Code Amendment Proposal Form
For public amendments proposed to the 2018 editions of the International Codes

Instructions: Upload this form and all accompanying documentation at [www.denvergov.org/BuildingCode](http://www.denvergov.org/BuildingCode). If you are submitting your proposal on a separate sheet, make sure it includes all information requested below.

All proposals must be received by **April 26, 2019.**

**CONTACT INFORMATION**

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**AMENDMENT PROPOSAL**

Please use a separate form for each proposal.

1) Code(s) associated with this proposal. Please use acronym: **IPC**

If you submitted a separate coordination change to another code, please indicate which code:

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Code Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBC-xxxx</td>
<td>Denver Building Code–xxxx (code) amendments</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
</tr>
<tr>
<td>IEBC</td>
<td>International Existing Building Code</td>
</tr>
<tr>
<td>IECC</td>
<td>International Energy Conservation Code</td>
</tr>
</tbody>
</table>

2) Please check here if a separate graphic file is provided: ☐

*Graphics may also be embedded within your proposal below.*

3) Use this template to submit your proposal or attach a separate file, but please include all items requested below in your proposal. The only formatting needed is **BOLDING, STRIKEOUT, AND UNDERLINING.** Please do not provide additional formatting such as tabs, columns, etc., as this will be done by CPD.

**Code Sections/Tables/Figures Proposed for Revision:**

**IPC - Section 1105**

**Proposal:**

**Section 1105 - Add new text as follows:**

**1105.3 Alternative roof drain sizing:** Roof drains may be sized based on the procedures of the 2009-IPC.
Section 1106 Add new text as follows:

### 1106.2.1 Alternative storm drain sizing

Storm drains may be sized based on the procedures of the 2009 IPC.

### 1106.3.1 Alternative vertical leader sizing

Vertical leaders may be sized based on the procedures of the 2009 IPC.

#### Supporting Information:

**Purpose:**

To provide an enforceable method of building storm system sizing.

**Reasons:**

The 2018 IPC requirements for storm system sizing are based on the flowrate through the roof drain. IPC 1105.2 states: “Roof drain flow rate. The published roof drain flow rate, based on the head of water above the roof drain, shall be used to size the storm drainage system in accordance with Section 1106. The flow rate used for sizing the storm drain-age piping shall be based on the maximum anticipated ponding at the roof drain.”

This was first introduced in the 2015 IPC based on an early ASPE research project. There was no nationally recognized testing standard at the time of publication then and there was none at the time of publication of the 2018 version. As of May 2019 the leading manufacturers of roof drains still have not published flow rates based on level of ponding at the roof drain. Without published roof drain flow rate data, this is an unenforceable code provision.

There is now a first version of a roof drain flow rate standard ASPE/IAPMO/ANSI Z1034-2015 Test Method for Evaluating Roof Drain Performance. However the major manufacturers still have not published flow rate data for their roof drain products. Recent conversations with the manufacturers and representatives indicates that it will be a long time before such data is available across their lines.

The engineering concept of using published flow rate data is valid, and the 2018 IPC method will be appropriate once the manufacturers have caught up with the new testing standard.

**Substantiation:**

See attached information from three major manufacturers of roof drains downloaded from their websites. None of these manufacturers have published anything other than the methods used for decades.

Storm drain systems have been designed and reviewed since the adoption of the 2016 DBC-IPC without roof drain flow rate data. This proposal is in the context of documenting current policies into the Denver Amendments.

#### Note:

This section MUST include these items:

- **Purpose:** State the purpose of the proposed amendment to physical, environmental and customary characteristics that are specific to the City and County of Denver (e.g., clarify the code; revise outdated material; substitute new or revised material for physical, environmental and customary characteristics; add new requirements to the code; delete current requirements, etc. to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver)
- **Reasons:** Clearly justify the change to current code provisions, stating why the proposal is necessary to reflect physical, environmental and customary characteristics that are specific to the City and County of Denver. Proposals that add or delete requirements shall be supported by a logical explanation that clearly shows why the current code does not reflect physical, environmental and customary characteristics that are specific to the City and County of Denver and explains how such proposal will improve the code.
- **Substantiation:** Substantiate the proposed amendment based on technical information and substantiation. Substantiation provided which is reviewed and determined as not germane to the technical issues addressed in the proposed amendment shall be identified as such.
- **Bibliography:** Include a bibliography when substantiating material is associated with the amendment proposal. The proponent shall make the substantiating materials available for review.

#### Referenced Standards:

No new standards are required.

#### Note:

List any new referenced standards that are proposed to be referenced in the code.
**Impact:**

No cost impact to design or construction as this documents current design practice.

**Note:** Discuss the impact of this proposal in this section AND indicate the impact of this amendment proposal for each of the following:

- The effect of the proposal on the cost of construction:  ☐ Increase  ☐ Reduce  ☒ No Effect
- The effect of the proposal on the cost of design:  ☐ Increase  ☐ Reduce  ☒ No Effect
- Is the proposal more or less restrictive than the I-codes:  ☐ More  ☐ Less  ☒Same

**Departmental Impact:** (To be filled out by CPD staff)

**Note:** CITY STAFF ONLY. Discuss the impact of this proposal in this section AND indicate the impact of this amendment proposal for each of the following:

- The effect of the proposal on the cost of review:  ☐ Increase  ☐ Reduce  ☐ No Effect
- The effect of the proposal on the cost of enforcement/inspection:  ☐ Increase  ☐ Reduce  ☐ No Effect
Specification Drainage Products

Roof & Deck Drain Selection

Roof & Deck Drains

Roof Drain Selection & Placement

Wade makes it easy to size roof drains. The four things you will need to know are:
1) Rate of precipitation
2) Total area of roof
3) Size of leader required
4) Area handled by each drain

When sizing roof drains, the limiting factor for the amount of water each drain will carry away is the size of leader. Therefore, increasing leader size decreases the number of drains required.

| STEPS FOR SELECTING ROOF DRAIN LEADER SIZES AND QUANTITY REQUIRED FOR A GIVEN ROOF |
|------------------------|---------------|-----------------|
| STEP | Requirement | Example |
| 1 | Calculate Total Roof Area | Total Roof Area—500’ by 270’ equals 135,000 Sq.Ft. |
| 2 | Determine maximum hourly rainfall in inches | For this example—Use 4” per/hr |
| 3 | Select Leader Size | Assume that 6” leaders are desired for this job |
| 4 | From Table 1, Determine the square feet that can be drained by one 6” roof leader at the maximum 4” hourly rainfall rate | From Table 1 One 6” Leader at 4” hourly rainfall rate will drain 13,500 square feet of roof area. |
| 5 | Divide the total roof area by the area that one 6” leader will accommodate. The result is the number of drains required for the building. If the result is fractional, use the next higher number | 135,000 Square Feet (Total Roof Area) divided by 13,500 Square Feet (Maximum Rate for 6” Drain at 4” per hour) 135,000 / 13,500 = 10 (10 Drains Required) |

| TABLE 1 | ROOF DRAIN VERTICAL LEADER REQUIREMENTS FOR ROOF AREAS AT VARIOUS RAINFALL RATES |
|------------------------|---------------|-----------------|---------------|---------------|
| Leaders (Pipe Size) | Open Area (Sq.In.) | 1” | 1-1/2” | 2” | 2-1/2” | 3” | 4” | 5” | 6” | 7” | 8” |
| 2 | 3.14 | 2,880 | 1,920 | 1,440 | 1,150 | 960 | 720 | 575 | 480 | 410 | 360 |
| 3 | 7.06 | 8,880 | 5,860 | 4,400 | 3,520 | 2,930 | 2,200 | 1,720 | 1,470 | 1,260 | 1,100 |
| 4 | 12.56 | 18,400 | 12,700 | 9,200 | 7,360 | 6,130 | 4,600 | 3,680 | 3,070 | 2,630 | 2,300 |
| 5 | 19.60 | 34,600 | 23,050 | 17,300 | 13,840 | 11,530 | 8,650 | 6,920 | 5,765 | 4,945 | 4,325 |
| 6 | 28.30 | 54,000 | 36,000 | 27,000 | 21,600 | 18,000 | 13,500 | 10,800 | 9,000 | 7,715 | 6,750 |
| 8 | 50.25 | 116,000 | 77,400 | 58,000 | 46,400 | 38,680 | 29,000 | 23,200 | 19,315 | 16,570 | 14,500 |
The modern roof drain is designed to drain off rainwater in the most effective manner possible while maintaining an aesthetic appeal because in many instances it is placed in full view of the public.

Through the years, Smith has attempted to satisfy both the artistic eye of the architect and the calculating mind of the engineer, concluding the properly designed roof drain must have the following features:

- Pleasing dome shape with a low profile and adequate free drainage area
- Corrosion-resisting dome material
- Effective debris protection
- Overflow drainage to allow drainage during debris build-up
- Gravel stop
- Positive Flashing Clamp
- Seepage control channels
- Sump designed to minimize air entrapment
- Flexibility to meet all construction requirements

Smith roof drains include all of these features.
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High Density Polyethylene Dome</td>
</tr>
<tr>
<td>2</td>
<td>Combined Cast Iron Flashing Clamp and Gravel Stop</td>
</tr>
<tr>
<td>3</td>
<td>Secured Square Hole Grate</td>
</tr>
<tr>
<td>4</td>
<td>Flashing Clamp for Square Grate</td>
</tr>
<tr>
<td>5</td>
<td>Fixed Extension</td>
</tr>
<tr>
<td>6</td>
<td>Fixed Extension Gasket</td>
</tr>
<tr>
<td>7</td>
<td>Drain Body</td>
</tr>
<tr>
<td>8</td>
<td>Sump Receiver</td>
</tr>
<tr>
<td>9</td>
<td>Underdeck Clamp</td>
</tr>
<tr>
<td>10</td>
<td>Adjustable Extension Sleeve</td>
</tr>
<tr>
<td>11</td>
<td>O-Ring Gasket</td>
</tr>
<tr>
<td>12</td>
<td>Reversible Collar</td>
</tr>
<tr>
<td>13</td>
<td>Neoprene Gasket</td>
</tr>
</tbody>
</table>
SELECTING A ROOF DRAIN

To select the proper roof drain, the following information must be determined by the designer/specifier:

- Type of roof construction
- Roof pitch
- Maximum volume of expected rainfall and storm design criteria (This information must be obtained from your local weather bureau and/or local code authority)
- Desired rate of drainage
- Safety overflow requirements (Emergency/secondary overflow roof drains are recommended. Local codes vary but it is recommended to provide a 1 to 1 ratio)

• Roof load (The maximum possible rainwater [build-up] load should be determined and provided to the structural engineer for inclusion in the roof structure design)
• Location of drains (Consult your local code requirements)
• Size
• Vandal-proofing

• NOTE: ALWAYS CONSULT YOUR LOCAL CODE FOR SIZING AND DESIGN CRITERIA WHEN DESIGNING THE ROOF DRAIN SYSTEM. LOCAL CODE REQUIREMENTS TAKE PRECEDENCE OVER CATALOG INFORMATION.
• DATA SHOWN IN TABLES 1 AND 2 BELOW ARE TAKEN FROM THE UNIFORM PLUMBING CODE (UPC) - 2006 EDITION.

SUGGESTED STEPS FOR SELECTING PROPER ROOF DRAIN LEADER SIZES AND NUMBER REQUIRED FOR A GIVEN ROOF

1. Calculate the total roof area.
2. Determine the maximum hourly rainfall in inches. (The figure can be acquired from your local weather bureau and/or local code authority.)
3. Select leader size.
4. From Table 1, determine the number of square feet that can be drained by one roof leader at the maximum rainfall rate.
5. Divide the total roof area by the area that one leader will handle. The above result is the number of roof drains required for the building. If the result is a fraction less, use the next higher.

Example: Using a 4" Vertical Leader

1. Total roof area - 500' by 200' = 100,000 sq. ft.
2. Determine rate of rainfall - for this example use 4".
3. After studying building plan and physical arrangement, assume that 4" leaders are required for this project.
4. From Table 1 - one 4" leader at 4" rate of rainfall will take care of 3,460 sq. ft. of roof area.
5. Number of roof leaders required is 29 (100,000 sq. ft. divided by 3,460 sq. ft.), Therefore 29 roof drains would be required.

Example: Using a 6" Vertical Leader

1. Total roof area - 500' by 200' = 100,000 sq. ft.
2. Determine rate of rainfall - for this example use 4".
3. After studying building plan and physical arrangement, assume that 6" leaders are required for this project.
4. From Table 1 - one 6" leader at 4" rate of rainfall will take care of 10,200 sq. ft. of roof area.
5. Number of roof leaders required is 10 (100,000 sq. ft. divided by 10,200 sq. ft.), Therefore 10 roof drains would be required.

TABLE 1
ROOF DRAIN VERTICAL LEADER REQUIREMENTS FOR HORIZONTAL ROOF AREAS AT VARIOUS RAINFALL RATES

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 IN./HR.</td>
<td>2 IN./HR.</td>
</tr>
<tr>
<td>02</td>
<td>3.14</td>
<td>2,176</td>
</tr>
<tr>
<td>03</td>
<td>7.06</td>
<td>6,440</td>
</tr>
<tr>
<td>04</td>
<td>12.56</td>
<td>13,840</td>
</tr>
<tr>
<td>05</td>
<td>19.60</td>
<td>25,120</td>
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<tr>
<td>06</td>
<td>28.30</td>
<td>40,800</td>
</tr>
<tr>
<td>08</td>
<td>50.25</td>
<td>88,000</td>
</tr>
</tbody>
</table>

TABLE 1 IS BASED ON TABLE 11-1 FROM THE UNIFORM PLUMBING CODE (UPC) - 2006 EDITION

[1] For rainfall rates other than those listed, determine the allowable roof area by dividing the area given in the 1 in./hr. column by the desired rainfall rate.

STEPS FOR CALCULATING DRAINAGE REQUIREMENTS FOR ABOVE EXAMPLE USING G.P.M.

1. Use the following formula to determine G.P.M.:

\[
\text{G.P.M.} = 0.0104 \times R \times A \\
\text{G.P.M.} = \text{Gallons per minute} \\
R = \text{Rainfall intensity - inches/hour} \ A = \text{Roof area - square feet} \\
0.0104 = \text{Conversion factor - G.P.M./sq. ft. for 1" (one) inch/hr. rainfall}
\]
2. Example:
   A. 4" rainfall inches/hr.
   B. 100,000 sq. ft. roof area

   C. G.P.M. = .0104 x 4" x 100,000 sq. ft. = 4,160 G.P.M.

   TABLE 2 IS BASED ON TABLE 11-2 FROM THE UNIFORM PLUMBING CODE (UPC) - 2006 EDITION.

   [2] The sizing data for vertical conductors, leaders, and drains are based on the pipes flowing 7/24 full. Head of water over drain will determine exact flow rates.
   [3] The sizing for the horizontal piping is based on the pipes flowing full.
   [4] To avoid severe hydraulic jump and/or backpressure, good engineering practice requires the vertical leader transition into a larger size horizontal storm drain per the GPM flow indicated in Table 2 for 1/8" and 1/4" sloped storm drains.

3. Refer to table 2: a 4" leader [2] will handle 144 G.P.M.
   \[
   4,160 \text{ G.P.M.} / 144 = (28.8) \text{ 29 - 4" vertical leaders required.}
   \]

   Refer to Table 2: a 6" leader [2] will handle 424 G.P.M.
   \[
   4,160 \text{ G.P.M.} / 424 = (9.8) \text{ 10 - 6" vertical leaders required.}
   \]
SIZING DATA (For Conventional Drainage)

Zurn makes it easy to size roof drains. The four things you will need to know are: 1) rate of precipitation; 2) total area of roof; 3) size of leader required; and 4) area handled by each drain.

When sizing roof drains, the limiting factor for the amount of water each drain will carry away is the size of leader. Therefore, increasing leader size decreases the number of drains required.

STEP-BY-STEP SIZING OF ZURN DRAINS

**Step 1:** A. Calculate total roof area.
   Example: Roof area is 300 x 500 ft; 300 x 500 = 150,000 sq. ft.
   B. Determine the size of leader to be used.
   Example: 4" leader size is selected.

**Step 2:** Locate building site on map below to find rainfall rate. **Note:** This map is taken from the National Standard Plumbing Code, Appendix A, and should only be used for general reference. Consult local codes for more precise data. Example: For a building located in Erie, PA, the map shows a 4" hourly rainfall.

**Step 3:** Cross reference leader size with hourly rainfall in chart below to obtain roof area that can be handled by each leader. Example: For a 4" hourly rainfall and 4" leader, each drain can handle 4,600 sq. ft. of roof area.

**Step 4:** Divide total roof area by area found in Step 3 to obtain the number of drains required. Example: 150,000 sq. ft. divided by the 4,600 sq. ft. equals 32.6, or 33 drains required. The drains should be equally spaced and located symmetrically about the roof.
<table>
<thead>
<tr>
<th>Leader Size</th>
<th>Hourly Rainfall In Inches</th>
<th>Total Square Footage Covered Per Drain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipe Size (Inches)</td>
<td>Open Area (Sq. In.)</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>3.14</td>
<td>2,880</td>
</tr>
<tr>
<td>3</td>
<td>7.06</td>
<td>8,880</td>
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<td>6</td>
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</tr>
<tr>
<td>8</td>
<td>50.25</td>
<td>116,000</td>
</tr>
</tbody>
</table>
*Above sizing data is offered as a guide only. For actual applications consult local codes.