Pavement Design
Soil R-Value Determination
for
MN Cities and Counties

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We all have a stake in A TO B

Soil R-Value Determination

OUTLINE:

- What is R-Value?
- How is it Measured?
- How is it Calculated?
- Determining R-Value for Pavement Design
- Resources

What is R-Value

- Developed by Caltrans for pavement design.
- Through use of a stabilometer the resistance, “R” value, of aggregate bases, subbases and subgrade soils is determined.
- R-Value Test Procedures:
  - California Test 301
  - ASTM D2844
  - AASHTO T190

What is R-Value

- The R-value is the ability of a soil medium to resist lateral spreading due to an applied vertical load, such as tire loads.

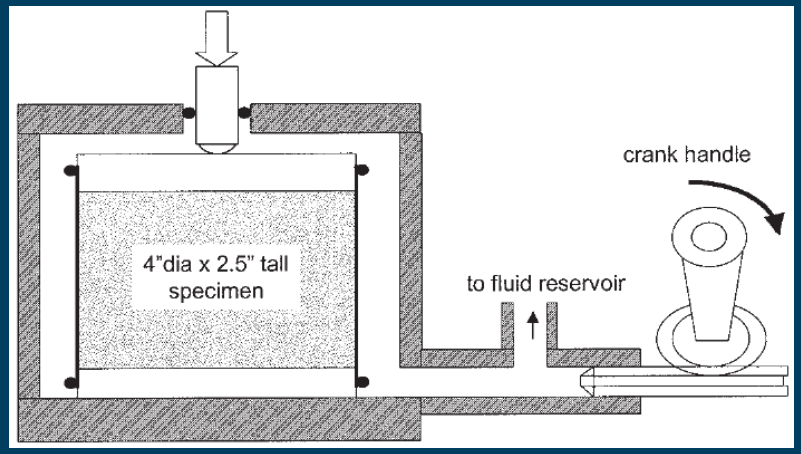
(geotechnicalinfo.com)

(bing.com)

How is R-Value Measured?

A compacted cylindrical soil sample is placed in a Hveem Stabilometer device and compressed.

Hveem Stabilometer



Schematic Hveem Stabilometer

The stabilometer measures the horizontal pressure that is produced while the soil sample is under compression.

How is R-Value Calculated?

Using readings obtained from the Stabilometer test, R-value is calculated using this formula.

$$R = 100 - \left[\frac{100}{\frac{2.5}{d}\left(\frac{P_v}{P_h} - 1\right) + 1} \right]$$

where:

R = "R-VALUE BY STABILOMETER"

P_v = 1.1 MPa vertical pressure

P_h = "STABILOMETER P_h at 8900 N" (the horizontal pressure Part 4, Section B, 1 through 11).

d = "DISPLACEMENT" (Part 4, Section B, 12 through 16).

(Caltrans Test 301)

Determining R-Value for Pavement Design

- Actual R-Value
  - Hire a soil/geotechnical consultant to perform soil borings to profile the soils, obtain samples and run test for you.
  - MnDOT Materials and Pavement Research Laboratory in Maplewood can perform the test for you.
- Calculated R-Value
  - From FWD data, use MnDOT TONN Analysis.
- Estimated R-Value
  - Have soil/geotechnical consultant estimate it for you.
  - Talk with your MnDOT District Materials or Soil Engineer.
  - Consult the MnDOT Pavement Manual Table 5-3.3(a) & 5-3.3(b).
  - Contact SALT Pavement Engineer.

designbolts.com

Typical Soil R-Values

Table 5-3.3(a). Stabilometer R-values by soil type, based on data collected by Mn/DOT through 1974.

AASHTO Soil Type	Textural	Assumed R Value	Comments
A-1-a	Sands, Gravels	75	Excellent confidence in using assumed value.
A-1-b	Sands, Sandy Loams (nonplastic)	70	If percent passing #200 sieve is 15 to 20%, R value may be as low as 25. In such cases, it is highly desirable to obtain laboratory R-values.
A-2-4 & A-2-6	Sandy Loams (nonplastic, slightly plastic, or plastic)	30 (70 for LS and LFS)	Loamy Sands and Loamy Fine Sands commonly have R-value of 70. Laboratory R values range from 10-80 for the entire A-2 classification. It is highly desirable to obtain laboratory R values for the Sandy Loams. See Table 5-3.1 for sampling frequency.
A-3	Fine Sands	70	Excellent confidence in using assumed value.
A-4	Sandy Loams (plastic) Silt Loams Silty Clay Loams Loams Clay Loams Sandy Clay Loams	20	Laboratory R values range from 10 to 75. It is highly desirable to obtain laboratory R values. See Table 5-3.2 for sampling frequency.
A-6	Clay Loams Clays Silty Clay Loams	12	Laboratory R values commonly occur between 8 and 20.
A-7-5	Clays Silty Clays	12	Data available is limited.
A-7-6	Clays	10	Laboratory R values commonly occur between 6 and 18.

MnDOT

Table 5-3.3(b) Typical assumed R-values for granular subgrades

Subgrade	Assumed R-Value
Four feet of select granular	70
One foot of select granular and three feet of granular	60
Four feet of granular	50

Granular - (Mn/DOT Spec. 3149.2B1)
Select Granular - (Mn/DOT Spec. 3149.2B2)
(AASHTO Soils Types - A-1-a, A-1-b, and A-3)

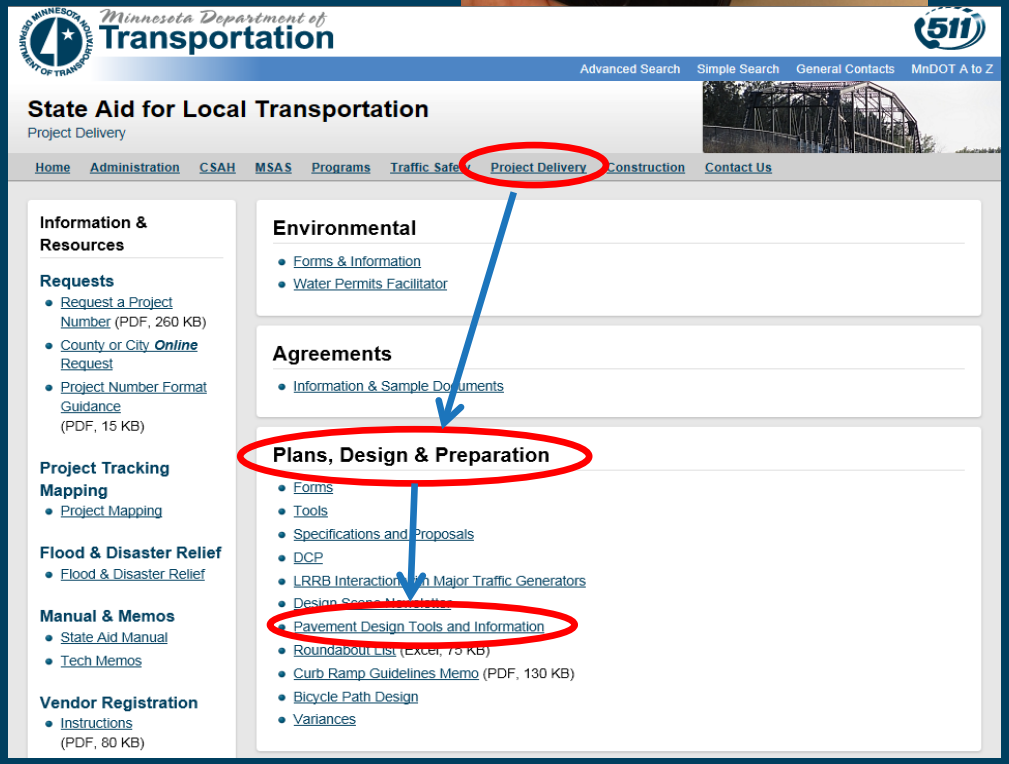
Relationship of Soil Factor to R-Value

SOIL FACTOR (S.F.)	ASSUMED R-VALUE	GENERAL PLASTICITY[4]
50 - 75	70 - 75	NP
50 - 75	30 - 70	SP
50	70	NP
100 - 130	20	SP
130+	na	na
100	12	P
120	12	P
130	10	P

NP = Non-Plastic
SP = Semi-Plastic
P = Plastic

Resources

- State Aid Website:
  - Project Delivery
    - Plans, Design & Preparation
      - Pavement Design Tools and Info.



Resources

- MnDOT District Materials/Soil Engineer
- Joel Ulring

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  "P" – Pavement Design

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