Code Amendment Proposal Application OSSC 22-01

Department of Consumer & Business Services
Building Codes Division
1535 Edgewater NW, Salem, Oregon
Mailing address: P.O. Box 14470, Salem, OR 97309-0404
Phone: 503-378-4133, Fax: 503-378-2322
Oregon.gov/bcd

APPLICANT INFORMATION	
Name:	Jeni Hall
Representing:	
Email address:	Jeni.hall@energytrust.org
PROPOSAL INFORMATION	
Specialty code:	Oregon Structural Specialty Code (OSSC)
Code section(s):	IFC 2021 1207.11.7
Briefly explain the subject of your proposal:	The proposal addresses the need for a clearly defined area in which a residential garage Energy Storage System (ESS) installation would trigger the "Subject to Vehicle Damage" requirement found in 1207.11.7. The existing language has led to widely varying interpretations and enforcement of impact protection.

Code Review Committee Outcomes

Nov. 17, 2021 – Approved to appear in Section 430.

PART I – CODE AMENDMENT LANGUAGE

Background: This proposal was prepared by the Sustainable Energy Action Committee (SEAC) and it is recommended for Approval at the Public Comment hearings of the International Code Council (ICC) taking place September 21 – 28, 2021. The proposal, reasoning, and technical justification have been provided verbatim for the Oregon OSSC Code Review Committee's consideration. The full ICC Code Change Agenda, Report of the Committee Action Hearing, and the Public Comment Agenda for the 2021 Group A Code Change cycle can be found online: https://www.iccsafe.org/products-andservices/i-codes/code-development-process/2021-2022-group-a/

SEAC is a national forum for stakeholders (including, but not limited to, AHJs, designers, engineers, contractors, first responders, manufacturers, suppliers, utilities, and testing labs) to collaboratively identify and find solutions for issues that affect the installation and use of solar energy systems, energy storage systems, demand response, and energy efficiency. The purpose of the group is to facilitate the deployment and use of affordable, clean and renewable energy in a safe, efficient, and sustainable manner. All recommendations from SEAC are approved by diverse stakeholders through a consensus process.

2021 International Fire Code

Revise as follows:

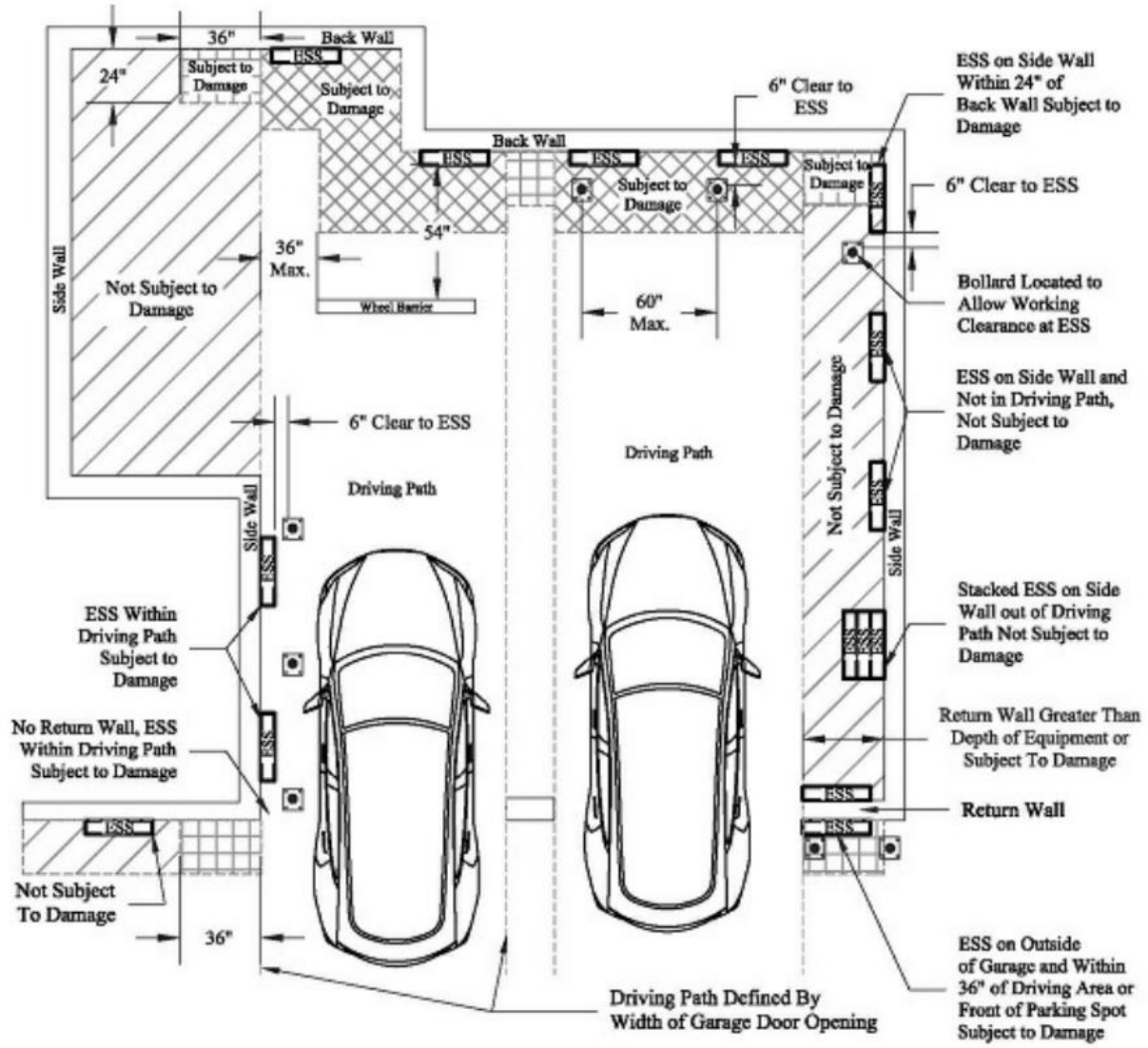
1207.11.7 Protection from impact. ~~Stationary storage battery systems~~ ESS installed in a location subject to vehicle damage in accordance with ~~shall~~ Section 1207.11.7.1 or 1207.11.7.2 shall be provided with impact protection in accordance with Section 1207.11.7.3. ~~be protected by approved barriers. Appliances in garages shall also be installed in accordance with Section 304.3 of the International Mechanical Code.~~

Add new text as follows:

1207.11.7.1 Garages. Where an ESS is installed in the normal driving path of vehicle travel within a garage, impact protection complying with Section 1207.11.3 shall be provided. The normal driving path is a space between the garage vehicle opening and the interior face of the back wall to a height of 48 in. (1219 mm) above the finished floor. The width of the normal driving path shall be equal to the width of the garage door opening. Impact protection shall also be provided for an ESS installed at either of the following locations (See Figure 1207.11.7.1):

1. On the interior face of the back wall and located within 36" to the left or to the right of the normal driving path.
2. On the interior face of a side wall and located within 24 inches from the back wall and 36 inches of the normal driving path.

   Exception: Where the clear height of the vehicle garage opening is 7 ft 6 in, (2286 mm) or less, ESS installed not less than 36 inches (914 mm) above finished floor are not subject to vehicle impact protection requirements.



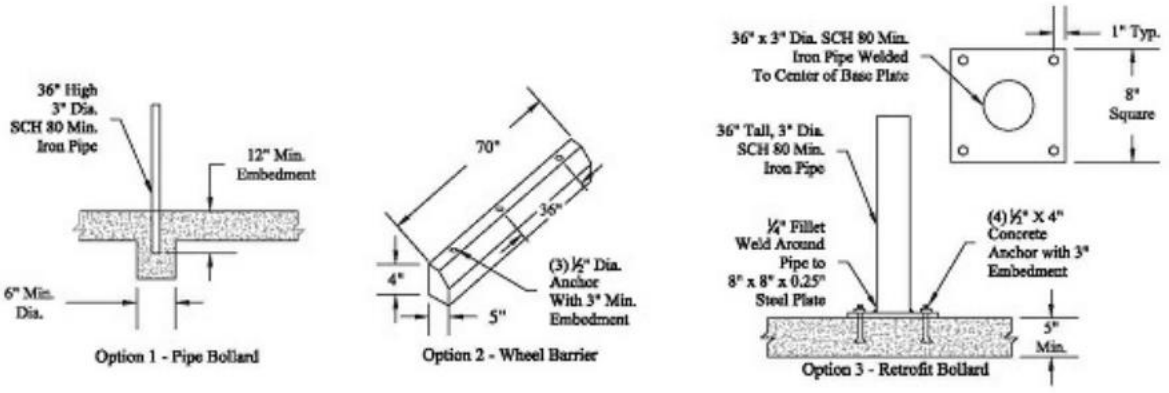


FIGURE 1207.11.7.1 ESS VEHICLE IMPACT PROTECTION

1207.11.7.2 Other locations subject to vehicle impact. Where an ESS is installed in a location other than as defined in Section 1207.11.7.1, and is subject to vehicle damage, impact protection shall be provided in accordance with Section 1207.11.7.3.

1207.11.7.3 Impact Protection Options. Where ESS is required to be protected from impact in accordance with Section 1207.11.7.1 or 1207.11.7.2 such protection shall comply with one of the following:

1. Bollards constructed in accordance with one of the following:
    - 1.1. Minimum 48 inches (1219 mm) in length by 3 inches (76mm) in diameter schedule. 80 steel pipe embedded in a concrete pier not less than 12 inches (304 mm) deep and 6 inches (152 mm) in diameter, with at least 36 inches (914 mm) of pipe exposed, filled with concrete, and spaced at a maximum interval of 5 feet (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from an ESS.
    - 1.2. Minimum 36 inches (914 mm) in height by 3 inches (76 mm) in diameter schedule 80 steel pipe fully welded to a minimum 8 inches (203 mm) by 8 inches (203 mm) by ¼ inch (6.4 mm) thick steel plate and bolted to a concrete floor by means of 4 - ½ inch (13 mm) concrete anchors with 3 inch (76 mm) minimum embedment. Spacing shall be not greater than 60 inches. (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.
    - 1.3. Pre-manufactured steel pipe bollards shall be filled with concrete and anchored in accordance with the manufacturer's installation instructions, with spacing not greater than a 60 inches. (1524 mm). Each bollard shall be located not less than 6 inches (152mm) from the ESS.
2. Wheel barriers constructed in accordance with one of the following:
    - 2.1. 4 inches (102 mm) in height by 5 inches (127 mm) in width by 70 inches (1778 mm) in length wheel barrier made of concrete or polymer, anchored to the concrete floor not less than every 36 inches (914 mm) and located not less than 54 inches (1372 mm) from the ESS. Minimum 3 - ½ inch (13 mm) diameter concrete anchors with 3 inch (76 mm) embedment per barrier shall be used. Spacing between barriers shall be no greater than 36 inches. (914 mm).
    - 2.2. Pre-manufactured wheel barriers shall be anchored in accordance with the manufacturers installation instructions.
3. Approved method designed to resist a 2000 lbf (8899 Newtons) impact in the direction of travel at 24 inches (608 mm) above grade.

Reason: Summary

First, a minor editorial change is needed to replace stationary storage battery system with ESS. This should have been part of a global change last cycle.

Second, the last sentence referring to appliances has been removed. Section 304.3 is related to the elevation of ignition sources not vehicle impact protection. The concern about raising ignition sources has historically been applied to fuel-fired appliances such as water heaters. These types of appliances are the only equipment able to be listed as flammable vapor ignition resistant. Even when a water heater has not been evaluated to ANSI Z21.10, only the actual

ignition source needs to be elevated above 18”, not the entire water heater. It’s important to note that NFPA 70 does not consider the area below 18” a classified location in above-grade residential garages.

The third and most substantial change addresses the need for a clearly defined area in which a residential garage ESS installation would trigger the “Subject to Vehicle Damage” requirement found in 1207.11.7. The existing language has led to widely varying interpretations and enforcement of impact protection.

New language (1207.11.7.1) has been added to define this area and set the expectation that the barriers are intended to deflect, resist, or visually deter an impact. This language mirrors the existing Section 312.3 in the IFC.

A minimum installation height of 48” within the likely impact area has been added to allow elevation of the ESS as a permissible mitigation option. An exception to this 48” minimum has been included to recognize that a reduced garage opening height would thereby limit vehicle height and allow a lower placement of equipment before additional protection is needed. This exception is inspired by existing IMC Commentary:

“The height of the vehicle entry opening of the garage or carport can be used as a guide in determining how tall of a vehicle could be driven into the garage or carport”

A new Figure 1207.11.7.1 has been added to illustrate the zones in which a typical residential garage ESS installation would trigger the need for impact protection. This figure is based on existing IMC commentary related to the installation of fuel-fired appliances that may pose a fire hazard when damaged. The IMC commentary Figure 304.6 (2) has been modified to reflect common ESS installation locations and takes a similar approach to mitigating the risk of impact. New language (1207.11.7.2) has been added to address other than garage locations that may also have vehicle access such as residential driveways, and also allows some flexibility to the AHJ and installer for larger, non-typical, or custom residential garages where the normal path of vehicle travel falls outside of the area defined in 1207.11.7.1.

Finally, the prescriptive barrier and post designs per IBC 1607.10 or IFC 312.2 may be appropriate for an energy storage system in a public access parking lot, garage, or other throughway. We are therefore not proposing any changes to 1207.4.5. However, the forces assumed in these sections are not representative of the impact scenarios expected in a private residential garage reserved for permanent occupants.

For example, the calculation in IBC 1607.8.3 results in approx. 12K lb-force applied to the anchorage, which causes readily available bollard to concrete connections to fail. This effectively eliminates the possibility of retrofitting a floor mounted bollard as a solution. Additionally, the posts described in IFC 312.2 can not be reasonably installed in an existing residential garage, and although uncommon especially those with tensioned concrete slabs. This leaves AHJs and installers with no guidelines for a retrofit bollard designed to deter vehicle operators from carelessly striking the ESS units. While IFC Section 312.3 does allow an alternative approach, designers, installers, and code officials will benefit from more explicit guidance within Section 1207.11. In new construction posts designed in accordance with Section 312 may be feasible, however it is unlikely that a homebuilder would be able to anticipate the installation of an ESS in a specific location in a garage. The proposed options for impact protection were inspired by existing IMC commentary figure 304.6(2). These options have been modified to provide a consistent amount of force resistance across the available choices, something the IMC commentary does not do. These options more reasonably reflect the expected impact scenario described in the commentary text:

> “The barriers shown in the commentary figure will not eliminate all possibility of a motor vehicle contacting the appliances but will offer a reasonable warning to a driver who is slowly navigating near the appliances”

And:

> “Although this section does not specifically require the impact protection provided to stop any type of vehicle at any speed, the intent is for the impact protection to cause the driver to want to stop vehicle movement out of concern for damage that could be occurring. The choice of the type, structural capacity and the location of barriers is the responsibility of the designer.”

Between limiting the locations that ESS Batteries can be installed, and defining the requirements when impact protection is required, the result will be an improved level of protection from the risk of vehicle impacts, and damage mitigation if incidents do occur.

Technical Justification

An engineering review of the impact protection guidance found across the I-Codes and ASCE 7-16 was completed. Specifically Section 312 of both the prior and existing IFC, Section 4.5.3 of ASCE 7-16, and commentary language and figures associated with Section 304.6 of the IMC.

It is important to recognize that the prescription of the IFC Section 312 for bollards in public driving areas does not lead to a bollard that will resist 12k lbs. as prior editions of the code suggested. In actual testing ((Harrison (SwRI), Evaluation of collision protection provided by vehicle impact bollards and propane cylinder exchange cabinets 2013)) the static resistance was between 900 lbs. at 36” (2.7k lbs. reaction) and 11k lbs. at 36” (33k lbs. reaction).

ASCE 7-16 specifies vehicle barrier systems must resist 6k lbs. load at between 18” and 27” (9k to 13.5k lbs. reaction) There are no commonly available retrofittable bollards that can do this in an average residential garage without adding thickness to the concrete.

The IMC commentary figure when back calculated sets a bar of physical resistance which seems more appropriate to this risk and allows for solutions that are more practical to apply. For example, the bollard shown in IMC commentary Figure 304.6(2) will take an impact of about 625 lbs. load applied at 24", resulting in a 1250 lb reaction force at the post to base plate connection. Likely outcomes based on this force include:

- No damage at 0.5 mph impact from an average passenger car.
- Bollard would deflect permanently a few inches at a 2 mph collision speed
- Anchor bolts would shear off or blowout at a 5 mph collision speed.

The limitation is mostly the concrete to base plate connection. The IRC requires a 2500-3000 psi mix for garages, and garages are often of stronger mix, especially in freeze prone areas. The average garage concrete slab will fall within these specifications: 2500 - 4000 psi concrete with 5" min thickness. Using 1/2" epoxy anchors this equates to roughly a 2mph impact that could be sustained without significant damage to the bollard. This is aligned with a standard Uline 4.5" bollard with 1/8" wall thickness and a 8x8x3/8" base plate. More strength requires a larger base plate, as the limitation is the connection to the concrete.

The bolt down bollard specified in this proposal will take a 2000 lb impact, 24" off the ground with no damage, given 3000 psi concrete. More than 6" of permanent deflection would require a

very significant force, and then only touching the face of the ESS. This seems a reasonable level of protection, and clearance distance.

Bibliography:

Harrison, O. (2013). Evaluation of Collision Protection provided by vehicle impact bollards and propane cylinder exchange cabinets (Rep. No. 18.19083.01.107.FR1). Southwest Research Institute.

Cost Impact: The code change proposal will not increase or decrease the cost of construction This proposal clarifies and gives more technical rigor to the requirements.

Part III – CODE AMENDMENT PROPOSAL CRITERIA

Proposal

1. Describe the concept and purpose of this proposal.

   The proposal addresses the need for a clearly defined area in which a residential garage Energy Storage System (ESS) installation would trigger the "Subject to Vehicle Damage" requirement found in 1207.11.7. The existing language has led to widely varying interpretations and enforcement of impact protection.

2. What problem in the existing Oregon code or national model code is this proposal solving? How does this amendment address the issue? If you have evidence demonstrating the problem, submit that information.

   b. If this proposal corrects inadequate application by a code section to a method, material or design, explain how: *The "Subject to Vehicle Damage" requirement found in 1207.11.7 does not have sufficient clarity and the existing language has led to widely varying interpretations and enforcement of impact protection. For more detail see the reasoning and technical justification included in Part I Code Amendment Language.*

   d. If this proposal is for a fire or life safety matter, or is it otherwise needed to protect the health, safety, welfare, comfort and security of occupants and the public, explain why: *Battery Energy Storage Systems (ESS) installed in residential garages may need protection from vehicle impact. This proposal clarifies the "Subject to Vehicle Damage" requirements to aid code officials and contractors in consistently identifying and addressing this risk. Between limiting the locations that ESS Batteries can be installed, and defining the requirements when impact protection is required, the result will be an improved level of protection from the risk of vehicle impacts, and damage mitigation if incidents do occur. For more detail see the reasoning and technical justification included in Part I Code Amendment Language.*

   g. If this proposal provides for the use of unique or emerging technologies, or promotes advances in construction methods, devices, materials and techniques, explain how: *This proposal relates to battery Energy Storage Systems (ESS) which are being installed in increasing numbers on both residential and commercial properties.*

3. Has this been proposed at the national model code level. If so, explain when it was proposed, what happened, and why it was not adopted. Provide all associated national model code hearing information and background.

Yes. This proposal was prepared by the Sustainable Energy Action Committee (SEAC) and it is recommended for Approval at the Public Comment hearings of the International Code Council (ICC) taking place September 21 – 28, 2021. The proposal, reasoning, and technical justification have been provided verbatim for the Oregon OSSC Code Review Committee's consideration. The full ICC Code Change Agenda, Report of the Committee Action Hearing, and the Public Comment Agenda for the 2021 Group A Code Change cycle can be found online:

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Implementation and fiscal impact

1. Explain how the proposed provisions would be enforced? Are additional inspections or permits required? Describe any necessary equipment, training, tests or special certifications.

   This proposal clarifies and gives more technical rigor to the already existing code requirements. No additional inspections or permits are needed.

2. What is the fiscal impact of this proposal?

   The code change proposal will not increase or decrease the cost of construction.

Impacted stakeholders and other specialty codes

1. It is important that proposals be shared with stakeholders that will be impacted by them. Was this proposal developed with people or organizations likely to be affected by it? Has it been reviewed or shared with people or organizations likely to be affected by it? If so, who, and if not, why not?

   This proposal was originally prepared by the Sustainable Energy Action Committee (SEAC). The proposal, reasoning, and technical justification have been provided here verbatim for the Oregon OSSC Code Review Committee's consideration. SEAC is a national forum for stakeholders (including, but not limited to, AHJs, designers, engineers, contractors, first responders, manufacturers, suppliers, utilities, and testing labs) to collaboratively identify and find solutions for issues that affect the installation and use of solar energy systems, energy storage systems, demand response, and energy efficiency. The purpose of the group is to facilitate the deployment and use of affordable, clean and renewable energy in a safe, efficient, and sustainable manner. All recommendations from SEAC are approved by diverse stakeholders through a consensus process.

   This proposal was also shared with the Technical Committee of the Oregon Solar + Storage Industries Association (OSSIA) during a coordination meeting on August 26, 2021.

2. Does this proposal impact other specialty codes or statewide programs?

   The Oregon Department of Energy (ODOE) administers a statewide Solar+Storage rebate program. The clarity from this proposal may also have a positive impact on that program offering.