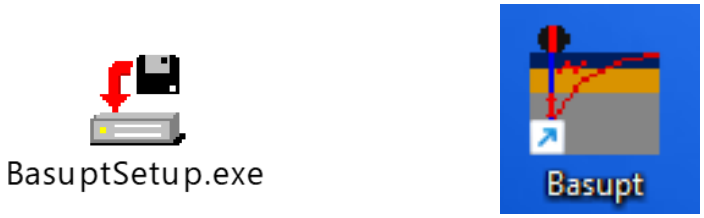
BASUPT User Manual

The Base Support Validation (BASUPT) software is provided by TxDOT to compute target deflections at the center of the load plate (designated as R1) and 12 inches from the center of the load plate (R2) at a Falling Weight Deflectometer (FWD) drop load. These values are essential for validating the adequacy and uniformity of base support before placing the surface layer and assessing pass/fail condition during construction quality control. While surface temperature is considered when testing on Hot Mix Asphalt (HMA), it is not required for treated or untreated bases.

INSTALLATION

To install the software, follow these steps:

1. Run the **BasuptSetup.exe** file provided by TxDOT as shown in Figure 1 (a).
2. If prompted to overwrite existing DLL files, select **"NO"**.
3. Confirm that the **BASUPT** icon appears on your desktop as Figure 1 (b).



(a) Program Setup File (b) Desktop Icon

Figure 1. BASUPT Setup Program and Loaded Icon.

MAIN INTERFACE AND INPUTS

Launching the BASUPT application (by double-clicking the desktop icon) opens the main interface where users enter project information, select project location, and specify pavement structure parameters. Figure 2 shows the BASUPT main screen.

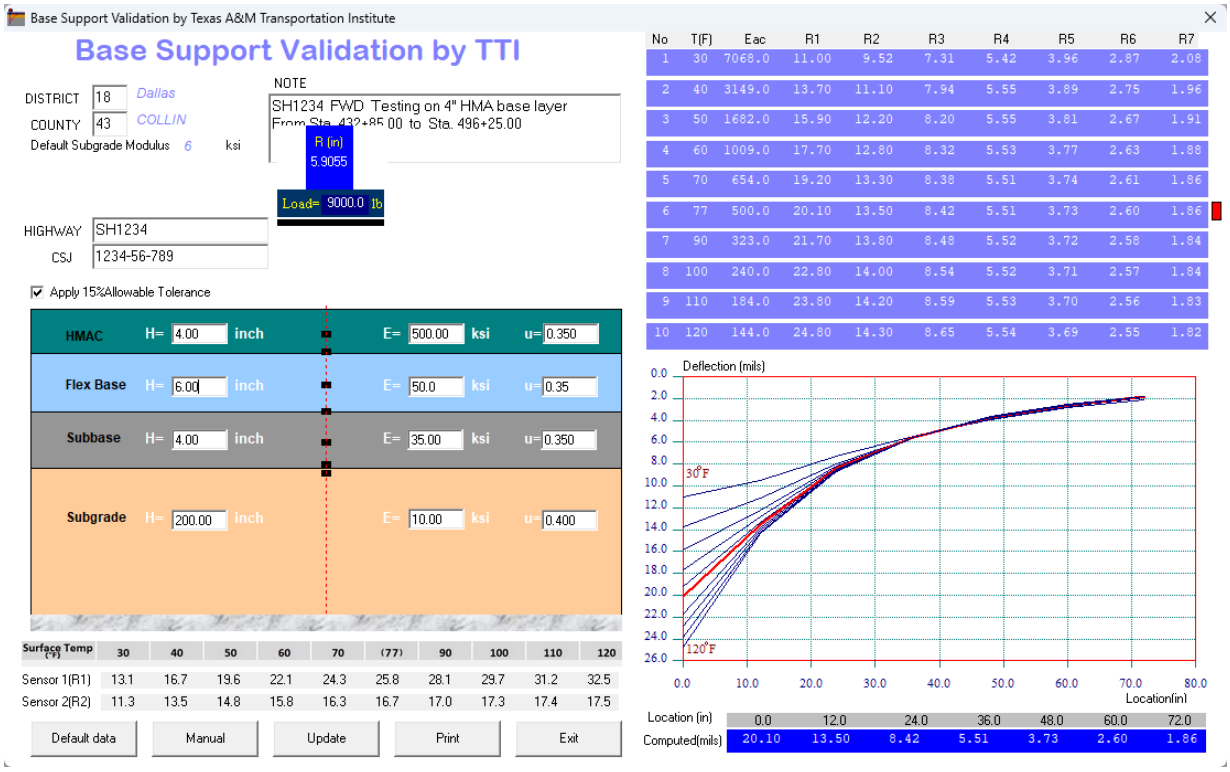


Figure 2. BASUPT Main Screen Computing Target Deflections for different Temperatures

Project Location (Default Subgrade Modulus)

BASUPT includes default subgrade modulus values for every county in Texas. These values are activated by selecting the district name in the input field.

1. Click the **District** or **County** input box in the main screen to open the Texas map, as shown in Figure 3.
2. Select **District** using the dropdown arrows or by clicking on the map.
3. Select **County** using the dropdown arrows.
4. Click "**Return**" to return to the main screen; the default subgrade modulus will be entered automatically. These defaults may be overwritten based on field data or user experience.

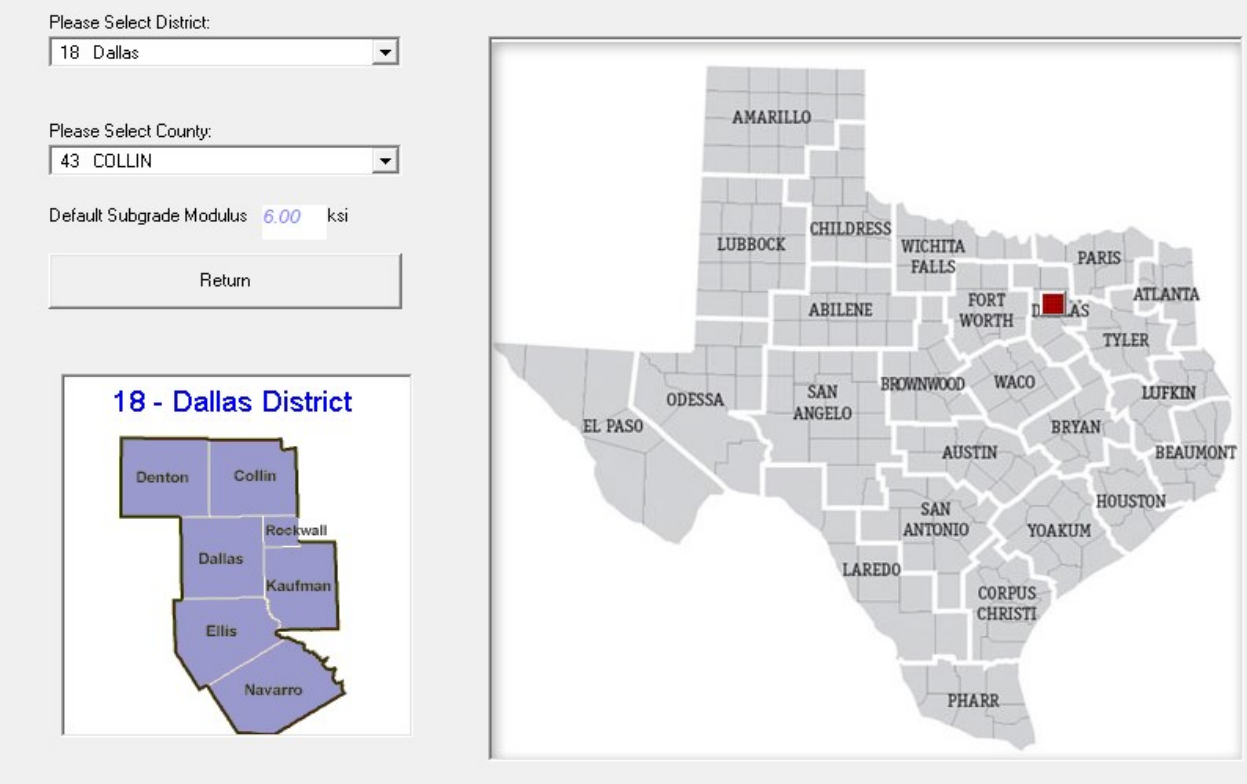


Figure 3. Selecting District and County to obtain Default Subgrade Modulus Value.

Project Information

Enter the project information, including the highway name, Control-Section-Job (CSJ) number, and any additional information in the Notes field.

FWD Load and Plate Radius

The default FWD plate radius is 5.9060 in. (150 mm), and the default target load is 9,000 lb. as illustrated in Figure 4. While both values are adjustable for calculation purposes, it is recommended that the plate radius remain unchanged.

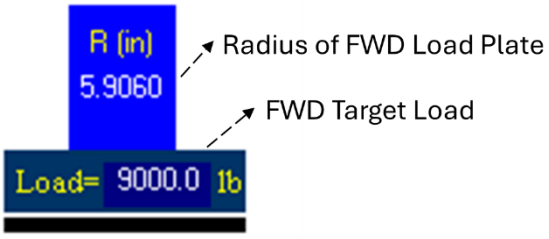


Figure 4. FWD Plate Radius and Target Load Used for Deflection Calculation.

Allowable Tolerance (AT)

While the FWD target load is set, the actual load applied in the field frequently exceeds that value. The BASUPT software allows users to apply an allowable tolerance (AT) of 15 percent to provide the permissible limit of variation in FWD deflection. When the AT is enabled, the target deflections R1 and R2 will be increased by that percentage value. This feature is useful for base support validation and construction quality control by accounting for higher FWD loading that may cause deflections to exceed target values.

Layer Material and Thickness

BASUPT supports up to a four-layer system: HMA, base [flexible base or cement treated base (CTB)], subbase, and subgrade.

- **Base Type:** Double-click the base label to switch between Flexible Base and CTB, as illustrated in Figure 5. For different base types, enter the appropriate moduli and Poisson's ratios to adjust the analysis.
- **Layer Thickness:** Enter the thickness for each layer in inches.
- **Removing Layers:** To remove a layer from the computation (for systems with fewer than 4 layers), enter **0** for the layer thickness.
- **Subgrade Depth:** The default subgrade thickness (i.e., depth to bedrock) is **200 in.** unless the actual thickness is known.

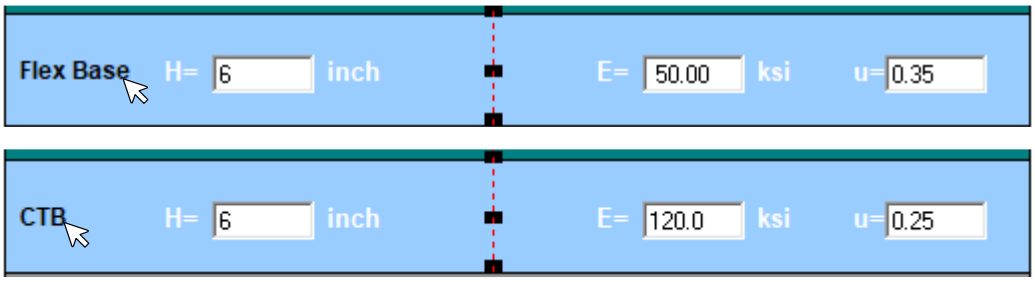


Figure 5. Base Type Active within BASUPT

Layer Modulus Values

The BASUPT software includes TxDOT-recommended modulus and Poisson's ratio values for commonly used Texas materials, as presented in Table 1. These defaults may be overwritten based on field data or user experience. Clicking the "**Default data**" button resets all fields, including thickness, modulus, and Poisson's ratio. When FWD testing is performed on a base layer, it is recommended to be conducted at least 3 days after compaction for CTB, and at least 1 day for untreated base, asphalt-treated base, or HMA.

Table 1. Default Modulus Values for Common Base and Subbase Layers.

Material Type	TxDOT Standard Specification	Default Modulus Values	Poisson's Ratio
Hot-Mix Asphalt	Item 341 or 344 (Dense-graded or Superpave)	500 ksi (at 77°F pavement temp.)	0.35
Flexible base	Item 247 (over raw subgrade)	No more than 3 times subgrade modulus (max. 75 ksi)	0.35
	Item 247 (over treated subgrade)	50 ksi	0.35
Treated base	Item 275 (Cement, Road mix)	120 ksi *	0.25
	Item 276 (Cement, Plant mix)	200 ksi *	0.25
	Item 292 (Asphalt)	300 ksi	0.35
	Item 290 (Emulsified) Item 291 (Foam asphalt)	100 ksi (1-3 days after compaction) 200 ksi (Design modulus)	0.35
Treated subgrade	Item 260 (Lime)	35 ksi	0.35
	Item 275 (Cement)	35 ksi	0.35
Raw Subgrade		County-specific values	0.40

* The design modulus applies to cured materials. If the modulus is evaluated during the first 3 days after compaction, the expected value may be adjusted based on prior experience with the materials used.

COMPUTING TARGET DEFLECTIONS

After entering all inputs, click "**Update**" to calculate the FWD deflection. The deflection table and deflection bowl at different temperatures will appear on the right side of the screen, as shown in Figure 5. Temperature-dependent deflections are generated when FWD testing is performed on the HMA layer due to its viscoelastic property. When testing directly on flexible base or treated base (HMA thickness is set to 0), the deflection at each geophone remains the same across all temperatures. Additionally, a temperature-based R1 and R2 table at the bottom left displays deflection values ranging from 30°F to 120°F, which are used for base support validation in the field.

In the deflection table, "Eac" indicates the HMA modulus at each temperature after applying the correction factor (CF):

$$E_{ac\ at\ T} = \frac{E_{77°F}}{CF}$$

$$CF = \frac{T^{2.81}}{200{,}000}$$

where $E_{ac\ at\ T}$ is a HMA modulus at a temperature (T, °F) and $E_{77°F}$ is the HMA modulus at 77°F.

To verify the deflection at a specific temperature, select the corresponding temperature line in the deflection result table. A red square will indicate the selected row, and the computed deflections will be displayed at the bottom of the deflection bowl diagram, as illustrated in Figure 6.

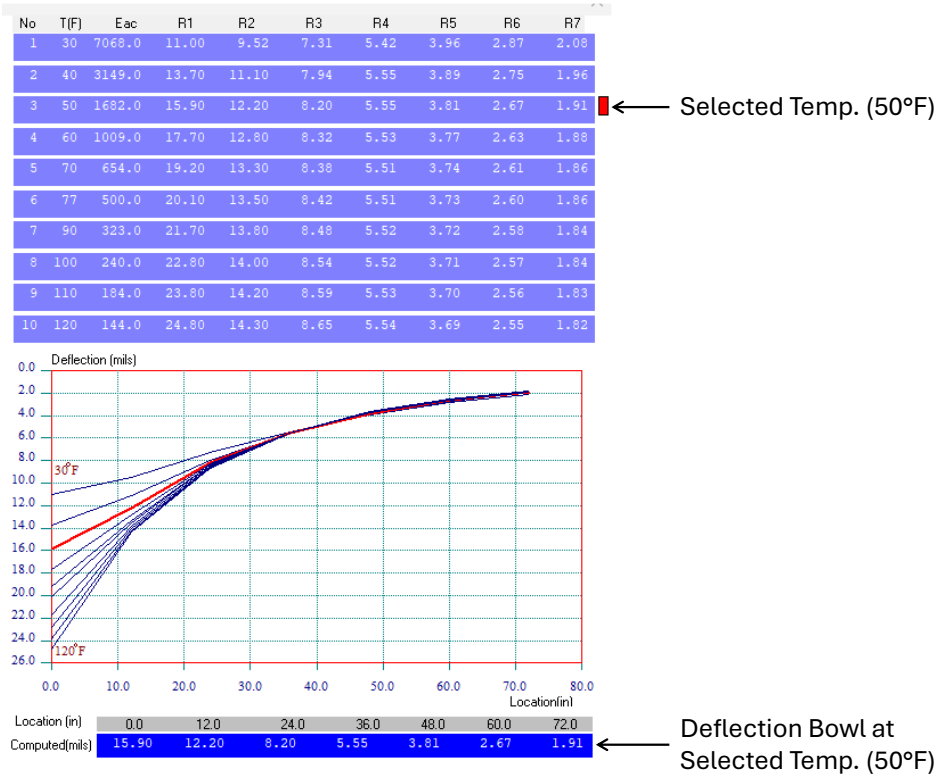


Figure 6. FWD Deflection at Different Temperatures

PRINT FINAL RESULTS

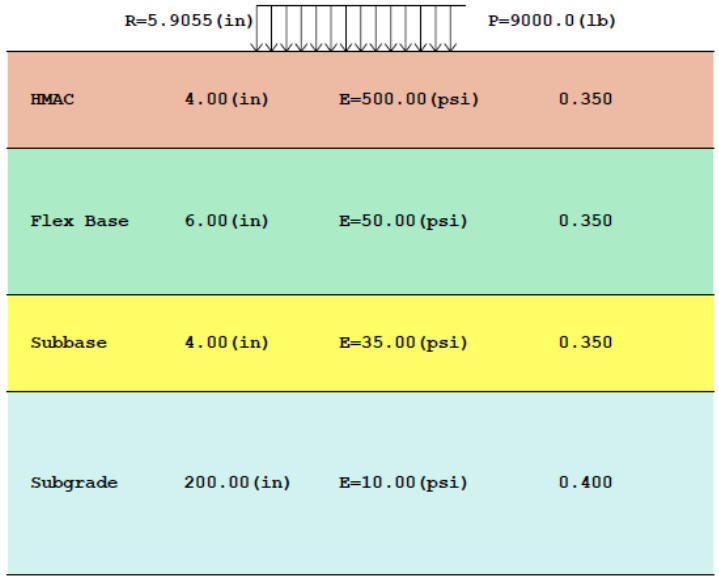
Click the "**Print**" to print and save the final analysis results in a single-page PDF, as presented in Figure 7. The report includes:

- Project information
- Pavement structure, including material type, thickness, modulus, and Poisson' ratio
- Target Deflections (mils) for Field Testing, providing only R1 and R2 deflections at different pavement temperatures, which will be used to verify both adequacy and uniformity of base support before placing the surface layer
- Indication of whether the 15% allowable tolerance was applied
- Tables and diagrams of the deflection bowl for all sensors at different pavement temperatures

Base Support Report for SH1234

DISTRICT	COUNTY	HIGHWAY	CSJ	DATE
Dallas	COLLIN	SH1234	1234-56-789	2/9/2026

NOTES: SH1234 FWD Testing on 4" HMA base layer
From Sta. 432+85.00 to Sta. 496+25.00



Target Deflection (mils) for Field Testing

Surface Temp 'F	30	40	50	60	70	77	90	100	110	120
Sensor 1 (R1)	12.65	15.76	18.29	20.36	22.08	23.12	24.96	26.22	27.37	28.52
Sensor 2 (R2)	10.95	12.77	14.03	14.72	15.30	15.53	15.87	16.10	16.33	16.45

Note:Applied 15% allowance tolerence

No	T(F)	Eac	R1	R2	R3	R4	R5	R6	R7
1	30	7068.0	11.00	9.52	7.31	5.42	3.96	2.87	2.08
2	40	3149.0	13.70	11.10	7.94	5.55	3.89	2.75	1.96
3	50	1682.0	15.90	12.20	8.20	5.55	3.81	2.67	1.91
4	60	1009.0	17.70	12.80	8.32	5.53	3.77	2.63	1.88
5	70	654.0	19.20	13.30	8.38	5.51	3.74	2.61	1.86
6	77	500.0	20.10	13.50	8.42	5.51	3.73	2.60	1.86
7	90	323.0	21.70	13.80	8.48	5.52	3.72	2.58	1.84
8	100	240.0	22.80	14.00	8.54	5.52	3.71	2.57	1.84
9	110	184.0	23.80	14.20	8.59	5.53	3.70	2.56	1.83
10	120	144.0	24.80	14.30	8.65	5.54	3.69	2.55	1.82

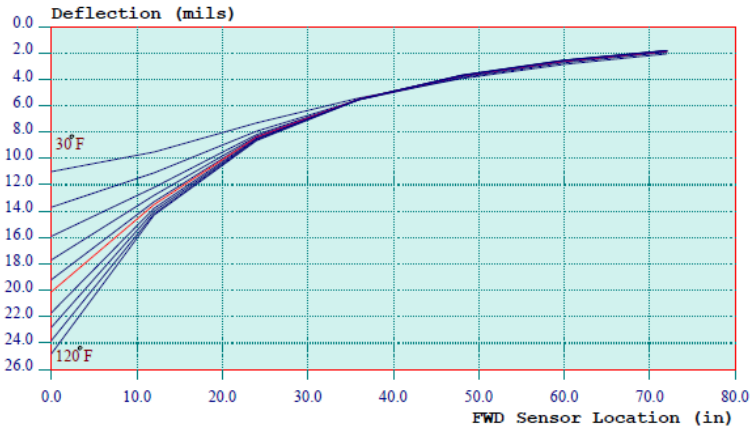


Figure 7. BASUPT Final Report