Position Paper: Uses and Misuse of Wheel Stops at Parking Spaces in California (January 15, 2018) ©

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Uses and Misuse of Wheel Stops at Parking Spaces in California

As documented in the following photographs, wheel stops are physical barriers installed at parking spaces to deter potentially problematic vehicle movement. It is important to emphasize that these devices do not function as a protective safeguard against moving vehicles – serious injuries and/or extensive property damage are the not-uncommon consequences of cars accidently being driven over standard wheel stops.¹

Instead, in most situations, 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. For example, when a slowly-moving vehicle comes into contact with the concrete wheel stops seen in Photo 1, the driver knows that any further forward movement could lead to a physically damaging interaction with this massive wall.

¹ These accidents often occur when a driver mistakenly steps on the gas pedal instead of the brake.

Photo 1 – These wheel stops protect drivers and their cars from damaging interaction with this concrete wall.
Photo 2 – These wheel stops prevent: a) encroachment into the marked accessible pathway, and b) damaging interaction with steel posts that hold required signage. (Also note the structural bollards at right.)

Photo 3 – These wheel stops protect drivers and their cars from damaging interaction with required steel posts.
Photo 4 – Wheel stops often are improperly positioned at (or near) the painted edge of a parking space – thereby increasing the risk of injurious pedestrian falls.

Photo 5 – These closely adjacent wheel stops serve to create an unduly narrow pedestrian passageway that increases the risk of injurious falls.
Introduction

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. Nationwide, many hundreds (if not thousands) of individuals annually suffer a wide range of trip and fall injuries from unexpected interaction with these projections. Ensuing insurance claims and associated legal filings tend to highlight stark differences between typical defense and plaintiff assessments of the merits of such litigation. We have encountered the following (highly generalized) litigation perspectives:

- Defense attorneys and consultants, focused on the purportedly ‘open and obvious’ nature of subject wheel stops, who argue that the injured plaintiffs simply should have better watched where they were walking.

- Plaintiff attorneys and their consultants who strive to delineate a variety of factors (physical and personal) that purportedly have rendered the subject wheel stops unobvious and unduly dangerous in alleged violation of certain codes, standards, and/or industry practice.

While recognizing that most of these injury claims involve unique sets of specific conditions and circumstances that often will tend to favor either the plaintiff or the defendant, our goal for this educational brief is to present a balanced viewpoint that includes general risk assessments and ‘best practice’ recommendations regarding standard uses of wheel stops in parking lots. To this end, this position paper reviews and incorporates relevant guidance from the following literature:

- Traffic Engineering Handbook by Institute of Transportation Engineers (ITE)
- ASTM F1637 (Standard Practice for Safe Walking Surfaces)
- 2010 ADA Standards for Accessible Design
- Chapter 11 (Accessibility) of the 2015 International Building Code
- Chapters 11A and 11B of the 2016 California Building Code

Literature Review – ITE Traffic Engineering Handbook

Founded in 1930, the Institute of Transportation Engineers “…is an international membership association of transportation professionals who work to improve mobility and safety for all transportation system users and help build smart and livable communities …(t)hrough meetings, seminars, publications and a network of more than 14,000 members, working in more than 90 countries.”

ITE’s Traffic Engineering Handbook 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’.” [Bold emphasis added.]

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2 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)
3 www.ite.org/aboutite/index.asp
Chapter 14 (Section K.4) of the 2009 ITE Handbook provides the following guidance: “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);”
- “...using boundary control and curb placement that avoids vehicle overhang into public right of way and sidewalks;”
- “...providing adequate light to discern fixed objects.”

We agree with the ITE team that paths of travel in parking lots and facilities should be adequately lit in a manner that enables intended users to discern fixed objects, including wheel stops. Similarly, we generally would agree that the use of wheel stops in pedestrian pathways should be minimized – except where required by controlling regulations regarding accessibility\(^5\) or as deemed necessary to deter damaging vehicle encounters.

- Note: in lieu of wheel stops, the authors of the ITE Handbook (at Chapter 14, Section G.2) recommend the use of ‘bollards’\(^6\): “to limit encroachment into the accessible route (wheel stops should not be used).”

- While we would agree that the use of structural bollards, where practical, often is preferable to wheel stops at transitions between parking areas and designated pedestrian travel paths, particularly at locations of high pedestrian traffic (e.g., at main entryways to grocery stores), there certainly are situations where the use of either or both of these devices is appropriate.

  - Consider Photo 2 (taken in an Amtrak parking garage). The red and yellow cars are parked in accessible spaces required by the Americans with Disabilities Act. In front of each of parking space is a steel post that supports signage mandated by the California Building Code. The wheel stops serve to lessen the chances of damaging ‘car vs. post’ interactions, and both the wheel stops and steel posts serve to prevent encroachment into the striped pedestrian pathway.

  Meanwhile, the adjacent concrete-reinforced structural bollards provide a strong physical barrier against runaway vehicle intrusion into a heavily used area of pedestrian egress.

- We recommend that designers of new parking facilities and lots should closely consider the use of structural bollards to protect areas of concentrated pedestrian traffic.

**Literature Review – ASTM Standard F1637 (Standard Practice for Safe Walking Surfaces)**

ASTM F1637 (Standard Practice for Safe Walking Surfaces), first issued in 1995, is a voluntary standard published by ASTM International\(^7\) --- founded in 1898 as the American Society for Testing and Materials --- which is comprised of a large worldwide body of technical experts and business professionals, serving in 143 standards-writing committees, that produce 12,000 technical standards used throughout the world to enhance safety, improve quality, and build consumer confidence in manufactured products.

- The ASTM committee that addresses pedestrian safety is F13 (Pedestrian/Walkway Safety and Footwear), which controls 16 standards distributed between seven subcommittees.

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\(^5\) E.g., Section 11B-502.2 of 2016 California Building Code: “A curb or wheel stop shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.”

\(^6\) Structural “bollards” (see Photo 2) 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.

\(^7\) [www.astm.org](http://www.astm.org)
An “industry standard” is a consensus-written document that reflects a broad spectrum of interests within a specific industry or professional field. (The industry standards produced and maintained by ASTM are known to exhibit great technical competence and high credibility.) In general, ASTM standards are voluntary in nature unless subsequently adopted by a regulatory entity or specifically referenced by a licensed design or engineering professional.

- For example, the many ASTM standards that are partially or fully referenced within the California Building Code have the same force of law as other CBC requirements.
- Similarly, ASTM standards can achieve the legal force of contract law when referenced by licensed professionals in project specifications and stamped construction drawings.

In contrast, certain ASTM standards, including F1637, simply provide a recommended standard of care that may voluntarily be accepted and promoted by affected interest groups.

- To the best of our knowledge, no regulatory entity or other government body has formally adopted the standards of care recommended by the authors of ASTM F1637 for ensuring safe walking surfaces. Instead, this document’s guidance represents recommended safety practices developed by a committee of knowledgeable safety professionals.

Section 9 of ASTM F1637 provides the following guidance regarding wheel stops:

- 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.
- 9.3 Wheel stops shall be in contrast with their surroundings.
- 9.4 Wheel stops shall be no longer than 6 feet and shall be placed in the center of parking stalls. The minimum width of pedestrian passage between wheel stops shall be 3 feet.
- 9.5 The top of wheel stops shall not exceed 6.5 inches in height above the parking lot surface.
- 9.6 Adequate illumination shall be maintained at wheel stops as governed by local codes and ordinances or, in their absence, recommendations set forth by the Illuminating Engineering Society of North America.
- 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.

Upon review:

- In general, we would agree that the use of wheel stops in parking facilities should be avoided where practical; however, there certainly are situations where the installation of wheel stops make good sense and, as further reviewed below, wheel stops often are required at parking spaces that adjoin accessible paths of travel.
- Similarly, while we would agree that use of wheel stops in “foreseeable pedestrian paths” should be minimized where legal and practical, we also recommend that both components (“foreseeable” and “pedestrian paths”) of this broad phrase should be defined narrowly.

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8 1997 UBC/2006 IBC Nonstructural Comparison & Cross Reference, International Code Council, Whittier, CA: “ASTM employs a consensus process that ensures technically competent standards that have the highest credibility when used as the basis for regulatory policy.”

9 For example, while it is likely that, sooner or later, pedestrians will walk across one or more of the wheel stops seen in Photo 1, these wheel stops are not located on a formal or informal “pedestrian path”. (Similarly, even if it were certain that meandering pedestrians would, over time, elect to wander across every square foot of any particular parking lot, it would not be reasonable to assert that every square foot of this facility is located on a pedestrian pathway.)
• We agree that wheel stops should be in contrast with their surroundings (e.g., see Photo 1) and should be adequately lit for intended pedestrian use in conformance with applicable codes and ordinances. (The potential applicability, in certain situations, of recommendations set forth by the Illuminating Engineering Society of North America should be considered by the designer on a case-by-case basis.)

• As previously noted, we recommend that designers of new parking facilities and lots should closely consider the potential merits of using structural bollards to protect areas of highly concentrated pedestrian traffic from moving vehicles.

• Typical front wheel-to-wheel track clearances for most automobiles measure about five feet (or less). Commonly, the minimum prescribed widths of accessible automobile parking spaces in California range from eight\textsuperscript{10}-to-nine\textsuperscript{11} feet (and the minimum prescribed widths of accessible van parking spaces range from eleven\textsuperscript{12}-to-twelve\textsuperscript{13} feet).

  o With the centered maximum 6-foot-long wheel stops accepted by the authors of ASTM F1637, at least one of the front tires will come in contact with the wheel stop when entering any of these accessible parking spaces, no matter its prescribed minimum width.

• Wherever the use of wheel stops is deemed necessary at parking spaces, we recommend that the designer should consider the potential merits of specifying centered wheel stops (max. 6 feet) that serve to create minimum 3-foot wide pedestrian passageways between wheel stops at adjoining spaces.

Additional Discussion: the Use of Non-Centered Wheel Stops at Parking Spaces

As extensively reviewed throughout this position paper, the use of shorter (typically, 3- or 4-foot) non-centered wheel stops at both regular and accessible parking spaces is common. These smaller wheel stops (e.g., Photos 1 thru 5) tend to be positioned at or near the painted striping that delineates one or the other sides of the space.

• An advantage of shorter wheel stops (compared with longer) is the decreased safety risk to pedestrians whenever the wheel stops are not covered by parked vehicles.

• However, when vehicles are parked, a disadvantage of smaller non-centered wheel stops is an increased safety risk (compared with centered wheel stops) from that portion of the wheel stop that commonly protrudes out from under the parked car (e.g., see Photo 5).

• We urge parking space designers to closely consider, on a case-by-case basis, the potential pros and cons of the use of ‘shorter non-centered’ vs. ‘longer centered’ wheel stops.

Further, where the parking space designer reasonably has determined that the use of non-centered wheel stops is appropriate, we recommend these devices be installed no closer than 8 to 10 inches (where practical) from the inner edge of the painted perimeter striping. In other words, because the striping at accessible parking spaces commonly is four inches wide, it is our opinion that wheel stops positioned directly opposite the same perimeter striping, as seen in Photo 5, should provide a minimum 20 to 24-inch wide pedestrian passageway between them.\textsuperscript{14}

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\textsuperscript{10} Section 502.2 of 2010 ADA Standards for Accessible Design: “Car parking spaces shall be 96 inches wide minimum.”

\textsuperscript{11} Section 11B-502.2 of 2016 California Building Code: “Car parking spaces shall be 108 inches wide minimum.”

\textsuperscript{12} Section 502.2 of 2010 ADA Standards: “…van parking spaces shall be 132 inches wide minimum.”

\textsuperscript{13} Section 11B-502.2 of 2016 CBC: “…van parking spaces shall be 144 inches wide minimum.”

\textsuperscript{14} As previously noted, we agree with the authors of ASTM F1637 that parking facility designers should strive (best practice) to provide minimum 36-inch wide pedestrian passageways between adjoining wheel stops where practical.

First published in 1961 as industry standard ASA A117.1,¹⁵ and now co-published by the American National Standards Institute¹⁶ and the International Code Council¹⁷, industry standard ICC/ANSI A117.1 (Accessible and Usable Buildings and Facilities) has long served as the primary technical underpinning for most federal, national, and state laws and codes regarding access for the physically disabled.

Section 502.8 of A117.1-2009 mandates that: “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.” (Note: this foundational standard neither requires nor forbids the use of wheel stops. Instead, its authors simply specify that parking spaces must be designed and constructed in such a manner that parked cars cannot encroach into the required width of accessible pedestrian routes.)

Similarly, 29 years prior to the issuance of A117.1-2009, the authors of A117.1-1980¹⁸ also had specified: “Parked vehicle overhangs shall not reduce the required width of an accessible route.” Further, per Figure 1 below, this mandate had been supplemented by a detail (titled ‘Dimensions of Parking Spaces’) demonstrating the use of centered wheel stops to prevent such encroachment.

![Figure 1 - This supplemental (i.e., non-binding) detail, copied from A117.1-1980, shows centered wheel stops.](image)

¹⁵ A117.1-1961 (American Standard Specifications for Making Buildings and Facilities Accessible to, and Usable by, the Physically Handicapped) by American Standards Association and the National Society for Crippled Children and Adults in coordination with University of Illinois under a grant from the Easter Seal Research Foundation.

¹⁶ www.ansi.org

¹⁷ www.iccsafe.org

The very same verbiage and detail are found in A117.1-198619 and A117.1-199220; however, in subsequent editions of this A117.1 standard this non-binding supplemental detail has been replaced with a new detail (‘Vehicle Parking Space Size’) that provides no informal guidance regarding how wheel stops (or other devices) could be used to prevent improper “overhangs” of parked vehicles.

**Literature Review – 2010 ADA Standards for Accessible Design**

Promulgated by the U.S. Department of Justice, the 2010 ADA Standards for Accessible Design establish updated minimum requirements (scoping and technical) for newly designed/constructed and altered public accommodations and commercial facilities to ensure minimum accessibility and usability by disabled individuals in accordance with the requirements of Titles II and III of the Americans with Disabilities Act of 1990.

- 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 ADA Standards confirms: “Wheel stops are an effective way to prevent vehicle overhangs from reducing the clear width of accessible routes.”

In short, for the 2010 ADA Standards, the DOJ has formally adopted the language of Section 502.8 of ICC/ANSI standard A117.1-2009 and then informally has accepted the use of wheel stops (where needed) to prevent parked vehicles from encroaching into the minimum required width of adjacent accessible pedestrian routes.

- As reviewed and detailed above, the origins of this informal wheel stop guidance can be traced back to the ASNI A117.1-1980 standard.
- As reviewed and detailed later in this paper, the requirements of the 2010 ADA Standards have been copied and promulgated in Chapter 11B of the current California Building Code.

**Literature Review – Chapter 11 (Accessibility) of 2015 International Building Code**

The International Building Code (IBC), first published by the International Code Council in 2000, is a “model” code that sets forth current minimum requirements to safeguard the public health, safety and general welfare of the occupants of new and existing buildings and structures. As a model code, the IBC has no force of law unless adopted and promulgated by a controlling jurisdiction.

- E.g., as further reviewed below, the non-binding 2015 International Building Code model serves as the foundation for the greatly amended statewide 2016 California Building Code.

Accessibility provisions of the model IBC are founded on ANSI A117.1 (as reviewed above):

- “While the IBC contains scoping provisions for accessibility (e.g., what, where and how many), ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities, is the referenced standard for the technical provisions (i.e., how).”21

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21 Introductory section (‘Effective Use of the International Building Code’) to the model 2015 IBC.
Therefore, across the United States, wherever and whenever any edition of the model IBC has been adopted and promulgated by a controlling jurisdiction, the technical requirements of the referenced ICC/ANSI A117.1 standard then have gained the force of law --- unless specifically modified by the controlling codes authority (e.g., the State of California).

- Similar to the ICC/ANSI A117.1 standard (as discussed above), current and past editions of the IBC provide no specific additional guidance or supplemental details regarding use of wheel stops to prevent parked cars from encroaching into the required width of accessible pedestrian routes.

**Literature Review – Chapters 11A and 11B of 2016 California Building Code**

As noted above, the 2016 California Building Code is modeled on the 2015 International Building Code. However, IBC Chapter 11 (Accessibility) has been replaced with two new chapters:

- Chapter 11A (Housing Accessibility), controlled by Department of Housing and Community Development, and
- Chapter 11B (Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing), controlled by the Division of the State Architect.

California’s leaders have had a long history of supporting the rights of the physically disabled:

- In the 1950’s and 1960’s, advocacy organizations throughout the nation increasingly pushed proposed new regulations and standards to support improved access to the built environment for the physically disabled --- (industry standard ASA A117.1 was first issued in 1961).
- Beginning in 1968, California adopted new and updated laws and regulations mandating minimum accessibility provisions for new and altered public and commercial buildings (per revisions to the Government Code) and then for new multifamily residential buildings (per revisions to the state’s Health and Safety Code).
  - Successive editions of A117.1 had set the minimum technical basis for implementation of these new laws.
- Then, a new ‘State Building Code’ first issued in 1981 and reissued in 1985 (followed by the renamed ‘California Building Code’ issued in 1989 and then reissued in 1991) compiled and codified these various accessibility provisions, including the following mandate:
  - “In each parking area, a bumper [i.e., wheel stop] or curb shall be provided and located to prevent encroachment of cars over the required width of walkways.”
  - Further, the 1981 and 1985 State Building Code included the supplemental details copied below at Figures 2 and 3:

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22 Until promulgation of the 2007 CBC (modeled on the 2006 IBC), prior editions of the California Building Code (since 1989) and its predecessor State Building Code (since 1973) had been based upon the model Uniform Building Code published by the International Conference of Building Officials.


24 In coordination with the U.S. Department of Housing and Urban Development, the scope of ANSI A117.1-1980 was expanded to include residential construction.

25 Introduction to 1981 State Building Code: “This 1981 Supplement of Part 2, Title 24, California Administrative Code is totally rewritten and reformatted from prior editions which were known as ‘Basic Construction Regulations.’ This edition of Part 2 has been reitled as the ‘State Building Code’ and incorporates by reference the 1979 Edition of the Uniform Building Code in accordance with Health and Safety Code Sections 18916 (e) and 18939.”
Figure 2 – Supplemental detail from the 1981 State Building Code depicts the use of non-centered wheel stops.

Figure 3 – Supplemental detail from the 1981 State Building Code depicts the use of non-centered wheel stops.
Comparable details are found in the 1991 California Building Code:

Figure 4 – Illustrative detail from 1991 California Building Code depicting: “4’ 0” wheel bumper – Typ.”

Figure 5 – Illustrative detail from 1991 California Building Code.
• While the various accessibility requirements of prior editions of the California Building Code and predecessor State Building Code promulgated by both the Department of Housing and Community Development and the Division of the State Architect had been dispersed throughout each code, beginning with the 1995 CBC these dual-track provisions were compiled and expanded by HCD and DSA into new Chapters 11A and 11B.
  o The technical foundation of these new chapters remained ASNI A117.1.

• Beginning with the 1981 State Building Code and extending through the 2010 CBC, the state’s ongoing requirements for accessible parking spaces included the following: “In each parking area, a bumper [i.e., wheel stop] or curb shall be provided and located to prevent encroachment of cars over the required width of walkways.”
  o Figures 6, 7 and 8 below are supplemental details in the 2001, 2007 and 2010 editions of the CBC. (As seen at Figures 4 and 5 above, similar details can be found in the 1989, 1991, 1995 and 1998 editions). Note that all of these figures depict non-centered wheel stops where needed to prevent improper vehicle encroachment into accessible walkways.

Figure 6 – Supplemental detail from 2001 California Building Code depicts the use of non-centered wheel stops at accessible parking spaces.
Figure 7 – Supplemental detail from 2001 California Building Code depicts the use of non-centered wheel stops.

Figure 8 – Supplemental detail from 2001 California Building Code depicts the use of non-centered wheel stops.
Prior to issuance of the 2013 California Building Code, the Division of the State Architect re-wrote Chapter 11B to conform to (and exceed, where deemed appropriate) the provisions, numbering and verbiage of the 2010 ADA Standards. E.g., as initially reviewed above:

- Section 502.7 of the 2010 ADA Standards and Section 11B-502.7 of the 2013 and 2016 editions of the CBC mandate that: “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, Section 11B-502.7.2 of the 2013 CBC and 2016 CBC advises: “A curb or wheel stop shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.” [Bold emphasis added.]

- This CBC section has the force of law throughout the State: wheel stops shall be installed where necessary to prevent vehicle encroachment into the required width of accessible pathways.

- Further, as reviewed above, this requirement conforms to the guidance of Advisory 502.7 of the 2010 ADA Standards: “Wheel stops are an effective way to prevent vehicle overhangs from reducing the clear width of accessible routes.”

Additionally, it is important to note the intent of the California Building Code, the 2010 ADA Standards, the model International Building Code, and the foundational ICC/ANSI A117.1 standard that appropriate measures (such as wheel stops or structural bollards) be taken at all parking spaces, both regular and accessible, where necessary to prevent vehicle encroachment into the required width of accessible routes.

- Further, it is the intent of the California Building Code (and the model International Building Code) that appropriate measures be taken at all parking spaces as necessary to prevent vehicle encroachment into the required width of non-accessible egress routes.

Finally, as evidenced by the representative details above, our historical review of all past editions of the California Building Code (dating to 1989) and its predecessor State Building Code (dating to 1981) confirms that the controlling State agencies always have accepted the use of shorter (i.e., 3 to 4 feet) non-centered wheel stops at accessible parking spaces.

- In other words, we have found no historical evidence that either HCD or DSA ever has acted upon the above-noted recommendations of the authors of ASTM standard F1637 supporting the use of longer (maximum 6 feet) centered wheel stops.

- Similarly, we have found no historical evidence that would indicate any State agency’s disapproval (whether formal or informal) of the use of centered wheel stops.

**Summary Findings and Recommendations**

Summarized below are our professional findings and recommendations derived from this historical research and our relevant experience:

1) Wheel stops are barriers installed within parking spaces to deter potentially problematic vehicle movement.
   - Unlike structural bollards, wheel stops do not function as an actual physical barrier against moving vehicles – serious injuries and/or extensive property damage are not-uncommon consequences of cars accidently being driven over such wheel stops.
   - Instead, wheel stops typically serve to provide a physical signal to the driver that no additional forward movement is advised.
2) There are two commonly accepted uses for wheel stops within parking facilities and lots:
   • To warn and deter drivers from damaging structural encounters (e.g., ‘car vs. building’, ‘car vs. car’, and ‘car vs. steel post’); and
   • To deter improper vehicle encroachment into standard and accessible pedestrian paths of travel (e.g., at sidewalks) and other required routes of egress.

3) Wheel stops constitute potential tripping hazards for pedestrians --- parking lot designers should, where practical, strive to minimize the use of wheel stops except as needed to deter damaging structural encounters and/or improper vehicle encroachment into pedestrian paths of travel.

4) Where practical, the use of structural bollards often is preferable to wheel stops at transitions between parking spaces and locations of concentrated pedestrian traffic.
   • The potential safety benefits of structural bollards at areas of highly concentrated pedestrian traffic (e.g., at main entryways to grocery stores) are recognized worldwide.26

5) While the Traffic Engineering Handbook published by the Institute of Transportation Engineers advises parking facility designers to avoid using wheel stops “in pedestrian path areas”, this guidebook is not intended to establish minimum standards of practice and is contradicted by the 2010 ADA Standards and related state and regional codes.

6) We fully agree with the ITE team that parking lots and facilities should be adequately lit in a manner that enables intended pedestrians to discern fixed objects, including wheel stops.

7) While the wheel stop guidance published within voluntary standard ASTM F1637 (Standard Practice for Safe Walking Surfaces) should be closely considered by parking facility designers, this document does not, in and of itself, establish minimum standards of practice.
   • We recommend, as advised by the authors of ASTM F1637, that the potential merits of using centered (max. 6-foot length) wheel stops that would be fully covered by parked cars should be evaluated by parking facility designers.
   • When vehicles are parked, a potential disadvantage of smaller non-centered wheel stops is an increased safety risk (compared with centered wheel stops) caused by that portion of the wheel stop that commonly protrudes out from under the parked car.27
   • An advantage of shorter wheel stops (compared with longer) is the decreased safety risk (due to the smaller size) to pedestrians when the wheel stops are not covered by parked vehicles.
   • We recommend that parking space designers should closely consider the potential pros and cons of the use of ‘shorter non-centered’ vs. ‘longer centered’ wheel stops.

8) Where the parking designer reasonably has determined that the use of non-centered wheel stops is appropriate, we recommend that these devices be installed no closer than 8 to 10 inches, where practical, from the inner edge of the painted perimeter striping (commonly 4 inches wide).
   • In short, we recommend that wheel stops positioned directly opposite the same striping (e.g., Photo 5) typically should provide a minimum 20- to 24-inch wide pedestrian passageway unless there is a practical (i.e., functional) reason that would necessitate a narrower path.

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26 ‘Road Safety Committee Inquiry into Pedestrian Safety in Car Parks’, Parliament of Victoria, Australia, May 2010: “The installation of ‘isolation devices’ to separate pedestrians from vehicles can include the use of kerbs, wheel stops, vehicle guard rails and vertical bollards. Bollards are being increasingly used in areas of high risk, such as a convenience store with a high turn over of parking along its front entrance, a walk-up parking pay station within a car park, or the entrance to escalators into a shopping centre.”

27 Ibid.: “Wheel stops, low concrete barriers to prevent vehicle tyres moving, are used to prevent the ends of cars encroaching onto pedestrian paths, however, they are discouraged by the Institute of Transportation Engineers and some municipalities ...due to the tripping hazard they present to pedestrians.”
9) When specifying or detailing wheel stops as needed to prevent damaging structural encounters and/or improper vehicle encroachment into pedestrian paths of travel, parking lot designers have a duty to reasonably consider (and implement, where deemed appropriate) measures that would serve to lessen pedestrian risks. For example:

- All wheel stops should present a color (whether painted or unpainted) that contrasts with the surrounding pavement. (Reference the absence of contrasting color at Photo 6 below.)
- Similarly, adjacent wheel stops should be positioned in such a manner so as to maintain a safe pedestrian passageway between them.28

10) Since 1961, industry standard ICC/ANSI A117.1 (Accessible and Usable Buildings and Facilities) and its predecessors have served as the technical foundation for federal and state accessibility laws and regulations nationwide, including a mandate that: “Parked vehicle overhangs shall not reduce the required width of an accessible route.”

- The current standards and codes that specifically approve the use of wheel stops to achieve this goal are applicable to all (regular and accessible) affected parking spaces.

11) Similarly, it is the intent of the California Building Code (and the model International Building Code) that appropriate measures be taken at all parking spaces as necessary to prevent vehicle encroachment into the required width of both accessible and non-accessible egress routes.

- While the various code details shown above at Figures 2 thru 8 indicate informal approval of the shorter non-centered wheel stops commonly seen throughout California, none of them support positioning the wheel stop directly at the perimeter striping, as seen in Photo 7.

Summary Discussion

Despite increased risks of injurious pedestrian falls, there are valid uses for wheel stops in most parking facilities. Properly positioned wheel stops serve to lessen the likelihood of damaging structural encounters, improve some aspects of pedestrian safety, and promote improved egress and accessibility in conformance with applicable codes and standards. While these benefits generally tend to outweigh the associated risks, designers should evaluate intended and installed wheel stops to identify those that might fail a risk-benefits analysis.

- In general, high-risk/low-benefit wheel stops should be eliminated.
- Alternately, designers should take reasonable actions (e.g., repositioning, repainting, signage and/or improved lighting) that serve to lessen pedestrian hazards.

In short, designers of parking lots and facilities have a general duty to recognize and address the varying pedestrian risks associated with necessary (and potentially unnecessary) wheel stops.

- While pedestrians similarly have a general duty to be aware of their surroundings, it is not reasonable for designers to assume that every person legitimately walking within a parking area will be equally alert and focused at all times and for all age groups.29
- Instead, these designers should act, where appropriate, to improve the risk-benefits ratio of needed wheel stops. Unduly high-risk/low-benefit wheel stops should be eliminated from the design or additionally remediated.

28 County of San Diego Parking Design Manual, 2013: “If a wheel stop is used, the length shall be 4’ to 6’ long and 4” high. …It shall be placed so as to avoid bumper overhang beyond the designated parking space and to avoid creating a safety hazard for pedestrians.”

29 Per the National Safety Council (www.nsc.org), while “falls” constitute the overall leading cause of unintentional nonfatal injuries treated in hospital emergency departments, the incident rates and potential severity of these falls increase significantly for the elderly. Therefore, for all risk-benefits evaluations of wheel stops, parking lot designers should particularly consider the naturally diminishing physical capacities of elderly patrons.
In particular, where non-centered wheel stops are specified, designers should assess the increased pedestrian risks associated with wheel stops that are positioned at (or close to) the perimeter striping – thereby unduly impeding the pedestrian passageway between parked cars.

Photo 6 – This wheel stop should be painted and repositioned away from the painted line.

Photo 7 – This wheel stop should be repositioned away from the painted line.
Photo 8 – Obviously, this failed wheel stop should be properly reinstalled.

Photo 9 – These wheel stops should be painted and repositioned away from the painted lines. (Note that the white wheel stop at the center of this photograph is not attached and serves no functional purpose.)
As seen in Photo 10, closely adjacent wheel stops can serve to create unduly narrow pedestrian pathways that increase the potential for injurious falls. Inspection at this parking facility revealed no functional purpose (no increased benefit that would offset the increased risk) for this close spacing.

- In addition, this unfavorable risk-benefits ratio was exacerbated by the designer’s placement of a storm drain directly within this path of pedestrian travel serving the main entry to a large grocery store). 30
  - The increased risks associated with this unduly narrow pathway will be exacerbated for any pedestrians who instinctively hesitate to step onto or across this metal grille.
  - Also note that the closely positioned wheel stops serve to impede rainwater drainage into the storm drain --- the resulting ponded water further exacerbates the risk-benefits ratio.

![Photo 10](image)

**Photo 10** – The increased risks associated with the unduly narrow pathway between these concrete wheel stops will be exacerbated for any pedestrians who instinctively hesitate to step onto this metal grille.

We recommend that parking designers should take action to eliminate or reduce pedestrian hazards at those wheel stops that fail a case-by-case risk-benefits analysis.

- In particular, close analysis should be given to those wheel stops terminating at (or unduly close to) the parking space’s perimeter striping. (Such overly close positioning likely serves no practical vehicle-management purpose that would justify the increased pedestrian risks.)
- Such case-by-case wheel stops risk-benefits analysis should be a standard practice for all parking facility designers.

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30 Site observations confirmed a steady volume of pedestrian traffic across this location. Note that a large portion of the matted debris sitting atop the storm drain is worn away by repeated foot traffic on the metal grille.
In our professional opinion, satisfactory remediation of unduly high-risk/low-benefit wheel stops commonly entails more than just application of a warning coat of paint. In Photo 10, for example, consider: a) the metal grille covering the storm drain, b) the narrow (<11”) passageway between the closely set wheel stops, and c) the ponded water due to impeded drainage. The blue paint certainly does not serve to inform pedestrian users how best to navigate across these perceived hazards.

- In short, the safest pedestrian options (step on the metal grille? step over the grille onto the wheel stops? step into the narrow gap between the wheel stops? step over the wheel stops?) will not be open and obvious to all users. In contrast, appropriate positioning of these wheel stops would have greatly alleviated these pedestrian concerns.

For parking space designers, Section 1.1.2 of the 2013 and 2016 California Building Code imposes an inherent duty to reasonably protect pedestrian users: “The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare ...from hazards attributed to the built environment.” To satisfy this CBC burden, parking facility designers should proactively identify and remediate unduly high-risk/low-benefit wheel stops.

In like manner, owners and managers of existing parking facilities similarly should implement or commission, on a reasonably regular basis, site-specific assessments of the potential pedestrian risks and intended long-term benefits of installed wheel stops. The nature of these comparative evaluation processes always will be somewhat subjective.

- The parking lots seen in Photos 1, 2 and 3 experience widely differing pedestrian usage and occupancy loads --- potential hazards and risks associated with the small, aged commercial lot (used by regular year-to-year tenants) at Photo 1 are far less than those at the large, heavily used parking facility serving the shopping mall at Photo 3.

In every case, 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.

Consider, for example, 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 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 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?

- Attorneys for both the injured plaintiffs and the defendant driver noted that newer stores owned by the same grocery chain had such protective bollards (e.g., see Photo 12).

We recommend that owners/managers of existing buildings with areas of highly concentrated pedestrian-vehicular interaction consider the use of structural bollards to better protect pedestrians. Often, the services of a licensed architect or engineer should be used for this evaluation process.
Photo 11 – Wheel stops cannot prevent vehicular intrusion into the often-crowded entryway to this grocery store.

Photo 12 – This new store (by same owner) was designed with structural bollards to prevent vehicle intrusion.
In general, it is our assessment that it is not reasonable (or realistic) to assert that structural bollards should be retrofitted at entryways to all public stores and commercial buildings to prevent all such vehicle-pedestrian interactions. In like manner, any defense argument that store owners never have a duty to upgrade the as-built pedestrian protection (often nothing more than an aged wheel stops and concrete curbs) at existing facilities also should be rejected. Instead, every situation requires its own site-specific risk-benefits evaluation by competently informed professionals.

Similarly, regarding wheel stop personal injury claims in California, attorneys and their consultants should carry out an informed risk-benefits evaluation of each accident scene. To this end, plaintiff experts should not assert that ASTM F1637 is a controlling nationwide standard. Similarly, defense consultants should be prepared to justify the positioning of non-centered wheel stops in relation to the increased hazards associated with very narrow pedestrian passageways between parked cars.

In summary, our professional opinions regarding uses and misuse of wheel stops include:

- While the authors of ASTM F1637 advise: “Parking lots should be designed to avoid the use of wheel stops”, strict adherence to this guidance is generally impractical, unrealistic, and contrary to construction codes and reasonable industry practice.
- Even so, designers should recognize that the presence of wheel stops in parking facilities serves to increase the risks for injurious pedestrian falls, particularly for elderly pedestrians.
- Therefore, parking designers should undertake actions (e.g., proper painting, signage, lighting, positioning, etc.) that reasonably serve to best moderate these risk factors.
- Specifically, designers should implement a risk-benefits analysis for each wheel stop and should act, where deemed appropriate, to eliminate or remediate those wheel stops that are found to exhibit unduly high-risk/low-benefit characteristics.
- In many cases, relatively minor re-positioning of wheel stops can serve to greatly lessen tripping risks for unwary pedestrians --- in general, there are no functional justifications for terminating non-centered wheel stops at or very near perimeter striping in a manner that unduly impedes the pedestrian passageways between parked cars.
- Installation of bollards should be considered at areas of highly concentrated pedestrian-vehicular interaction at existing (e.g., Photo 11) and new buildings: wheel stops simply cannot be expected to stop all moving vehicles. Generally, the professional services of an experienced architect, engineer, or traffic control professional should be used for this “bollard vs. wheel stop” risk-benefits evaluation process.

Finally, in regards to related personal injury litigation, we urge consultants to acknowledge the basic principle that wheel stops can be both potentially hazardous to pedestrians and yet vital to the safe and accessible functioning of parking facilities and associated walkways. This risk-benefits analysis should be carried out by expert professionals on a case-by-case basis.

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(All views and recommendations expressed within this position paper are the professional opinions solely of the above-identified consultants. This position paper is general and introductory in nature and is neither intended nor authorized for project-specific use by any attorney, building professional, or other participant in the construction, codes, design, or litigation fields.)