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Position Paper: Let's Eliminate Parking 'Wheel Stops' at Busy Storefronts (December 1, 2019) ©

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Let's Eliminate Parking 'Wheel Stops' at Busy Storefronts

Introduction

In a previous paper, "*Uses and Misuse of Wheel Stops at Parking Spaces in California*"[1], we noted that ***wheel stops*** are physical barriers installed at parking spaces to deter potentially problematic vehicle movement. We emphasized that these devices do not serve as protective safeguards against moving vehicles – serious injuries and/or extensive property damage are common consequences of cars accidently being driven over standard wheel stops.[2] Instead, the main purpose of a wheel stop simply is to serve as a physical signal to the driver that no additional forward movement is advised.

In general, there are two standard uses for wheel stops at parking facilities and lots:

i. To warn and deter drivers from damaging structural interactions (e.g., 'car vs. building', 'car vs. car', and 'car vs. steel post' encounters); and

ii. To deter improper vehicle encroachment into pedestrian paths of travel (e.g., at sidewalks).

However, wheel stops also constitute potential tripping hazards for pedestrians.[3] Nationwide, many hundreds (if not thousands) of individuals annually suffer a wide range of trip and fall injuries from unexpected interaction with these projections. In our previous paper, we strongly recommended that owners, designers, and managers should:

- Recognize that the presence of wheel stops in parking facilities serves to increase risks of highly injurious pedestrian falls, particularly for elderly pedestrians, and undertake actions (e.g., proper painting, lighting, positioning, etc.) that reasonably serve to best moderate these risk factors;
- Implement a risk-benefits analysis for each wheel stop and, where appropriate, act to eliminate those wheel stops that are found to exhibit unduly high-risk/low-benefit characteristics; and
- Specifically, consider the use of structural ***bollards***[4] in lieu of wheel stops at areas of highly concentrated pedestrian-vehicular interactions.[5]

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[1] http://www.ravelar.com/articles/Use-Misuse-Wheel-Stops.pdf

[2] These accidents often occur when a driver mistakenly steps on the gas pedal instead of the brake.

[3] Slip, Trip, and Fall Prevention for Healthcare Workers: "*Concrete wheel stops in parking lots can be a tripping hazard and should not be used*.", Centers for Disease Control and Prevention (www.cdc.gov)

[4] Structural "bollards" are short vertical posts, commonly constructed from steel and/or reinforced concrete, that can serve as a physical barrier against improper vehicle intrusions into pedestrian pathways.

[5] In general, the professional services of an experienced architect, engineer, traffic control consultant, or (in California) a "Certified Access Specialist" are recommended for this "bollard vs. wheel stop" risk-benefits evaluation process.

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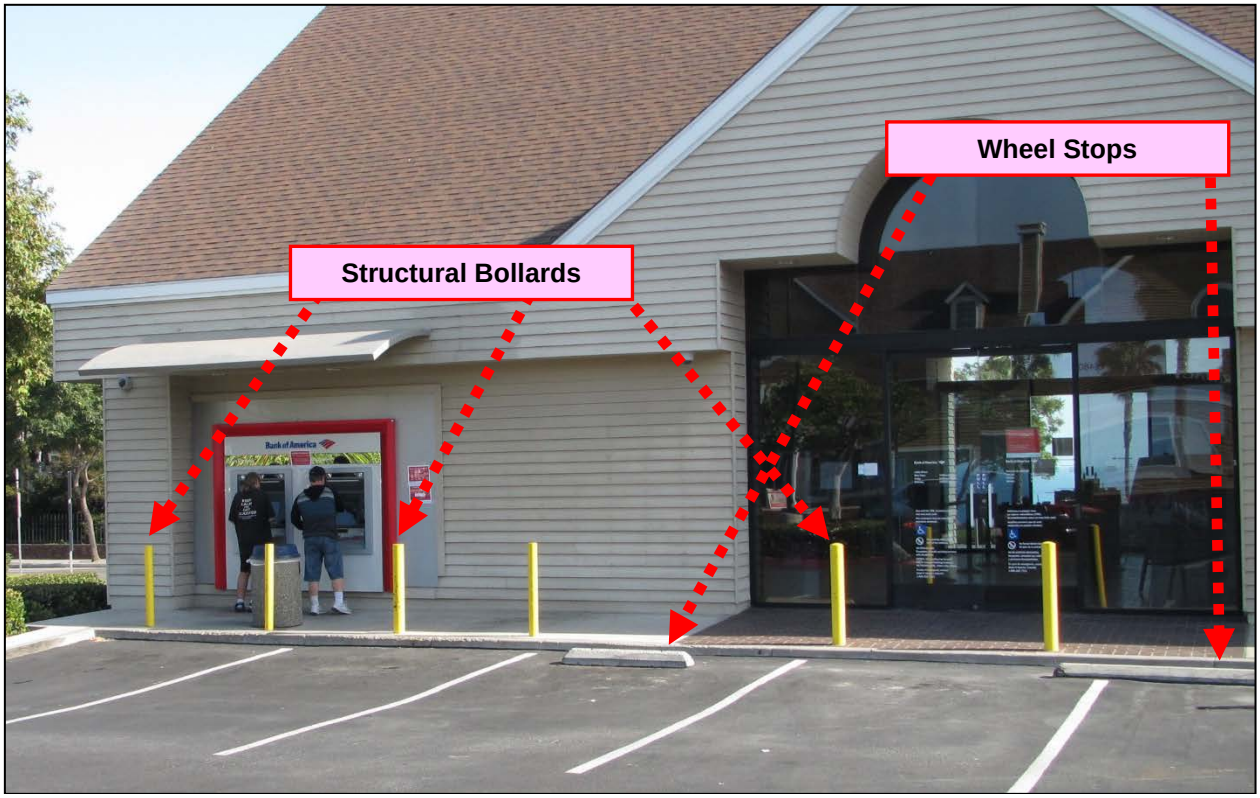

Photo 1 – This bank in Southern California has installed yellow-painted bollards to better protect customers and employees at the main entry and at the ATM kiosk at left. (Concrete wheel stops remain at two parking spaces.)

Photo 2 – Similarly, in this parking lot serving a U.S. Post Office branch in Fullerton, CA, original wheel stops have been replaced with structural bollards to better protect customers and employees.

Introduction – Are Wheel Stops Required by Any Code?

As documented and detailed in our prior position paper,[6] installation of wheel stops or similar devices are recommended – by the federal American with Disabilities Act (ADA) and per numerous state codes (e.g., Chapter 11B of the California Building Code) – at accessible parking spaces where necessary to prevent vehicle intrusion into the code-required clear width of adjacent accessible routes, such as sidewalks, as seen at Photo 3 below.

- Section 502.7 of the 2010 ADA Standards states: "*Parking spaces and access aisles shall be designed so that cars and vans, when parked, cannot obstruct the required clear width of adjacent accessible routes*." (Further, Advisory 502.7 of the 2010 Standards advises: "*Wheel stops are an effective way to prevent vehicle overhangs from reducing the clear width of accessible routes*.")
- Under Chapter 4 of the 2010 ADA Standards, the minimum required clear width of an accessible route varies from 36 to 60 inches. Here in California, CBC Chapter 11B mandates a minimum clear width of 48 to 60 inches at walks and sidewalks.

Photo 3 – At this shopping mall in Southern California, the concrete wheel stops deter vehicle encroachment into the required clear width (60 inches) of this wheelchair-accessible sidewalk.

[6] L. Haughton, J. Agnello, AIA, and D. Field, AIA: "*Uses and Misuse of Wheel Stops at Parking Spaces in California*" (http://www.ravelar.com/articles/Use-Misuse-Wheel-Stops.pdf)

In short, the only code-mandated purpose of a wheel stop is to deter potential vehicle encroachment into the required clear width of an accessible sidewalk or route. Therefore, at Photo 4, because the bollards in front of the accessible parking spaces at this busy storefront preclude any degree of vehicle encroachment into the accessible sidewalk (behind the bollards), there was no code mandate to install these wheel stops at which multiple pedestrian customers later suffered trip-and-fall injuries.

Photo 4 – At this busy storefront in Southern California, multiple pedestrian customers suffered trip-and-fall injuries at these non-required and unnecessary wheel stops.

More and more, parking lot designers and managers have recognized the benefits of using structural bollards in lieu of wheel stops. In Photos 5 thru 7 below, there are no wheel stops anywhere at this large shopping mall in Southern California:

Photo 5 – Structural bollards prevent vehicular encroachment into the accessible route of pedestrian travel.

Photo 6 – The large parking lot in Southern California was designed and constructed without wheel stops, which are potential tripping hazards (and which are not required by state or federal laws, codes, or regulations).

Photo 7 – Structural bollards prevent vehicular encroachment into the accessible route of pedestrian travel.

Similarly, in Photos 8 and 9 below, note how the City of Novato (in Northern California), during the highly successful revitalization of its "Old Town" district, has strategically positioned structural bollards, light poles, and large planters to eliminate the need for wheel stops or curbs to deter vehicular encroachment into the public sidewalks. Also note the modern "zero curb" transition fostered by the strategic use of bollards and other barriers.

Photo 8 – City of Novato's revitalized "Old Town" district: structural bollards, lamp poles, and planters prevent vehicular encroachment into the accessible public sidewalks.

Photo 9 – City of Novato's revitalized "Old Town" district: structural bollards, lamp poles, and planters prevent vehicular encroachment into the accessible public sidewalks.

Introduction – Key "Industry Standards" Also Favor the Use of Bollards

The Traffic Engineering Handbook published by the highly respected Institute of Transportation Engineers (www.ite.org) provides "*practicing professionals and other interested parties with a basic, day-to-day source on the proven techniques of professional traffic engineering …but is not intended to be a 'standard of practice'.*"[7] Chapter 14 of the 2009 ITE Handbook advises that: "*Pedestrian vulnerability to slip, trip and fall in parking facilities can be reduced by certain design decisions:*

- "*not utilizing wheel stops in pedestrian path areas (only against walls or boundary conditions where pedestrians cannot travel);*" (E.g., see Photo 10 below.)
- "*…using boundary control and curb placement that avoids vehicle overhang into public right of way and sidewalks…*" (E.g., see Photos 1, 2, 8, and 9 above.)
- "*Where curbless design is used, the sign post can be placed at the head of the accessible parking space (with protection such as bollard) to limit encroachment into the accessible route (wheel stops should not be used).*" (E.g., see Photos 5 and 7 above and 17 below.)

Photo 10 – These distinctive wheel stops, which are not located within an intended pedestrian route, reasonably (in our opinion) serve to protect drivers and their vehicles from damaging interactions with this concrete wall.

Similarly, Section 9 of ASTM F1637 ("*Standard Practice for Safe Walking Surfaces*")[8], a voluntary industry standard published by ASTM International (formerly, the American Society for Testing and Materials), strongly recommends the use of bollards in lieu of wheel stops due to their inherent risks:

- "*9.1* ***Parking lots should be designed to avoid the use of wheel stops***."
- "*9.2* ***Wheel stops shall not be placed in pedestrian walkways or foreseeable pedestrian paths***."
- "*…9.7* ***Bollards, not less than 3 feet in height, may be placed in the center of parking stalls as an alternative to wheel stops****. Bollards should be appropriately marked to enhance visibility*."

[Bold emphasis added.]

[7] Foreword to 717-page 6th edition (2009) of ITE's Traffic Engineering Handbook.
[8] www.astm.org/Standards/F1637.htm

Discussion – "Loss Control" Guidance from Insurance Companies

Insurance "loss control" guidelines encompass a wide range of risk management recommendations and practices designed to reduce the likelihood of claims being made. Across North America, more and more insurance entities are urging their commercial clients: a) to limit, whenever possible, usage of wheel stops, and/or b) to install crash-protective bollards – particularly at busy storefronts:

- 2014 AIG Loss Control Bulletin: "*Are bollards used whenever possible, limiting the use of wheel stops?*"
- 2014 AmTrust Financial: "*Are bollards used whenever possible, limiting the use of wheel stops?*"
- 2013 Argo Insurance "Grocers Insurance Safety Tip of the Month": "*Consider this scenario*:

  "*A driver mistakenly steps on the gas pedal instead of the brake when pulling into the handicap parking space in the front of a store. The car hops the parking bumper, crosses the sidewalk, and crashes into the store's entrance doors*."

  "*Parking lot accidents are often foreseeable. We know that people can do unexpected things with their cars. A foot can slip off the clutch, causing the vehicle to jump forward and overshoot parking spaces; or a driver may inadvertently step on the gas pedal instead of stepping on the brake*."

  "*For retailers with older stores, parking lots designed with parking spots directly in front of the store, including handicap parking in front of entrance doors, can increase the risk of a customer, employee, or building being struck by a vehicle. Current parking lot design standards do not allow parking directly in front of a store primarily to avoid these types of accidents*."

  "*Because parking lot and vehicle accidents do occur, store owners should install pedestrian protection on their side walk where parking spaces are located directly in front of the building, sidewalk, and/or entrance doors. …Bollards create a strong safety barrier between vehicles and your building and pedestrian walkways*."

  "*Retailers are implicitly 'inviting' customers to their store to shop. Because of this invitation, retailers are obligated to create and maintain a safe shopping environment. Enhance your store's pedestrian safety and building security by installing protective bollards*."
- 2018 Sompo International Insurance: "*Wheel stops are traditionally made of concrete, rubber, or wood (e.g., old railroad ties) and are often installed to provide separation between vehicles and pedestrian walkways. While they can be an effective means of preventing pathway encroachment, they are a leading cause of trip and fall occurrences because they sit low to the ground and are often out of a pedestrian's direct line of sight. As such, more and more parking areas are removing them altogether, or replacing them with alternative solutions*."

  "*When evaluating the use of wheel stops, be sure to consider the following: Are wheel stops really needed? **Even in locations where wheel stops are already in use, it is important to carefully evaluate if they are needed or an alternative solution is more appropriate**. …Alternatives to wheel stops include bollards, landscape pots and flexible ADA signage, all of which can help reduce slip, trip and fall occurrences*." [Bold emphasis added.]
- 2019 Red River Mutual (Canada) "Loss Prevention Safety Tip": "*A combination of methods can be implemented to protect your business from damage due to vehicle impact.*

  "*The types of barriers that can be erected to prevent these accidents include bollard posts, large planters or other architectural items that actually enhance appearance while offering a layer of protection. Bollards can be removable, retractable or fixed…*"

  "***Standard 6 to 8-inch car stops or curbs are not effective barriers for moving vehicles**. Once the wheels roll up over the edge, there's nothing to impede the vehicle's momentum*." [Bold added.]

Discussion – Added Safety Benefits of Structural Bollards

Clearly, the primary reason to consider reducing (or even eliminating) wheel stops from most parking facilities, particularly at areas of concentrated pedestrian usage, is to reduce the potential for injurious trip-and-fall incidents. An additional safety benefit of replacing wheel stops with structural bollards is the associated reduction in the potential for vehicle crashes into busy storefronts and/or pedestrians.

Consider, at Photo 11 below, the two parking spaces positioned directly adjacent to the entrance of a popular grocery store in Northern California. For years, this narrow entryway also had been used at various times by local community groups for their fundraising purposes, until an elderly driver who mistook his car's gas pedal for the brake pedal inadvertently drove over a wheel stop into a group of young girls selling cookies.

A key dispute of the ensuing litigation was whether or not the store owner had reasonably assessed and abated potential risks of accidents related to this vehicle/pedestrian interaction zone. In particular, should the owner have recognized that bollards were needed to prevent foreseeable vehicle intrusion into this often-crowded entryway?

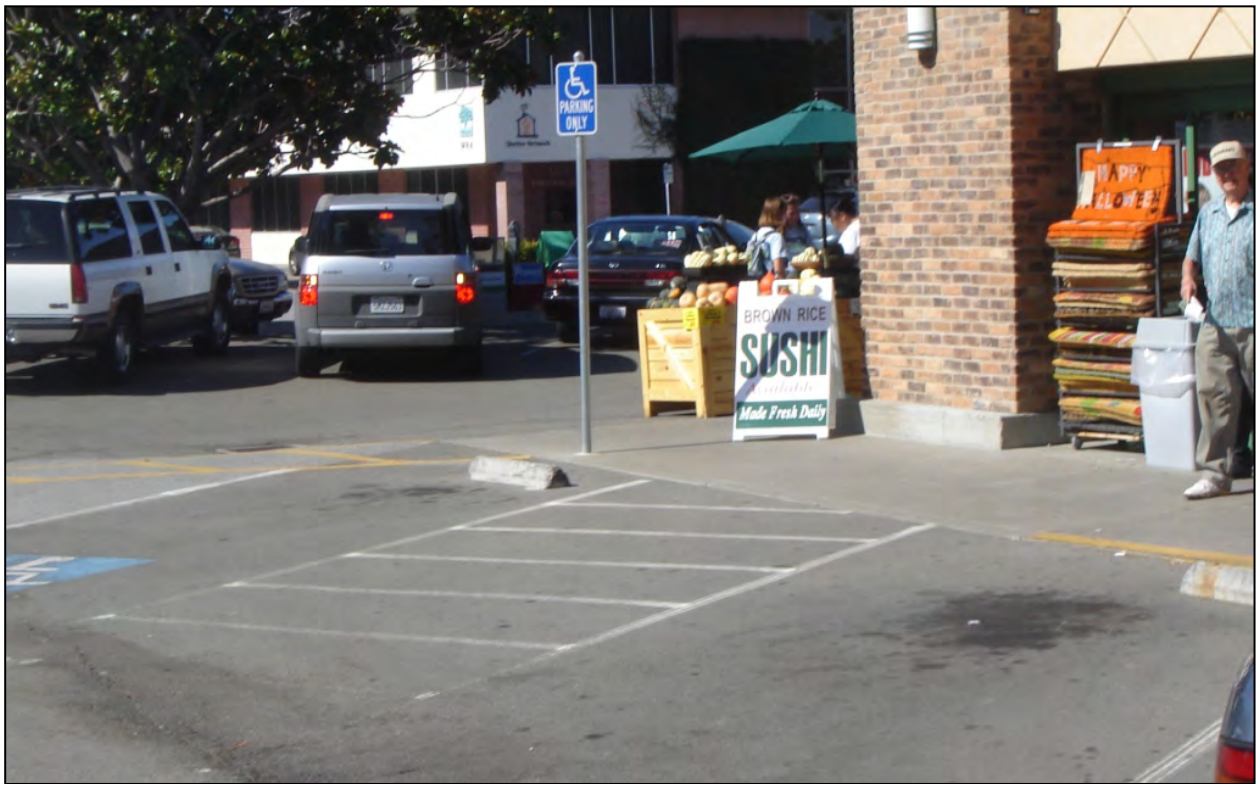

Photo 11 – These wheel stops did not prevent a driver from accidently accelerating into a group of young girls selling cookies at the often-crowded entryway to this grocery store.

In 2018, a news release from the Storefront Safety Council (www.storefrontsafety.org) reported:

- *"Vehicles crash into commercial locations such as retail centers, restaurants, convenience stores and office buildings more than 60 times per day in the United States, killing approximately 500 victims per year and seriously injuring more than 4,000 people annually…"*

  "'Data from this past year seem to show the impact of two particular hazards,' said Rob Reiter, co-founder of the Storefront Safety Council. "The latest stats are showing an increase in incidents involving texting and other distracted-driving risks, as well as an increase in incidents involving

> *drugged or impaired driving, which is likely a result of the national opioid crisis and the legalization of marijuana in certain states.'"*[9]
>
> "*The Storefront Safety Council was launched in 2011 to reduce the number of vehicle-into-building crashes. These mostly preventable accidents are injuring and killing Americans where they work, play, shop and eat. The Council is comprised of volunteers from a variety of backgrounds who are passionate about ending storefront crashes*."

Obviously, these startling vehicle-into-building and related vehicle-into-pedestrian statistics involve far more than drivers accidentally accelerating over wheel stops after mistaking their cars' gas pedals for their brakes. Even so, it is abundantly clear that every time a wheel stop reasonably can be replaced with a structural bollard, particularly at busy storefronts, the overall safety and welfare of these businesses' customers and the general public will have been significantly increased.

Further, an additional degree of safety at accessible parking spaces is provided when posts supporting required signage are encased and protected (i.e., compare Photo 12 below with Photo 11 above) by bollards. Otherwise, when a vehicle accidently hits a signpost, it is not uncommon for the metal sign to fold forward into the car window – potentially injuring the occupants.

Photo 12 – Structural bollards also protect the required signposts at these accessible parking spaces.

[9] Also reference Mr. Reiter's personal website: www.storefrontcrashexpert.com.

To these ends, consider the following extracts from Section 17.48.070 ("Parking lot safety standards") of the current City of Malibu Municipal Code:[10]

- "*Vehicle Impact Protection Devices Required. Vehicle impact protection devices shall be required for parking spaces that are angled between thirty (30) to ninety (90) degrees relative to any outdoor pedestrian seating area that is adjacent to the head of the parking space; the requirement to install vehicle impact protection devices shall apply to all commercial uses.*"
- "*Vehicle impact protection devices may take the form of bollards, barriers, or a combination of both…*"
- "*Performance Standard. All vehicle impact protection devices shall be engineered and determined to be in compliance with the low-speed vehicle impact testing standards F3016 (S20 or S30) prescribed by ASTM International. …If the vehicle protection device is not S-rated, an analysis of the site conditions, approach routes, topography and type of proposed vehicle impact protection device(s), including size and depth of footings, shall be submitted showing the vehicle impact device(s) to be equivalent to an S20 or S30 standard.*"[11]
- "*Sign Poles Located within Five Feet of the Head of a Parking Space Shall be Mounted on a Vehicle Impact Protection Device.* ***Any sign pole which is taller than thirty-six (36) inches in height, and which is located within five feet of the head of the parking space that is required by this section to have a vehicle impact protection device, shall be securely mounted or affixed to a vehicle impact protection device in a manner that prevents it from detaching in the event it is impacted by a vehicle.*** *The vehicle impact protection device, pole and sign shall be centered at the head of the parking space. The exception to this requirement is when the sign pole is located between required vehicle impact protection device(s) and pedestrian outdoor seating in such a manner that the device(s) would prevent a vehicle from hitting the sign pole.*" [Bold added.]

It should be noted that above-cited bollard expert Rob Reiter closely assisted the City of Malibu with initial drafting and subsequent finalization of the City's boldly proactive safety standard.

- "*In drafting the amendments, staff has worked with Rob Reiter, a Safety and Security Specialist and cofounder of the Storefront Safety Council, to ensure that the proposed amendments maintain the high safety standard originally envisioned by the ordinance. Mr. Reiter was one of the expert's staff consulted during the creation of the original ordinance.*"
- "*The other issue that has arisen is that there is no adopted standard for determining whether an existing or planned barrier such as a wall, large tree or large rock meets the ASTM F3016 testing standard as these barriers have not been tested and certified as meeting the standard. Staff has fielded several questions as to the appropriate expert to certify compliance. In some instances, according to Mr. Reiter, a traffic safety engineer may be the best option for property owners or in some instances, a combination of a traffic safety engineer and a structural engineer.*"[12]

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[10] https://qcode.us/codes/malibu/view.php?version=beta&view=mobile&topic=17-17_48-17_48_070

[11] https://www.astm.org/newsroom/new-astm-low-speed-impact-testing-standard-aid-lowering-risk-storefront-car-accidents: "*Grainy security-camera footage capturing a car as it plunges through glass into a store is seen all too often on television and Internet news sites. The commonplace nature of such accidents signals a need for better storefront protection from errant cars. Protective barriers are becoming an increasingly important component of preventing or minimizing the damage from such accidents. Now, a new ASTM standard quantifies the dynamic performance of vehicle protective devices at speeds of 50 km/h (30 mph) and lower.* ***ASTM F3016, Test Method for Surrogate Testing of Vehicle Impact Protective Devices at Low Speeds, was developed by Subcommittee F12.10****… All interested parties are welcome to participate in the ongoing standards development activities of F12.10. 'The subcommittee is particularly interested in working with stakeholders who want a testing protocol that will provide definitive guidance for testing products to be incorporated into public safety programs, site security specifications and property protection features,' says ASTM member Rob Reiter, co-founder, Storefront Safety Council.*" [Bold emphasis added.]

[12] https://www.malibucity.org/AgendaCenter/ViewFile/Item/3376?fileID=5190

Discussion – California Assembly Bill 2161 (AB-2161)

Effective January 1, 2017 (approved by Governor Jerry Brown on July 22, 2016): new Section 11895 of the California Insurance Code requires, in part:

"*(a) An insurer may consider the installation of vehicle barriers as a safety measure and may provide or offer a discount on the property owner's insurance covering damage or loss to the covered commercial property or liability arising out of the ownership, maintenance, or use of the commercial property relative to the reduced risk to the property as a result of installation of the barriers…*"

"*(b) For the purposes of this section, a vehicle barrier is a safety device that meets, at a minimum, the vehicle impact protection standards as provided by the State Fire Marshal and adopted by the California Building Standards Commission and that is installed to protect persons located within, in, or on the property of, buildings, or to protect pedestrians, from collisions into those buildings by motor vehicles.*"

These provisions (while relatively modest in actual force)[13] were shepherded through the Legislative process by Assemblymember Bill Quirk (D-Hayward), who subsequently was honored for his efforts by being named "Legislator of the Year" by the California Public Parking Association (CPPA):

- "*Ron Profeta, the 2016 President of CPPA made the announcement today at its 33rd Annual Conference. Assemblymember Quirk was granted this award for his work on AB 2161, which provides for clearer codes statewide for safety barriers used in places such as parking lots (especially retail, and storefronts) and provides for insurers to give discounted rates to property owners and business owners who install approved protective devices. 'Saving lives, saving property, saving money -- how many times can you say those things about a single piece of legislation?' Profeta said.*"

  "'*I am humbled by CPPA's award. Storefront crashes happen far more frequently than people realize. Many of these crashes result in tragedy. I know that my bill will help save lives by guiding standards and building codes. I thank CPPA for their recognition,' Assemblymember Quirk stated upon learning he was the recipient of the award.*"[14]

We also applaud Assemblymember Quirk for his efforts to promote the use of structural bollards, particularly at busy storefronts. Similarly, the Storefront Safety Council has reported:

- "*AB-2161, written and championed by California State Assemblyman Bill Quirk (D-20), passed the California Assembly and Senate with no dissenting votes, and was signed into law July 22 by Governor Jerry Brown. The new law makes California the first state in the U.S. to encourage through statute the use of protective safety barriers at vulnerable locations including parking lots, retail centers, office buildings and restaurants.*"

  "*The law 'provides that the use of certain vehicle barriers at a commercial property may be considered by insurers as safety devices that qualify for a discount on the owner's insurance premiums,' explained Storefront Safety Council Co-Founder Rob Reiter.*"[15]

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[13] As originally proposed (but not ultimately adopted), AB 2161 additionally would have mandated that: "*The California Building Standards Commission, in collaboration with the State Architect and the State Fire Marshal, **shall** consider standards, and **shall** update standards as it determines necessary, for the installation of vehicle barriers to protect persons located within, or in or on the property of, buildings, or to protect pedestrians, from collisions into those buildings by motor vehicles. …the standards considered shall include existing standards adopted or developed by a standard-setting organization recognized by the commission, including, but not limited to, the American Society for Testing and Materials (ASTM) or another similar organization.*" [Bold emphasis added.]

[14] https://a20.asmdc.org/press-release/california-public-parking-association-names-assemblymember-quirk-%E2%80%9Clegislator-year%E2%80%9D-his

[15] http://www.storefrontsafety.org/blog/category/restaurant-crashes

Discussion – Must Accessible Parking Spaces Be Positioned at Busy Storefront Entryways?

Consider the busy storefronts and adjacent accessible parking spaces seen above in Photos 1, 2, 4, 5, 11, and 12 --- must these accessible parking spaces be located directly in front of these businesses?

- Section 208.3.1 of the 2010 ADA Standards (and associated Section 11B-208.3.1 of the California Building Code) mandate that accessible parking spaces serving a particular building or facility must be located on the shortest wheel-chair accessible route from the adjacent parking facility or lot to the accessible main entrance.
- Further, where parking serves more than one accessible entrance, such accessible parking spaces must be dispersed and positioned on the shortest accessible routes to every accessible entrance.

In short, while there is no code or standard that requires the creation of <u>new</u> accessible parking spaces directly in front of busy storefront entryways, the closest <u>existing</u> parking (wherever located) must be made accessible. Often, as seen in Photos 1, 2, 4, 5, 11, and 12, it does make the most sense (socially and economically) to provide these accessible spaces directly at busy storefronts, per Photo 13:

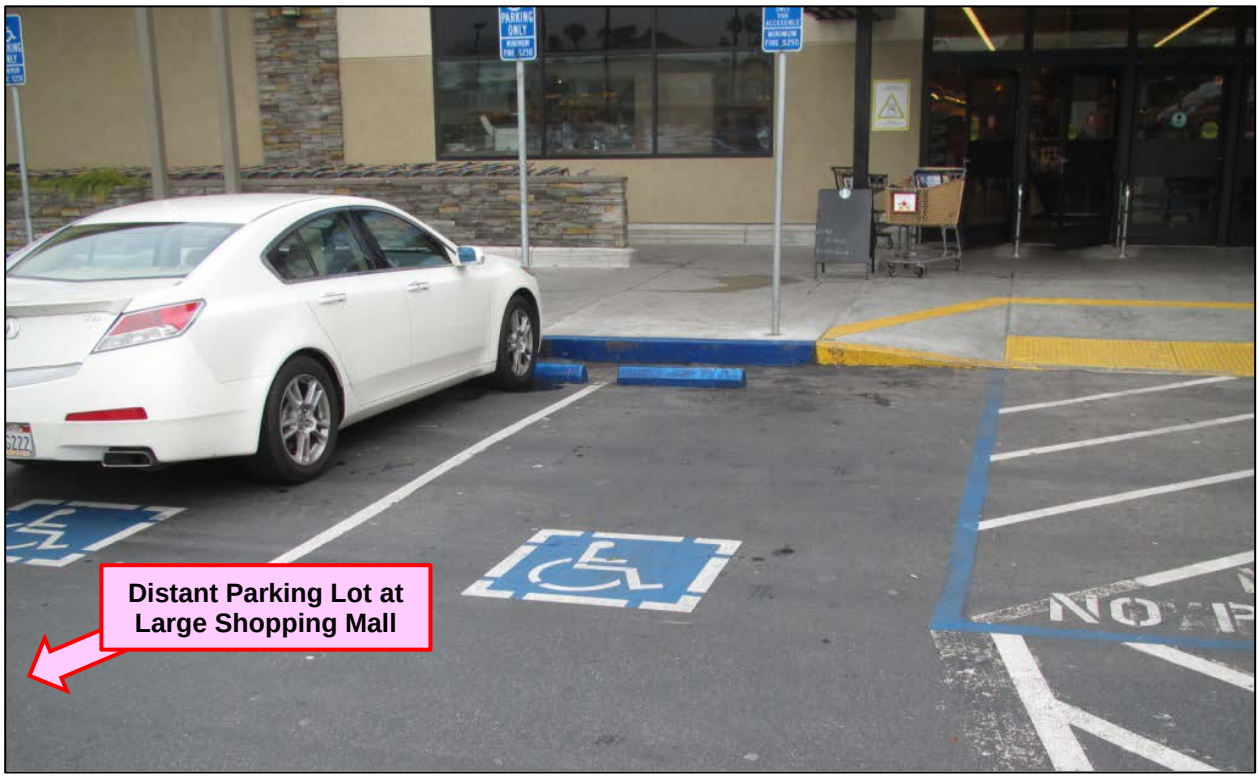

Photo 13 – At this busy storefront, patrons steadily stream across the wheel stops at these accessible parking spaces while traveling to and from a distant parking lot at a large shopping mall in Northern California.

However, in our professional opinion, this store's customers would be better served (and far safer) if owners or managers elected to: a) install structural bollards, preferably compliant with ASTM F3016, and b) eliminate these existing wheel stops, which serve no code-required nor code-recommended purpose (and at which one or more injurious falls are known to already have occurred).

Clearly, from a loss control (risk reduction) perspective, these proactive, and relatively inexpensive, actions would serve to halt runaway vehicles while concurrently removing known pedestrian tripping hazards (and might even lead to an insurance discount per AB-2161). This should be a simple risk-benefits equation.

- **Case Study #1**

Despite varying degrees of risk for injurious pedestrian falls, there can be valid uses for certain wheel stops in parking facilities. Properly positioned wheel stops can serve to lessen the likelihood of damaging structural encounters, improve certain aspects of pedestrian safety, and promote improved egress and accessibility in conformance with applicable codes and standards.

Still, where it reasonably can be expected (or already has been evidenced) that the inherent pedestrian trip-and-fall risks associated with wheel stops outweigh projected benefits, they should be removed in favor of structural bollards. Generally, the services of experienced architects, engineers, or traffic control professionals should be used for such risk-benefits evaluation processes.

- Further, here in California, the services of a Certified Access Specialist also may be necessary to confirm state/federal requirements for accessible parking spaces and associated paths of travel.[16]

Consider, at Photo 14, the dangerously positioned wheel stop at an accessible parking space serving a popular grocery store in Northern California. After multiple pedestrian injuries, store managers had the wheel stops painted with black/yellow striping --- unfortunately, such falls continued to occur.

- Eventually, upon litigation by an injured customer, the managers (presumably after consultation with an appropriate professional) acknowledged that the presence of the structural bollards fully obviated any code-required need for these wheel stops and had them removed (Photos 15 and 16).

Photo 14 – Case Study #1: after multiple pedestrian falls, this dangerous, non-required wheel stop was removed.

[16] Reference the "Voluntary Certified Access Specialist Program" promulgated at Title 21, Subchapter 2.5 of the California Code of Regulations and controlled by the Division of the State Architect.

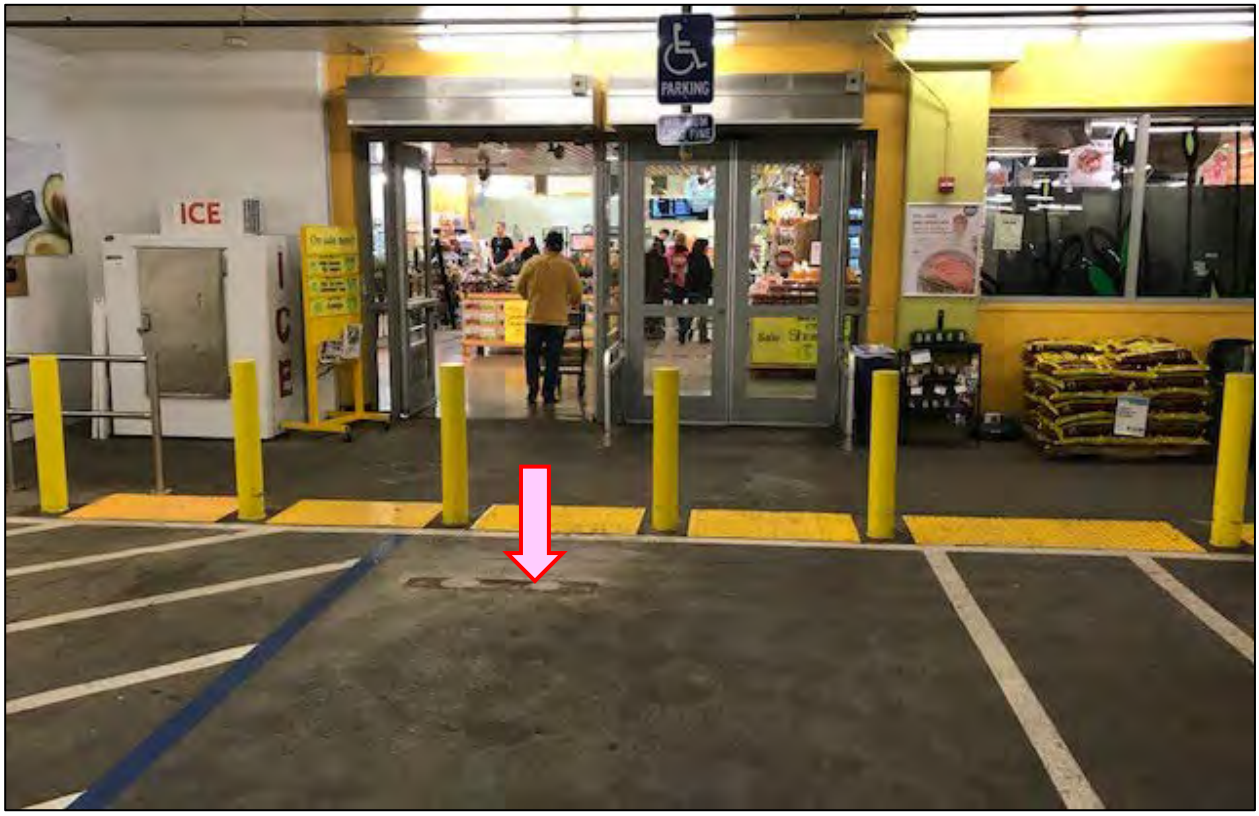

Photo 15 – Case Study #1: after multiple pedestrian falls, this dangerous, non-required wheel stop was removed.

Photo 16 – Case Study #1: after multiple falls, these dangerous, non-required wheel stops were removed.

Parking owners and managers should make wheel stop modifications (including their removal, where appropriate) and/or upgrades that reasonably serve to promote a high degree of life safety. A foundational principle of this proactive process should be recognition that the greater the rates and range of pedestrian and vehicular traffic at and near any particular wheel stop the greater the foreseeable likelihood of an eventual injurious accident unless additional measures are taken to abate these undue hazards. At busy storefronts, such risk-benefits analyses almost always will support a decision to install structural bollards (to prevent vehicle encroachment) and to remove all wheel stops (thereby eliminating pedestrian tripping hazards).

Summary Discussion and Recommendations

We applaud the Storefront Safety Council and the authors of ASTM F3016 ("*Standard Test Method for Surrogate Testing of Vehicle Impact Protective Devices at Low Speeds*")[17] for their efforts to promote and standardize the design and testing of structural bollards and their use to lessen the risks and severity of increasingly common vehicle-into-pedestrian and vehicle-into-building crashes.

Our simple goals for this paper are: a) to highlight the unacceptably high risks of pedestrian injuries inherent with placing wheel stops at or near most busy storefronts; b) to emphasize that the only code-required (or code-recommended) purpose for using wheel stops is to deter vehicle encroachment into the required width of accessible pedestrian routes; and c) to recommend, at a minimum, substituting any form of structural bollards, light posts, and/or planters that reasonably can serve to thwart such vehicle encroachment and therefore also allow total removal of existing wheel stops at storefronts.

- **It's a "Win-Win" Equation: (Bollards - Wheel Stops) = (Increased Vehicular Protection + Decreased Risk of Pedestrian Trip-and-Fall Incidents)**

➢ Case Study #2

Consider at Photo 17, at a popular grocery store in Northern California, the well-designed accessible parking spaces serving the accessible pedestrian route to the main entry. Structural bollards prevent vehicle encroachment into this wheelchair-accessible path of travel and protect against vehicle-to-pedestrian and vehicle-to-vehicle interactions and also protect required signposts and signage. There are no wheel stops anywhere in this parking lot.

Photo 17 – Case Study #2: These well-designed accessible parking spaces serve the wheelchair-accessible walkway leading to the main entry (at left) at a highly popular store in Northern California.

[17] https://www.astm.org/Standards/F3016.htm

Clearly, upon comparison with the relatively hazardous accessible parking conditions documented in Photos 4, 11, 13, and 14 above, the design professionals responsible for the layout seen in Photo 17 should be commended. Reviewers should note the following:

- Due to existing site conditions, it is not practical to provide wheelchair-accessible parking spaces directly along the storefront (at the left). The parking spaces seen in Photo 17 and the associated pedestrian route are fully ADA-compliant.
- Along with the structural bollards, the positioning (perpendicular to the busy storefront) of these accessible spaces serves to further lessen risks of vehicle-pedestrian incidents if drivers mistake their gas pedals for their brakes.
- Further, encasing the required signposts into the bollards greatly lessens risks of injury to drivers and passengers caused by smashed windows due to crumpled signage during such accidents.
- Along with the absence of wheel stops, the "zero curb" transitions from the striped access aisles to the accessible walkway even further reduce risks of pedestrian trip-and-fall injuries.
- Also note: the whitish markings seen on these recently installed black-painted structural bollards simply represent widespread paint failures (due to improper priming of the galvanized steel) – not evidence of vehicle impact.

  However, even if it could be argued that these paint failures actually were evidence of damaging vehicle-bollard interaction, we still categorically would reject any argument to install wheel stops to signal drivers about getting too close to these barriers. The pedestrian health and safety hazards inherent with wheel stops far outweigh any relatively minor concerns about scraped bumpers.

It is not our position that the excellent design seen in Photo 17 represents a new minimum industry standard for accessible parking spaces; however, this installation (no wheel stops, structural bollards encasing required signposts, zero curb transitions, and parking perpendicular to the busy storefront) certainly represents modern "best practice". We urge all parking designers, engineers, and managers to similarly strive to improve pedestrian safety by eliminating or reducing the use of wheel stops at busy storefronts and comparable areas of pedestrian congestion.

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