



MEMO

November 29, 2018

To: District Engineers

From: Camille Thomason, P.E.
Director, Design Division

Subject: Updated Rainfall Data

The National Oceanic and Atmospheric Administration (NOAA) has released updated precipitation frequency estimates for Texas. They are published as *NOAA Atlas 14, Volume 11: Precipitation-Frequency Atlas of the United States*. The Volume 11 publication, specific for Texas, will be in two parts – 1) the rainfall data and supplementary maps are immediately available at <https://hdsc.nws.noaa.gov/hdsc/pfds/>, 2) accompanying documentation describing the data and methods will be published in Dec 2018.

TxDOT has been a contributing financial partner to this Atlas 14, Volume 11 update for Texas as well as a participant on the technical peer review panel. This updated study is considered the best available data for Texas rainfall frequencies. Reasons why it is considered best available include – 23 additional years of rainfall records (1995-2017, including Hurricane Harvey rainfall totals), evaluation and use of many additional rainfall gages, and improved statistical approaches.

Generally, significant increases have been observed for less frequent storms, like the 24-hr 100-yr event, in Central Texas and Coastal areas around Houston and Beaumont. The Rio Grande Valley, Del Rio and Eagle Pass area, and the Guadalupe Mountains, are other areas with observed increases. Other parts of the state have more varied results with even some decreases observed. Areas with significant rainfall increases are expected to indicate the need for larger hydraulic structures, such as bridges and culverts, which would increase construction costs. Correspondingly, areas with decreases will indicate the need for smaller hydraulic structures, which would decrease construction costs. It is important to review any specific area of interest to assess the degree to which the rainfall estimates have changed and thus how project costs may be affected.

Applicability – Use of this new rainfall data is considered best available data and will be incorporated into the Hydraulic Design Manual (HDM) by May 2019. However, this memo is considered equivalent policy to the HDM and will be publically available here - <https://www.txdot.gov/inside-txdot/forms-publications/consultants-contractors/publications/design.html>. As such, contracts that generally stipulate compliance with TxDOT policies, manuals, and procedures, such as professional services contracts, Design-Build contracts, or intra-agency agreements, are immediately subject to this memo, unless the work is complete or substantially complete. Any decision to revise or re-design projects, as a result of the update, is at the district's discretion.

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Project Timing – The updated data is available for immediate use on all TxDOT projects, including Alternative Delivery Projects. Current TxDOT projects are all at various stages of completion – planning, schematic, final design (i.e. PS&E preparation), letting, and construction. Projects in planning and schematic phases should be able to have the new rainfall data incorporated into the designs without significant difficulty. Changes for projects at the final design stage or later will need to be considered on a case-by-case basis. Those decisions will be at the districts’ discretion.

The remainder of the memo describes specific approaches that can be used to incorporate the new rainfall data into TxDOT projects.

Statistical Flow Models – Statistical Stream Gage Analysis and Regression Equation procedures remain unchanged with the new rainfall values. This is because these methods are based on stream flow statistics, not rainfall statistics.

Rainfall-Runoff Models

- **Rational Method** – Software that facilitates Rational Method calculations, like GEOPAK, often has Intensity-Duration-Frequency (IDF) curves from prior rainfall data embedded into the software. Designers may continue to use these older values, but should evaluate the new NOAA rainfall changes for their project area and, if there are increases, estimate an appropriate level of freeboard for use. The freeboard amount and a description of how it was generated should be noted in both the plans and the drainage report. IDF point values are available from the new NOAA rainfall data, but linear interpolation or location-specific curve generation may be needed to obtain values between certain time increments. These new IDF values can be imported for each project into GEOPAK as an alternate approach. This same location-specific IDF curve approach can be used for Rational Method calculations performed outside of GEOPAK as well.

TxDOT is currently working with Texas Transportation Institute (TTI) staff, as part of research project 0-6980, to update the IDF curve relationships for the state of Texas based on this newly released NOAA rainfall data. This work will include a refresh of the EBDLKUP-2015v2.1.xlsx file linked in the Hydraulic Design Manual (HDM) and is planned for completion in Oct 2019. Concurrently, TxDOT is transitioning from GEOPAK to Open Roads Designer (ORD) and Subsurface Utility Design and Analysis (SUDA). By the time TTI generates new IDF curve equations for Texas, these equations are expected to be provided as back-end files embedded in SUDA rather than GEOPAK later in 2019. Methods for determining freeboard amounts or alternate approaches should be coordinated with the District Hydraulic Engineer (DHE) and additional support may be provided by Design Division, Hydraulics staff.

- **Hydrograph Methods** – Software, like HEC-HMS, that facilitates hydrograph methods, like NRCS, utilizes Depth-Duration-Frequency (DDF) tabular data that is directly accessible from the new NOAA data. These DDF values can be determined at each project location through NOAA’s Precipitation Frequency Data Server (PFDS) and may be used immediately.

The Natural Resources Conservation Service (NRCS) National Engineering Handbook (NEH), Part 630, Chapter 4 includes a detailed discussion on updating the temporal distribution of rainfall based on the new NOAA Atlas 14 rainfall data from the older Type I-III distributions commonly used in Texas today. TxDOT is evaluating this proposed approach to temporal distribution of rainfall and further guidance may be forthcoming. Meanwhile, continued use of Type II and III temporal distribution of rainfall for Texas is considered appropriate.

Supplemental Data – Interested parties are encouraged to review other data available on NOAA’s PFDS website. This includes GIS data, cartographic maps, and seasonality analyses, among other items. These additional items may be of use to other professionals such as environmental, construction, and maintenance personnel. For example, the seasonality analysis shows that extreme rainfall events in Texas are most likely in the months of May-June and Sep-Oct.

If you have questions or need additional information regarding this new rainfall data, please contact Saul Nuccitelli, P.E., CFM, Design Division-Roadway and Hydraulic Design Section, at (512) 416-2219.

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