

# **IDF Curve Guide (Rainfall Intensity)**



**Roadway Design Division**

Website: [www.tn.gov/tdot/roadway-design/training.html](http://www.tn.gov/tdot/roadway-design/training.html)

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## **Introduction**

Rainfall intensity is the average rainfall rate (in/hr) for a duration equal to the time of concentration for a selected return period. Once a particular return period has been selected for design, and the time of concentration calculated for the drainage area, the rainfall intensity can be determined from Rainfall Intensity Duration Frequency (IDF) Curves

The Precipitation Frequency Data Server (PFDS) is a point-and-click interface developed to deliver NOAA Atlas 14 precipitation frequency estimates and associated information. Estimates and their confidence intervals can be displayed directly as tables or graphs via separate tabs.

1. First step is to click the link below or copy and paste the URL into a browser of your choice.

<https://hdsc.nws.noaa.gov/hdsc/pfds/>

NOAA's National Weather Service  
Hydrometeorological Design Studies Center  
Precipitation Frequency Data Server (PFDS)

www.nws.noaa.gov

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Precipitation Frequency Data Server (PFDS)

State:

Updated data available

PRVI

- Click on the state of Tennessee or select Tennessee in the drop-down menu about the map.

### NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: TN

**Data description**

Data type: Precipitation depth Units: English Time series type: Partial duration

**Select location**

1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude:  Longitude:

b) By station (list of TN stations): Select station

c) By address

2) Use map (if ESRI interactive map is not loading, try adding the host: <https://js.arcgis.com/> to the firewall, or contact us at [hdsc.questions@noaa.gov](mailto:hdsc.questions@noaa.gov)):

a) Select location  
Move crosshair or double click

b) Click on station icon  
 Show stations on map

**Location information:**  
Name: Murfreesboro, Tennessee, USA\*  
Latitude: 35.8509°  
Longitude: -86.4764°  
Elevation: 609.23 ft \*\*

\* Source: ESRI Maps  
\*\* Source: USGS

- Under Data description, what type of data that will be shown can be selected. Precipitation Depth indicates to what depth liquid precipitation would cover a horizontal surface in an observation period if nothing could drain, evaporate, or percolate from this surface.

Precipitation intensity will be used the most. Precipitation intensity is the average rainfall rate (in/hr) for a duration equal to the time of concentration for a selected return period. Once a particular return period has been selected for design, and the time of concentration calculated for the drainage area, the rainfall intensity can be determined from Rainfall Intensity Duration Frequency (IDF) Curves.

For this guide, select Precipitation Intensity from the drop-down menu under Data Type.

**Data description**

Data type: Precipitation intensity Units: English Time series type: Partial duration

- Under Select Location, manually enter the project location. This can be done in one of three ways. First is by the Latitude and Longitude of the project. This will be the most accurate since it will be the exact location of the project. The second method will be by selecting a station in a city that is already collected. Third method would be by address. Type in the address or county of the project to see the data for that specific location.

**Select location**

1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude:  Longitude:

b) By station (list of TN stations):

c) By address

- For this example, the station at Nashville WSO Airport was selected.

### NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: TN

**Data description**

Data type:  Units:  Time series type:

**Select location**

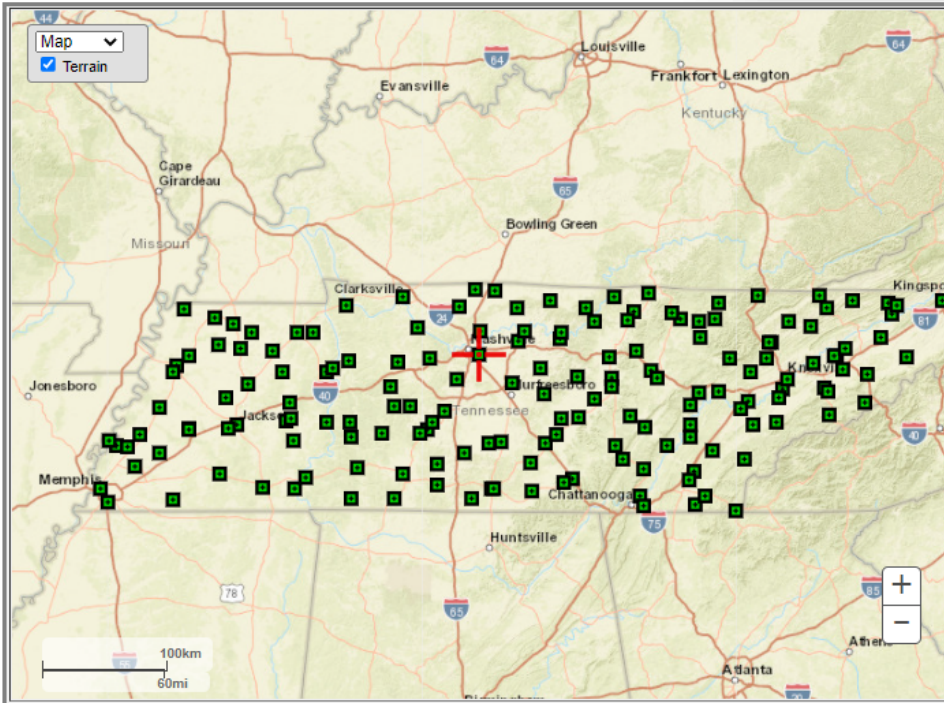
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude:  Longitude:

b) By station (list of TN stations):

c) By address

2) Use map (if ESRI interactive map is not loading, try adding the host: <https://js.arcgis.com/> to the firewall, or contact us at [hdsc.questions@noaa.gov](mailto:hdsc.questions@noaa.gov)):



a) Select location  
Move crosshair or double click

b) Click on station icon  
 Show stations on map

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**Location information:**  
Name: Nashville, Tennessee, USA\*  
Station name: NASHVILLE WSO AIRPORT  
Site ID: 40-6402  
Latitude: 36.1253°  
Longitude: -86.6764°  
Elevation: 600 ft

\* Source: ESRI Maps  
\*\* Source: USGS

6. Scroll down to see the data for the location selected. Both the tabulated data and graphical data can be seen by selecting the respected tab.

**POINT PRECIPITATION FREQUENCY (PF) ESTIMATES**  
 WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION  
 NOAA Atlas 14, Volume 2, Version 3

PDS-based precipitation frequency estimates with 90% confidence intervals (in inches/hour) <sup>1</sup>											
Duration	Average recurrence interval (years)										
	1	2	5	10	25	50	100	200	500	1000	
5-min	4.57 (4.22-4.98)	5.35 (4.97-5.82)	6.17 (5.69-6.71)	6.82 (6.28-7.40)	7.63 (7.00-8.29)	8.24 (7.50-8.95)	8.83 (7.99-9.80)	9.41 (8.45-10.2)	10.1 (8.99-11.0)	10.7 (9.38-11.7)	
10-min	3.65 (3.38-3.95)	4.28 (3.97-4.68)	4.94 (4.55-5.37)	5.45 (5.02-5.92)	6.08 (5.57-6.61)	6.56 (5.98-7.12)	7.02 (6.35-7.83)	7.46 (6.70-8.12)	8.00 (7.10-8.73)	8.39 (7.39-9.19)	
15-min	3.04 (2.82-3.30)	3.59 (3.32-3.90)	4.16 (3.84-4.53)	4.60 (4.23-4.99)	5.14 (4.71-5.58)	5.54 (5.04-6.01)	5.92 (5.35-6.43)	6.27 (5.64-6.83)	6.71 (5.96-7.33)	7.02 (6.18-7.89)	
30-min	2.08 (1.93-2.28)	2.48 (2.30-2.69)	2.96 (2.73-3.22)	3.33 (3.07-3.62)	3.81 (3.49-4.14)	4.17 (3.80-4.53)	4.53 (4.10-4.92)	4.88 (4.39-5.31)	5.34 (4.74-5.83)	5.69 (5.00-6.23)	
60-min	1.30 (1.20-1.41)	1.56 (1.44-1.69)	1.90 (1.75-2.08)	2.17 (2.00-2.36)	2.54 (2.32-2.75)	2.83 (2.57-3.07)	3.12 (2.82-3.39)	3.42 (3.08-3.73)	3.83 (3.40-4.18)	4.15 (3.65-4.55)	
2-hr	0.768 (0.711-0.833)	0.914 (0.847-0.994)	1.11 (1.03-1.21)	1.27 (1.17-1.38)	1.48 (1.36-1.61)	1.66 (1.51-1.80)	1.83 (1.65-1.99)	2.01 (1.81-2.19)	2.26 (2.00-2.47)	2.45 (2.15-2.89)	
3-hr	0.566 (0.514-0.605)	0.662 (0.612-0.722)	0.803 (0.742-0.873)	0.919 (0.845-1.00)	1.08 (0.984-1.17)	1.20 (1.09-1.31)	1.33 (1.20-1.45)	1.47 (1.31-1.80)	1.66 (1.48-1.81)	1.80 (1.57-1.97)	
6-hr	0.335 (0.307-0.368)	0.398 (0.365-0.438)	0.481 (0.442-0.530)	0.553 (0.505-0.607)	0.650 (0.590-0.715)	0.731 (0.657-0.803)	0.816 (0.727-0.898)	0.904 (0.798-0.995)	1.03 (0.894-1.13)	1.13 (0.988-1.25)	
12-hr	0.197 (0.182-0.215)	0.234 (0.218-0.258)	0.284 (0.261-0.310)	0.325 (0.298-0.355)	0.383 (0.349-0.418)	0.430 (0.389-0.468)	0.480 (0.431-0.522)	0.532 (0.473-0.579)	0.604 (0.529-0.659)	0.661 (0.572-0.725)	
24-hr	0.118 (0.111-0.125)	0.141 (0.133-0.150)	0.171 (0.162-0.182)	0.196 (0.185-0.208)	0.231 (0.217-0.244)	0.258 (0.242-0.274)	0.287 (0.269-0.304)	0.317 (0.295-0.336)	0.358 (0.331-0.379)	0.390 (0.359-0.413)	
2-day	0.070 (0.066-0.075)	0.084 (0.079-0.089)	0.102 (0.097-0.109)	0.118 (0.111-0.125)	0.139 (0.131-0.148)	0.157 (0.147-0.168)	0.175 (0.163-0.185)	0.195 (0.180-0.208)	0.221 (0.204-0.234)	0.243 (0.222-0.257)	
3-day	0.049 (0.047-0.053)	0.059 (0.056-0.063)	0.072 (0.068-0.078)	0.082 (0.078-0.087)	0.097 (0.091-0.103)	0.109 (0.102-0.115)	0.121 (0.113-0.128)	0.134 (0.124-0.141)	0.151 (0.140-0.160)	0.165 (0.151-0.175)	
4-day	0.039 (0.037-0.042)	0.047 (0.044-0.049)	0.057 (0.054-0.060)	0.065 (0.061-0.069)	0.076 (0.072-0.080)	0.085 (0.080-0.090)	0.094 (0.088-0.099)	0.104 (0.096-0.109)	0.116 (0.108-0.123)	0.126 (0.116-0.134)	
7-day	0.027 (0.026-0.029)	0.032 (0.031-0.034)	0.039 (0.037-0.042)	0.045 (0.042-0.048)	0.053 (0.050-0.056)	0.060 (0.058-0.063)	0.066 (0.062-0.070)	0.073 (0.068-0.078)	0.083 (0.076-0.088)	0.091 (0.083-0.097)	
10-day	0.022 (0.021-0.023)	0.026 (0.025-0.027)	0.031 (0.030-0.033)	0.036 (0.034-0.038)	0.041 (0.039-0.044)	0.046 (0.043-0.048)	0.051 (0.047-0.053)	0.055 (0.051-0.058)	0.062 (0.057-0.065)	0.067 (0.061-0.070)	
20-day	0.015 (0.014-0.016)	0.017 (0.017-0.018)	0.021 (0.020-0.022)	0.023 (0.022-0.024)	0.026 (0.025-0.028)	0.029 (0.027-0.030)	0.031 (0.029-0.032)	0.033 (0.031-0.035)	0.036 (0.034-0.038)	0.038 (0.036-0.040)	
30-day	0.012 (0.012-0.013)	0.014 (0.014-0.015)	0.017 (0.016-0.017)	0.018 (0.018-0.019)	0.021 (0.020-0.022)	0.023 (0.021-0.024)	0.024 (0.023-0.026)	0.026 (0.025-0.027)	0.028 (0.027-0.030)	0.030 (0.028-0.032)	
45-day	0.010 (0.010-0.011)	0.012 (0.011-0.012)	0.014 (0.013-0.014)	0.015 (0.014-0.016)	0.017 (0.016-0.017)	0.018 (0.017-0.019)	0.019 (0.018-0.020)	0.020 (0.019-0.021)	0.022 (0.021-0.023)	0.023 (0.022-0.024)	
60-day	0.009 (0.009-0.009)	0.011 (0.010-0.011)	0.012 (0.012-0.013)	0.013 (0.013-0.014)	0.015 (0.014-0.015)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.019 (0.018-0.020)	0.020 (0.019-0.021)	

<sup>1</sup> Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS). Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values. Please refer to NOAA Atlas 14 document for more information.

Estimates from the table in CSV format:

**POINT PRECIPITATION FREQUENCY (PF) ESTIMATES**  
 WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION  
 NOAA Atlas 14, Volume 2, Version 3

PF tabular

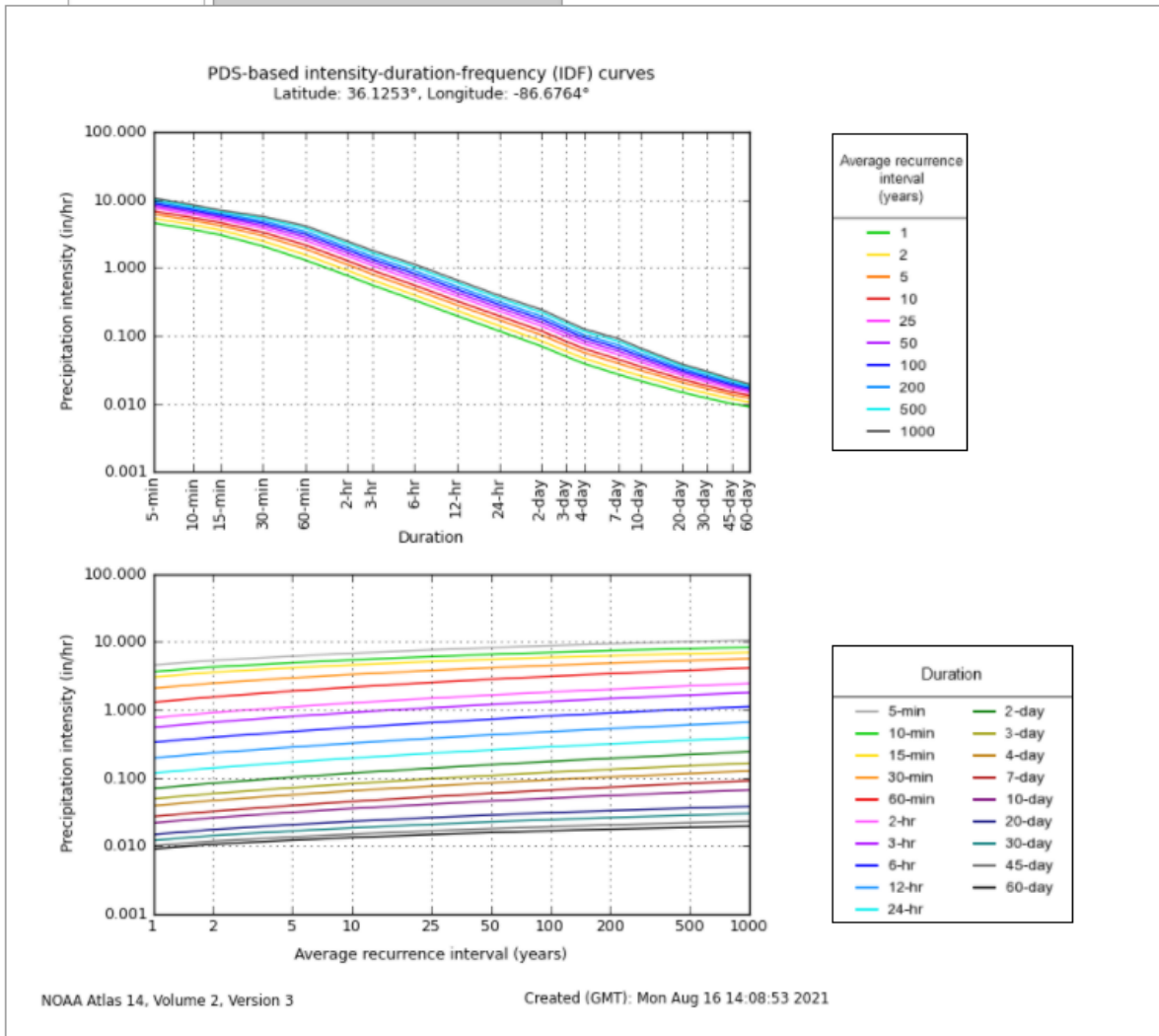
PF graphical

Supplementary information

Print page

Curves

PF estimates with confidence intervals



7. In most cases, the tabular data will be easier to analyze the precipitation frequency (in/hr). The data can be interpolated to determine more accurate data.

Each column is a different average recurrence interval in years. In the Drainage Manual Chapter 4, Table 4-1 list the frequency to use based on certain criteria.

Each row is a different duration from 5 minutes to 60 days. What to use here depends on what is trying to be accomplished.