Data Analysis and Prevention of Vehicle-Into-Building Crashes

An examination into the frequency of vehicle-into-building crashes and a solution to protect people from such accidents.

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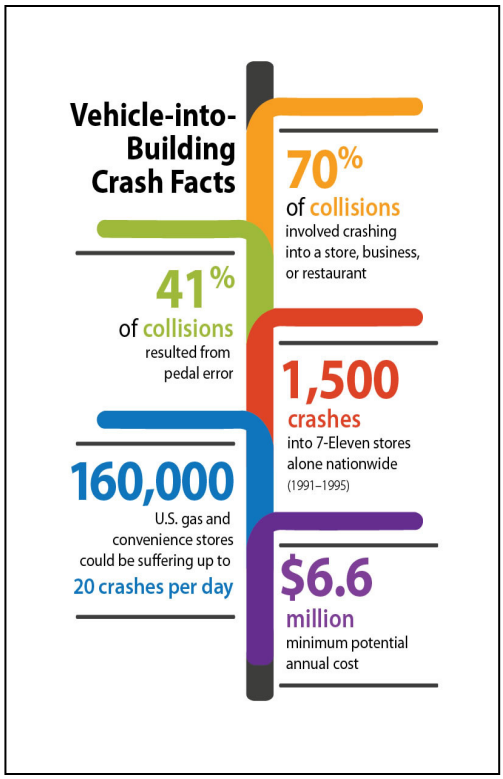

Vehicle-into-building accidents occur more frequently than you might think. They occur most frequently when a driver is entering or leaving a parking space perpendicular to the building. Even at these relatively low speeds, collisions like these can result in serious injury or death. However, there are simple preventative measures to protect pedestrians, store employees, or store patrons from being injured, even killed, when these incidents occur.

Assessing Current Crash Data

Currently, no formal reporting method of vehicle-into-building accidents exists in the United States. Thus, the authors have gathered the data presented here using public documentation sources including media reports and press articles, as well as legal cases. A quick search of vehicle-into-building accidents from April 1 to May 31, 2013, yielded over 300 media reports found.

From the collected data, we determined that, on average, at least five reported vehicle-into-building accidents occur daily in the United States. We analyzed the data to evaluate a variety of details about the crash. The causes for crashes and the building types impacted were of particular interest (see figures 1 and 2). Of the collisions analyzed, 70 percent involved vehicles crashing into a store (e.g., gas station, grocery store), a business (e.g., bank, carwash, gym), or a restaurant. The data also showed that 41 percent of collisions resulted from pedal error (either the

driver's foot slipping from one pedal to the other or mistakenly pressing the gas instead of the brake.

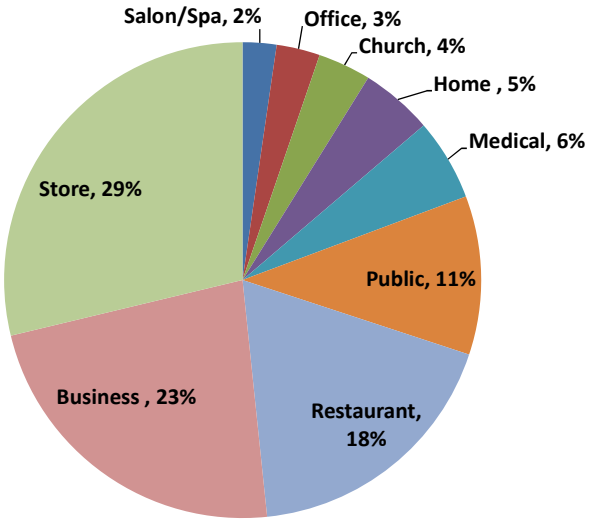

Figure 1: Vehicle into Building Crashes by Building Type

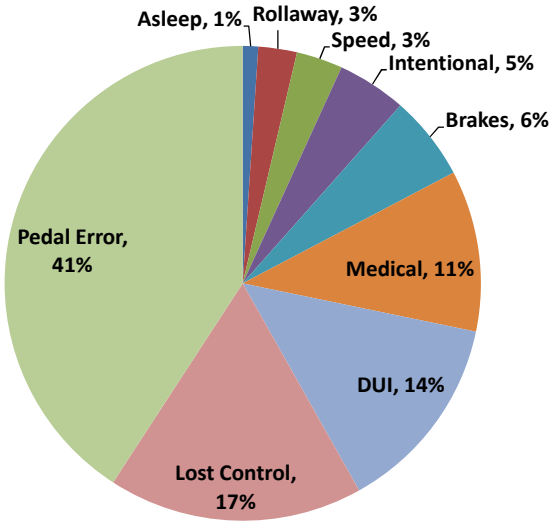

Figure 2: Vehicle into Building Crashes by Cause

An Historical Problem, A Contemporary Opportunity

While the data assessed represents only anecdotal data covering two months, an abundance of historical data demonstrates the ongoing nature of this safety issue. Figure 3, a San Francisco newspaper clipping ca. 1932, shows a vehicle crashed into a storefront. Note the caption, which states that the incident shown in the picture is the fifth such occurrence since 1930.

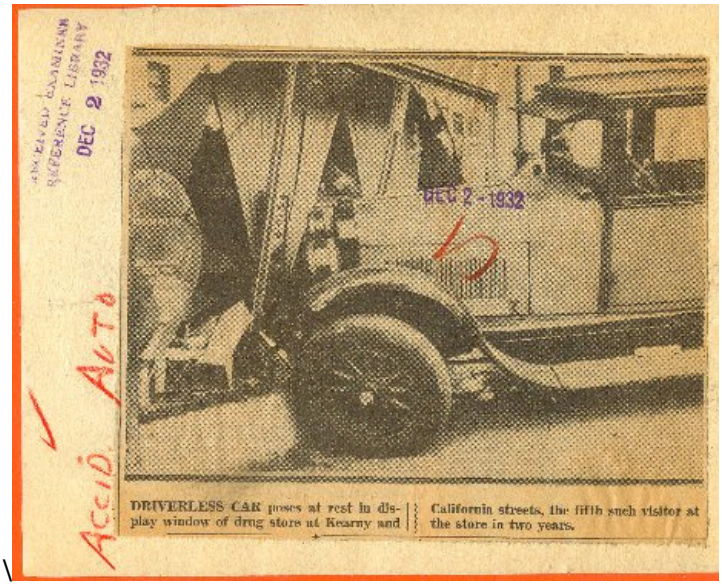

Figure 3: 1932 Storefront Crash

Data gathered between 1991 and 1995 shows that sixty years later, Southland Corporation—owner of 7-Eleven convenience stores—suffered more than 1,500 crashes into their 7,000 stores. Of those crashes, some stores were struck twice, and a handful three times. Based on the crash frequency and total number of stores open during the period, we determined that1.0 to 1.5 storefront crashes occurred per day at 7-Eleven stores. Subsequent analysis of additional data gathered from 1996 to 2001 shows that crashes occurred at approximately the same relative rate at another chain of convenience stores, Cumberland Farms, with 145 of their 600 U.S. stores struck by vehicles.

Extrapolating from these documented incident rates, we estimate that up to 20 vehicle-into-building crashes per day (or 7,300 per year) could be occurring at the 160,000 convenience stores in the United States. The National Safety Council has attempted to monetize societal costs of crashes in the United States and has assigned the following societal costs to different kinds of injuries and crashes:

- Death $1,420,000.
- Nonfatal Disabling Injury $78,700.
- Property Damage Crash (including non-disabling injuries) $9,100.

Using even the most conservative figure (i.e., assuming all crashes are "property damage" only), the potential costs to the convenience store industry of 7,300 crashes per year would come to $6.6 million. Unfortunately, the authors believe the actual costs to be many times that amount as a result of additional costs, claims, and settlements.

The Need for Standards When Installing Protective Devices

As business owners became increasingly aware of this threat to their and their customers' safety, some began to install hardware to protect pedestrians and store fronts. For instance, around 2004, a company initiated a program of installing bollards they perceived as appropriate protective devices between the interaction of pedestrians and vehicles. (A bollard is a post in a series of posts preventing vehicles from entering an area.)

However, there is currently no dynamic testing standard that proves whether or not those protective devices are actually effective in stopping a vehicle from driving through a storefront. Due to a lack of awareness, poor installation techniques, and an absence of clear test and performance standards and codes, not all bollards or barriers stop vehicles effectively. Figure 4 shows a concrete-filled bollard knocked over by a vehicle as the vehicle proceeded through the storefront.

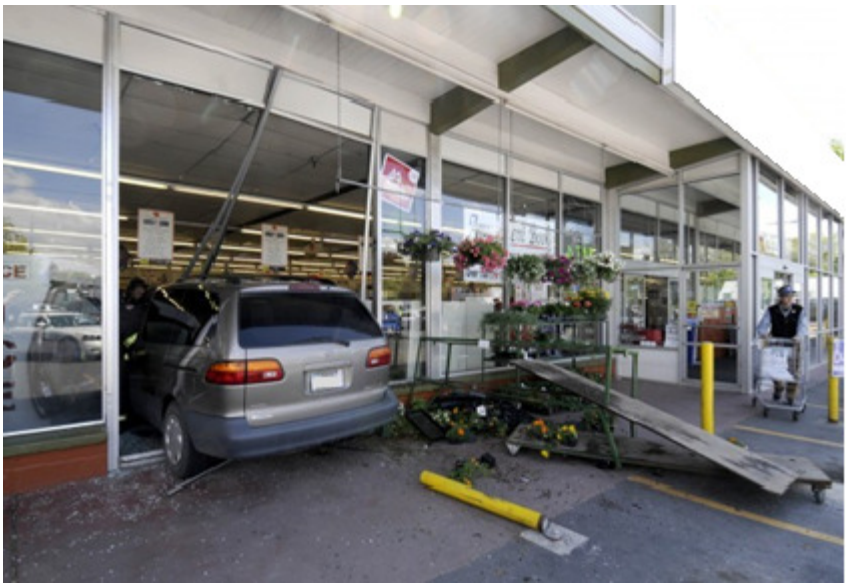

Figure 4: Vehicle Crashes through Bollard into Grocery Store

Other types of hardware used as protective devices include items such as wheel stops, curbs, fences, and planters. As is the case with bollards, however, no standard exists for dynamically testing these devices. Figure 5 illustrates that wheel stops and curbs do not stop vehicles. Figure 6 illustrates a car crashing into an outdoor restaurant patio through a “protective” wall. As shown in these photos, installing protective devices without proper testing is akin to installing automobile seat belts without first assessing how well they restrain passengers in a crash. In short, without dynamic testing to prove the safety benefits of protective devices installed by store owners, lives are put at risk unnecessarily, and society is bearing the long-term costs of those injuries and fatalities.

Figure 5: Curbs and Wheel Stops do not stop

Figure 6: Car Crashes into Patio (Source: the big lead)

TTI: Proven, Accredited Testing Facilities

People driving cars make mistakes. Technology exists to protect people and assets from errant vehicles. While some attempts have been made to protect pedestrians, many attempts fall short of this objective because the devices employed have not been properly performance tested. Proper assessment requires validation of designs through standardized and competent full-scale testing of the protective devices (e.g., bollards, fences, walls, decorative benches, planters, etc.) used by store owners to protect their customers.

Researchers at the Texas A&M Transportation Institute (TTI) are working with other concerned professionals and ASTM International to develop a new *Standard Test Method for Surrogate Testing of Vehicle Barriers At Low Speeds*. This standard will allow for the uniform testing of protective devices to ensure that installed devices will truly stop a vehicle from entering a protected area. Authors Alberson and Reiter serve on the ASTM F12-10 committee working on this test standard and act as co-chairmen of the working group.

Manufacturers and end-users will have the opportunity to conduct testing of these devices at the TTI Proving Ground, accredited by the American Association for Laboratory Accreditation (A2LA) in 2009, where similar ASTM testing was conducted for the U.S. State Department, which refined requirements for similar devices used to protect U.S. facilities, like embassies, abroad.

While this proposed new standard will provide a uniform testing method, it will be the responsibility of local agencies to require any protective device installed be tested to a desired performance level. Additionally, it will be the responsibility of these local agencies to determine if the installation of tested devices is only required for new construction projects, or if such devices are required in existing locations where hazardous vehicle and pedestrian interactions might occur. The data indicates that vehicle-into-building crashes are surprisingly common where Americans live, work, play, and shop; such incidents are also preventable with the proper implementation of affordable measures that have been tested and proven effective.