone was hit with 14 CAT events in the first six months of the year, resulting in $76 billion in insured losses (see Figure 3). The Insurance Information Institute estimates the period from 2008 to 2015 has been the most expensive on record for insured losses from “convective events” – thunderstorms, tornado, hail, lightning, and flash floods.18 Nationally, 2.5 percent of all vehicle appraisals generated in CY 2016 had primary impact of hail, salt water or fresh water - up from 1.5 percent in 2015, and the highest since 3.5 percent in 2011 and 3.1 percent in 2012. States hardest hit in 2016 included Montana (16.7 percent), Wyoming (16.5 percent), Colorado (11.4 percent), Nebraska (10.9 percent), Kansas (10.5 percent), North Dakota (9.9 percent), and Texas (8.6 percent).

Much of the extreme weather in 2016 has been blamed on a strong El Niño phase that intensified the subtropical jet stream leading to strong storms in Texas and other southern states, record warm temperatures throughout most of the U.S., and warm and dry conditions in Canada that saw one of its worst wildfires ever. As of midyear 2016, the El Niño system was being replaced by La Nina which tends to promote the formation of hurricanes in the tropical North Atlantic,19 but had not provided much relief in terms of heat. The first half of 2016 set another record in terms of warm temperatures, after two prior consecutive record hot years.20 In fact, researchers at the National Center for Atmospheric Research warn that as the average temperature warms up, the air gets warmer and moister, and the number of heavy downpours in the U.S. could increase five-fold by the end of the century.21 Unfortunately, as more people move to areas like Texas and Florida, two of the three states that have accounted for nearly one-third of all insured catastrophe losses from 1996-2015,22 the exposure to the industry grows.

A comparison of data reported in AAA’s American Driving Survey, 2014-2015 shows the number of trips taken, the total number of miles driven, and the total number of minutes of driving reported in a 24-hour period (weighted to reflect all drivers aged 16 and older nationwide) were higher in the South and West census regions than in the Northeast or Midwest (see Figure 4).23

Finally, as the population in these areas grow, so too does the driving-aged population, simply leading to more congested roads, and potential exposure to accidents.
A comparison of both population growth and miles driven in the U.S. underscore the link between population growth and increasing miles driven overall. Surprisingly, the Midwest has seen the largest increase in the miles driven per person over the last three years (2014-2016) (see Figures 5.1-2). Among the top 10 states with the most growth in miles driven between CY2014 to September and CY2016 to September, six were in the South (NC, FL, DE, AR, GA, SC), one was in the Midwest (MI), and none were in the Northeast. Among the top 10 states with the largest population growth over that same period, most also fell within the South and West.

Metro Areas Continue to See Growth, Congestion

According to data from the World Bank, the number of urban residents globally is expected to increase by 1.5 times by 2045. Data from the U.S. Department of Transportation reveals the U.S. population has also become increasingly urban, with the most growth occurring in the suburban areas.26 In fact, three quarters of all population growth since 1980 has occurred in the suburbs.27 And even while the annual population growth rate of large cities in the U.S. between 2010 and 2013 was double what it had been in the previous decade, outpacing the growth rate in suburbs, approximately 50 percent of all Americans still live in the suburbs.28 As most commuters living in the suburbs begin and end their commute with a vehicle, improved employment rates leads to more miles driven.

With more of the population shifting to urban areas, the growth in overall miles driven on urban roads (includes suburban roads) in the U.S. has continued to grow from 64 percent of total miles driven in CY 2004 to just under 70 percent in CY 2016, despite a slight lag in this trend experienced during the last recession.29 (see Figure 6).
When broken down further by road type, the roads that have seen the most growth in overall miles driven over this period are both rural and urban interstates (see Figure 7). Unfortunately, as the Highway Loss Data Institute has found, every 5mph increase in posted speed limits on these roads yields an 8 percent increase in traffic fatalities (see Figure 8).24

With more people comes greater congestion. Road congestion in the U.S. has increased substantially over the last several decades. Data from The Texas A&M Transportation Institute and INRIX show that the total congestion problem is larger than the pre-recession levels (see Figure 9), with the average American motorist enduring about 5 percent more traffic-related delays than the pre-recession peak of 2007, and it is not just a big-city problem.25 Hours of delay per auto commuter have increased in population areas as small as those with less than 500,000, and extends to the densely populated areas of more than 3 million.26 Not surprisingly, cities that have experienced faster than average growth in employment and population have also seen some of the largest increases in traffic congestion, while the opposite is true for urban areas that are experiencing less growth.27 By 2014, severe and extreme congestion levels affected 1 in 4 trips versus 1 in 9 trips back in 1982.28

<table>
<thead>
<tr>
<th>CY</th>
<th>RURAL INTERSTATE</th>
<th>OTHER RURAL</th>
<th>OTHER URBAN</th>
<th>ALL SYSTEMS</th>
</tr>
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<td>-4.0%</td>
<td>-2.0%</td>
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</tr>
<tr>
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<td>-2.0%</td>
<td>-1.0%</td>
<td>-3.0%</td>
<td>0.0%</td>
</tr>
<tr>
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<tr>
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<td>0.0%</td>
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<td>0.0%</td>
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<tr>
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<td>0.0%</td>
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<tr>
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<td>'15</td>
<td>-2.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Higher Speeds Lead to More Fatalities (Figure 8)

The maximum daytime speeds that states allow on some stretches of their highways as of April 13, 2015.


<table>
<thead>
<tr>
<th>TRAVEL TIME INDEX</th>
<th>DELAY PER COMMUTER (HOURS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.90</td>
<td>1.00</td>
</tr>
<tr>
<td>1.10</td>
<td>1.20</td>
</tr>
<tr>
<td>1.30</td>
<td>1.40</td>
</tr>
<tr>
<td>1.50</td>
<td>1.60</td>
</tr>
</tbody>
</table>

There is an 8.0% Increase in fatality rates on interstates and freeways for every 5 mph increase in maximum state speed limits and a 4% increase on other roads.

U.S. Individual Vehicle Miles Driven by Road Type Percent Change from Prior Year (Figure 7)

(Each year represents YTD data through September)

U.S. National Road Congestion Measures, 1982 to 2014 (Figure 9)

Perhaps it should not come as a surprise then that according to the National Safety Council’s annual report “Injury Facts”, the percent of motor vehicle accidents that were ‘Collision with Other Motor Vehicle’ had grown to a 20-year high by CY 2014 (see Figure 10).

As consumers become increasingly frustrated with wasted time behind the wheel, move to urban areas with alternative modes of transport, and have greater access to technology that enables them to work from home, the personal vehicle has begun to see a drop in its dominance as a primary means of transportation, and one most frequently used when commuting to work (see Figure 11). During this time, the share of people using a personal vehicle dropped by 2.2 percentage points, while public transportation (+0.5%), bike commuting (+0.2%) and working from home (+1.2%) have taken more share.

And yet, with unemployment numbers down nationally, and 85.7 percent of individuals still using a personal vehicle as their most frequent method of commuting to work, the sheer number of those on the road continues to grow.

And some alternative modes of transportation don’t actually remove a vehicle from the road. For example, whether someone drives their own car or takes a ride-sharing service, there is still a vehicle on the road. According to a survey conducted by the Pew Research Center on the sharing economy, only 15 percent of U.S. adults have used a ride-hailing services such as UBER or Lyft. Among 18-to-29-year-olds however, the percent is nearly double (28 percent) versus only 4 percent for individuals age 65 and older, driving the median age of ride-hailing service users to 33. Not surprisingly, the survey also found usage is heavily concentrated among urban residents, and that frequent users of these services are less likely to own their own personal vehicle, and more likely use a range of other transit options. Most of the data would also suggest that the biggest impact of ride-hailing services to date is the loss of sales to the taxi industry. Data from Certify, a business-expense software company shows the steady growth in the share of ride-hailing as compared to total ground transportation transactions, which is triple the share for taxis, and even beating out car rental for the first time in Q1 2016 (see Figure 12).
Consumers are Younger, More Diverse, Digitally Enabled and Connected

Between 1965 and 2015, new immigrants to the U.S. and their children and grandchildren accounted for 55 percent of the overall growth in the U.S. population, adding 72 million people to the nation’s population as it grew from 193 million in 1965 to 324 million in 2015. Between 1970 and 1990, newly arrived immigrants primarily settled in four large states (NY, CA, TX, FL), but since 1990, new arrivals have dispersed more widely across the country. For example, foreign-born populations in Georgia, North Carolina, and Nevada have increased more than thirtyfold between 1960 and 2013.

If current demographic trends continue, the Pew Research Center projects that between 2025 and 2065, future immigrants and their families will account for 88 percent of the U.S. population increase, or 103 million people as the population grows to 441 million.

An estimated 51 percent of the immigrants that have arrived since 1965 were from Latin America (includes Central and South America), and one-third were from Asia; however, Pew Research projects the composition of the U.S.’s immigrant population will change again by 2065, with the differing growth rates of the nation’s racial and ethnic groups reshaping the U.S. demographic profile (see Figure 13). As the demographic profile of the U.S. continues to change, understanding how to reach a changing customer base in an environment where technology is also forcing change becomes ever more important.

According to the University of Georgia’s Selig Center for Economic Growth, the purchasing power of the U.S. Latino community grew 155 percent between 2000 and 2015, to $1.3 trillion, higher than that of blacks ($1.1 trillion) and Asians ($770 billion). The automotive industry for example, has already begun to see the growth opportunity within the changing demographics – particularly among Hispanic buyers. Per Unision and GFK Automotive, new vehicle sales to Hispanics grew at nearly triple the rate of the total market in 2015, a record year overall. These consumers will then also be purchasing insurance, and subsequently carriers must be knowledgeable about differences in how this group prefers to be engaged with – and that includes, marketing, sales, and service. Increasingly, consumers of all ages are shopping for auto insurance via digital channels. According to research by ComScore, the number of consumers who shopped for auto insurance in 2015 held steady at 46 percent, consistent with 2014, but 71 percent of them shopped online, up from 47 percent in 2013.

With nearly six-in-ten Hispanics falling within the Millennial or younger generations, it’s critical that businesses also understand key differences among consumers by age. Millennials overall have surpassed Baby Boomers to become the largest single generation. More Millennials continue to live in metropolitan areas and have higher levels of both diversity and education. And yet, Millennials continue to have among the lowest employment rates (see Figure 14).

Data from Pew Research has shown different demographics have varying degrees of reliance on smartphones as their primary means of accessing the internet. Among those Americans that are most reliant are younger adults and non-whites: 12 percent of African-Americans and 13 percent of Latinos compared with 4 percent of whites.

As the population shifts to less than 50 percent whites in the next several decades, the ability for companies to market themselves in a mobile environment becomes that much more important. Mobile strategies will increase in importance in areas such as employee recruiting as well, with data from Pew Research finding that 63 percent of smartphone-dependent users got job information on their phone in the last year, and 39 percent used their phone to submit a job application. The Consumer Technology Association conducted its own smartphone study and found that smartphones are owned by 74 percent of U.S. households (up 2 percentage points since 2015), with an average of 2.4 smartphones per household.

A recent survey/report completed by Novarica found Millennials typically prefer self-service shopping, spending time upfront researching information such as customer reviews and product specifications online, comparing products side-by-side to make their decision. In fact, data from a Gallup poll from 2016 reveals around 7 out of 10 millennials (71 percent) went online to compare prices (up 9 percentage points from a survey completed a year prior), versus only 35 percent of other generations (up only 2 percentage points).
Other research has shown that the ability to create a digital communication channel is important, as most Millennials value speed and ease of contact. For example, data from a survey conducted by business contact centers revealed the best way for businesses to contact Millennials is by social media and chat, while all older generations still prefer the phone (see Figure 15). 55

When it comes to auto claims, similar generational differences in the use of digital channels can also be seen. In Accenture’s Claims Customer Survey, younger respondents showed a greater interest in the use of digital technologies during the claims process (see Figure 16). 56 And when respondents of all ages were asked if they valued the ability to communicate with their insurer during the claims process, 44 percent said they would switch to another carrier if they couldn’t provide this capability. 57 After speed of settlement, transparency of the claims process and the ability to communicate received the highest votes for ‘important’ or ‘very important’ (see Figure 17). 58

The ability to provide personalized advice or assistance when buying insurance is another area which consumers are increasingly interested in and searching out – 80 percent of Accenture’s survey respondents said it was “very important” or “somewhat important” to their decision to switch to another insurance company in the next 12 months. 59 Additionally, the percent of respondents that indicated that they “Yes, certainly” or “Yes, probably” be willing to pay more for this personalized assistance grew from 35 percent in 2012 to 41 percent in 2015. 60 The ability to use the Internet of Things (IoT) technology to provide personalized service is also important – the survey revealed that 71 percent of insurance customers would be interested in an automatic claim submission service triggered from an auto accident or from a connected home. 61 With Millennials finally entering the auto marketplace, the insurance industry can expect to see more as well. A study by Polk conducted the 1st half of 2016 shows the number of new vehicles registered to Millennials grew by 35 percent between CY2011 and CY2016, while new vehicle registrations overall grew only 26 percent. 62

Percent of Survey Respondents that Used a Digital Channel for FNOL (Figure 16)

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Digital Channel Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>55+ AGE GROUP</td>
<td>14%</td>
</tr>
<tr>
<td>35-54 AGE GROUP</td>
<td>18%</td>
</tr>
<tr>
<td>18-34 AGE GROUP</td>
<td>25%</td>
</tr>
</tbody>
</table>


“How Important to You are the Following During the Claims Process?” (Figure 17)

<table>
<thead>
<tr>
<th>Importance Level</th>
<th>55+ AGE GROUP</th>
<th>35-54 AGE GROUP</th>
<th>18-34 AGE GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Important</td>
<td>9%</td>
<td>14%</td>
<td>29%</td>
</tr>
<tr>
<td>Extremely Important</td>
<td>1%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td>Not Important</td>
<td>28%</td>
<td>22%</td>
<td>9%</td>
</tr>
<tr>
<td>Not at All Important</td>
<td>25%</td>
<td>23%</td>
<td>18%</td>
</tr>
</tbody>
</table>


Popularity of Business Contact Channels, by Age (Figure 15)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet / Web Chat</td>
<td>2% (1st choice)</td>
<td>2% (1st choice)</td>
<td>7% (1st choice)</td>
<td>2% (1st choice)</td>
</tr>
<tr>
<td>Social Media</td>
<td>2% (1st choice)</td>
<td>12% (1st choice)</td>
<td>2% (1st choice)</td>
<td>1% (1st choice)</td>
</tr>
<tr>
<td>Electronic Messaging (e.g. email, SMS)</td>
<td>2% (1st choice)</td>
<td>20% (2nd choice)</td>
<td>34% (2nd choice)</td>
<td>6% (2nd choice)</td>
</tr>
<tr>
<td>Smartphone Application</td>
<td>11% (4th choice)</td>
<td>12% (2nd choice)</td>
<td>24% (2nd choice)</td>
<td>1% (1st choice)</td>
</tr>
<tr>
<td>Telephone</td>
<td>8% (5th choice)</td>
<td>1% (5th choice)</td>
<td>3% (5th choice)</td>
<td>3% (4th choice)</td>
</tr>
</tbody>
</table>

The arrival of the touchscreen was the last big shift in the way humans interact with computers. The leap to speech matters more.

The Economist

“Now We’re Talking” January 7, 2017.

Central to many of these IoT devices is a voice interface, where instead of windows, icons, menus or touchscreens, you simply talk to the device. And, thanks to deep learning through digital neuron networks (DNN), computers are able to handle natural language. A key advantage to voice as a computing interface is its ease of use, particularly when someone’s hands and/or vision are occupied. By 2020, Andrew Ng, Chief Scientist at Baidu predicts

“The Consumer

McKinsey estimates the total potential economic impact of IoT will be $3.9 trillion to $11.1 trillion annually by 2025.44 Much of the potential value comes from business-to-business (B2B) applications that use the data from the IoT devices, as well applications connecting the consumer IoT to B2B systems, such as using connected health-care devices to assist health-care providers and payors.47 Ultimately IoT devices within vehicles for example could provide data on condition-based maintenance, usage-based design, pre-sales analytics that monitor and improve performance.48 Insurers using this data could then price risk better, and offer other value-added services for their customers.

There remains a fair amount of work left to define who owns the data collected from the IoT devices used by consumers, and how they can use it. A survey of 1,900 individuals by the Ponemon Institute revealed 82 percent of respondents felt IoT manufacturers had not provided details about how personal information is handled.49 More respondents from this same survey were more concerned about security in an IoT device than privacy (74 percent for security / 52 percent privacy); and many respondents indicated they would like to receive compensation and information about the smart devices they are using (see Figure 19).50 Given the value that IoT has the potential to provide in sectors such as healthcare, energy, asset tracking, smart cities and more, industry organizations and governments can already be seen tackling key issues, including: data privacy and consumer literacy, and network security and resilience. The need to address the risks of data breaches and cyberattacks as more technologies such as IoT and artificial intelligence (AI) become mainstream was highlighted by the World Economic Forum in its Global Risks Report 2017. The October 21st internet blackout triggered by hundreds of thousands of household IoT devices overwhelmed servers, and forced many major services offline, serving as a big wake-up call for cyber risk.51

Manufacturers of Smart Devices Should Provide the Following Information (Figure 19)

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage</th>
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</thead>
<tbody>
<tr>
<td>COMPENSATE ME IF MY INFORMATION IS LOST OR STOLEN</td>
<td>74%</td>
</tr>
<tr>
<td>TELL ME WHAT INFORMATION IS COLLECTED</td>
<td>77%</td>
</tr>
<tr>
<td>TELL ME HOW THE INFORMATION IS USED</td>
<td>77%</td>
</tr>
<tr>
<td>TELL ME WHAT COULD HAPPEN IF THE SMART DEVICE IS HACKED</td>
<td>60%</td>
</tr>
<tr>
<td>ALLOW ME TO CONTROL WHAT INFORMATION IS COLLECTED</td>
<td>60%</td>
</tr>
<tr>
<td>TELL ME WHEN MY PERSONAL INFORMATION IS LOST OR STOLEN</td>
<td>57%</td>
</tr>
<tr>
<td>ASK ME BEFORE ANY DATA IS SAFEGUARDED</td>
<td>52%</td>
</tr>
<tr>
<td>TELL ME IF MY DATA IS SAFEGUARDED</td>
<td>50%</td>
</tr>
<tr>
<td>DON’T KNOW</td>
<td>17%</td>
</tr>
<tr>
<td>NO INFORMATION IS NECESSARY</td>
<td>14%</td>
</tr>
</tbody>
</table>

Adding a sensor to something does not magically endow it with value for its user, particularly when weighed against potential risks... As a society, we all face the potential to both suffer and benefit from a connected world.

It is the responsibility of the entities that are digitalising our physical world to educate, to safeguard, and to help foster new, responsible behavioural precedents in the internet of things.

Altimeter Group

As Consumers Shift More Purchasing Online Road Congestion Grows

According to the U.S. Census Bureau, the percent of households with a computer and the percent of households with an Internet connection have shown continued strong growth, with both measuring over 75 percent by CY 2014 (see Figure 20).29 As consumers spend more time online, the share of retail sales that are e-commerce have grown from less than 2 percent in CY 2000 to over 10 percent by CY 2015.30 The AlixPartners 2014 Home Delivery Survey found consumers’ average number of online and other nontraditional retail-channel orders per year was 14.4—up from 9.8 in 2012, a 47 percent increase. And, 48 percent of respondents said they had ordered online at least once a month during the past year—up from 32 percent in 2012.31 A comparison of the average number of orders in the past 12 months by age group revealed those in the 18-24 age range had the most (20.3) versus only 9.3 for those in the 65+ age range.32

Overall new projections released by the U.S. Department of Transportation’s Bureau of Transportation Statistics (BTS) and Federal Highway Administration (FHWA) show that freight tons moving on the nation’s transportation network will grow 40 percent in the next three decades while the value of the freight will almost double, increasing by 92 percent.33 Trucks are by far the single most-used mode to move freight, moving 64 percent of the tonnage in 2015 and 69 percent of the value.34 Tonnage for trucking is forecast to grow 44 percent by 2045, and value is forecast to grow 84 percent.35 With economic growth picking up overall, and more goods being purchased online, fleet traffic has also grown, particularly in urban areas. According to data from the Census Bureau’s 2012 Commodity Flow Survey, 78 percent of freight travels less than 250 miles in the U.S., with 65 percent of all freight traveling under 50 miles.36

In New York’s borough of Manhattan, there are 10 out of 43 zip codes where the demand for parking delivery trucks today exceeds the linear capacity of the streets. 37, 38

M. Jaller, J. Holguín-Veras, and S. Hodge

“Parking in the City: Challenges for Freight Traffic.” 2013. (www.goodsmovementmatters.org)

Perhaps that is driving some of the changes seen in the types of large truck accidents in the U.S. According to the Federal Motor Carrier Safety Administration, between 2013 and 2014, while the overall involvement of large trucks in crashes declined by 5 percent, the large truck involvement rate in injury crashes increased 21 percent, and the large truck involvement rate in property-damage-only crashes increased by 29 percent.39 Additionally, among the top truck driver-related factors and violations recorded for 2014 were “Speeding of Any Kind” (71 percent), and “Distraction/Inattention” (6.2 percent).40 In their 27th annual “State of Logistics” report produced by the Council of Supply Chain Management Professionals (CSCMP), a key observation was that “...gaps in infrastructure and accelerating trends for speed will increasingly put pressure on a logistics system not designed for e-commerce driven ‘last mile, last minute’ delivery service.”41

The impact of greater congestion to auto insurance results, particularly commercial, was observed by the Property Casualty Insurers Association of America (PCIAA) in their review of Commercial Auto Cost Drivers. There are five times as many people that reside in the top 10 worst performing commercial auto loss ratio states than the 10 best performing, and half of the American Trucking Research Institute’s 10 most congested states are among the top 10 worst performing commercial auto loss ratio states.42

U.S. Census Bureau Computer and Internet Use at Home Over Time (Figure 20)

Note: Data for 1984 and 1997 are from the Current Population Survey. Data for 2005 and 2014 are from the American Community Survey. The Internet rates shown here include all connection types, including dial-up connections and those connecting without paid subscriptions.

There is a great deal of research available documenting the numerous demographic changes occurring in the U.S. now and into the future. More people are moving to the southeastern and western parts of the U.S., where population growth unfortunately meant higher volumes and dollars for claims related to severe storms in 2016. Nearly 85 percent of working adults still use their personal vehicle as the primary method for commuting to work, but telecommuting, bike commuting, public transportation, and ride-sharing are growing in share, and point to a desire among consumers to take advantage of the wasted time which can be spent behind the wheel of a car stuck in traffic. The key is to do so without adding greater driver distraction, a key variable believed to be behind increases in road fatalities in the U.S.

The U.S. population is becoming older, more diverse, and the largest segment of population – Millennials, are proving to be different from previous generations. Many Millennials are postponing marriage, home and vehicle ownership, and are remaining in urban areas. They are also much more diverse ethnically, but share a key characteristic - they are part of the first generation to truly grow up ‘digital’. They expect all interactions to be supported digitally, and are choosing which companies they want to work with/buy from based on their ability to support that. Other generations have quickly followed suit in the adoption of digital technologies, which has now expanded into the Internet of Things, which offers immense opportunities to change the way business is done.

Many of these demographic shifts have been in place for many years, and will continue to evolve with time. Most however are large-scale and slow-moving, so businesses have time to adapt their marketing, sales, and service plans accordingly. Those that have done nothing to date are behind, but technology can help close the gap.

As more of our lives are conducted online, several new concerns emerge. Data privacy, security, and ownership issues will need to be addressed, and consumers have growing expectations that they will receive something of value in exchange for sharing their personal information. As consumers do more research and make more purchases online, companies need to update their mobile and digital strategies. Growth in online shopping and next-day delivery are adding to already congested roads in many urban areas. Long term communities and their governments hope to take advantage of data generated by consumers and their IoT devices, to combat congestion and support smarter mobility.

Ron Nelson speaks to creating technology that allows consumers to do more self-service using the tools they want to use, and how data can help create a better overall experience for the customer.
In 2011, venture capitalist Marc Andreessen wrote an insightful essay for the Wall Street Journal describing “Why software is eating the world.”1 The basic premise being that traditional human-centric (consumer) service is being replaced by technologies accessible through the web and smartphone, forcing massive disruption across traditional business models.

Increasingly, smartphones are like a remote control, enabling consumers to control the world around them with a click of a button through interactive services such as booking flights, ordering movie tickets, making dinner reservations, ordering food delivery, hailing a ride, or even turning off lights in our connected home. Moreover, consumers can stay informed about the progress of their transactions through text, email, and in-app messaging. All of this is possible without speaking or meeting with a customer service representative.

Liquid Expectations

The result of these massive waves of disruption is a relatively new consumer attitude referred to by marketing professionals as “liquid expectations”.2 This term is being used to describe how modern consumers’ expectations flow from one industry to a completely different and unrelated industry. For example, a consumer may naturally compare how their airline flight check-in experience relates to their vehicle check-in experience at an automotive repair shop.

The New Normal

As evidenced across many industries, the new normal is for businesses to offer consumers with self-service choices. By offering multiple service channels, a consumer can shape their own interaction. In many ways, choice begets convenience, and convenience begets high satisfaction – which is ultimately the goal. A recent study by Microsoft and Parature found that 68 percent of consumers aged 18 to 36 years old will stop doing business with a brand due to a single poor customer service experience.3 For modern consumers, the concept of a “poor customer service” experience isn’t limited to just a rude service interaction, but more broadly applies to whether their liquid expectations were met from a self-service technology standpoint.

Online Appointments

One profound benefit of self-service technologies like website and mobile apps is that they are available 24x7 and therefore extend the service window of a traditional business. For example, CCC operates Carwise.com, a website that helps millions of consumers each find automotive repair shops in their area. In looking at Carwise.com web traffic, we found that 37.8 percent of visitors are searching for a body shop outside of normal business hours. For many repair shops this translates into missed opportunities since there is oftentimes no mechanism for a consumer to book an appointment with the shop after hours.

The Lobby Experience

Another area where liquid expectations are not being met today in collision repair is the lobby experience. Today’s consumers are increasingly becoming accustomed to self-service kiosk options offered by airlines and movie theaters, for example, which are convenient when there aren’t enough service personnel to handle influxes of customers.

Today the collision repair lobby experience is antiquated — by the time a vehicle-owner reaches a repair shop, they have likely had multiple phone calls to their carrier and the collision repairer. When they arrive at the shop, they’re asked to fill out all the same information again on a paper-and-clipboard. It’s fair to assume that for a modern consumer, this does not meet their liquid expectations.

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About the Author

Ron Nelson is Vice President of Products & Technology at CCC Information Services Inc.
Despite the daily headlines regarding companies like Google, UBER, MIT, Mobileye and others, the traditional car ownership model is not dead. There are still more than 260 million cars and trucks on the road in the U.S. with an average age of 11-plus years, pointing to likely long lead times before vehicles that are semi- or fully-autonomous really proliferate.

This quote from Dave Leggett, editor of automotive industry research firm justauto.com sums it up: “The traditional car ownership model that has served the auto industry so well for the past century is far from dead. However, we are seeing some important changes in the transportation market - especially in urban areas - and participants in that market, including suppliers, need to be acutely aware of future pressure points and how their business can be impacted.”

New Vehicle Sales

U.S. vehicle sales for 2016 came in 0.3 percent above the 17.47M sales from 2015 to land at 17.539M total sales, another new record (see Figure 21). With 2016 sales, the U.S. has seen seven consecutive years of annual sales gains, the longest streak since 1909-17. Driving the growth in sales over the last seven years have been pent-up demand, more leasing, favorable finance deals, and steady job growth.

Most analysts believe sales will begin to flatten in the next several years, with projections between 17.1M and 17.2M for CY2017 but the overall number projected still points to further growth in the U.S. vehicle fleet. Data from IHS Markit shows that the U.S. experienced its largest increase ever in light VIO (vehicles in operation - includes cars and light trucks) in 2016, growing 2.4 percent versus the prior year, and exceeding the growth rate of 2.1 percent in 2015.
The National Auto Dealers Association (NADA) reports the average transaction price of new vehicles has grown each year by nearly 2 percent (see Figure 22). Much of the increase stems from changing demands on automakers to meet government fuel economy and safety standards, as well as growing demands among consumers for more features, and growing consumer preference for light trucks. In 2016, 60.7 percent of all vehicles sold in the U.S. were light trucks, the highest share for trucks ever (see Figure 23). Crossovers alone accounted for nearly one-third of all sales in 2016, increasing 8.5 percent in overall count. In contrast, midsize car sales dropped 12 percent and compact car sales fell 5.2 percent.

It is estimated that the government-mandated safety and emissions equipment alone can add more than $5,000 to the price of a new vehicle. The estimated average new car price for a “1967 comparable car” with added safety and emissions equipment was $14,359 in 2014. Without the added safety and emissions equipment, that same vehicle’s price was $8,860 (see Figure 24).

As the cost of vehicles have grown, consumers have extended both the overall term and value of their auto loans. Per Experian, consumers in the U.S. now have more than $1 trillion in outstanding automotive loan balances. More than 86 percent of new vehicles and 54 percent of used vehicles were purchased with financing in Q3 2016 with the average new car loan sitting at $30K with an average 68-month loan term, and the average used car loan of $19K with a 63-month loan term. The unfortunate reality is that without a lengthy and large loan, most consumers in the U.S. can no longer afford to purchase a new car. Data from the Economic Policy Institute shows that wages for the top 1 percent have grown 138 percent since 1979, but only 15 percent for the other 90 percent, while the average price of a new vehicle has grown more than 600 percent from a less than the $6K price tag in the late 1970’s to more than $32K today.

Vehicle affordability was a key factor driving up new vehicle leases in 2016, and leasing in turn remained a key driver behind new vehicle sales in 2016. 32 percent of new vehicles sold during the first six months of CY16 were leases, double the lease volume than in the first half of CY11.

U.S. Light New Vehicle Sales in Millions (Figure 21)

NADA “Average Selling Price of New Vehicles Sold” (Figure 22)

Light Truck Share of U.S. Annual New Light Vehicle Sales (Figure 23)

Estimated Average New Car Price for a 1967 “Comparable Car” (Figure 24)
Parts of the Problem

It should perhaps come as no surprise then that as the overall cost of a vehicle has risen, so too would the cost of its parts. A comparison of OEM (original equipment manufacturer) list prices for parts commonly replaced on vehicles in ‘year one’ of their lifespan can help illustrate part price increases over the last two decades.

For example, the OEM list price for headlamp assembly for the MY 1997-2001 Toyota Camry LE was $196 in CY 1998 (‘year one’).

The same part for the MY 2002-2006 redesign in CY 2003 jumped to $253, stayed in the same ballpark for the MY 2007-2011 redesign as recorded in CY 2008. However, by CY 2013, the headlamp assembly for the MY 2012-2017 redesign jumped by over $100 to $357.

Percent Change in Average OEM List Price for Vehicle Part as of Year 1 of Each New Model Series/Redesign (Figure 25.1)

Average OEM List Price ‘Year 1’ of Each New Model Series/Redesign (Figure 25.2)
Historically, parts have each accounted for about 40 percent of the total repair cost—with the remainder for labor, paint, tax, sublet, etc. And while seasonality created a bit of a see-saw effect, the spend on parts has stayed surprisingly stable over the last twenty years, and only in the last several years experienced an increase (see Figure 26).

Why this is happening becomes most apparent when comparing the same trend by vehicle age (see Figure 27). The share of overall repair cost for replacement parts for current model year vehicles has risen sharply, while vehicles aged 7-years plus have seen much less change in the trend. Certainly, some of this would have to do with the availability of alternative parts for the older models, but it also certainly underscores the growing impact parts have on the overall cost to repair a vehicle.
Changes in technology (such as the introduction of more complex lighting technology in headlamps) as well as changes in material types among various body panels have led to higher cost parts for the industry. For example, the percent of replaced lamps that are LED or Xenon has grown each year over the last 10-plus years (see Figures 28.1-2). In 2016, the average cost of a Xenon/LED lamp was 56 percent higher ($527) than non-Xenon/LED lamps ($338). And while the cost difference has shrunk over the years, it has more to do with the increasing complexity of all lamps.

With parts accounting for a growing share of the overall spend, anticipating changes in their prices will become a key tool in pricing loss costs - particularly as the frequency and number of new model introductions and redesigns is expected to grow in the future.

With a plateau reached in new vehicle sales, competition among the automakers will become fiercer. The ability to produce the right vehicles at the right quantity and with the right amount of refresh/redesign/new launch becomes ever more critical. In their report “Car Wars 2016-2019: 25th Anniversary”, Bank of America Merrill Lynch compares the replacement rate and showroom age of automakers, and forecasts the number of new model launches for 2016-2019. Between 2016 and 2019, an average of 48 new models each year are anticipated, or 193 total over the full period, compared to just 38 new models (BoFA refers to these as “major” vehicle releases) launched each year between 1996-2015.97 Kelley Blue Book previewed 46 new models for MY 201698 - the market certainly seems on track. The desire to speed up vehicle changes and get fresh product to customers faster has forced automakers to make their assembly lines, tools, vehicle platforms and auto parts much more flexible and interchangeable.99

Auto Claim Mix Shifts Newer with Increases in New Vehicle Sales

Strong new vehicle sales over the last several years is just one of several factors driving change within the fleet of vehicles on the road in the U.S. today. Vehicles last longer than ever before, and scrappage rates remain low: only about 11M light vehicles, or 4.3 percent of the overall vehicle population were taken out of the U.S. VIO in 2015.100 In fact, IHS Markit forecasts that between now and CY 2021, the market will see a further shift of vehicle volume to the newest and oldest segments as the drop in vehicle sales from the Great Recession works its way through the vehicle population (see Figure 29).101 It’s expected that vehicles aged 16-years plus will grow by 30 percent from 62 million vehicles in CY 2016 to 81 million vehicles by CY 2021.102

IHS Automotive’s Vehicles in Operation in U.S. by Vehicle Age - Projected Change (Figure 29)

<table>
<thead>
<tr>
<th>Age of Vehicles in Operation</th>
<th>Forecast Growth/Decline (%) by CY 2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 YEARS</td>
<td>16.0%</td>
</tr>
<tr>
<td>6-11 YEARS</td>
<td>5.0%</td>
</tr>
<tr>
<td>12+ YEARS</td>
<td>10.0%</td>
</tr>
</tbody>
</table>


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If the same rates of change in the vehicle age distribution occur within automotive claims by CY 2021, CCC projects the industry would see an increase in newer age vehicle claims where total loss frequency is lower but repair costs are higher. In fact, applying the rates of change projected for the U.S. vehicle fleet by IHS Markit to the current CCC vehicle claim mix by vehicle age results in a decline of 0.3 percentage points in the overall frequency of potential total losses by CY 2021, and an additional increase of 0.6 percent in vehicle repair costs beyond what the industry may already experience from inflation in parts, labor and other repair components (see Figure 30).

A larger share of the volume of vehicles totaled are also falling in the older ages, with vehicles 16-years and older now accounting for 15.3 percent of all collision and liability total losses in CY 2016 versus 13 percent in CY 2012 (see Figure 31). In fact, assuming the industry experiences similar rates of total loss frequency per individual vehicle age in CY 2017, the growth in older vehicles’ share alone may lead to another full percentage point in total loss frequency. Because, despite the shift in automotive claims towards a newer vehicle fleet again, many older model year vehicles remain.

Total loss volume historically has also reflected changing dynamics within the automotive marketplace and consumer preferences. Comparison of the mix of total loss vehicles by vehicle type across the different age ranges reveals the impact of shifting consumer preference to light trucks and economic conditions (see Figure 32). For example, vehicles aged 11-15 years in CY 2016 are MY 2001-2005, vehicles sold during a mild recession as well as the heyday of mid-size SUV sales. Vehicles aged 7-10 years are MY2006-2009 when the home construction industry was slowly imploding, gas prices were rising, and truck sales dropped, particularly pickups. And finally, vehicles aged current to 3 years are MY2013-2016 when light truck (particularly crossover) sales surged again.
Looking at total loss frequency historically also underscores how much variability there is based on the health of the used vehicle market (see Figures 33.1-2). When the used vehicle market hardened in 2005-2006 and then in 2010-2011, total loss frequency fell, as fewer vehicles may have reached the total loss threshold. Now as we head into a softening used vehicle market, we are seeing total loss frequency on the rise, particularly given the older fleet where minimal damage can quickly reach the total loss value threshold.

With total loss frequency expected to rise further, change within used vehicle prices could drive overall loss costs associated with total loss claims up even further, particularly if used vehicle prices remain elevated as they have over the last several years. With many of the trends discussed below, it looks as if perhaps used vehicle prices may finally be trending down.

**Used Vehicle Sales**

Strong new vehicle sales, particularly leases, have created some headwinds for the used vehicle market in the coming years. Increased supply into the wholesale used vehicle market, shifting consumer preference to light trucks, and rising new vehicle incentive levels are expected to help soften used vehicle prices in the coming years, although these very same trends have also led to much wider price differences across vehicle segments.

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**Used Vehicle Market Health and Total Loss Frequency** *(Figure 33.1)*

Total Loss Frequency per Vehicle Age CY2003-2016

**Used Vehicle Market Health and Total Loss Frequency** *(Figure 33.2)*

As Used Vehicle Prices Soften, Total Loss Frequency Rises

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**Used Vehicle Sales**

Strong new vehicle sales, particularly leases, have created some headwinds for the used vehicle market in the coming years. Increased supply into the wholesale used vehicle market, shifting consumer preference to light trucks, and rising new vehicle incentive levels are expected to help soften used vehicle prices in the coming years, although these very same trends have also led to much wider price differences across vehicle segments.
Retail used vehicle sales were strong in 2016, increasing 0.6 percent in total unit count versus the prior year (see Figure 34). Sales of certified pre-owned vehicles also hit a new record of over 2.6 million, up 3.5 percent in CY16 vs the prior year.

Higher wholesale volumes helped feed the demand, but large additional growth in supply anticipated over the next several years will be harder to market. As the supply of newer model year vehicles has grown, their pricing has begun to soften, and most analysts believe more downward pressure will occur in CY 2017 and CY 2018 when off-lease volume sees about a 16 percent annual growth rate.

Despite these significant increases in off-lease/off-rental/repossession volume entering the market, Manheim’s used vehicle value index registered an increase of 0.3 percent year-over-year (see Figure 35). Countering the downward pressure on pricing that increased supply was a shift towards higher value light trucks, higher volumes of newer used vehicles in the marketplace, and higher average new vehicle MSRP. The Manheim index does adjust for mix and mileage and seasonality, but because it is a dollar value index, it will reflect the overall impact of rising new vehicle MSRP. Nearly all types of cars (subcompacts, compacts, large luxury, mid-size, etc.) have depreciated more than utility vehicle segments, vans, and pickups. Much of this has to do with both greater supply in the car segments, but also with demand in the marketplace shifting to light trucks.

Given that the largest increase in wholesale supply has come from lease vehicle returns aged three-years-old, prices of vehicles aged 4-6 were most impacted, while the oldest segment of vehicles remains the strongest in terms of pricing.

Wholesale prices across different vehicle segments underscore the impact of changing consumer preference and the impact to pricing due to an influx in supply for certain segments. For example, as consumer preference has shifted to light trucks, wholesale prices over the last four years for pickups rose 28 percent, while compact car values fell 14 percent. Nearly all types of cars (subcompacts, compacts, large luxury, mid-size, etc.) have depreciated more than utility vehicle segments, vans, and pickups.

Total Loss Claim Costs Reflect the Changing Vehicle Mix and Associated Costs

Analysis of collision/liability total loss valuation data by vehicle type and vehicle age illustrates the range in price fluctuation over the last several years (see Figure 36). So for example, the newest pickups (aged 0-3 years) saw an increase in average adjusted vehicle value between CY2015 and CY2016 of 2.7 percent, while those aged 4-6 years saw a slight drop of 0.6 percent, but as an overall vehicle segment were up 1.9 percent. Conversely, cars aged 4-6 years experienced a drop of 6 percent, while cars aged 11-15 years dropped only 2.2 percent. And, across all vehicle types, vehicles aged 11-15 years dropped by 0.4 percent, while vehicles 4-6 years dropped 3.4 percent, for an overall increase of 0.8 percent.
Total Loss Adjusted Vehicle Values for Collision/Liability Claims
CY2012-2016 by Vehicle Type and Vehicle Ages (Figure 36)

CAR TYPE AVERAGE

SUV VEHICLE TYPE AVERAGE

TOTAL OF ALL VEHICLE TYPES - AVERAGE

PICKUP VEHICLE TYPE AVERAGE

Source: CCC Information Services Inc.
### Total Loss Valuations - Vehicle Mix Statistics by Calendar Year (Figure 38)

<table>
<thead>
<tr>
<th>CY 2007</th>
<th>CY 2008</th>
<th>CY 2009</th>
<th>CY 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Final Valuation Amt Avg</td>
<td>$7,695</td>
<td>$7,962</td>
<td>$8,863</td>
</tr>
<tr>
<td>% Chg from prior year</td>
<td>2.9%</td>
<td>-0.8%</td>
<td>-4.8%</td>
</tr>
<tr>
<td>Avg Vehicle Age</td>
<td>8.50</td>
<td>8.30</td>
<td>8.75</td>
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<tr>
<td>Avg Odometer</td>
<td>102,174</td>
<td>103,436</td>
<td>106,742</td>
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<tr>
<td>Avg Mileage per Vehicle Year</td>
<td>12,020</td>
<td>12,027</td>
<td>12,021</td>
</tr>
<tr>
<td>Light Trucks % Vol</td>
<td>34.0%</td>
<td>34.7%</td>
<td>35.5%</td>
</tr>
<tr>
<td>SUV's % Vol</td>
<td>14.4%</td>
<td>15.1%</td>
<td>16.1%</td>
</tr>
<tr>
<td>Car Final Val Amt Avg</td>
<td>$6,822</td>
<td>$6,944</td>
<td>$6,662</td>
</tr>
<tr>
<td>% Chg from prior year</td>
<td>3.8%</td>
<td>1.7%</td>
<td>-4.1%</td>
</tr>
<tr>
<td>Truck Final Val Amt Avg</td>
<td>$9,326</td>
<td>$8,680</td>
<td>$8,307</td>
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<tr>
<td>% Chg from prior year</td>
<td>0.6%</td>
<td>-4.4%</td>
<td>-4.6%</td>
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<tr>
<td>Asian Vehicles % Vol</td>
<td>36.4%</td>
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<td>37.6%</td>
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<tr>
<td>Domestic Vehicles % Vol</td>
<td>57.7%</td>
<td>56.7%</td>
<td>55.7%</td>
</tr>
<tr>
<td>European Vehicles % Vol</td>
<td>5.9%</td>
<td>6.3%</td>
<td>6.7%</td>
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<td>Asian Veh Final Val Amt Avg</td>
<td>$8,195</td>
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<td>% Chg from prior year</td>
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<td>Domestic Veh Final Val Amt Avg</td>
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<td>% Chg from prior year</td>
<td>2.1%</td>
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<tr>
<td>European Veh Final Val Amt Avg</td>
<td>$12,038</td>
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<td>% Chg from prior year</td>
<td>1.7%</td>
<td>-3.9%</td>
<td>-8.6%</td>
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<tr>
<td>Theft % Vol</td>
<td>1.7%</td>
<td>3.4%</td>
<td>2.7%</td>
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<tr>
<td>Vehicle Current Yr &amp; Newer %</td>
<td>3.0%</td>
<td>2.5%</td>
<td>1.6%</td>
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<td>Vehicles 1-3 Years %</td>
<td>14.3%</td>
<td>14.1%</td>
<td>13.1%</td>
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<td>Vehicles 4-6 Years %</td>
<td>20.5%</td>
<td>20.2%</td>
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<tr>
<td>Vehicles 7 Years &amp; Older %</td>
<td>62.1%</td>
<td>63.3%</td>
<td>65.5%</td>
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<td>Collision %</td>
<td>60.0%</td>
<td>60.0%</td>
<td>63.2%</td>
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<td>Comprehensive %</td>
<td>9.6%</td>
<td>11.1%</td>
<td>10.9%</td>
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<td>Liability %</td>
<td>30.4%</td>
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<tr>
<td>Luxury % Vol</td>
<td>9.5%</td>
<td>9.9%</td>
<td>10.4%</td>
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</tbody>
</table>

### Source
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Troubling Signs for Future Total Loss Settlement

Many families today are unable to afford a new vehicle. According to U.S. Census data, median family income in 2014 was just over $53K, only about two percent higher than in 1990 when it was $52,623.\(^3\)

Edmunds.com reports the percent of consumers purchasing a new vehicle with a trade-in has actually fallen from more than 50 percent in 2012 to 45 percent for the first nine months of 2016, while the percent of consumers purchasing a used vehicle with trade-in has grown from about 27 percent in 2012 to 31 percent by 2016.\(^4\) The bad news is that more of these trade-ins had negative equity: 32 percent of new-car purchases, and 25 percent for used-car purchases.\(^5\) This is the highest rate on record, with the Q3 2016 new-car buyers saddled with an average of $4,832, and used-car buyers stuck with an average of $3,635 of negative equity at time of trade-in.\(^6\)

Increased negative equity could be a factor encouraging consumers to take on loans with longer terms. According to Experian Automotive, 86.1 percent of new-vehicle buyers and 54.2 percent of used-vehicle buyers bought their vehicles with financing, with the average loan for a new vehicle exceeding $30K, and the average loan for a used vehicle over $19K. In order to keep monthly payments down, consumers have extended the term length of their loans; as of Q3 2016 the average loan term for a new vehicle was 68 months, and 63 months for used vehicles.\(^7\) In fact, over 30 percent of new loans and 18 percent of used loans have a term between 73-84 months as of Q3 2016.\(^8\) This means either consumers will have to experience a total loss claim over the next year may have bought their vehicle when used vehicle prices were at their peak; as prices soften over the coming year with increased supply and pressure from softening new car sales, their vehicle may have depreciated much more than anticipated. Providing customers with information at policy renewal on the present value of their insured property could potentially help keep them better informed, and avoid difficult surprises if there was a total loss claim.

Historically total loss claims where the consumer is upside down on their remaining auto loan have been more difficult to settle. Consumers often have little understanding of just how quickly a vehicle depreciates, and often don’t have good visibility into broader market trends that may be driving vehicle values down. Many of the consumers that experience a total loss claim over the next year may have bought their vehicle when used vehicle prices were at their peak; as prices soften over the coming year with increased supply and pressure from softening new car sales, their vehicle may have depreciated much more than anticipated. Providing customers with information at policy renewal on the present value of their insured property could potentially help keep them better informed, and avoid difficult surprises if there was a total loss claim.

Transformation of the Vehicle as an IoT Device Presents Opportunities, Challenges for the Auto Industry

The challenges for automakers continues to grow. Near term automakers must make significant investment to meet the fuel economy standards of 54.5 mpg by 2025, continue to expand globally, and meet growing consumer demand for more features and safety technologies. There is also immense pressure to develop vehicles that are semi- or fully-autonomous, are connected, and provide more flexibility as the whole notion of personal mobility further changes and expands beyond just a single car – single owner. The car is the new smartphone, an Internet of Things (IoT) device that is becoming ever more digitized, and capable of providing immense amounts of data about the consumer, where and how he/she drives, their preferences, their connections, etc. In 2016, there was a convergence of numerous exponential technologies that have allowed companies to introduce new disruptive products and services to consumers, not previously imagined. And the pace of disruption will only increase in the future. A presentation in Oslo in March 2016 by Tony Seba, provided the example of just how quickly sensors have changed (see Figure 39).\(^9\)

The automotive industry has already begun to feel the impact of the shifts towards the shared economy and autonomous vehicles. Numerous mega-deals among automotive suppliers, such as the $8B acquisition of auto supplier HARMAN by Samsung Electronics, underscore the race by suppliers to be able to provide the capabilities in vehicle light-weighting, ADAS, connectivity, semi- or fully-autonomous driving, electric vehicles, artificial intelligence, etc. that the vehicle marketplace is demanding.

Sensors: 1,000x Changes in 7 Years (2007-2014) (Figure 39)

<table>
<thead>
<tr>
<th>Unit</th>
<th>Change</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NUMBER OF SENSORS</td>
<td>Up 1,000x</td>
<td>From 10 million to 10 billion</td>
</tr>
<tr>
<td>COST</td>
<td>Down 1,000x</td>
<td>e.g. from $250/axis for gyros to $0.75 for three axis</td>
</tr>
<tr>
<td>POWER CONSUMPTION</td>
<td>Down 1,000x</td>
<td>From W to mW and mW to pW, depending on sensor</td>
</tr>
<tr>
<td>PHYSICAL SIZE</td>
<td>Down 1,000x</td>
<td>e.g. gyro from 2,000 mm² to 2 mm²/axis</td>
</tr>
<tr>
<td>NUMBER OF TRANSISTORS</td>
<td>Up 1,000x</td>
<td>From 1,000s per sensor to 1,000,000s/sensor</td>
</tr>
</tbody>
</table>


In 2016, cars became part of the tech industry’s mission. Artificial intelligence, lidar, and data security are now part of everyday car speak.

The Verge, Tamara Warren

“In 2016 cars are at the frontier of technology,” www.theverge.com, Jan. 2012

In their “State of Auto Tech” presentation from July 2016, CB Insights identifies the diverse group of investors looking into auto tech, including accelerators, startups, venture capital firms, and large corporations. They identify nearly 100 startups that are targeting various automotive applications and solutions around vehicle cybersecurity, connected car, V2V and V2X communication, ADAS and car automation, auto repair, tires, navigation and mapping, driver safety, battery storage, sensor hardware, and engine efficiency (see Figure 40).123

Within the automotive retail sector, combined sales of used vehicles, new vehicles, and parts and service, are estimated at $1 trillion annually, split today among 10K owners.124 With all of the anticipated changes to how vehicles are sold, greater use of things like over-the-air updates from OE’s, the cost to maintain technology needed to sell and service the changing vehicle fleet, Morgan Stanley Research predicts the dealership population in the U.S. will shrink another 60 percent, but in half the time it took to decline 60 percent to 10K dealerships between 1947 and 2014.125

At CES® this year, nearly 150 auto-tech exhibitors displayed their technology, spanning an exhibit space of four football fields, more than 20 percent more space than in 2016.126 Automakers are responding with major investments in technology, expanding relationships with traditional suppliers, and establishing new ones with technology companies. Almost every day a new partnership or acquisition is announced, or new startup launched. Many of their efforts seem to be focused in three major areas – electrification, startup launched. Many of their efforts seem to be focused in three major areas – electrification, partnership or acquisition is announced, or new

Given the significant rise in auto fatalities over the last two years (see Figure 41), government agencies are anxious to find ways to reduce accident frequency and severity. In early December 2016, the National Highway Traffic Safety Administration (NHTSA) released a proposed rule looking to require and standardize vehicle-to-vehicle (V2V) communications for new light vehicles. The capabilities proposed include the ability for the vehicle to send basic safety messages on vehicle location, speed, and bearing to other vehicles, with added vehicle capabilities to consume that data and take corrective action through advanced driver assistance systems such as automatic braking. NHTSA is looking for a final rule to be issued by 2019, with a phase-in period beginning in 2021, with full compliance by automakers by 2023.127 This ruling could help accelerate the share of the vehicles on the road that are connected.

Today’s average vehicle pulls in data to its master onboard computer system from numerous wired and wireless connections, infotainment platforms, mobile devices, and GPS units.128 The explosion of data from the vehicle about its performance, safety, physical surroundings, and passengers translate to new business opportunities but also new security risks. Who should have access to this information, and who is responsible when something goes wrong, are all questions that have yet to be fully answered.

Traffic deaths rose 7.2% between 2014 and 2015 - nearly double the 3.5% rate of increase in miles driven.

Ytd to October, 2016 road fatalities rose another 7% from the same period in 2015.
The development process for cars is changing from mechanical to electronic systems to fully computerized and programmable systems. The car is now software-defined.

Danny Shapiro, Senior Director-Automotive at Nvidia

Historically vehicle data has been accessed via a plug-in device to the OBD-II port, developed initially to help access a vehicle’s emissions data. As the industry looks forward to emerging technologies such as telematics, connectivity, ADAS, autonomous driving, AI, and intelligent transportation, the need for better communication of vehicle data is clear. To date, two new vehicle data communications methodologies have been proposed by industry global standards organizations SAE International and the International Organization for Standardization (ISO). A key difference between the two concepts is who will control access to the vehicle data, and what level of access will be allowed.122

This will be a key issue to watch moving forward, particularly as more and more vehicles roll off the assembly line ‘connected’. Berg Insights estimate that nearly 12 percent of all cars sold worldwide in 2013 were equipped with OEM embedded telematics system, and that the market will reach 54.5 million units in 2020.124 Approximately 5 percent of vehicles sold in 2014 included connectivity in excess of a Bluetooth smartphone connection, where the car itself could receive a 4G/LTE data signal; industry analysts project that percentage will grow to 57 percent by 2019, and 89 percent by 2024.126

With greater complexity comes greater vulnerability from cyber-attacks; the industry will need to rethink design from the bottom up – that’s where tech companies are forcing change. Most connected cars on the road today are also not designed with a secure architecture. Vehicle design has been focused on ensuring the vehicle can operate in maximum and extreme conditions, and typically incorporate 50 to 100 individual electronic control modules to address distinct functions using minimal resources and communicate their messages across a shared network. Subsequently, a single rogue message on that network could wreak havoc across the vehicle’s entire operation.126 Look for increased focus on improving cybersecurity of vehicles as connectivity grows.

Growing Complexity of Vehicles Poses Vehicle Maintenance/Repair Challenges, but Numerous Opportunities Through Telematics

As the number of software-connected automotive components has grown, so too has the number of software-related recalls. According to Stout Risius Ross “Automotive Warranty & Recall Report 2016”, software-related recalls accounted for less than 5 percent of all recalls in 2011, but by 2015 it grew to more than 15 percent, with the number of unique recall campaigns nine times higher than in 2011.127 And automakers are also taking a hit to their reliability ratings as they incorporate more high-tech features. The 2016 J.D. Power Vehicle Dependability Study found that satisfaction among owners of MY 2013, dependability dropped 3 percent, and that 1 in 5 of the problems reported involved audio, communication, entertainment, and navigation technology.128

Many of the features being added to vehicles today focus on convenience, fuel efficiency, and safety. All of these technologies are driving rapid adoption of microprocessors, sensors, infrared imaging, cameras, radar and other technologies in vehicles. Many of these parts are mounted in parts of the car that tend to get damaged often – even in minor accidents – including, bumpers, fenders, quarter panels, grills, mirrors, lamps, etc. Each of these components are essentially brand new components on a vehicle (typically with non-OEM alternative) that have the potential to be damaged or misaligned during a vehicle accident, resulting in new labor and parts costs that didn’t exist previously. And, because many of these advanced electronics and driver assist systems don’t provide a visual indication that there is a system malfunction or diagnostic trouble code (DTC), additional labor time to conduct both a pre-repair and post-repair scan to identify what was damaged and ensure it was fixed might also be necessary.129

For example, changing anything that affects ride height, braking, steering or lighting can affect a collision avoidance system operation.129 Additionally, adaptive cruise-control operations can be affected by any wheel and suspension modifications, including replacing a wheel or tire. A good example is the 360-degree camera views available on the 2015 F-150 pickup truck. Damage to the side-view mirror alone requires a full recalibration to be performed, a process that requires special tools such as calibration mats, access to detailed OEM service information related to DTC’s and other information, a scanning device capable of reading and clearing any fault codes, as well as “...a flat open area...with a minimum of six feet of open space to each side, seven feet of open space in front, and 11 feet of open space behind the vehicle.”129

Recently several automakers have released position statements regarding the need for repairers to conduct pre-repair and post-repair scans.129 Nissan, for example, states “...it is necessary in most repair situations for the vehicle to have a pre- and post-repair scan so that the repairer is informed of any trouble codes present, even in cases where there are no identifier lights on the dash. It is the stance of Nissan North America, that all of our vehicles be scanned following a collision repair.”132 Mopar’s “Scan Tool Position Statement” includes more specific guidance regarding the types of safety and security related systems that must be tested for fault codes (DTCs) such as air bags, seat belts, forward-facing camera and radar, and other automated electronic driver assistance systems. Yet in their description of the collision conditions that could potentially trigger a DTC code before or during a collision repair and lead to later problems, they include “Vehicle is involved in an accident or collision, even though the damage may appear minor.”134 And while not every automaker has yet to release a position statement, many more OE’s indicated they would be doing so in the near future.

Today there are three types of scan tools available: OBD-II generic, OBD-II enhanced, and factory scan tools. Each provide varying levels of information re: the fault codes (diagnostic trouble codes, or DTCs), which by themselves do nothing other than let the user know that a fault has been detected, not what caused it, or how to fix it. All scanner tools display “generic” or “global” OBD2 codes, but some do not display all manufacturers’ “enhanced codes”. Only professional level scan tools (which are costly) have the bi-directional capability and the proper software for accessing and running the tests needed for many of today’s vehicle systems. Specific details on the cost of the devices, as well as the software license fees for each of the OE’s can be found on the National Automotive Service Task Force’s website, and cost anywhere from $1,000 to $7,000 annually for the service information subscription alone. For a repairer potentially working on many different vehicle makes these costs can add up very quickly. An alternative

© 2017 CCC Information Services Inc. All Rights Reserved.
Telematics is like the doctor and insurer starting with the results of a blood and urine test;
In collision repair, it’d be the speed and direction of an impact, which allows a sense of potential hidden damage and a broad sense of what’s wrong.

It’s not a substitute for your doctor examining you physically, but it’s a better perspective on what actually could be wrong with you.

John Huetter

As more vehicles become connected, there is an opportunity to access the vehicle fault codes, capturing date/time stamps for each, and potentially notifying both the customer and the automaker of an issue with the vehicle before it becomes something much more costly to repair. Data on fault codes existing both before and after the accident could be used to help identify potential damage to the vehicle, which parts might need repair/replacement, and also whether or not the vehicle needed to be towed from the accident or if it could be driven away. A discussion of the numerous possibilities to change the historically linear and lengthy claims process to a much more expedited non-linear process was included in CCC’s 2016 Crash Course. With nine out of every 10 new vehicles by 2025 expected to be equipped with integrated telematics, and consumers today already opting into programs with their OE automaker or insurer to participate in a telematics program, it’s already happening. We are essentially in the very early stages of a major industry transformation, one that has been talked about for years, and whose disruption and opportunities to reach customers in brand new ways are seemingly limitless.

When Will Vehicles Drive Themselves?

Nearly every day a new headline about vehicle autonomy appears in the news. In 2016, self-driving vehicle technology made significant progress, and companies such as Google (or Waymo), Tesla, UBER, Delphi, Volvo, and numerous others introduced either a vehicle or system designed for full autonomy. Advanced driver assistance systems (ADAS), technology key to vehicle autonomy, are moving mainstream, with many more automakers offering these features in their vehicles. According to a report by Tractica, ADAS component shipments such as cameras, image processors, system processors, ultrasonic sensors, solid-state lidar, high-end lidar, radar sensors, and infrared sensors are expected to grow to 1.2 billion units by 2025 versus 218.1 million in 2016.19

Vehicles will change with growing automation but so too will their role in society, and in ways that are hard to foresee.

Dr. Bryant Walker Smith,
International Transport Forum

The transformation of a vehicle to an IoT device is happening. The vehicle is being transformed from a mostly mechanical object to a fully wired, connected electronic object. Even the driver now is shifting into passenger mode, with telematics offering the ability to reach consumers more often and in many new ways. The explosion of data from the vehicle about its performance, safety, surroundings and passengers translates to new business opportunities but also new security risks. Who should have access to that information, who owns the data, and who is responsible when something goes wrong are all questions that have yet to be fully answered.

Connected vehicle technology will alter the entire automotive supply chain. Historically the auto industry has been comprised of large OEs working with suppliers, marketing their vehicles to consumers, and selling them through a network of dealers. Once the vehicle was sold, and any warranty had expired, there was historically little interaction between the OE, the dealer and the consumer. The Takata airbag recall underscores just how little visibility automakers have into where their vehicles ultimately end up. This ecosystem also supported numerous aftermarket companies to maintain, and repair the vehicle for the consumer. With the connected car, opportunities to extend the relationship between the OE and the consumer grow, potentially driving immense change throughout the auto ownership lifecycle. As more technology is introduced to move the vehicle to full autonomy, ‘proximity’ between the automakers, suppliers and consumers will have to grow, if for no other reason than to be able to control the rollout and potential recall of autonomous vehicle technology.

Up next Mac Fraser speaks to the opportunities available to the insurance and collision repair industries through telematics.

CCC INSIGHT

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In his report prepared for the International Transport Forum at the OECD, Dr. Bryant Walker Smith describes two likely, but different, paths towards full vehicle autonomy. The first is “something everywhere” – a model seemingly embraced by automakers, where automation is added to conventional vehicles, traditional ownership models remain, yet the proximity between the automaker and its customer grows (think Tesla). The second is “everything somewhere”, a model perhaps best suited to urban areas, designed to provide capabilities such as shuttling people, deliveries, where the asset is owned by a public or private entity versus an individual. As government regulations, technology, consumers, and infrastructure all move towards greater acceptance and adaptation, autonomous vehicles will make their way into the mainstream.

In mid-December 2016, NHTSA laid out a strategic plan to “…deliver a future free from motor vehicle fatalities.” The plan focuses on three key areas: proactive vehicle safety; advanced vehicle safety technologies, and human factors. Automated and connected driving are central to the second area, and with their Federal Automated Vehicle Policy, they have attempted to provide a framework for automakers and other companies to safely test and deploy automated vehicles while encouraging innovation. As the auto industry moves its way through the five levels of automated driving, judicial, legislative and regulatory change will also be needed. The whole notion of what is being insured, how to underwrite, who to pursue when things don’t work as designed, etc. will all have to change. Clearly there are immense possibilities with vehicle autonomy – and with more and more vehicles coming equipped with ADAS, the impacts are already being felt –
THE EXPANDING ROLE OF TELEMATICS
MAC FRASER

By 2022, there will be an estimated 2 billion connected vehicles on the road. This transformation will impact insurers, repairers and original equipment manufacturers (OEMs), creating new risks and opportunities.

Changing the Conversation
In the past, a lot of the interactions that an insurer had with the customer would be at renewal time or when there was a claim. With connected cars, insurers can now have a pipeline and ongoing communication channel to their customer, creating opportunities for service, engagement, and driver improvement. This signals broader thinking about what connected car data – or telematics – can do, expanding opportunities beyond only marketing and policy discounts.

For example, telematics can help improve the claims experience. Instead of requiring the customer to call or go online and submit details regarding an accident, the vehicle itself could initiate the first notice of loss (FNOL), sharing crash data with the insurer and repairer, and ultimately streamline the entire claims process.

In another example, based on the accelerometer and point of impact data, analytics can help insurers determine whether there may be injuries, and the most efficient location for medical help. The ability to access more information via connected car data could also help inform future repairs. Today’s vehicles are becoming increasingly complex, and many OEMs now recommend or require repairers to complete pre- and post-repair scans on vehicles to help ensure vehicle damage is properly identified and repaired. These scans collect data from the vehicle itself on what parts of the vehicle are damaged via diagnostic trouble codes (DTCs), increasingly important as the electronic content and complexity of vehicles grows.

As more vehicles become connected, repairers could get access to DTCs and other information regarding the accident before the vehicle even shows up at the shop. This would not only streamline the repair process, but could potentially inform better decisions regarding which parts need to be repaired or replaced, helping to avoid costly delays from missed damage. The ability to tap into data from similar types of accidents and damaged vehicles could also provide repairers with better insight for diagnosis and execution of the repairs.

As more information from the vehicle itself becomes available via connected car data, the opportunities for improved communication and streamlined processes across the spectrum grows, and with it the opportunity to develop new relationships with the consumer and others across the ecosystem. Subsequently, selecting a platform that not only provides capabilities of today but also future proofing to quickly adapt to rapidly changing technologies and services in the future becomes ever more critical.

About the Author
Mac Fraser is the General Manager of CCC DRIVE™ at CCC Information Services Inc.

Delivering on the Promise
Today telematics data comes from a variety of sources: onboard diagnostics (OBD) through aftermarket devices that gather data from the vehicle; smartphones, either alone or paired or “tethered” to a beacon or tag type of device using Bluetooth® technology; or embedded systems via vehicle manufacturers. For many insurers, building the infrastructure and systems required to gather, process and deliver the data is impractical from both a cost and resource standpoint, especially as additional channels come online in the future from dozens of different in-vehicle systems. The breadth of these channels can create confusion and raise questions around which technology to use, the longevity of each, and data standards, to name a few. As the technology develops further, the relationships between a consumer, an OEM auto manufacturer and an insurer will likely change.

The CCC DRIVE™ platform enables providers to bring in data from a variety of devices - hardware, mobile, and connected cars into a single integrated platform. The data is synthesized, scored and packaged, providing analytics for additional insights, creating opportunities to deliver value-added services, an improved claims experience, and additional channels for insurers to grow. Integration of other data into the platform such as traffic and weather data could also create additional opportunities for new products and value add services.

Repairers could also benefit from access to information collected from connected cars. Aggregate data on which types of vehicles and accidents are occurring in a given area might help repairers know where to expand or grow their locations, and what type of equipment and training requires investment.

The ability to access more information via connected car data could also help inform future repairs. Today’s vehicles are becoming increasingly complex, and many OEMs now recommend or require repairers to complete pre- and post-repair scans on vehicles to help ensure vehicle damage is properly identified and repaired. These scans collect data from the vehicle itself on what parts of the vehicle are damaged via diagnostic trouble codes (DTCs), increasingly important as the electronic content and complexity of vehicles grows. As more vehicles become connected, repairers could get access to DTCs and other information regarding the accident before the vehicle even shows up at the shop. This would not only streamline the repair process, but could potentially inform better decisions regarding which parts need to be repaired or replaced, helping to avoid costly delays from missed damage. The ability to tap into data from similar types of accidents and damaged vehicles could also provide repairers with better insight for diagnosis and execution of the repairs.
The U.S. automotive insurance market will face numerous challenges in 2017 and beyond. Insurance carriers are responding to consumer demand for more choice and personalization across all areas of their business, providing greater access to their services via mobile devices, for example. Competition remains fierce among traditional insurers, and the numerous startups investing in InsureTech.

As the auto industry responds to demand for shared mobility, autonomy, and greater connectivity, the type of insurance product carriers will underwrite and the way claims are resolved is changing. Data about the driver will become supplemented with data from the vehicle itself. Access to data, and the ability to mine that data, and potentially take advantage of technology such as artificial intelligence will require carriers to work with numerous new types of unstructured data in a secure environment. With more information about policyholders, potential customers, and claimants available from the vehicle and other IoT devices, there is an opportunity to shift from the linear, people-intensive processes that exist today, integrating data sets to speed and improve decision-making, combat fraud, and deliver more emergency and value-added services to drivers and vehicle occupants.

Knowing how and when and where to make the right investments and partnerships will be critical, particularly given the immense pressures due to higher loss costs and lower investment returns.
Rising Frequency and Costs of Claims Continues

Despite strong growth in auto insurance premiums in the last several years, related to strong new vehicle sales (see Figure 42), significant increases in severity and frequency, and much lower investment yields have weakened underwriting and operating results (see Figure 43). The combined ratio for both private passenger and commercial auto have remained well over 100 the last several years, and is expected to remain high through 2017 (see Figure 44).
Private passenger auto collision, property damage, and comprehensive have experienced larger increases in severity over the last five years than frequency (see Figure 45). Both the rate of auto accidents and their size or severity are rising. For the two-year period ending March 2016, loss costs overall were up 13 percent, more than 10 times the rate of inflation.¹⁴

Vehicle claim costs remain elevated and are expected to increase further in 2017 as vehicle complexity within a fleet that is growing younger continues to drive up both vehicle values and repair costs.

Auto collision claim frequency is experiencing smaller increases than those seen in late 2014 and early 2015, but continues to rise slowly. Significant weather events as described earlier in this report drove comprehensive frequency up in 2016 after flat or declining frequency through most of 2015. Only property damage continues to see frequency rising between 1-2.5 percent since mid-2015.
Miles driven were up more than 3 percent in 2016 through September, after rising 3.5 percent overall in 2015, and are now more than 5 percent higher overall than the last peak in miles driven, which was set in the rolling 12-months ending November 2007. An increase in the number of vehicles on the road, and more miles driven per vehicle remain the key factors. Police-reported crashes recorded by NHTSA saw an increase of nearly 7 percent in 2014, and nearly an additional 4 percent in 2015 (see Figure 46). With economic growth, employment, and gas prices expected to remain stable in 2017, frequency will likely remain high. And while autonomous vehicle technology continues to make strong strides, adding more technology which should help reduce frequency, in the near term the driver is still in charge. As more vehicles offer things like Wi-Fi and connected services, growing driver distraction suggests more versus fewer accidents in the near future.

Accidents Rise and So Do Casualty Losses

In CY 2015, data from the NHTSA reveals an increase in both the fatality rate and the injury rate per 100 million vehicle miles traveled in the U.S. after numerous years of decline (see Figure 48) – (worth noting is that the increase in both fatalities and injuries is tied primarily to increases in Motorcycle, Pedestrian, and Cyclist fatalities as we will discuss below in more detail).

AAA Foundation for Traffic Safety: Measuring Cognitive Distraction in the Automobile (Figure 47)

Cognitive Workload Scale

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Cognitive Workload Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Driving and performing math and memorization tasks</td>
<td>1.00</td>
</tr>
<tr>
<td>Driving and texting using speech-to-text</td>
<td>1.21</td>
</tr>
<tr>
<td>Driving and talking on hands-free cell phone</td>
<td>1.75</td>
</tr>
<tr>
<td>Driving and talking on hand-held cell phone</td>
<td>2.33</td>
</tr>
<tr>
<td>Driving and talking to passenger</td>
<td>2.45</td>
</tr>
<tr>
<td>Driving and book on tape</td>
<td>3.06</td>
</tr>
<tr>
<td>Driving and radio</td>
<td>3.10</td>
</tr>
<tr>
<td>Driving</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Not surprisingly, frequency for bodily injury and personal injury (PIP) coverages have also trended upwards over the last several years (see Figure 49), as miles driven, particularly on interstates, has grown. Bodily Injury (BI) claim severity experienced increases of more than 5 percent a year between 2006 and 2008, several points higher than the average increase of 3.31 percent in the Consumer Price Index during that same period. It then experienced slightly smaller increases in claim severity between 2009 and 2012, but between 2013 and 2016, BI claim severity has again begun to grow faster than inflation. PIP severity has also seen steady increases in severity over the last several years. Historically, most of the trends in PIP have been driven by three of the largest states with no-fault approaches to compensating auto injuries – Florida, Michigan, and New York. A comparison of the Bureau of Labor’s CPI data reveals the medical care index for all of 2016 increased by 4.1 percent versus only 2.6 percent in 2015 – substantially higher than the overall CPI of 2.1 percent. The indices for physician services, hospital services, and prescription drugs also saw large increases in 2016, after larger than average increases in 2015 (see Figure 50).
The personal vehicle is still used as the primary method of commuting to work by most Americans. However, over the last several years, particularly in urban areas, other modes of commuting have grown. Data from the U.S. Census Bureau’s American Community Survey (ACS) shows a 21 percent increase in the number of Americans that reported their primary method of commuting to work was by walking between 2005 and 2013.\(^{147}\) Unfortunately, pedestrians now also account for growing percentage of traffic fatalities and injuries – the number of pedestrian fatalities increased 19 percent from 2009 to 2014.\(^{148}\) and NHTSA’s data reveals another 9.5 percent increase in 2015 in the actual number of fatalities (although the share of pedestrian fatalities as a percent of total traffic fatalities increased only 2 percent from 15 percent in 2014 to 15.3 percent in 2015 as all categories saw an increase) (see Figure 51).\(^{149}\) Among the factors leading to higher injury and fatality rates for pedestrians are economic conditions, demographics, weather, fuel prices, miles traveled overall, and the growing use of cell phones while walking.\(^{150}\)

Bike commuting has also grown. Data from the U.S. Census Bureau’s American Community Survey reveals an increase of 62 percent between 2000 and 2013.\(^{151}\) In communities deemed “Bike Friendly Communities” by the League of American Cyclists, bike commuting has grown even faster -103 percent, with cities like Portland up 408 percent; Denver up 103 percent; Washington, D.C. up 498 percent; and Chicago up 389 percent.\(^{152}\) Even among non-“bike-friendly communities” bike commuting was up 31 percent between 2000 and 2013. Subsequently, it is not surprising that neck injuries and treatment plans including chiropractic care continue to top the list.

To understand further some of the key factors driving the above trends in auto BI and PIP claim frequency and loss costs, Auto Injury Solutions (AIS), a CCC company, completed an analysis of over 2.5 million auto BI and PIP/ Medpay claims for the period 2013-2016. The results of this analysis are outlined here.

Pedestrian Fatalities Percent of Total Traffic Fatalities (Figure 51)

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</tr>
</thead>
<tbody>
<tr>
<td>PEDESTRIANS</td>
<td>11.0%</td>
<td>11.0%</td>
<td>11.0%</td>
<td>11.0%</td>
<td>11.0%</td>
<td>13.0%</td>
<td>13.0%</td>
<td>13.5%</td>
<td>13.7%</td>
<td>14.3%</td>
<td>14.5%</td>
</tr>
</tbody>
</table>

Percent of Occupants and Non-Occupants Killed and Injured in Traffic Accidents (Figure 52) 2010-2015

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>PASSENGER CAR OCCUPANTS</td>
<td>11.0%</td>
<td>13.0%</td>
<td>14.3%</td>
<td>14.5%</td>
<td>15.0%</td>
<td>15.3%</td>
</tr>
<tr>
<td>LIGHT TRUCK OCCUPANTS</td>
<td>3.1%</td>
<td>3.1%</td>
<td>3.2%</td>
<td>2.9%</td>
<td>2.8%</td>
<td>2.9%</td>
</tr>
<tr>
<td>LARGE TRUCK OCCUPANTS</td>
<td>2.1%</td>
<td>2.1%</td>
<td>2.1%</td>
<td>2.1%</td>
<td>2.1%</td>
<td>2.1%</td>
</tr>
<tr>
<td>MOTORCYCLE OCCUPANTS</td>
<td>2.3%</td>
<td>2.1%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.2%</td>
</tr>
<tr>
<td>PEDESTRIANS</td>
<td>11.0%</td>
<td>13.0%</td>
<td>15.0%</td>
<td>15.3%</td>
<td>15.0%</td>
<td>15.3%</td>
</tr>
<tr>
<td>PEDALCYCLISTS</td>
<td>1.9%</td>
<td>2.1%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>2.2%</td>
</tr>
<tr>
<td>OTHER UNKNOWN</td>
<td>0.6%</td>
<td>0.6%</td>
<td>0.7%</td>
<td>0.8%</td>
<td>0.8%</td>
<td>0.6%</td>
</tr>
</tbody>
</table>

National Safety Council Injury Facts - Share of Motor Vehicle Accidents Annually by Type (Figure 53)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ANGLE COLLISION</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>HEAD-ON COLLISION</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>REAR-END COLLISION</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>SIDESWIPE AND OTHER</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>NONCOLLISION PEDESTRIAN, BIKE, TRAIN, ANIMAL</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
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<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>
Further Insight into BI Trends

For the period of study (2014-2016), there have been only moderate changes in the procedures used in the treatment of bodily injury claims, underscoring the consistency in the types of injuries and diagnoses over that same time period (see Figure 54).

Analysis of the top ten procedures based on overall dollars billed (number of times a procedure prescribed times the dollars charged) also shows very little change over the last three years. Perhaps the most noteworthy change in ranking of procedures based on dollars billed is the movement up in the ranking for emergency department visits (see Figure 55).

Historically, increases in utilization have been a principal cause for the rising costs in medical dollars for BI claims. However, for the observation period from 2014 to 2016, the number of unique procedures has stayed flat at 17 for all three years, while the average number of procedures has fallen from 175 in CY14-15 to 171 in CY 2016.

So why are third party medical costs increasing? The newer drivers of rising cost are twofold: a) the same type of injuries are being treated with more expensive treatment approaches (e.g., emergency room and hospital related treatments); and b) cost increases in these more expensive care modalities are increasing at a much faster rate than traditional modalities such as chiropractic and physical therapy related procedures.

Further Insight into PIP/Medpay Trends

Further Insight into PIP/Medpay Trends

Further Insight into PIP/Medpay Trends

PIP/Medpay claims analyzed from 2014 to 2016 reveal very little change also in the diagnoses of injuries: neck sprain and strain held the top spot all three years, while lumbar sprain and strain exchanged rank two and three and thoracic sprain and strain in CY 2016 after holding reversed rank in CY 2014-2015. When we look at PIP/Medpay billed claims however, rising costs are coming not only from higher costs per procedure, but also the number of visits. Figure 56 shows how the average number of unique procedures for first party claims has stayed fairly constant through the period analyzed, but the average number of procedures has actually grown.

BI Claims: Top Medical Treatment Procedures Based on Total Dollars Billed for Period CY2014-2016 (Figure 55)

<table>
<thead>
<tr>
<th>Procedure Ranking Based on Dollars Charged</th>
<th>CY2014</th>
<th>CY2015</th>
<th>CY2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERAPEUTIC PX&gt; AREAS EACH 15 MIN EXERCISES</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>OPERATING ROOM/OTHER</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MANUAL THERAPY TOS&gt; REGIONS EACH 15 MINUTES</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CHIROPRACTIC MANIPULATIVE TR SPINAL 3-4 REGIONS</td>
<td>4</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>EMERGENCY DEPARTMENT VISIT HIGH/URGEENT SEVERITY</td>
<td>5</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>MRI SPINAL CANAL CERVICAL W/O CONTRAST MATERIAL</td>
<td>6</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>CT CERVICAL SPINE W/O CONTRACT MATERIAL</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>MEDICAL/SURGICAL SUPPLIES: OTHER IMPLANTS</td>
<td>8</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>CHIROPRACTIC MANIPULATIVE TR SPINAL 1-2 REGIONS</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MRI SPINAL CANAL LUMBAR W/O CONTRACT MATERIAL</td>
<td>10</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>EMERGENCY/OTHER</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CT HEAD/brain w/o contrast material</td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Auto Injury Solutions (AIS), a CCC Company.

First Party Casualty - Average Total Number of Procedures Increasing While Average Number of Unique Procedures Remains Flat (Figure 56) All Closed Claims CY2014-2016

Procedures in Third Party Auto Casualty 2014-2016 (Figure 54)

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Analysis of the top medical procedure codes billed for PIP/Medpay claims (see Figure 57) also demonstrates stability in the procedures billed/claims over the observation period. Emergency department visit high/urgent severity saw the largest shift over the three-year period, jumping from number 7 in the ranking to number 2 of procedures billed; and appeared in the top 10 procedures for the first time over the period analyzed in CY 2016.

Finally, a comparison of the average charge per claim and the average charge per claim excluding duplicates reveals the increase in medical inflation, where the same types of treatments and procedures are simply being billed at higher rates (see Figure 58).

In general, the same type of injuries are being treated with more expensive treatment approaches (e.g., emergency room and hospital related treatments); and cost increases in these more expensive care modalities are increasing at a much faster rate than traditional modalities such as chiropractic and physical therapy related procedures. The percent of claims that include these types of medical services has also grown. Other factors included high injury claim frequency rates, excessive attorney involvement, and high rates of claim abuse.

Prescription drug costs continue to escalate in worker compensation and auto injury claims with utilization increases driven by physicians increasingly dispensing drugs directly, looking for additional sources of revenue as reimbursements are cut by PPACA reforms. There have been numerous states that have considered (Maryland, Pennsylvania, North Carolina) or passed (Hawaii, Indiana) restrictions on physician dispensing as a result. Overutilization of opioids specifically is a huge problem. In 2012, 259 million prescriptions were written for opioids, which is more than enough to give every American adult their own bottle of pills.

As more individuals have moved to high deductible insurance plans, or plans with co-insurance provisions that mean higher out-of-pocket expenses, the temptation to find a way to have that covered elsewhere grows. Attorney involvement for injury claims remains high. In an online poll conducted by the Insurance Research Council, almost half of respondents hired attorneys, mostly because it was suggested to them either by someone they knew (33 percent) or by an attorney (16 percent), and nearly two-thirds of them contacted the attorney within one week of the accident. Other reasons cited for engaging an attorney were the belief that attorney involvement would lead to higher settlement (22 percent), delays in getting claim settled (15 percent), and unhappiness with settlement amount offered (10 percent). With attorney involvement adding significant costs and delays for the system and the claimants, this becomes a costly misperception.

PIP/Medpay Claims: Top Medical Treatment Procedures Based on Total Dollars Billed for Period CY2014-2016 (Figure 57)

<table>
<thead>
<tr>
<th>Procedure Ranking Based on Dollars Charged</th>
<th>CY 2014</th>
<th>CY 2015</th>
<th>CY 2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>THERAPEUTIC PX 1/&gt; AREAS EACH 15 MIN EXERCISES</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CT CERVICAL SPINE W/O CONTRAST MATERIAL</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>MANUAL THERAPY 1/&gt; REGIONS EACH 15 MINUTES</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CT HEAD/Brain W/O CONTRAST MATERIAL</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>CHIROPRACTIC MANIPULATIVE TX SPINAL 3-4 REGIONS</td>
<td>5</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>OPERATING ROOM/OTHER</td>
<td>6</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>EMERGENCY DEPARTMENT VISIT HIGH/URGENT SEVERITY</td>
<td>7</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>EMERGENCY/OTHER</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>MRI SPINAL CANAL CERVICAL W/O CONTRAST MATL</td>
<td>9</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>MRI SPINAL CANAL LUMBAR W/O CONTRAST MATL</td>
<td>10</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>EMERGENCY DEPARTMENT VISIT MODERATE SEVERITY</td>
<td>10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Auto Injury Solutions (AIS), a CCC Company.

PIP/Medpay Increasing Average Charges per Claim CY2014-2016 (Figure 58)

Source: Auto Injury Solutions (AIS), a CCC Company.
Research from the Insurance Research Council suggests that despite the fact that the property-casualty insurance industry was not directly included or targeted by the Patient Protection and Affordable Care Act (ACA), the cost-containment efforts by other public and private health insurance systems may be leading to higher billings and utilization for the P/C insurance industry. As the IRC noted in a study released in 2010, insurers have historically been targeted, with hospital cost shifting for auto liability claims in states with tort-based auto injury insurance systems resulting in $1.2B in excess charges in a single year. In October of 2013, the NICB had predicted that frequency of fraudulent property-casualty insurance claims would increase as fraud-fighting provisions of the ACA were implemented. Research from the IRC suggests 21 percent of bodily-injury (BI) claims and 18 percent of personal injury protection (PIP) claims closed with payment had the appearance of fraud and/or buildup, and claims appearing to have fraud and/or buildup were more likely than other claims to involve chiropractic treatment, physical therapy, alternative medicine and pain clinics.

Efforts by the new republican-controlled U.S. government to repeal the ACA are already well under way, and with no replacement plan yet proposed, there is a great deal of uncertainty about what ultimately will happen to healthcare in the U.S. under the new administration and congress. While it is difficult to know exactly what will happen, prior statements made by Trump and his appointees suggest that significant tax cuts included in his economic plan will add to the pressure to reduce healthcare expense, with much of the pressure likely to be felt by Medicaid. Subsequently, with less money available in the system, the P/C insurance industry might become an even bigger target of cost-shifting in the future.

CCC INSIGHT

The types of auto related BI and PIP/Medpay diagnoses most frequently seen in the last three years have remained relatively unchanged and are predominately by nature soft tissue neck and back injuries. The manner in which they are being treated however has become more complex and the overall cost of treating these same injuries has increased despite the prevalence of improved head restraint systems, seat backs and other related occupant safety features.

Between 2014 and 2016, the average age of the claimant increased by one year in both BI and PIP claims. Continued increases in this metric over the longer term point to higher medical costs per patient as the treatment of older patients, all things considered equal, can become more complex and thus more costly relative to their younger counterparts. For while the U.S. Census Bureau anticipates the U.S. population will increase from 319 million in CY 2014 to 417 million by CY 2060, 20 percent of Americans by 2030 will be 65-years of age and older. Additionally, many of the top BI and PIP/Medpay treatment procedures by their nature, have ranges to be considered when being billed - these ranges include the level of service selected or the number of units that are employed.

For example, there are instances where the injury and related documentation do not clearly support the level of emergency room service evaluation, and another, potentially more expensive level is chosen within that category’s range. Similarly, for timed-based modalities, questions arise regarding whether the injury and medical notes support the number of units billed. Understanding why some cases utilize manual therapy for 20 units while other cases use 10 units for the same condition is important. In either example, a subjective soft tissue injury (being subjective because it is difficult to objectively verify the injury) is being treated with modalities that have a range of utilization/billing options, yielding a situation that could contribute to the IRC observations around buildup.

With numerous external factors such as the outcome of the ACA, and the dominance of both subjective injuries and range-based treatment modalities, the industry faces continued challenges in the future. In 2017, CCC will help customers be better informed for casualty claims through the integration of data captured from the specifics of the auto physical damage event.

Dr. Mary Capelli-Schellpfeffer speaks to why emergency room treatment has grown in usage for auto casualty claims.
In the US, a collision is one of the most common causes of a visit to a hospital emergency department. How does that happen? Most often, first responders arriving to an accident scene follow clinical protocols that are established between medical experts, emergency medical service providers, and local, regional, and national authorities overseeing first responses to traumatic events. The decision to transport a person with injuries is usually made based on findings where the collision happened.

Triage measures of changed breathing, heart rate, and consciousness that are visible or monitored can result in immediate ambulance transfer to an emergency department. Evidence that the affected vehicle’s driver or occupants might have scrapnel wounds from flying debris, broken bones, or bleeding will also lead to an emergency department visit, often with a “trauma activation” at the destination. This activation means that trained professionals with expertise in rapid response to surgical or medical crises will be assigned to imminent care and trauma center access.

Fortunately, the majority of personal auto collisions result only in property damage with low risk of death. Rescue personnel and police professionals may or may not be present when everyone “walks away” from the accident. In these situations, the decision to go to a hospital is in reality left to the driver and the vehicle’s occupants. The driver and occupants may be relieved to have survived a “near miss” and even refuse initial medical care after a low risk collision. Yet in the hours and days after their collision, pain, physical changes, and emotional distress may surface. During this period, an emergency department can become “the place to go for help.” Evaluation by a doctor, diagnostic tests with x-rays and scans, prescriptions, and more planned treatment may be required to respond, perhaps because their traumatic condition is prohibitive. Or alternatively, the accident may actually have happened so fast—at less than a second duration—that knowing the answer is not humanly possible to respond...

In particular, vehicle technology advances can assist a doctor or nurse’s assessment regarding how the collision occurred when the vehicle’s driver or occupants may not be able to respond...

Slower-speed auto collisions without triggers for trauma center activation tend to happen more frequently in urban settings. Urban road corridors are notable for traffic density and longer, lower-speed travel times between employment, schools, and recreational activities like big sporting events. As a result, cities the higher frequency of lower severity injuries and more access to emergency departments lead to more urban emergency room usage occurring in larger hospital systems after low risk auto collisions.

In the near future, the beneficial effects of smartphone cameras used in documenting auto physical damage as well as connected vehicle technologies that can offer information about the circumstances around an accident, including the vehicle’s acceleration and deceleration approximated by delta-V, will become more influential in emergency triage as well as injury evaluation and management. These advances will bring immediate information about potential “mechanisms of injury” to the clinical setting.

In the near future, the beneficial effects of smartphone cameras used in documenting auto physical damage as well as connected vehicle technologies that can offer information about the circumstances around an accident, including the vehicle’s acceleration and deceleration approximated by delta-V, will become more influential in emergency triage as well as injury evaluation and management. These advances will bring immediate information about potential “mechanisms of injury” to the clinical setting.

In particular, vehicle technology advances can assist a doctor or nurse’s assessment regarding “How did the collision occur?” when the vehicle’s driver or occupants may not be able to respond, perhaps because their traumatic condition is prohibitive. Or alternatively, the accident may actually have happened so fast—at less than a second duration—that “knowing the answer” is not humanly possible for the driver or occupants because conscious awareness and memory formation requires more time.

About the Author
Dr. Mary Capelli-Schellpfeffer M.D., MPA is the Vice President, General Manager, Medical Advisory Solutions, and Chief Medical Officer of AIS, a CCC Company.
In order to respond to market demands to improve customer satisfaction, lower costs, and improve efficiencies, InsureTech is pursuing innovations for underwriting, front- and back-office operations, product development, and omni-channel distribution.190

Technologies such as artificial intelligence, connected devices, location-based sensors, drones, new payments, and the blockchain will play a key role in addressing what are seen as four major opportunities for InsureTech: 1) new tech-enabled products and business models; 2) technologies to reduce risk/number of claims; 3) innovative distribution models; and 4) lower cost of claim processing.171

With all of the additional data now available, it becomes ever more imperative for carriers to be able to build and scale their technology to be able to handle new and different data types, and large volumes of data. Data security also remains critical.

On pages 83-85, Dr. Reza Roholamini, PhD. speaks to the challenges and opportunities facing organizations as they look to take advantage of the growing volume, variety, and velocity of data needed to be competitive in our new digital world.

Telematics Data is Changing, Improving the Auto Claims Process

One of the earliest examples of insurers offering a new tech or data-enabled product is user-based insurance (UBI) or pay-as-you-drive insurance (PAYD). According to data from Willis Towers Watson, the number of U.S. states with 10+ user-based-insurance (UBI) programs has grown from three in January 2013 to 46 by January 2016.172 Nearly 10-20 percent of all auto policyholders in the U.S. are in UBI programs.179 Their data also suggests that 25-50 percent of customers will opt for a UBI policy when offered, with 88 percent of Millennials saying they are interested in UBI programs.194

Analyists project UBI programs will achieve a compound annual growth rate of more than 60 percent between 2017 and 2020, as consumer acceptance, particularly their willingness to share data grows.195 While UBI has seen most growth to date within auto insurance, analysts predict it will spread to other lines and sectors such as small commercial, home, life and health insurance, as consumers adopt more IoT devices that share data such as energy use, and exercise. Already carriers such as Liberty Mutual offer discounts to customers that choose to share data from their smart home devices; John Hancock policyholders can earn up to a 15 percent discount on their life insurance policy if they share information from FitBit devices; and AIG has invested in Human Condition Safety, maker of wearable devices to monitor employees’ movements in hazardous work environments to help reduce on-the-job accidents.196

The new data available from IoT can lend insurers more pricing precision for individual risk assessment and pricing, better reserve-setting, and the potential to do more real-time pricing and policy term modifications.177 There is also opportunity to help reduce claims and fraud, by using sensors to monitor conditions in the home, how a vehicle is being driven, and monitor fitness. And finally, through increased interaction with the consumer, insurers have the opportunity to provide value-added services that help drive engagement and loyalty.

Greg Bannon speaks to the opportunities to use telematics data to inform the auto casualty claims process within the auto insurance on pages 86-87.

Insurance Represents the Largest Long-Term Opportunity in FinTech Global Revenue Pools ($, Billions) (Figure 59)

<table>
<thead>
<tr>
<th>Payments</th>
<th>Investments</th>
<th>Lending</th>
<th>Insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>$481</td>
<td>$851</td>
<td>$1,628</td>
<td>$4,778</td>
</tr>
</tbody>
</table>

Data, Information, and Knowledge – The Trinity of Enterprise Value

Based on the fundamental premise that data, information, and knowledge, are three intricate, indispensable, and interdependent elements, hyperscale systems – distributed computing environments that efficiently scale from a few servers to thousands of servers – are being built to unearth its untapped business values with unprecedented processing power, speed, and accuracy. CCC is at the center of this innovation within the insurance industry, working to help customers convert data from discrete facts into meaningful structures, and ultimately, into domain knowledge. Enterprises seeking to capture a strategic advantage and growth will need to harness the value buried deep inside this domain knowledge, which includes generating metrics, categorizing results, assessing values, making forecasting and predictions and finally enabling informed decisions.

The first thing to understand is that today’s data is different. We think about it in the context of “3 V’s”: Volume, Variety, and Velocity.

The vast amount of dataset (Volume) that are generated now are distributed, diverse, disparate, and heterogeneous in nature. They are structured, unstructured, and semi-structured (Variety). And, these data set are growing at exponential pace (Velocity). For example, a single blade in a GE gas or wind turbine, generates 500 gigabytes of data each day. That means in 30 days a single blade would generate as much content as the print collection of the Library of Congress. For the record, there are about 4,500 GE gas turbines around the world, each with dozens of blades. There are examples like this everywhere, including within the P&C insurance industry.

The 3Vs of the modern data characteristics generate enormous challenges in the areas of storage, retrieval, security, sharing, analysis and reporting. On the flip side, they also open massive business opportunities throughout different phases of data lifecycle. Besides the 3Vs nature of the data we also recognize the density of information embedded in them. That is where true enterprise value lies. Without it any enterprise will be flying blind.

CCC NEXT GEN HYPERSONAL PLATFORM & APPLICATIONS

Data is Liquid and it is Everywhere – A New Paradigm

The nature of today’s hyperscale data has striking similarities with water – precious, abundant resources that are essential to survival. Hyperscale data, like water, is also storable, transportable, transformable, vulnerable, and susceptible to contamination when being processed for consumption. And, much like the way massive resources and infrastructures – dams/reservoirs, electric power stations, security and backup systems, purification and filtration systems, distribution-channels, maintenance, monitoring systems, billing/accounting/monetization systems – are built to harness the power of water, we believe that hyperscale data needs massive storage structures, security systems, high speed networks, processing machines, monitoring, and regulatory structure to extract and harness the vast power embedded in them.
CCC NEXT GEN HYPERSCALE

The CCC Hyperscale Platform

With so much excitement about the potential in the area of hyperscale data, predictive analytics, and deep learning and multilayer neural networks, the insurance industry in many ways is taking the lead in getting real business value from the technology buzz. We are immensely proud to be part of this new technology wave with our partners. We understand that as the hyperscale data business evolves, so does the technology stack, and enterprise application architectures are evolving from integration-centric enterprise service bus (ESB) architectures to application-centric, micro-services, platform-as-a-service (PaaS), multi-cloud, and API-driven architectures.

We understand APIs are the lynchpin to the success for many of our business and technology partners: these APIs are used by applications to access key services and data. These services can be micro-services, cloud workloads, legacy SOAP services, or the Internet of Things (IoT). Using the CCC API foundation layer, we reinforce our technology partnership to create rich insights into how safe drivers are using auto physical damage and injury data, telematics, big data, and analytics.

We recognize APIs and API management are essential to scale quickly and can support the ability to automatically and efficiently move large amounts of data in and out of platform; and to parallelize the execution, across multiple execution nodes in the application framework layer.

Data Ingress/Egress Layer

Our Ingress/Egress layer has two separate yet equally important goals: interactivity (real-time queries) and data freshness (real-time ingestion).

This layer has been built to help our clients make sense of large amounts of data in real-time. Every day the platform ingests tens of millions of new events, and currently handles several hundred million aggregated events. The platform has been designed to also support the ability to automatically and efficiently move large amounts of data in and out of platform, and to parallelize the execution, across multiple execution nodes in the application framework layer.

Data As a Service (DAAS) Layer

Our DAAS layer is built on the fundamental guiding principle that underlying raw business data will be very fluid – structured, unstructured, and semi-structured – and stored in diverse data storage types at a rate of an exponential pace. Treating DAAS and not a dependency layer, large scale applications can be built to be data storage, structure and location agnostic. By insulating the applications from the above three concerns that hamstrung application portability and scaling for several decades, DAAS enables the business logic to become highly portable across diverse applications platforms. Being location-agnostic enables applications to be highly available across different geographic regions as DAAS can be made available 24x7. Our DAAS layer has been built to address concerns on the both application level features and operational area, including application latency, linear scalability, high availability; and operational economics.

Application Framework Layer

The hyperscale application layer has been designed to support an array of diverse applications that can access data stored in the DAAS layer in a storage-, structure-, and location-agnostic way. It supports high velocity data streaming apps, high volume transactional and batch type apps, Petabytes scale business intelligence and predictive analytical apps, and multilayer neural network – (deep learning apps).

Hyperscale Data Security

Lastly, with big data comes big responsibility; its security. A multilayered data security strategy – prevention, detection, and policy/administration – can be both efficient and effective at maximizing security controls.

Preventive controls stop intruders from gaining unauthorized access to data. Detective controls centralize auditing and reporting across the organization so that either security breach or compromised system can be swiftly detected and necessary actions be taken. And finally, policies/administrative controls can prevent unlimited and ad-hoc access to application data while still allowing legitimate administrative activity.

CCC’s hyperscale data security layer has been implemented as a three-pronged approach: two level identification at encryption, and data de-identification.

The Road Ahead

Hyperscale data is still in its infancy and evolving, but its potential is immense. Equally are its challenges. We at CCC are working on next generation initiatives to address the huge challenges our partners face and deliver solutions that are unique to their business.

About the Author

Dr. Reza Rooholamini, PhD. is the Vice President of Architecture & Technology at CCC Information Services Inc.

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When my parents used to tell me: “drive safely” I thought it sounded cliché. Now, as a parent, and one who works in the automotive claims industry, I have a brand new appreciation for what driving safely actually means. Accidents happen in milliseconds and frequently catch you totally by surprise. I’d forgotten those facts, until I was in an accident of my own recently. If you have not experienced an airbag deploying, it is astonishing; let me describe the experience.

Suddenly, a rush of adrenaline hits. The airbag deploys in the vehicle. I look for my glasses which have flown off my face and across the car. I smell burnt pyrotechnics, which is quite alarming. My car door is bent, so I forcibly move the door to exit the vehicle. Fortunately for me, I was okay, except for a little sting on my shins. But, how would anyone know?

What most people don’t realize is just how much technology exists – and has existed – in vehicles to help you in the event of an accident. Black boxes have been used for many years, extracting facts about the accident, including the energy of the crash, to help settle claims. My colleague, Scott Palmer, has written about this extensively.

More recently, sensors in the car, apps on your phone, and devices plugged into your vehicle, make it extremely affordable and efficient to uncover a lot of information about the pre-accident behaviors of the driver, and the accident itself. It’s also extremely easy to network that data.

So where is the value? In 2013, the National Cooperative Highway Research Program published the following:

“The fourth leading cause of non-fatal injuries treated in emergency departments nationally is trauma sustained by vehicle occupants during crashes, with more than 2.6 million patients seen in emergency departments each year.

Through research, the Center for Disease Control concluded that severely injured patients receiving care at a Level I trauma center had a 25 percent reduction in risk of death.”

The National Cooperative Highway Research Program

What most people don’t realize is just how much technology exists – and has existed – in vehicles to help you in the event of an accident.

Greg Bannon is the Vice President of Product Management at CCC Information Services Inc.
PART 4
THE REPAIRER

The collision repair industry is currently riding a wave of increased accident frequency. Higher employment, low gas prices, more miles driven, greater road congestion, and numerous other factors have lifted frequency to pre-recession levels. However, their environment is also facing numerous challenges and demands from the vehicles themselves, as well as their customers. Consolidation is occurring quickly across all parts of the collision repair industry, as demands for capital investment for training and equipment grows. In this final section, we’ll explore some of these challenges in greater detail, and take a look at what the industry can expect in the near term from a frequency and loss cost perspective.

Collision Repair Industry Experiences Growth, Change

During the last Great Recession (CY 2007 to CY 2011), over 2K collision repair facilities in the U.S., reducing further a number that had already been trending down (see Figure 60). In recent years, that number has steadied, and even risen, as economic recovery, miles driven, extreme winter weather, and improved new vehicle sales began to support increases in auto accident frequency.

An older fleet in the U.S. did mean a growing share of those vehicles were total loss vehicles, but most collision repairers have been reporting improved sales coming out of the recession, as severe winter weather in many parts of the country in 2014 and 2015 supported increases in repairable appraisal counts. Claim counts were up further in 2016, with states like Texas and Colorado experiencing large swings in volume due to significant hail storms.
Survey responses to CollisionWeek’s quarterly study “Collision Repair Industry Business Conditions” regarding improved sales in the current quarter versus the same quarter prior year illustrate the improved environment for most shops, with most quarters since the recession demonstrating that more shops are reporting higher sales than the survey’s historic average of 33.3 percent (see Figure 61). The collision repair industry continues to see a great deal of multi-store operator (MSO acquisition activity. In its annual report, “A 2015 Profile of the Evolving North American Collision Repair Marketplace”, The Romans Group reported the top four independent consolidators accounted for 11.3 percent of the U.S. collision repair market in 2015, and could double in size by 2020. When the additional segments of >=$20M multiple-location independent and dealer operators (MLOs), franchise and banner groups, and the $10-$19M MLO’s are included, the total share by 2020 could grow to 45 percent. More shops are participating in insurance direct repair programs (DRP) than ever before. According to Body Shop Business’ annual survey of the collision repair market, 70 percent of shops are involved in at least one DRP, a number that has nearly doubled from only 36 percent in CY 2000. Analysis of the 14M auto claims processed by CCC on behalf of its insurance and collision repair customers reveals the percent of appraisals generated at a shop on behalf of an insurance company has grown to nearly 50 percent (see Figure 62). DRP specifically has flattened at 40.5 percent, as more carriers expand their options for customers in terms of method of inspection to methods like photo or video.

### U.S. Shops Specializing in Collision Repair (Figure 60)


### Percent of Shops Overall Reporting Higher Sales in Quarter vs. Same Quarter Prior Year (Figure 61)

CollisionWeek’s “Collision Repair Industry Business Conditions”

### Share of Appraisal Count Written By or With Shop (Figure 62)

DRP/Open Shop/Service Center

Source: CCC Information Services Inc.
Within the DRP volume there is a similar trend towards more volume from the large MSOs. Between CY 2000 and CY 2016 the share of overall repairable DRP appraisal count going to national MSO’s quadrupled, growing from 5.8 percent to 28.7 percent (see Figure 63).

Vehicle Repair Complexity Grows

Over the last several decades, repairers have faced numerous challenges from changing vehicle technology. The pace of change among vehicles today however is changing ever faster, and requiring repairers to get training, tooling, equipment and certification to deal with a growing number of complex material types such as aluminum and carbon fiber, as well as increasing electronic complexity. Repairers must consider damage information, metallurgy, OEM position statements and model-specific procedures from the manufacturer, particularly with structural repairs. All of these come at a cost, subsequently increasing the cost to operate a professional facility. Finding ways through technology to grow their business, maximize resources, and extend relationships will become even more critical in the coming years. Many more OEM’s are developing their own OEM certified repair programs that require varying levels of ASE certification, I-CAR training, I-CAR welding Certification, and specific tool and equipment. The programs are designed to help drive brand recognition, customer satisfaction with service and repair, keep OE warranties in place, and ensure eligible trade-ins and lease returns meet requirements for CPO programs. As vehicle complexity grows, OEM’s have become increasingly focused on encouraging the repairer community to review the OE repair procedures prior to repairing a vehicle. A recent survey released by GM unfortunately revealed only 20 percent of shops pull repair procedures for every vehicle they repair. This was significantly lower than the survey results from the Collision Advice-CRASH Network “Who Pays for What?” survey from 2016 where 48.7 percent of the respondent shops replied they “all” or “most of the time” researched OEM repair procedures. The data from both surveys however validates the need for improvement across the industry.

As automakers have responded to government regulation on fuel economy, emissions reductions, safety, and other factors, new products and technologies have been developed that have led to a much more technologically sophisticated vehicle fleet. In order for a vehicle to achieve the Insurance Information Institute for Highway Safety’s (IIHS) “Top Safety Pick” or “Top Safety Pick+” awards, a vehicle must receive a good or acceptable rating in the small overlap front test and a good rating in each of the Institute’s four other crashworthiness evaluations — moderate overlap front, side, roof strength and head restraints. Vehicles that also make front crash prevention systems available earn an advanced or superior rating and are eligible for the agency’s “Top Safety Pick+” award. To improve vehicle crash worthiness and occupant safety, automakers have designed vehicles with more energy transfer built into the vehicle design. They have also been using stronger materials in the front structure or in the upper and lower rails to reduce crush in the occupant compartment. This can often create additional challenges when identifying where the energy from a crash traveled through a vehicle, and where that vehicle might be damaged. As a result, repairers are finding it necessary to complete a pre-repair 3D measure during the blueprinting of the vehicle.

Automakers with strong small overlap front tests have used similar strategies to improve their vehicles’ occupant protection: reinforcing at least one part of the door frame; reinforcing the side frames that are tied into the main frame rail, thereby providing an additional load path for crash force, and addressing potential for the steering column - and as a result the front driver air bag to shift. And while changes to vehicle construction and the incorporation of crash avoidance technologies lead to fewer injuries and fatalities, there can also be an increase in the time and cost to repair the vehicle.

Over the last several years, automakers and suppliers have focused a great deal of energy on crash avoidance technologies, and adding in features like navigation systems, Wi-Fi, and other convenience items. As a result, when today’s newest vehicles are involved in an accident, the repair is more complex than for older model year vehicles. This has created challenges and opportunities for both insurers and repairers.

We’re getting to structures now, with multiple different materials, because of CAFE standards and heightened occupant safety standards, that do not perform the way they did five years ago, no less 30 years ago... They’re performing very differently and controlling the crash energy very differently. – Mark Allen, Collision Programs Manager for Audi of America

(Figure 63)
How Many Vehicles Might Avoid an Accident Altogether in the Future?

The Highway Loss Data Institute (HLDI) estimates that 40 percent of 2014 model year vehicles included front crash prevention as either a standard or optional vehicle option, yet, the actual market penetration in terms of share of registered vehicle count is much smaller.\textsuperscript{104} HLDI estimates that as of CY 2014, slightly more than 5 percent of registered vehicles included front crash prevention technologies.\textsuperscript{104} Despite a somewhat slower start, the rate at which systems such as lane-departure warning, adaptive cruise control, automatic emergency braking, autonomous parking, and adaptive headlights are making their way into the mainstream vehicle population is now ramping up.

Like many vehicle features, the advanced driver assistance systems (ADAS) started appearing first within the luxury vehicle population. But it's clear that more consumers want these features. In their 2016 “U.S. Automotive Warranties Claims Study (SM)*, J.D. Power found that new vehicles equipped with safety features like low speed collision avoidance and blind spot detection earn higher scores among consumers surveyed than similar vehicles without those technologies.\textsuperscript{395}

Research from HLDI has shown that some of these ADAS are more effective than others in helping to reduce accident frequency for auto property damage and casualty.\textsuperscript{104} The systems found most effective include forward collision warning, lane departure warning, side assist view (blind spots), and adaptive headlights. If all vehicles were equipped with these systems, HLDI and IIHS estimates predict the U.S. could see a 6 percent reduction in crashes with injuries, and a 30 percent reduction in fatal accidents.\textsuperscript{105}

In March 2016, NHTSA and IIHS announced a commitment of 20 major automakers representing 99 percent of all vehicles sold in the U.S. annually, to make front crash prevention systems standard on nearly all models by September 2022.\textsuperscript{312} This commitment, as well as consumer demand, are expected to lead to more models including this technology. In fact, shortly after the March announcement by NHTSA and IIHS, Toyota announced its Lexus Safety System ™\textsuperscript{49} and Toyota Safety Sense™ packages, anchored by automatic emergency braking (AEB), standard equipment on almost every model by the end of 2017.\textsuperscript{312} Yet despite this 2022 voluntary commitment by the automakers, IIHS still predicts the share of registered vehicles with front crash prevention will not reach 50 percent until CY 2027, and 80 percent in CY 2034.\textsuperscript{314}

Today one of the challenges in tracking market penetration and the effectiveness of these new technologies is that each manufacturer has its own ‘branding’ for its technology, with packages including a wide range of technologies. There is also a wide variation in the design of each system, and whether in the case of frontal crash warning/avoidance, it is designed to simply reduce the speed of the vehicle before impact, or actually bring it to a full stop. Additionally, research by IIHS/HLDI, NHTSA, AAA and others show a wide range of capabilities and performance across the various systems. Among the 12 crash prevention systems from seven auto manufacturers HLDI studied to compare insurance claim rates, the research organization found that across all crash configurations (not just rear-end crashes), claim rates for damage to other vehicles is 10 to 16 percent lower for vehicles equipped with a warning system and autobrake, and 7 to 22 percent lower for vehicles equipped with a warning system only. Worth noting is the difference in the average claim cost that in some cases is actually higher than for other vehicles not equipped with the safety technology. Some of the difference may be due to wide variability in the detailed crash information which is not included in the data supplied to HLDI, how each technology is designed to work, or even in some driver characteristics not accounted for. Certainly, vehicles equipped with this technology include more parts such as sensors and cameras than other similar vehicles without the safety technology.

Given the wide array of ADAS technologies in the marketplace today, the variation in how they are packaged, the different designs and goals of each system, and the rate at which each is entering the marketplace, it becomes difficult to project what the real long-term impact on auto claim frequency and auto loss costs may be. Perhaps the best approach still is to use historical claims data to gauge what percent of auto claims might benefit from the ADAS given the mix of auto claims by age, loss coverage, and impact. Next step is to apply an estimate of the ‘take-up’ rate of crash avoidance systems based on availability and consumer purchase, and an estimate of the likely reduction in frequency based on pooled data from analyses performed across automakers and their frontal and rear crash avoidance systems to date. This approach suggests the impact on auto claims to date has been relatively small, and will take time to significantly reduce auto accident/claim frequency.

In the past few years, we’ve recognized that the world of driving safety has started to change rapidly around us. New car safety technologies are being added to cars faster than any earlier generation. Even features that have been around for years are getting smarter and changing into new features entirely. Some can now even take over our cars to help us avoid crashes!

But how do safety features work? When should they be used? Do I have them in my car? And, how can I find answers to these questions?

Text from the website www.mycardoeswhat.org
So, if 50 percent of all registered vehicles, as HLDI suggests, are equipped with frontal crash avoidance by 2027, and 80 percent are so equipped by 2034, the corresponding reductions in frequency could be 7 percent fewer auto claims by 2027, and 12 percent fewer by 2034 (see Figure 64). So while this approach does not account for any improvement in the ADAS’s abilities to reduce accidents, and is only a high level estimate, it underscores the inevitable decline in frequency that these systems will have as their market penetration grows. And while the U.S. vehicle population is expected to grow, most analysts believe we can expect 2 to 3 percent growth annually, which helps counter some of the decline from ADAS, but not all.

As more and more vehicles include advanced vehicle features, whether designed for safety or convenience, vehicle complexity continues to grow. Growth in electronic vehicle content - items added to address vehicle safety or convenience (none of which were needed previously for the vehicle to simply operate in the past i.e. getting from point A to point B) are adding to the overall cost of repair. With over 80 percent of the cost of the vehicle repair from labor and replacement parts, the industry is experiencing further increases in both. As the data in Figure 65 illustrates, labor needed for part replacement, calibration, reset and scan as well as the cost of additional parts can add hundreds of dollars in additional fees. The next several years are going to be challenging, as automakers compete to position themselves for the changing world of personal mobility, introducing more and more technology that will be expensive to repair, but may not immediately deliver on all of its promises in terms of accident prevention.

Potential Impact to Auto Claim Frequency from ADAS (Figure 64)

![Potential Impact to Auto Claim Frequency from ADAS](image)

Growing Complexity Drives Up Parts and Labor Costs - The Two Main Contributors to Repair Cost (Figure 65)

Share of Total Repair Cost CY2016

- **OTHER**
  - 11%

- **MATERIALS**
  - 8%

- **LABOR**
  - 41%

**PARTS**

- Part cost inflation
- Part counts increase
- More ‘captive’ OE parts as vehicle age declines, more sensors, cameras, etc.

**VEHICLE REPAIR COST**

- Pre-Repair Scan (Avg Cost $125 per claim)
- Replacement Labor (Avg 0.2 to 6.0 labor hrs at average of $45 per hour per part)
- Calibration Labor (Avg 0.2 to 6.0 labor hrs at average of $45 per hour per part)
- Post Repair Scan (Avg Cost $125 per claim)
- Additional part component to be replaced (Avg cost per part $144)
- Few if any non-OEM alternatives available (OEM share of these parts 98%+)

Vehicle electronics are estimated to make up as much as 40-50% of the total cost of the vehicle, up from less than 20% a decade ago.

Sources: IIHS, HLDI, CCC Information Services Inc.
**Customer Complexity Grows**

Vehicles are not the only part of the business where repairers are having to adapt to change. Today’s customers have new demands on their ability to engage with businesses in a digital manner. Earlier the concept of “liquid expectations” was discussed—shops today must adapt their front end offices as well as their whole manner of communication with their customer and their business partners.

Consider for example how many customers select the shop for their vehicle’s repair. Data from IMR Inc. reveals the primary reasons for selecting a preferred outlet for collision repairs was “Previous Experience” at 32.2 percent. The next two closest reasons were “Convenient Location” at 11.2 percent and “Recommendations” at 9.7 percent. Online reviews can often be a critical starting point for many new customers. A 2011 Harvard Business School study compared start ratings to revenue and found that for every one star a business was lacking on their Yelp listing, they were losing up to 9 percent of revenue.

Probably most important of all metrics to a repairer, and for the whole collision repair ecosystem, is capture rate. How well does your shop do at getting the customer in the door for the preliminary estimate, and how many of those do you convert to a repair order (RO)? With no RO, the opportunity to get a positive, publishable review of the repair experience at your shop disappears. For CY 2016, the percent of appraisals that converted to RO’s for various insurer direct repair programs ranged from 65 percent to nearly 85 percent. Certainly, some of the difference depends on whether the insurer has their DRP program set up as more of a drive-in experience, where the primary up front task is to get an appraisal, versus setting the expectation about the repair process.

However, given the industry’s average cost to actually repair a vehicle is about $3,000, and the average appraisal to RO conversion rate is in the low 70 percent range, one additional percentage in capture rate for the industry equates to 1.3 percent in total repair dollars. For a $40B industry, the one percentage point equates to over $500M of additional revenue. So while insurers essentially are already paying the dollars out to their claimants, there is an opportunity for higher customer satisfaction—particularly as vehicles being bought are increasingly new and complex vehicles—if a shop is able to convert the consumer into a customer. For the rest of the industry, $500M in more repairs translates to more part sales, more paint sales, more repairer sales, and more sales to sublet companies. Growing vehicle complexity has also driven OEM engagement in the collision repair industry since they realize that a properly repaired vehicle translates into higher revenue not just from part sales, but from potential customer retention and higher quality products for resale in the CPO market.

In Crash Course 2016, analysis of customer satisfaction data revealed that shops wanting to improve satisfaction scores need to make sure that the quality is high and the car is not returned back to the shop after the vehicle has been delivered. But to get customer recommendations, shops need to make sure the service is great and customers are kept informed. In other words, quality is the table stakes-service gets repeat business. With “Previous Experience” and “Recommendations” chosen as key reasons why an individual selects a specific collision repairer, capturing business is as important as keeping it. Analysis of 2016 CSI data by share of DRP volume converted to RO’s reveals capturing the repair may help the insurance company as well (see Figure 66). Repairers with higher capture rates actually had on average higher CSI scores for the survey questions pertaining to: whether the consumer would recommend the insurer and how they felt the insurer handled the claim. Claim satisfaction has been shown to be an important determinant in customer retention, as the market remains extremely competitive, taking advantage of those items that drive satisfaction are easy decisions.

**In with the New, but the Old is Not Completely Out Yet**

During the last Great Recession, as new vehicle sales skidded to new lows, the average number of vehicles on the road in the U.S. grew. Data from IHS discussed earlier reveals that trend has finally begun to reverse; although with scarpage rates at an all-time low, repairers continue to see a large volume of older vehicles alongside a growing number of newer more complex vehicles. This shifting age distribution has become a key variable to watch for many reasons. A repairer in a market with many more older model year vehicles may be less inclined to make the significant investments in the tooling and training required to repair the new vehicles coming off the assembly line. The mix of vehicles a shop repairs/appraises can also have an impact on the key performance indicators used by many insurers and repairers.

**Younger Vehicles are Making an Impact**

Prior issues of Crash Course have explored in detail how changes in consumer preference have led to significant changes within the vehicle fleet on the road in the U.S., and ultimately the vehicle mix within automotive claims. The recession resulted in significant disruption in new vehicle sales in the U.S. When compared to the 16.7 million average annual number of vehicles sold in the U.S. in the 10 years ending CY 2007, the U.S. saw many fewer new vehicles entering the vehicle parc. The subsequent impact to auto claims was a significant rise in vehicles aged 7-years plus, and big drops in the newest vehicle age groups. Strong auto sales over the last several years have helped reverse that trend.

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**Capture Rate Drives Satisfaction with Insurer (Figure 66)**

![Capture Rate Drives Satisfaction with Insurer](image-url)
The average age of repairable vehicles has typically risen about 1/10th of a model year since 2005. The exception to this was between CY 2008 and CY 2011 when the average age increased much faster (see Figure 67). As of CY 2016 the average age is experiencing its second year of a 0.1 model year age decline, and is expected to decline slowly in CY 2017 as more new vehicles enter the U.S. car parc. It’s also worth noting that when comparing average vehicle age by age group, the average age has declined for all but the vehicles of 7-years plus which increased from 10.7 years in CY 2015 to 11.1 years in CY 2016. With newer vehicles accounting for a growing share of repairable volume again, the industry is seeing a reversal in some of the trends experienced during the recession. Specifically, newer vehicles tend to have more parts replaced, lower alternative parts utilization, and a lower repair percent of total labor spend. Throw into the mix the fact that vehicles overall have gotten more complex, and these trends accelerate even further. A comparison of key appraisal statistics for calendar years 2001, 2009 and 2016 for collision and liability losses by vehicle age group underscores this trend (see Figures 68.1-2). Dollars for replaced parts as a share of total repair cost and the average number of replaced parts per claim have increased – particularly for newer vehicles. The impact of the recession is quite clear when comparing the trend in terms of parts replaced per claim in the years leading up to CY 2008 and 2009.

### Collision and Liability Repairable Appraisals by Vehicle Age Group (Figure 68.1) CY2001 / 2009 / 2016

<table>
<thead>
<tr>
<th>Calendar Year</th>
<th>Vehicle Age Group</th>
<th>Share of Overall Vol by Age Group</th>
<th>Parts % Total Repair Cost</th>
<th>Avg # Parts Repl per Claim</th>
<th>Share of Overall Vol by Age Group</th>
<th>Parts % Total Repair Cost</th>
<th>Avg # Parts Repl per Claim</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
<td>CURRENT YR</td>
</tr>
<tr>
<td>2009</td>
<td>1-5 YRS</td>
<td>10.4%</td>
<td>0.5%</td>
<td>1.8%</td>
<td>10.4%</td>
<td>0.5%</td>
<td>1.8%</td>
</tr>
<tr>
<td>2010</td>
<td>6-7 YRS</td>
<td>10.7%</td>
<td>0.8%</td>
<td>2.2%</td>
<td>10.7%</td>
<td>0.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>2011</td>
<td>7 YRS PLUS</td>
<td>10.8%</td>
<td>0.9%</td>
<td>2.7%</td>
<td>10.8%</td>
<td>0.9%</td>
<td>2.7%</td>
</tr>
<tr>
<td>2012</td>
<td>4-6 YRS</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>2013</td>
<td>7 YRS PLUS</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>2014</td>
<td>7 YRS PLUS</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>2015</td>
<td>7 YRS PLUS</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
</tr>
<tr>
<td>2016</td>
<td>7 YRS PLUS</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
<td>10.8%</td>
<td>0.8%</td>
<td>2.6%</td>
</tr>
</tbody>
</table>
With the average price per part for newer model year vehicles tending to be more costly than for older models – either due to less competition or less complexity of the part itself – more parts being sold at a higher price is contributing to increasing repair costs again post-recession.

Alternative parts utilization continued to grow in 2016 with slight increases in both aftermarket and recycled part utilization (see Figure 69.1-3). And, driving the non-OE utilization metrics further is the significant share of claim counts that still exist for vehicles 7-years and older, where non-OE utilization is nearly 50 percent of all dollars spent on parts.

**CCC National Industry - Percent of Total Part Replacement Dollars by Part Type (Figure 69.1)**

**CY1998-2016**

**Percent of Total Part Replacement Dollars by Part Type and Vehicle Age Group (Figure 69.2)**

**CY2012 vs. CY2016**

<table>
<thead>
<tr>
<th>Year</th>
<th>Metrics</th>
<th>Current Yr or Newer Group</th>
<th>1 - 3 Years Old</th>
<th>4 - 6 Years Old</th>
<th>7 Years and Older</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY 2012</td>
<td>OEM</td>
<td>90.9%</td>
<td>74.2%</td>
<td>56.0%</td>
<td>48.1%</td>
<td>63.1%</td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>5.0%</td>
<td>11.2%</td>
<td>10.7%</td>
<td>21.5%</td>
<td>16.9%</td>
</tr>
<tr>
<td></td>
<td>RECYCLED</td>
<td>1.1%</td>
<td>6.4%</td>
<td>11.4%</td>
<td>22.4%</td>
<td>11.1%</td>
</tr>
<tr>
<td></td>
<td>RO</td>
<td>2.4%</td>
<td>3.3%</td>
<td>6.8%</td>
<td>7.1%</td>
<td>6.0%</td>
</tr>
<tr>
<td></td>
<td>OPTIONAL OEM</td>
<td>0.6%</td>
<td>1.0%</td>
<td>1.1%</td>
<td>0.9%</td>
<td>1.0%</td>
</tr>
<tr>
<td>CY 2016</td>
<td>OEM</td>
<td>89.7%</td>
<td>70.2%</td>
<td>55.8%</td>
<td>47.4%</td>
<td>62.7%</td>
</tr>
<tr>
<td></td>
<td>AM</td>
<td>5.3%</td>
<td>19.4%</td>
<td>23.5%</td>
<td>26.1%</td>
<td>19.9%</td>
</tr>
<tr>
<td></td>
<td>RECYCLED</td>
<td>1.6%</td>
<td>8.0%</td>
<td>15.5%</td>
<td>16.0%</td>
<td>8.8%</td>
</tr>
<tr>
<td></td>
<td>RO</td>
<td>1.6%</td>
<td>3.2%</td>
<td>3.9%</td>
<td>4.3%</td>
<td>3.5%</td>
</tr>
<tr>
<td></td>
<td>OPTIONAL OEM</td>
<td>1.9%</td>
<td>3.3%</td>
<td>3.5%</td>
<td>3.3%</td>
<td>3.2%</td>
</tr>
</tbody>
</table>

**Average Part Replacements per Claim by Part Type (Figure 69.3)**

**CY2012-2016**

<table>
<thead>
<tr>
<th></th>
<th>AVG OEM PART CNT PER CLAIM</th>
<th>AVG AM PART CNT PER CLAIM</th>
<th>AVG RECYCLED PART CNT PER CLAIM</th>
<th>AVG RO PART CNT PER CLAIM</th>
<th>AVG OPT OE PART CNT PER CLAIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>6.4</td>
<td>2.1</td>
<td>0.5</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>2013</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2014</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Repair Costs Trend Up

The average total cost of repair for vehicle appraisals in CY 2016 was $2,861, up 3.8 percentage points from 2015. Repair costs are now accelerating at a rate consistent with what the industry experienced pre-recession. Comprehensive losses saw the largest increase in 2016 of 8.9 percent, and with the added volume from numerous severe storms throughout the year, resulted in driving up overall auto loss costs (see Figure 70).

While comprehensive loss costs can vary widely by year, collision and liability losses are perhaps more predictable, and are driven most by the mix of vehicles within the population of claims.

All signs point to further increases in vehicle repair costs in the coming years. Key to the increase is growth in newer model year vehicle share, as well as the continued shift to light trucks and more expensive vehicles. In CY 2016, vehicle repair costs for non-comprehensive losses were up 2.5 percent with the largest increases occurring among current model year vehicles (up 4.5 percent) and vehicles aged 1-3 years (up 3.2 percent) (see Figure 71). Assuming a similar shift in vehicle age in CY 2017, and similar increases in repair costs, the industry may experience a further increase in the average repair cost for collision and liability losses of 2.6 percent.

Parts Replacement Becoming More Common

When combined, overall non-paint and paint labor accounted for just below 42 percent of the total cost of repairs in 2016, which has changed little over the last fifteen-plus years (see Figure 72).

### Average Total Cost of Repairs by Loss Category (Figure 70)

<table>
<thead>
<tr>
<th>Year</th>
<th>Liability</th>
<th>Comprehensive</th>
<th>Collision</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2010</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2011</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2012</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2013</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2014</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2015</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
<tr>
<td>2016</td>
<td>$1,500</td>
<td>$1,975</td>
<td>$2,450</td>
<td>$2,925</td>
</tr>
</tbody>
</table>

### CCC National Industry - Repair Dollars Distribution by Category (Figure 72) CY2009-2016

<table>
<thead>
<tr>
<th>Year</th>
<th>Non-Paint Labor</th>
<th>Paint Labor</th>
<th>Paint Materials</th>
<th>OEM Parts</th>
<th>Non-OEM Parts</th>
<th>MSC</th>
<th>Tax</th>
<th>Towing/Storage EPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>27.9%</td>
<td>14.7%</td>
<td>8.3%</td>
<td>24.3%</td>
<td>15.4%</td>
<td>5.9%</td>
<td>4.6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>2010</td>
<td>27.9%</td>
<td>14.6%</td>
<td>8.3%</td>
<td>24.3%</td>
<td>15.4%</td>
<td>5.9%</td>
<td>4.6%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2011</td>
<td>28.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>24.3%</td>
<td>15.4%</td>
<td>5.9%</td>
<td>4.6%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2012</td>
<td>28.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>25.5%</td>
<td>17.8%</td>
<td>6.3%</td>
<td>4.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2013</td>
<td>29.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>25.5%</td>
<td>17.8%</td>
<td>6.3%</td>
<td>4.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2014</td>
<td>29.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>25.5%</td>
<td>17.8%</td>
<td>6.3%</td>
<td>4.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2015</td>
<td>29.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>25.5%</td>
<td>17.8%</td>
<td>6.3%</td>
<td>4.7%</td>
<td>0.4%</td>
</tr>
<tr>
<td>2016</td>
<td>29.4%</td>
<td>14.7%</td>
<td>8.2%</td>
<td>25.5%</td>
<td>17.8%</td>
<td>6.3%</td>
<td>4.7%</td>
<td>0.4%</td>
</tr>
</tbody>
</table>
The average number of labor hours per appraisal sent through CCC in 2016 was up slightly, and the average hourly rate for sheet metal or body labor was up 1.1 percent versus 2015 (see Figure 73).

An increase in newer model year vehicles and higher average part counts per claim has also had an impact on the industry’s repair labor dollars as a share of total labor spend. A comparison of some of the top volume parts by vehicle age group shows, in some cases, the share of repaired parts is higher for newer model year vehicles than the older, suggesting that non-OE alternatives help drive the repair part-counts go down, and with them the repair labor hours; if at the same time more part replacements are made, a greater share of labor goes to replace.

Unfortunately given the change in vehicle material type and construction, repair is becoming less frequent. One of the key opportunities that remains for both repairers and insurers however is the repair of bumper covers. Bumper covers are one of the most commonly replaced parts, and given that the vast majority today are plastic, they lend themselves to being reconditioned in-house and out of the gate, saving at least one day on repair cycle time, gained by not waiting for a replacement bumper. Additionally, the shop avoids the time needed to repair those replacement bumpers that come with some minor damage, and the need to blend into the adjacent panel(s). A comparison of overall repair cycle times and productivity metrics for claims with front bumper covers that were repaired versus replaced reveals those claims with bumper repair had lower cycle times overall. And while there may be other factors driving the repair time overall, clearly the focus drives benefit (see Figure 75).

### CCC National Industry Average Labor Rates per Labor Category (Figure 73)

**CY202-2016**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sheet Metal</strong></td>
<td>$45.50</td>
<td>$45.15</td>
<td>$46.70</td>
<td>$47.10</td>
<td>$47.05</td>
</tr>
<tr>
<td><strong>Body</strong></td>
<td>$52.00</td>
<td>$52.45</td>
<td>$53.35</td>
<td>$54.20</td>
<td>$55.22</td>
</tr>
<tr>
<td><strong>Frame</strong></td>
<td>$37.64</td>
<td>$37.12</td>
<td>$38.29</td>
<td>$38.55</td>
<td>$38.22</td>
</tr>
<tr>
<td><strong>Labor</strong></td>
<td>$45.41</td>
<td>$46.04</td>
<td>$46.62</td>
<td>$47.23</td>
<td>$47.79</td>
</tr>
<tr>
<td><strong>Materials</strong></td>
<td>$26.17</td>
<td>$26.63</td>
<td>$27.02</td>
<td>$27.79</td>
<td>$28.32</td>
</tr>
<tr>
<td><strong>Paint</strong></td>
<td>$1.1%</td>
<td>$1.4%</td>
<td>$1.2%</td>
<td>$1.5%</td>
<td>$1.1%</td>
</tr>
<tr>
<td><strong>Mechanical</strong></td>
<td>$0.7%</td>
<td>$0.7%</td>
<td>$1.7%</td>
<td>$1.6%</td>
<td>$1.9%</td>
</tr>
<tr>
<td><strong>Body</strong></td>
<td>$1.7%</td>
<td>$1.8%</td>
<td>$1.5%</td>
<td>$2.9%</td>
<td>$1.8%</td>
</tr>
<tr>
<td><strong>Paint</strong></td>
<td>$1.1%</td>
<td>$1.3%</td>
<td>$1.3%</td>
<td>$1.3%</td>
<td>$1.2%</td>
</tr>
</tbody>
</table>

Source: CCC Information Services Inc.

### Analysis of Repair Cycle Time Metrics for Claims with Front Bumper Cover Repaired vs. Replaced (Figure 75)

- **Driveable No Airbag Deployed**
  - **Repair**
    - Labor: 39.2% of total labor
    - Avg Labor Hrs Per Repair: 6.3 days
  - **Replace**
    - Labor: 60.8% of total labor
    - Avg Labor Hrs Per Repair: 8.0 days

- **Non-Driveable No Airbag Deployed**
  - **Repair**
    - Labor: 18.5% of total labor
    - Avg Labor Hrs Per Repair: 4.4 days
  - **Replace**
    - Labor: 81.5% of total labor
    - Avg Labor Hrs Per Repair: 5.2 days

Source: CCC Information Services Inc.

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Training an Aging Workforce and Engaging a Younger One

One of the challenges of all of this new technology in today’s vehicles is finding enough technicians with the training required to repair them. The U.S. is already facing a shortage of trained body techs – a recent story in Automotive News spoke directly to this, and the efforts of the Collision Repair Education Foundation (CREF) to recruit individuals to the industry. In CREF’s recent “Snapshot of the Collision Repair Industry” report, shop respondents reported on average that they each have 0.9 unfilled entry-level technician openings, and 1.7 unfilled experienced technician openings. Perhaps most concerning is that more collision repair technicians are over 50 years old, and the average age of a technician today is 41 years old, which is an increase of almost 13 percent since 1995 (see Figure 76).

Like many industries, collision repair continues to face challenges keeping employees trained and properly equipped with required tools and documentation. Tapping into approaches tried elsewhere in the world, and among peers will continue to be important. Establishing an environment where training is valued, and viewed as a way to keep technicians engaged may help reduce turnover and keep your business competitive in the future.

Average Age of Collision Repair Technician (Figure 76)

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>CY16</td>
<td>40.9</td>
</tr>
<tr>
<td>CY15</td>
<td>38.7</td>
</tr>
<tr>
<td>CY17</td>
<td>38.7</td>
</tr>
<tr>
<td>CY04</td>
<td>37.8</td>
</tr>
<tr>
<td>CY01</td>
<td>36.3</td>
</tr>
<tr>
<td>CY98</td>
<td>35.9</td>
</tr>
<tr>
<td>CY95</td>
<td>35.5</td>
</tr>
</tbody>
</table>

Source: Collision Repair Education Foundation and I-CAR. “Snapshot of the Collision Repair Industry: Executive Summary of the 2016 Survey.”

CCC INSIGHT

The collision repair industry has seen a fairly significant lift in volume over the last several years, and from an accident frequency perspective, it is not likely the industry will see a significant decline in automotive claims in the near term. Higher employment, low gas prices, more miles driven, greater road congestion and numerous other factors continue to keep rates of accident frequency elevated. And while frequency remains elevated, the rates of increase have started to slow. It could be that the larger increases in frequency over the last several years were primarily driven by recovery from the recession, which will be less of a factor going forward. Barring any significant weather events such as the Polar Vortex of 2014 that led to more ice and snow-related crashes, the industry may see only moderate growth in overall counts, resulting from steady rates of frequency on a larger population of vehicles overall.

The collision repair industry, like so many others, is also struggling to meet the demands of an increasingly digital customer base, which is not only driving change among consumers, but also impacting the vehicles they are driving, and our industry is ultimately repairing, which affects the entire automotive supply chain. As vehicle complexity rises, so also do repair costs, and repairers will increasingly face pressure to do what they can to manage that increase. Focus on the customer and capturing the actual repair could help bring more revenue into the ecosystem overall.

The connected car means more data will be passed through the vehicle and shared throughout the automotive ecosystem. Repairers, like all companies, will need to ensure that data is kept secure. They will also need to identify ways to apply this valuable information to maximize customer opportunities and deliver satisfaction.

And while there have been numerous reports predicting the demise of the private passenger automobile insurance market as advanced driver assistance systems gain real market traction, there are more than 260M vehicles still on the road in the U.S. with an average age of 11.5 years, and market penetration of ADAS to date has been slow. Certainly, automaker announcements and the vehicles they are featuring at various auto shows and CES suggest we may start to see more technologies come more quickly from what we’ve seen to date, but the wide variation in how these systems perform, and how consumers adapt them suggests it will be several years before real impact is felt.
The pace of change in digital technology has ramped up, with even well-established technologies like smartphones facing competition for new markets from IoT devices such as Amazon’s Alexa. The vehicle of yesterday is quickly transforming into the mobility device of the future, where real-time connectivity offers opportunity to engage (and distract) the consumer in numerous new ways. Whether it’s the Vehicle, the Consumer, the Insurer, or the Repairer, all are experiencing an immense amount of change and disruption to traditional notions of how to conduct and grow business and engage and retain customers.

As more of consumers’ lives are conducted online via a digital device, several new concerns emerge. Data privacy, security, and ownership issues will need to be addressed, and consumers have growing expectations that they will receive something of value in exchange for sharing their information. As voice computing advances, consumers will see new opportunities to interface with things as mundane as a washing machine, but potentially to hand over control of a vehicle without having to use distracting controls.

Telematics too is offering the ability to reach consumers more often and in numerous new ways. The explosion of data from the vehicle about its performance, safety, surroundings and passengers translate to new business opportunities but also new security risks. As connected vehicle technology grows in market share and scope, it will drive disruption throughout the entire automotive supply chain. With the connected car, opportunities to extend the relationship between the OE and the consumer grow, potentially driving immense change throughout the auto ownership lifecycle, particularly as it relates to how and what is insured, who can be considered liable, and how best to retain customers going forward. Repairers too will be faced with ever more complex repairs, moving closer to an environment of potentially fewer but more expensive repairs.

These ultra-connected, high-tech and structurally sophisticated vehicles are also changing the landscape for insurers and collision repairers. Greater vehicle complexity from lightweight materials, complex construction, sensors and cameras create complexity in the repair process, which requires access to information on how to properly repair the vehicle, as well as the equipment, tools and training needed to complete accurate repairs. This dynamic means that capital or line-item investments must be made at a time when the long-term trend point to a slowly but surely shrinking market, thanks to broad demographic factors and burgeoning crash avoidance technology.

Today’s business imperative is that companies master their use of the digital tools, data and analytics best suited to survive in this new world. IT’S REALLY HAPPENING!


4. Ibid.


8. Ibid.


20. Ibid.


22. Ibid.


25. Ibid.

26. Ibid.

27. Ibid.


32. Ibid., p. 9.


37. Ibid.

38. Ibid.


41. Ibid, p. 38.

42. Ibid, p. 73.

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44. Ibid.


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114. Ibid. P. 23.
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173. Ibid, p. 11.


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182. Ibid.


186. Ibid.


Susanna Gotsch is Director, Industry Analyst at CCC Information Services Inc. She has been with CCC since July of 1992. Susanna brings twenty-plus years of experience within the automotive claims industry as Director, Industry Analyst.

She has authored *The Crash Course*, CCC’s annual publication on trends impacting collision repair and total loss costs since 1995. This publication has become a key resource for the industry in understanding how broader trends within the economy, new and used vehicle market places, and collision industry are impacting auto claim frequency and costs.

Ms. Gotsch also consults with the on-going development of CCC’s industry-leading data warehouse and reporting products.

Ms. Gotsch has presented her research at numerous industry meetings and symposium. In 2011, Ms. Gotsch was awarded the annual industry honorarium *Most Influential Women in the Collision Repair Industry* established by AkzoNobel Automotive & Aerospace Coatings America (A&AC). She has also served on the Board for the Women’s Industry Network (WIN)® since 2011.