

## Estimating 10-Ton Route Capacity (When 10)

1. Obtain at least ten deflection tests in each mile of road.
2. Convert the FWD deflections to Benkelman Beam equivalents,  $BB_{eq}$ .

$$BB_{eq} = 5.15 + 1.05 \times FWD_{D1(9k)}$$

Where:  $BB_{eq}$  = Equivalent Benkelman Beam deflection, in mils  
 $FWD_{D1(9k)}$  = FWD No.1 sensor deflection normalized to 9,000 lbs., in mils

3. Correct the individual deflections,  $BB_{eq}$ , to 80°F  $\{BB_{80} = BB_{eq} + \text{Temperature Correction}\}$
4. Compute the "Present Deflection".  $\{\text{Present Deflection} = BB_{80}\}$   
 Calculate 85th percentile of all deflections in each mile
5. Compute 20-year ESAL's

$$\text{20-year ESALs} = \text{HCADT} \times \text{20-year ESAL Conversion Factor}$$

6. Determine "Maximum Allowable Deflection"

For Computed 20-year ESALs and Time of Year select Maximum Allowable Deflection

7. Compare "Present Deflection" to "Maximum Allowable Deflection"

If "Present Deflection" > "Maximum Allowable Deflection" then roadway strength is insufficient.  
 If "Present Deflection" < "Maximum Allowable Deflection" then roadway strength is sufficient.

8. Check Time of Year adjustment for seasonal 10-ton capacity.

A. Compute estimated "Present Deflection"

1. Obtain Deflection Ratio for date in question (future).
2. Multiply "Present Deflection" by the ratio of the current Deflection ratio to the future Deflection ratio to obtain "Estimated Present Deflection".

$$\text{Estimated Present Deflection} = \frac{\text{Current Deflection Ratio}}{\text{Future Deflection Ratio}} \times \text{Present Deflection}$$

- B. Compare "Estimated Present Deflection" to "Maximum Allowable Deflection" to determine seasonal sufficiency.

## Benkelman Beam deflection corrections to 80 °F

Range of Deflection (mils)	Temperature °F				
	to 35	36 - 45	46 - 55	56 - 65	66 - 75
0 - 10	5	4	3	2	1
10 - 20	7	6	4	3	1
20 - 30	10	8	6	4	2
30 - 40	10	8	6	4	2
40 - 50	12	10	7	5	2
50 - 60	15	12	9	6	3

## Factors to Convert HCADT to ESAL

Two-Way HCADT	Factor for 20-Year ESALs	
	Two Lane	Four Lane
0 - 59	2256	2029
60 - 99	2599	2340
100 - 174	2796	2515
175 - 299	3088	2781
300 - 574	3530	3179
575 - 1399	3923	3530
1400 -	4267	3840

## Maximum Allowable Deflection for 10-Ton Routes

Design Number of ESALs (1000's)	On or before the 15 <sup>th</sup> of					
	May	June	July	August	September	October
100	64	56	53	51	48	46
150	56	49	47	45	42	40
200	51	45	43	41	39	37
250	48	42	40	38	36	34
300	45	39	38	36	34	32
350	56	38	36	34	32	30
400	41	36	24	33	31	29
450	40	35	33	31	30	28
500	38	34	32	30	29	27
600	36	32	30	29	27	26
700	35	30	29	27	26	24
800	33	29	28	26	25	23
900	32	28	27	25	24	22
1000	31	27	26	24	23	22
1250	29	25	24	23	21	20
1500	27	24	23	21	20	19
2000	25	22	21	20	18	17
3000	22	19	19	18	16	15
4000	20	17	17	16	15	14
5000	19	16	16	15	14	13

**Deflection ratios to calculate critical spring deflections from  
deflections taken during other non-frozen times of the year (1983 Revision)**

<b>PLASTIC EMBANKMENTS</b>									
<b>Asphalt Surface Thickness</b>	<b>Date of Test</b>								
	5/1	5/16	6/1	6/16	7/1	7/16	8/1	8/16	Sept.
	5/15	5/31	6/15	6/30	7/15	7/31	8/15	8/31	
≤ 2 in.	<b>1.12</b>	<b>1.29</b>	<b>1.44</b>	<b>1.53</b>	<b>1.60</b>	<b>1.65</b>	<b>1.69</b>	<b>1.73</b>	<b>1.79</b>
> 2 ≤ 3½	<b>1.17</b>	<b>1.34</b>	<b>1.50</b>	<b>1.59</b>	<b>1.63</b>	<b>1.67</b>	<b>1.71</b>	<b>1.73</b>	<b>1.75</b>
> 3½ ≤ 5½	<b>1.14</b>	<b>1.24</b>	<b>1.37</b>	<b>1.43</b>	<b>1.50</b>	<b>1.58</b>	<b>1.64</b>	<b>1.70</b>	<b>1.71</b>
> 5½ ≤ 8 in.	<b>1.17</b>	<b>1.25</b>	<b>1.25</b>	<b>1.25</b>	<b>1.26</b>	<b>1.30</b>	<b>1.41</b>	<b>1.50</b>	<b>1.55</b>
> 8 in. Conventional Construction	<b>1.13</b>	<b>1.18</b>	<b>1.16</b>	<b>1.13</b>	<b>1.15</b>	<b>1.18</b>	<b>1.29</b>	<b>1.37</b>	<b>1.45</b>
> 8 in. Full-Depth Construction	<b>1.12</b>	<b>1.16</b>	<b>1.16</b>	<b>1.10</b>	<b>1.09</b>	<b>1.15</b>	<b>1.33</b>	<b>1.46</b>	<b>1.55</b>

<b>SEMI-PLASTIC EMBANKMENTS</b>									
<b>Asphalt Surface Thickness</b>	<b>Date of Test</b>								
	5/1	5/16	6/1	6/16	7/1	7/16	8/1	8/16	Sept.
	5/15	5/31	6/15	6/30	7/15	7/31	8/15	8/31	
≤ 5 in.	<b>1.16</b>	<b>1.35</b>	<b>1.40</b>	<b>1.50</b>	<b>1.52</b>	<b>1.51</b>	<b>1.48</b>	<b>1.46</b>	<b>1.45</b>
> 5 in.	<b>1.29</b>	<b>1.40</b>	<b>1.46</b>	<b>1.50</b>	<b>1.54</b>	<b>1.58</b>	<b>1.64</b>	<b>1.69</b>	<b>1.71</b>

<b>NON-PLASTIC EMBANKMENTS</b>									
<b>Asphalt Surface Thickness</b>	<b>Date of Test</b>								
	5/1	5/16	6/1	6/16	7/1	7/16	8/1	8/16	Sept.
	5/15	5/31	6/15	6/30	7/15	7/31	8/15	8/31	
≤ 2 in.	<b>1.30</b>	<b>1.41</b>	<b>1.72</b>	<b>1.79</b>	<b>1.83</b>	<b>1.83</b>	<b>1.88</b>	<b>1.88</b>	<b>1.88</b>
> 2 ≤ 5½	<b>1.21</b>	<b>1.36</b>	<b>1.47</b>	<b>1.53</b>	<b>1.58</b>	<b>1.56</b>	<b>1.52</b>	<b>1.49</b>	<b>1.44</b>
> 5½ ≤ 8 in.	<b>1.00</b>	<b>1.02</b>	<b>0.98</b>	<b>1.00</b>	<b>1.05</b>	<b>1.05</b>	<b>1.07</b>	<b>1.11</b>	<b>1.11</b>