Background

The TxDOT Research Program and the U.S. Geological Survey Cooperative Water Program funded and published circa 1996–98 and subsequently enhanced at TxDOT bequest circa 2003–2004 comprehensive studies (atlases) of Depth-Duration-Frequency (DDF) of annual maximum rainfall. DDF values for Texas were mapped in Asquith and Roussel (2004), but these values in turn were never used to update so-called "*EBD* coefficients." The existing coefficients are a component of the nearly 1/2 century-old tool for estimation of intensity-duration frequency (IDF) of rainfall for small watershed drainage engineering throughout Texas

The project updated the *EBD* values and incorporated them into a re-designed, but well-used tool, EBDLKUP-2015.xlsx, to simplify rainfall intensity estimation. The project additionally built a companion tool to facilitate the use of hydrologic modeling software (HEC-HMS), and built substantial training materials.

What the Researchers Did

The researchers updated *EBD* coefficients for the IDF equation using the data mapped in Asquith and Roussel (2004). The researchers updated an existing tool (actually a substantial re-design of the tool, but the external look-and-feel was preserved) to simplify use of the IDF equation. The tool is named EBDLKUP-2015.xlsx.

Figure 1 is a screen capture of the interface to EBDLKUP-2015.xlsx

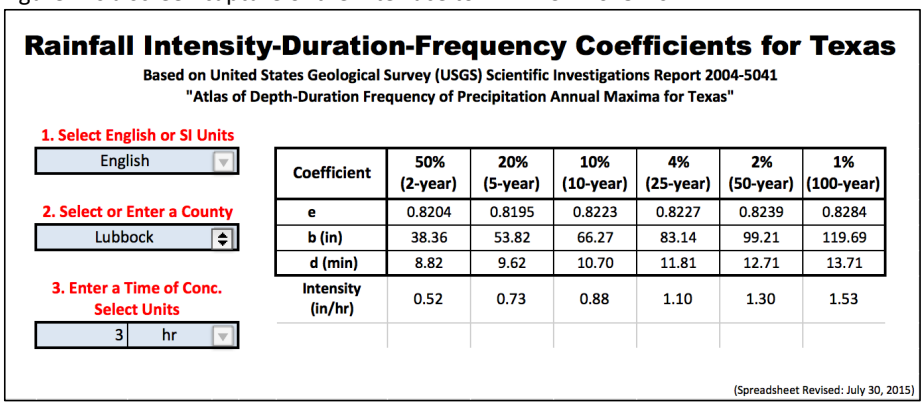
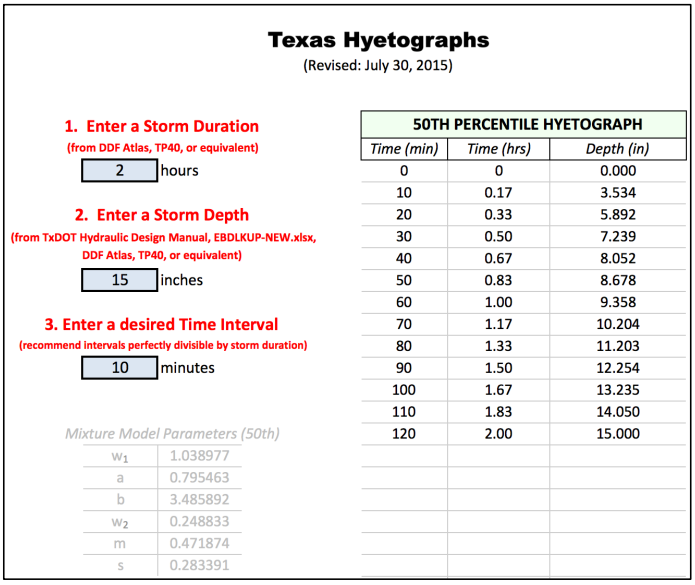


Figure 1. EBDLKUP-2015.xlsx User Interface

The researchers built a companion tool based on related TxDOT and USGS research to simplify construction of design storms for HEC-HMS. The companion tool is named

TXHYETO-2015.xlsx



Texas Hyetographs

(Revised: July 30, 2015)

1. Enter a Storm Duration

(from DDF Atlas, TP40, or equivalent)

2 hours

2. Enter a Storm Depth

(from TxDOT Hydraulic Design Manual, EBDLKUP-NEW.xlsx, DDF Atlas, TP40, or equivalent)

15 inches

3. Enter a desired Time Interval

(recommend intervals perfectly divisible by storm duration)

10 minutes

Mixture Model Parameters (50th)

w_1	1.038977
a	0.795463
b	3.485892
w_2	0.248833
m	0.471874
s	0.283391

50TH PERCENTILE HYETOGRAPH

Time (min)	*Time (hrs)*	*Depth (in)*
0	0	0.000
10	0.17	3.534
20	0.33	5.892
30	0.50	7.239
40	0.67	8.052
50	0.83	8.678
60	1.00	9.358
70	1.17	10.204
80	1.33	11.203
90	1.50	12.254
100	1.67	13.235
110	1.83	14.050
120	2.00	15.000

Figure 2. TXHYETO-2015.xlsx User Interface

The researchers built training materials to facilitate deployment of the tools within TxDOT. Each of the tools has a 5–7 minute training video/tutorial on the use of the tool. Additionally, a training module was constructed suitable for insertion into existing TxDOT training curriculum to further facilitate the rapid deployment of the 2015 tools.

What They Found

The updated EBD values differ from the previous values of circa 1985. Some counties analyzed were problematic in that the IDF curves did exhibit certain parallelism that is prevalent in the hydrologic literature; the inconsistencies with these counties were addressed in constructing the 2015 values.

Theodore Cleveland 10/5/2015 10:41 AM
Deleted: inconsistencies with these counties was

The new tools substantially reduce time required for design storm estimation as compared to using the Asquith and Roussel (2004) solely, and finally provide a mechanism to rapidly employ the findings of Williams-Sether and others (2004) for generating design storms based on Texas data.

What This Means

The 2015 values complete a hydrologic method update for Texas that will serve the hydrologic design community for decades.

The project was intended to be immediately implementable—thus the justification of deliberate preservation of the look-and-feel of earlier tools and substantial training components. In addition, the researchers suggest:

1. Deployment of EBDLKUP-2015.xlsx and TXHYETO-2015.xlsx.;
2. Update the TxDOT Hydraulic Design Manual to reflect the existence of these new tools as well as point to the training materials; and
3. Placing 2015-*EBD* values into GEOPAK Drainage design software currently used in Texas for transportation infrastructure design.

wasquith 10/5/2015 10:40 AM
Comment [1]: Confirm caps/no caps. Perhaps make no distinction in a PSR although somewhat useful in a final report.

The Value of Research

Substantial efficiency in small watershed drainage design will be realized. The new IDF coefficients (*EBD*-2015) are based on vastly more statistical information of rainfall than earlier coefficients. The new coefficients are implemented in a spreadsheet with same look-and-feel of the widely used canonical "TxDOT spreadsheet" by innumerable public and private entities. The spreadsheet tool is expected to require 1/4-hour effort to produce a table of design rainfall intensity suitable for engineering design documentation. Whereas a knowledgeable user going to the atlases, hand selecting depths and subsequently implementing required mathematical interpolation, and summarizing results suitable for engineering design documentation is expected commit about 2 hours of effort. The standardization of small watershed rainfall computations into new IDF coefficients is a flagship product of the TxDOT Research Program with public-service impact extending well beyond transportation drainage infrastructure design—for some parts of Texas this is effectively the only tool available for configuring design storms. The estimated economic value of the research is about $400,000/year in reduced time to estimate and document design storms for design of hydraulic components of transportation infrastructure.

Theodore Cleveland 10/5/2015 10:40 AM
Deleted: /4 hour

Theodore Cleveland 10/5/2015 10:40 AM
Deleted: knowledgable