STATE OF WASHINGTON

STATE BUILDING CODE COUNCIL

May 2018

Log No. _____

1. State Building Code to be Amended:

- ☐ International Building Code
- ☐ ICC ANSI A117.1 Accessibility Code
- ☐ International Existing Building Code
- ☐ International Residential Code
- ☐ International Fire Code
- ☒ Uniform Plumbing Code
- ☐ International Mechanical Code
- ☐ International Fuel Gas Code
- ☐ NFPA 54 National Fuel Gas Code
- ☐ NFPA 58 Liquefied Petroleum Gas Code
- ☐ Wildland Urban Interface Code

For the Washington State Energy Code, please see specialized energy code forms

Section(s): UPC Chapter 11
(e.g.: Section: R403.2)

Title: Secondary Roof Drain Sizing
(e.g: Footings for wood foundations)

2. Proponent Name (Specific local government, organization or individual):

Proponent: Washington Association of Building Officials Technical Code Development Committee (WABO TCD)

Title:

Date: February 14, 2022

3. Designated Contact Person:

Name: **Jon Siu**
Title: **Technical Consultant**
Address:

Office Phone: ( )
Cell: ( )
E-Mail address: jonsiuconsulting@gmail.com

4. **Proposed Code Amendment**. Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.

   Clearly state if the proposal modifies an existing amendment or if a new amendment is needed. If the proposal modifies an **existing amendment**, show the modifications to the existing amendment by underlining all added language and striking through all deleted language. If a new amendment is needed, show the modifications to the **model code** by underlining all added language and striking through all deleted language.

   Code(s) __UPC_____ **Section(s)** _1101.12.2, 1103

   Enforceable code language must be used.
   Amend section to read as follows:

   1101.12.2 Secondary Drainage. Secondary (emergency) roof drainage shall be provided by one of the methods specified in Section 1101.12.2.1 or Section 1101.12.2.2.

   1101.12.2.1 Roof Scuppers or Open Side. Secondary roof drainage shall be provided by an open-sided roof or scuppers where the roof perimeter construction extends above the roof in such a manner that water will be entrapped. An open-sided roof or scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1101.12.1. Scupper openings shall be not less than 4 inches (102 mm) high and have a width equal to the circumference of the roof drain required for the area served, sized in accordance with Table 1103.1, based on double the rainfall rate for the local area.

   Exception: Scupper openings shall be permitted to be sized for the normal rainfall rate where the structural design of the roof includes a ponding instability analysis in accordance with ASCE 7 for the additional ponding load resulting from twice the normal rainfall rate or a 15-minute duration/100-year return period storm. The analysis shall assume the primary drain system is blocked.

   1101.12.2.2 Secondary Roof Drain. Secondary roof drains shall be provided. The secondary roof drains shall be located not less than 2 inches (51 mm) above the roof surface. The maximum height of the roof drains shall be a height to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1101.12.1. The secondary roof drains shall connect to a piping system in accordance with Section 1101.12.2.2.1 or Section 1101.12.2.2.2.

   1101.12.2.2.1 Separate Piping System.
   The secondary roof drainage system shall be a separate system of piping, independent of the primary roof drainage system. The discharge shall be above grade, in a location observable by the building occupants or maintenance personnel. Secondary roof drain systems shall be sized in accordance with Section 1101.12.1 based on double the rainfall rate for ~~which the primary system is sized~~ the local area.

   Exception: The secondary drainage system shall be permitted to be sized for the normal rainfall rate where the structural design of the roof includes a ponding instability analysis in accordance with ASCE 7 for the additional ponding load resulting from twice the normal rainfall rate or a 15-minute duration/100-year return period storm. The analysis shall assume the primary drain system is blocked.

   1101.12.2.2.2 Combined System. The secondary roof drains shall connect to the vertical piping of the primary storm drainage conductor downstream of the last horizontal offset located below the roof. The

primary storm drainage system shall connect to the building storm water that connects to an underground public storm sewer. The combined secondary and primary roof drain systems shall be sized in accordance with Section 1103.0 based on double the rainfall rate for the local area.

1103.0 Size of Leaders, Conductors, and Storm Drains.

1103.1 Vertical Conductors and Leaders. Vertical conductors and leaders shall be sized by the maximum projected roof area and Table 1103.1. Vertical conductors and leaders for secondary roof drains shall be sized based on double the rainfall rate for the local area.

Exception: Vertical conductors and leaders for secondary drainage systems shall be permitted to be sized for the normal rainfall rate where the structural design of the roof includes a ponding instability analysis in accordance with ASCE 7 for the additional ponding load resulting from twice the normal rainfall rate or a 15-minute duration/100-year return period storm. The analysis shall assume the primary drain system is blocked.

1103.2 Size of Horizontal Storm Drains and Sewers. The size of building storm drains, or building storm sewers or their horizontal branches shall be based on the maximum projected roof or paved area to be handled and Table 1103.2. Building storm drains, building storm sewers, or their horizontal branches receiving drainage from secondary roof drain systems shall be sized based on double the rainfall rate for the local area.

Exception: Building storm drains, building storm sewers, or their horizontal branches receiving drainage from secondary drainage systems shall be permitted to be sized for the normal rainfall rate where the structural design of the roof includes a ponding instability analysis in accordance with ASCE 7 for the additional ponding load resulting from twice the normal rainfall rate or a 15-minute duration/100-year return period storm. The analysis shall assume the primary drain system is blocked.

1103.3 Size of Roof Gutters. The size of semi-circular gutters shall be based on the maximum projected roof area and Table 1103.3.

1103.4 Side Walls Draining onto a Roof. Where vertical walls project above a roof to permit storm water to drain into the roof area below, the adjacent roof area shall be permitted to be computed from Table 1103.1 as follows:

(1) [No change to Items (1) through (6)]

Secondary drainage systems for the adjacent roof area shall be sized based on double the rainfall rate for the local area.

Exception: Secondary drainage systems for the adjacent roof area shall be permitted to be sized for the normal rainfall rate where the structural design of the roof includes a ponding instability analysis in accordance with ASCE 7 for the additional ponding load resulting from twice the normal rainfall rate or a 15-minute duration/100-year return period storm. The analysis shall assume the primary drain system is blocked.

5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed. Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

This proposal aligns the UPC with the requirements for rain loading on roofs in ASCE 7, and with the 2021 IBC rain load requirements. Without this change, secondary drainage systems could be undersized, which could result in damage to roofs and possibly, collapse.

ASCE 7-16 Section 8.2 requires secondary drainage systems to be designed for a shorter-duration, more intense rainstorm (15-minute duration/100 year return period) than the primary drain systems (60-minute duration/100 year return period). The UPC sizing tables and rainfall rate maps in the 2021 IBC are based on the 60-minute/100-year event. Because the 15-minute/100-year rate works out to about double the 60-minute/100-year rate, 2021 IBC Section 1611.1 allows the designer to use twice the mapped rates in the code.

The exceptions allow the secondary drainage system to be designed for the normal rainfall rate (60-minute/100-year event) if the roof structure is designed to sustain the additional loads resulting from the larger event (either double the rainfall rate, or the specific 15-minute/100-year rainfall rate for the locality), taking the smaller drains into account. In this case, the rainwater will accumulate above the secondary drains since the secondary drains are not sized for the larger storm. The roof structure will then need to be analyzed for ponding instability to verify the additional loads will not induce progressive deflection (ponding instability), and that the structure's strength is adequate to resist the additional loads (per ASCE 7-16 Section 8.4). As a note, mapped 15-minute/100-year rainfall rates are not readily available for many parts of Washington State, so while NOAA has documents that describe how to calculate the rate, engineers may want to rely on the doubled rainfall rate in their analysis.

Note that the current code requires doubling the rainfall rate for vertical leaders that receive water from a combined primary and secondary drain systems (2021 UPC Section 1101.12.2.2.2). Since this pipe is already appropriately sized, it is not necessary to change the requirements in that section.

Based on conversations with colleagues who enforced the UPC, structural engineers and plumbing system designers rarely, if ever, coordinate on issues such as this. Therefore, the prescriptive portion of this proposal simplifies design, construction, and enforcement by requiring the secondary drain systems to be designed for twice the normal rainfall rate. This requirement carries through from the secondary drain on the roof all the way to the discharge. Most plumbing designers will use the rainfall rates in UPC Appendix D and the tables in Chapter 11 rather than consulting with the structural engineer or the IBC, so this proposal will ensure that the secondary drainage systems are properly sized, and will avoid conflicts between codes. If the plumbing system designer does not want to size secondary systems based on double the normal rainfall rate, an engineered solution will be necessary and the exceptions will require collaboration between the structural engineers and the plumbing system designers—preferably before the roof structure design is complete.

6. Specify what criteria this proposal meets. You may select more than one.

- ☒ The amendment is needed to address a critical life/safety need.
- ☐ The amendment clarifies the intent or application of the code.
- ☐ The amendment is needed to address a specific state policy or statute.
- ☒ The amendment is needed for consistency with state or federal regulations.
- ☐ The amendment is needed to address a unique character of the state.
- ☒ The amendment corrects errors and omissions.

7. Is there an economic impact: ☒ Yes ☐ No

If no, state reason:

If yes, provide economic impact, costs and benefits as noted below in items a – f.

a. ***Life Cycle Cost.*** Use the OFM Life Cycle Cost **Analysis tool** to estimate the life cycle cost of the proposal using one or more typical examples. Reference these **Instructions;** use these **Inputs.** Webinars on the tool can be found **Here** and **Here**). If the tool is used, submit a copy of the excel file with your proposal submission. If preferred, you may submit an alternate life cycle cost analysis.

b. ***Construction Cost.*** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

$Click here to enter text./square foot.

Unable to determine. Among other factors, it will depend on the size of the building (more stories => spread out the cost over more square footage or more units), the number of secondary roof drains required (which depends on the size of the roof), size of piping, and separate vs combined primary & secondary drainage systems.

(For residential projects, also provide $Click here to enter text./ dwelling unit)

Show calculations here, and list sources for costs/savings, or attach backup data pages

There are too many variables (design options) to give a "correct" answer. One option is to increase the pipe size. Going from a 3" PVC pipe to a 4" PVC pipe (one option) is estimated to be an increase of 27% for each lineal foot of pipe for the secondary system (based on Home Dept costs for Schedule 40 pipe). If the primary and secondary drainage systems combine into a single vertical leader (a common design), the vertical leader is already required to be sized for twice the rainfall rate, so any increase in cost will be confined to the cost of horizontal piping of the secondary drainage system. However, the total increase in cost is likely to be a very small fraction of the overall cost of the building.

c. ***Code Enforcement.*** List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:

This will depend on how strictly the code is enforced. Some jurisdictions do more than others. If everything is enforced, the increase in time should be minimal—just comparing the callouts for the pipe sizes or number of roof drains to the code requirements. Inspection should be minimal as well—expect to see a larger pipe or more pipes for secondary drains.

Note that the simplification in this proposal will result in the elimination of a potential increase in work for both structural plan reviewers and structural design engineers. Without this change, if IBC Section 1611.1 and ASCE 7-16 Section 8.2 were to be strictly enforced, the structural plan reviewers would need to ask the structural design engineer to provide ponding calculations because the secondary roof drain system would likely be designed for the 60/100 rainfall rate in the UPC.

d. ***Small Business Impact.*** Describe economic impacts to small businesses:

This will depend on whether the small business owns the building or leases. If leases, any increase will be buried in the lease cost but shared with other tenants. If they own the building, they will have to pick up the costs. However, as noted above, the cost increase will be minimal compared to the overall construction costs.

e. ***Housing Affordability.*** Describe economic impacts on housing affordability:

Similar to small business impacts. If the building is primarily residential, this will mostly affect larger buildings with flat roofs. More apartments in the building => more sharing of the cost. Given the overall cost increase is minimal, the impacts to housing affordability should be minimal.

f. ***Other.*** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:

As with many other structure-related regulations, the benefits will only be realized by building owners if there is a large event—in this case, a very large rain event over a short period of time, combined with clogging of the primary drain system. If the secondary drains are under-designed, they will not be able to drain the roof fast enough, and ponding may cause damage to the roofing and the roof structure. In extreme cases, roofs have collapsed from ponding.

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.