emtek™

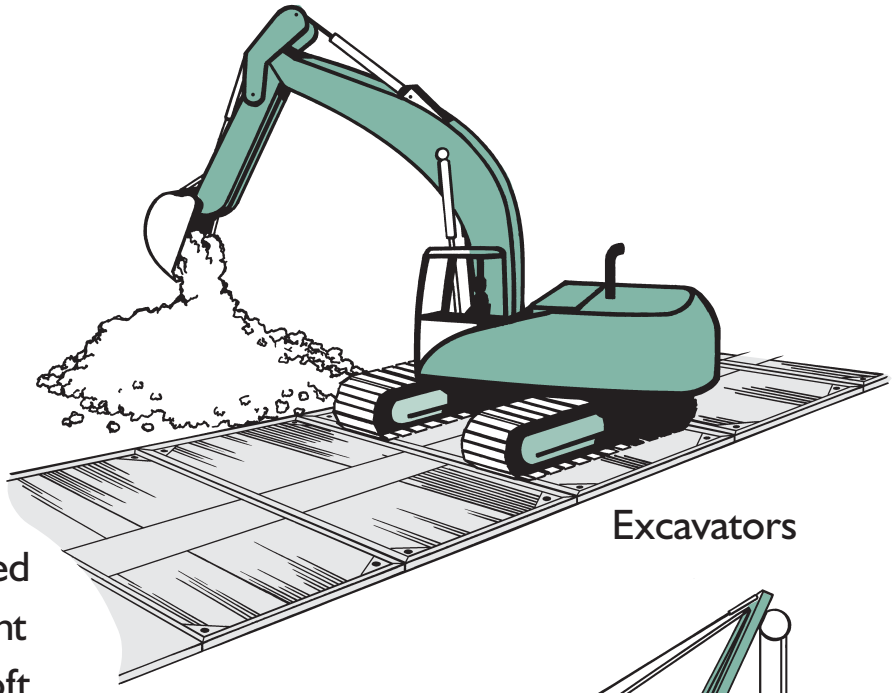
HEAVY EQUIPMENT MAT

RIGMAT DESIGN GUIDE

Anthony Hardwood Composites

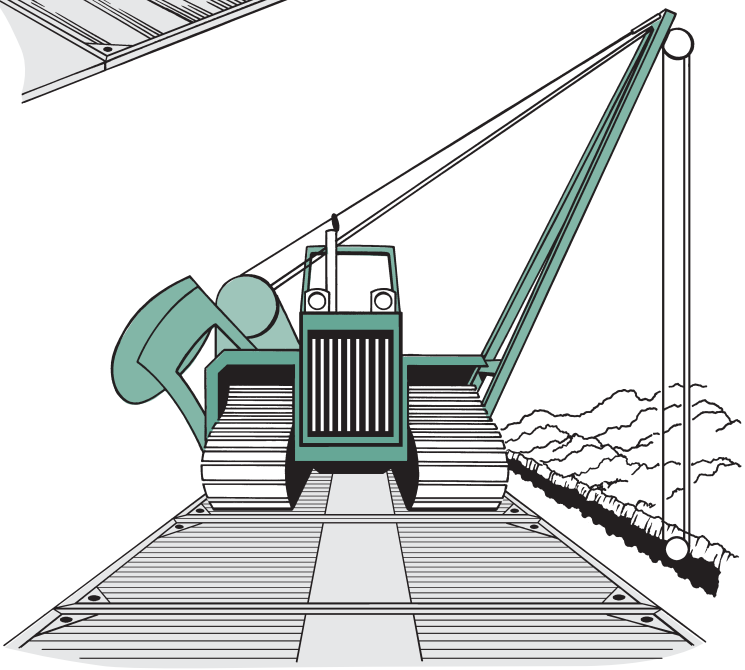
emtek™ rigmat

HEAVY EQUIPMENT MAT

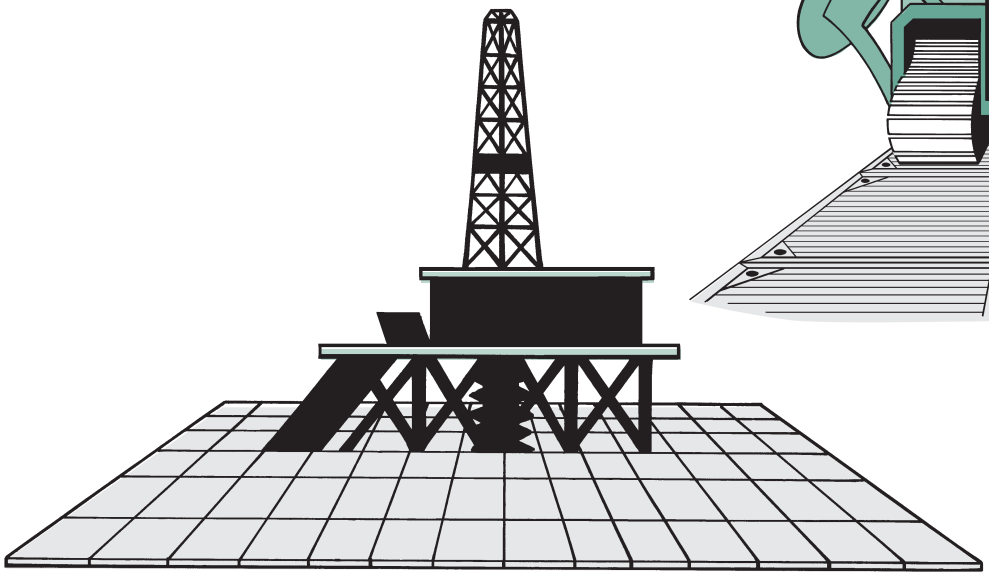


Excavators

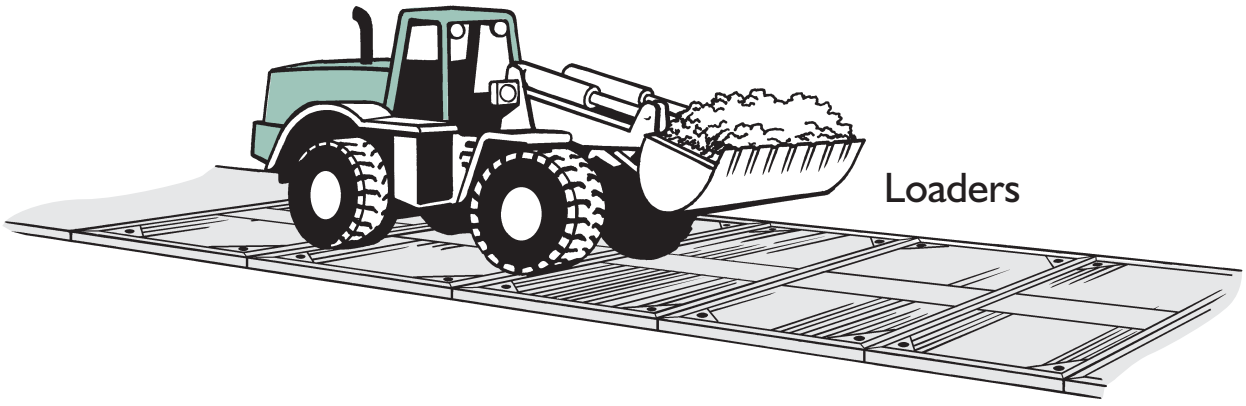
emtek *rigmat* is the engineered mat for enabling heavy equipment to operate on unstable or soft soil conditions.



Pipe Layers



Drilling Rigs



Loaders

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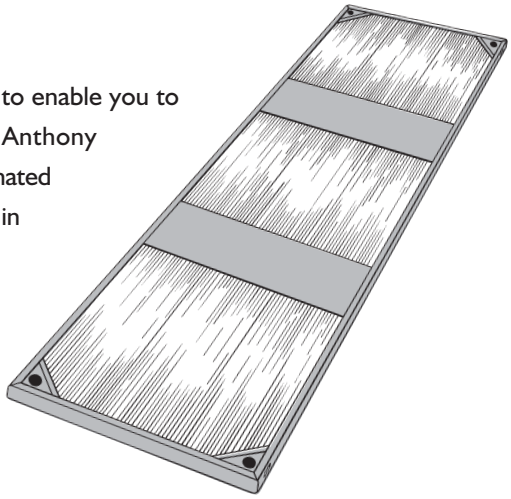
Introduction



This Design Guide is intended to provide design information to enable you to determine how ***emtek*** *rigmat* can best serve your needs. Anthony Hardwood Composites' ***emtek*** *rigmat* is an engineered, laminated wood mat that is made from indigenous Southern hardwoods in Sheridan, Arkansas and then framed with a 1/2" wall formed channel. By protecting the ***emtek*** core from handling abuse, the ***emtek*** *rigmat* will provide longer and more consistent usable mat life.

Durability

emtek *rigmat* is engineered to withstand the abuse of today's industrial construction sites. Control of raw material density in the manufacturing process ensures that ***emtek*** *rigmat* has a hard, impact resistant surface. The laminating process creates a composite structure that resists fracture.

Strength

Predictable, reliable strength is a necessity when the safety of workers and equipment assets are at stake. Patented construction creates a work platform that has engineering design values that exceed all sawn woods identified by the National Design Standard (NDS 2004). Every ***emtek*** *rigmat* component is proof loaded by machine to ensure that the finished mat will meet the strict design criteria and quality standards established by AHC.

Consistency

Uniform product dimensions with a consistent finish create a work surface that helps contractors reduce workplace hazards.

Storage and Work Environment Considerations

emtek *rigmat* mats are valuable to the contractor, and proper storage can extend the service life for many years. Product should be stored in an environment with good drainage. Stacking mats with stickers between layers provides an avenue for air movement that can reduce the effects of decay caused by prolonged exposure to moisture.

Wood is a natural polymer that exhibits good resistance to chemical exposure; however, extended contact with strong acids (ph<3) or strong bases (ph>9) can cause wood to degrade and compromise the structural integrity of the product. The resins used in ***emtek*** *rigmat* construction are thermoset polymers that are highly resistant to chemical attack and will degrade slower than the wood when exposed to high chemical concentrations. Chemical MSDS sheets should be referenced if the product's exposure is suspected.

Prolonged exposure to temperature above 150° F can cause the wood to degrade and should be avoided to ensure that the product performs at the designed levels.

How to use this guide…

emtek *rigmat* mats are essentially our standard ***emtek*** mat framed with steel for added durability. Like our standard ***emtek*** mats these are engineered to support specified loads. The tables in this guide show allowable loads. These loads are based solely on the strength of the ***emtek*** billets within the frame. No strength has been associated with the steel frame in the following allowable load tables. This is because the distance between steel members is too great to assume that loads can be effectively transferred from one steel member to the next with a moving load. Each mat has been proof loaded to 1.5 times the allowable load at the manufacturing facility to certify these values.

The following pages show different loading configurations for the mats. Mat thickness is actually 1/2" greater than the indicated size. This is because machining the ***emtek*** billets to accept the steel and create a flush surface results in an affective loss of material of 1/2". Generally pneumatic tired vehicles will be represented by the 6' wide loading configurations (Load Case 1 and Load Case 4). Tracked vehicles will generally be represented by the 9' wide loading configurations (Load Case 2 and Load Case 5). When one wheel or track is on one mat, the single load configurations shown in Load Case 3 and Load Case 6 will be applicable. In all cases the loads shown in the tables are in thousands of pounds (Kips). To get pounds simply multiply the number in the cell by 1000.

It is important to note that the loads are associated with one foot of mat width. If the footprint of the tire is 2' long then the allowable load can be multiplied by two. This is especially important when considering applications for tracked vehicles that can distribute loads along track lengths up to16' or longer.

There are two sets of tables. The first set is for applications where load is centered on the mat. The second set (Table 2) is for applications where the load is offcenter. In the applications of Uniform Bearing, we have shown different allowable loads for different soil conditions (Soil Type "1", "3", and "5"). These soil conditions are described in the notes on page 7 of the tables. It is important to choose the soil condition that most closely approximates the conditions that will be supporting the mats, as this will affect the allowable loads.

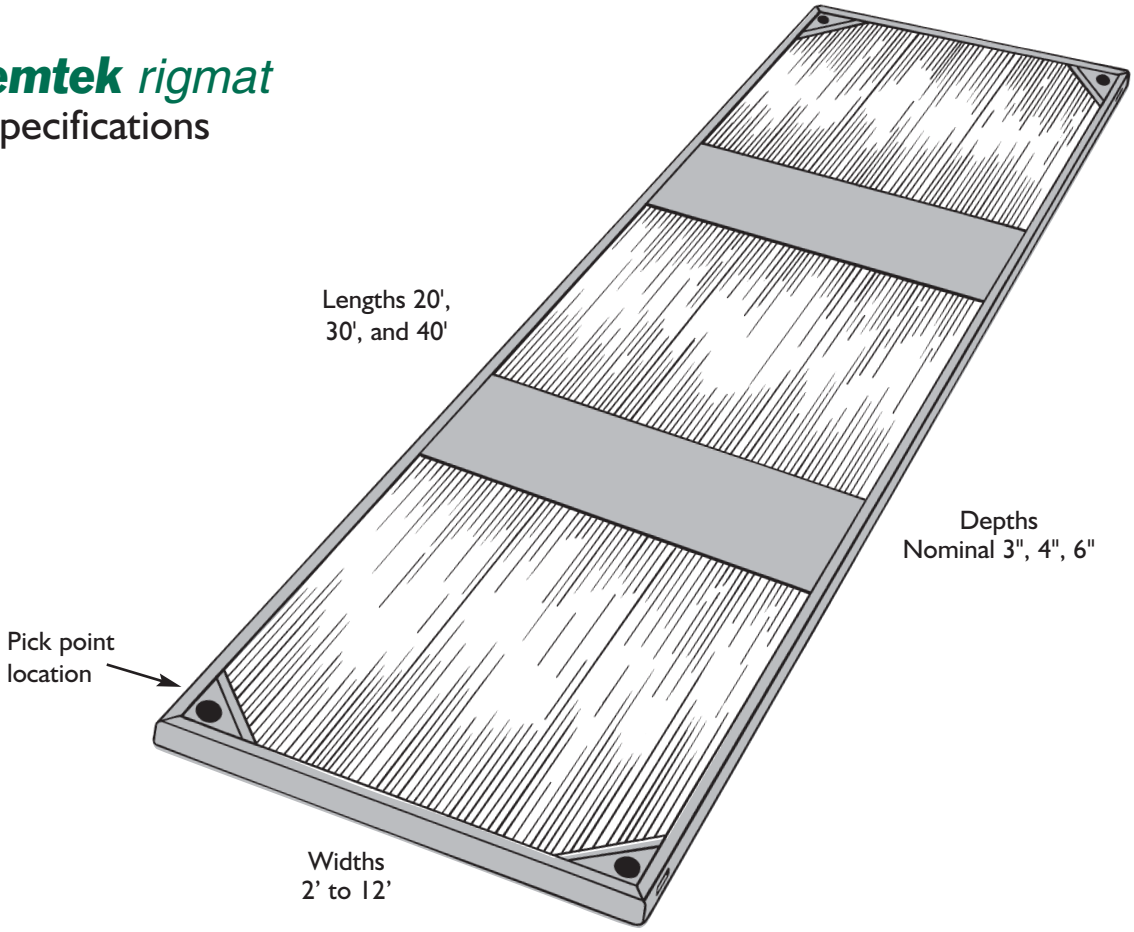
The tables show different deflection preferences. If you would like to see no more than 2" of deflection on the matted surface the lower rows of each mat size should be considered. If a deflection up to 4" is acceptable, then upper rows and the associated higher loads can be considered. In some cases loads are limited by the strength of the product, and maximum deflections are not allowed. In this case the deflection at the maximum allowable load is indicated.

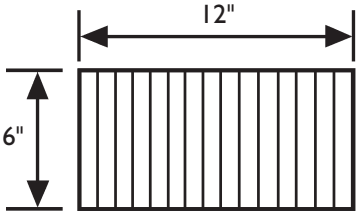
Certainly construction applications with heavy equipment will result in unique loads and loading configurations. If you have any questions regarding your unique situation please feel free to call us at **870-942-4000**.

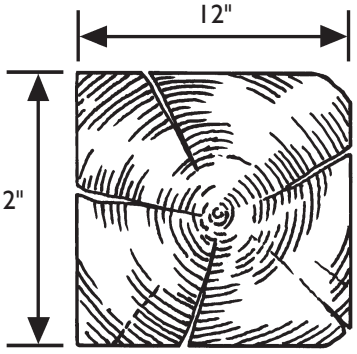
Caution to Users:

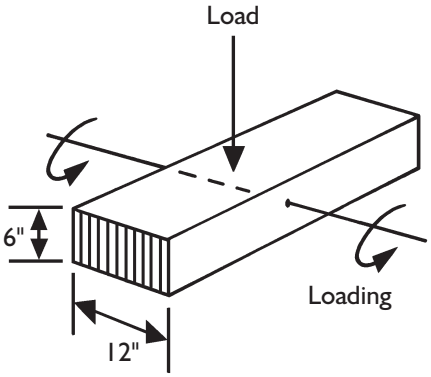
The design properties and strength characteristics of the ***emtek*** product are verified at the time of manufacture. During the service life of the product, use conditions will reduce the load carrying capacity of the product. If there are any questions as to whether the strength of the product has been compromised during handling, storage, aggressive use, etc., please feel free to contact us so we can help assess any potential degrade.

emtek rigmat
Specifications







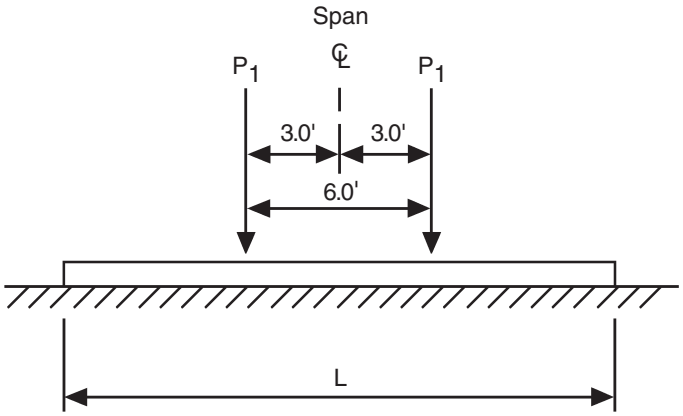


Though less than half the weight, 6" x 12" ***emtek*** *rigmat* is 10% stronger than a grade No. 2 12" x 12" white oak. Each beam produced by AHC has a rated structural capacity verified by intense quality control standards.

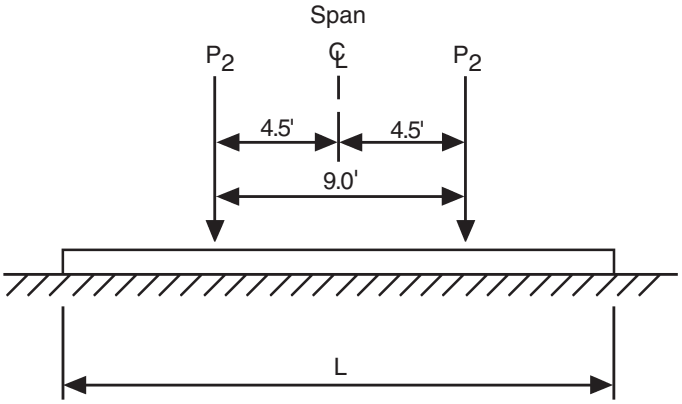
***emtek rigmat* Weight in Pounds**						
rigmat mat Size	2.75"		3.5"		5.5"	
	Dry	Wet/Treated	Dry	Wet/Treated	Dry	Wet/Treated
8' x 20'	3,948	4,228	4,645	5,018	6,037	6,597
8' x 30'	5,158	5,578	6,188	6,748	8,250	9,090
8' x 40'	6,367	6,927	7,732	8,479	10,462	11,582

Note: 1. Assumed density: dry 47 pcf; wet 52 pcf
2. The affective thickness in the table is 2.75", 3.5", 5.5", the actual thickness is 3", 4", 6".

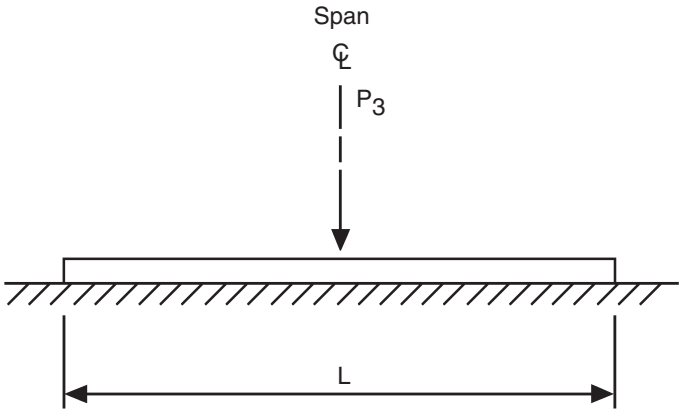
Load Diagrams
Uniform Bearing On Soil



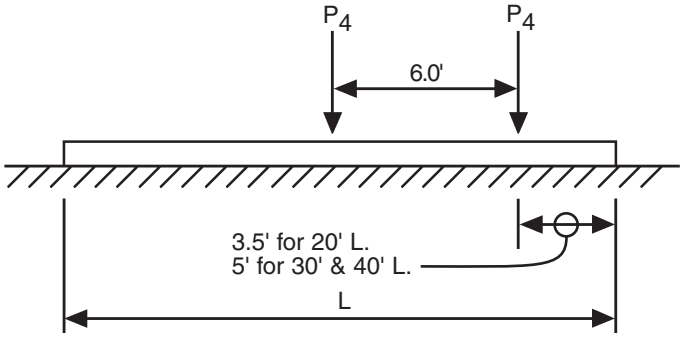
Load Case 1



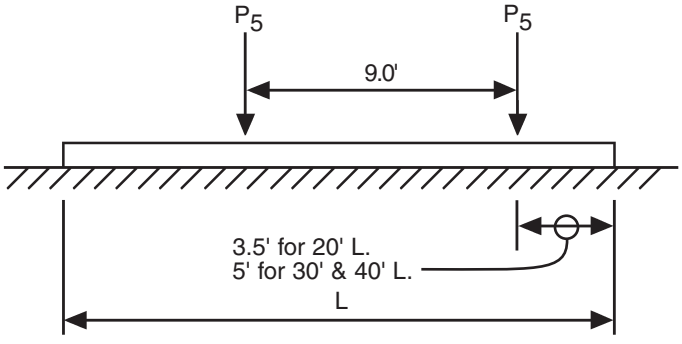
Load Case 2



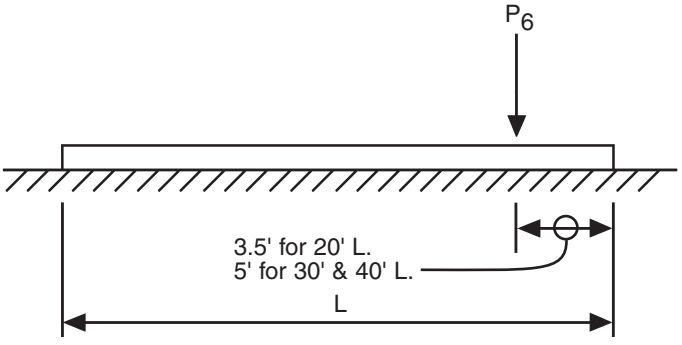
Load Case 3



Load Case 4



Load Case 5



Load Case 6

Table 1
Load Criteria (centered loading)

Load Per Linear Foot Of Width, K = Kip = 1,000 Lbs

Length		Thickness	Load Case 1			Load Case 2			Load Case 3		
Feet		Inches	P Load Kips	Defl. Inches	Bearing PSI	P Load Kips	Defl. Inches	Bearing PSI	P Load Kips	Defl. Inches	Bearing PSI
Uniform Bearing On Soil Type "1"											
40		2.75	3.4	**3.9**	3.9	4.6	**4.0**	4.0	4.1	**3.2**	3.1
		3.5	3.8	**4.0**	4.0	4.7	**4.0**	4.0	5.7	**3.7**	3.8
		5.5	4.6	**4.0**	4.0	5.2	**4.0**	4.0	8.2	**4.0**	4.0
	2.0 Defl. Limit	2.75	1.8	2.0	2.0	2.3	2.0	2.0	2.6	2.0	2.0
		3.5	1.9	2.0	2.0	2.4	2.0	2.0	3.1	2.0	2.0
		5.5	2.3	2.0	2.0	26	2.0	2.0	4.2	2.0	2.0
30		2.75	3.4	**4.0**	4.0	4.5	**4.0**	4.0	4.1	**3.3**	3.3
		3.5	3.7	**4.0**	4.0	4.6	**4.0**	4.0	5.5	**3.7**	3.7
		5.5	4.6	**4.0**	4.0	5.2	**4.0**	4.0	8.2	**4.0**	4.0
	2.0 Defl. Limit	2.75	1.7	2.0	2.0	2.3	2.0	2.0	2.5	2.0	2.0
		3.5	1.9	2.0	2.0	2.4	2.0	2.0	3.0	2.0	2.0
		5.5	2.3	2.0	2.0	2.6	2.0	2.0	4.1	2.0	2.0
20		2.75	3.4	**4.0**	4.2	4.7	**4.0**	4.2	4.0	**3.1**	3.5
		3.5	3.6	**4.0**	4.2	4.7	**4.0**	4.2	5.3	**3.7**	3.5
		5.5	4.5	**4.0**	4.2	5.2	**4.0**	4.2	8.1	**4.0**	4.2
	2.0 Defl. Limit	2.75	1.7	2.0	2.1	2.3	2.0	2.1	2.6	2.0	2.1
		3.5	1.8	2.0	2.1	2.3	2.0	2.1	2.9	2.0	2.1
		5.5	2.2	2.0	2.1	2.6	2.0	2.1	4.0	2.0	2.1
Uniform Bearing On Soil Type "3"											
40		2.75	7	**2.9**	8.6	8.6	**2.8**	8.4	5.7	1.9	5.6
		3.5	9.2	**3.7**	11	11.6	**3.5**	10.3	7.6	**2.2**	6.3
		5.5	11.8	**4.0**	12	14.5	**4.0**	11.9	13	**2.7**	11.4
	2.0 Defl. Limit	2.75	4.9	2.0	6.0	6.2	2.0	6.0	5.7	1.9	5.6
		3.5	5.1	2.0	6.0	6.7	2.0	6.0	7.2	2.0	6.0
		5.5	5.9	2.0	6.0	7.3	2.0	6.0	9.8	2.0	6.0
30		2.75	6.9	**2.9**	8.7	8.4	**2.8**	8.3	5.5	1.9	5.5
		3.5	9.0	**3.7**	10.9	11.4	**3.5**	10.3	7.4	**2.2**	6.4
		5.5	11.6	**4.0**	11.9	14.4	**4.0**	12.0	12.7	**2.7**	8.0
	2.0 Defl. Limit	2.75	4.8	2.0	6.0	6.1	2.0	6.0	5.5	1.9	5.5
		3.5	5.0	2.0	6.0	6.7	2.0	6.0	7.0	2.0	6.0
		5.5	5.8	2.0	6.0	7.2	2.0	6.0	9.6	2.0	6.0
20		2.75	6.8	**2.8**	8.3	6.2	2.0	6.3	5.3	1.8	5.6
		3.5	8.7	**3.5**	10.4	9.0	**2.5**	7.6	7.4	**2.1**	6.3
		5.5	11.6	**4.0**	11.8	14.5	**4.0**	11.8	12.3	**2.6**	7.6
	2.0 Defl. Limit	2.75	4.8	2.0	6.3	15.1	2.0	6.3	15.3	2.0	5.6
		3.5	4.9	2.0	6.3	8.9	2.0	6.3	7.4	2.0	6.3
		5.5	5.8	2.0	6.3	15.5	2.0	6.3	18.8	2.0	6.3
Uniform Bearing On Soil Type "5"											
40		2.75	8	**2.3**	10.1	9.7	**2.1**	10.3	6.5	1.5	7.2
		3.5	10.7	**2.7**	13.1	13.2	**2.5**	12.5	8.7	1.7	8.1
		5.5	16.7	**3.7**	18.3	22.6	**3.9**	19.0	14.7	**2.1**	10.2
	2.0 Defl. Limit	2.75	7.0	2.0	8.9	9.4	2.0	10.0	6.5	1.5	7.2
		3.5	8.2	2.0	10.0	10.6	2.0	10.0	8.7	1.7	8.1
		5.5	9.2	2.0	10.0	11.9	2.0	10.0	14.5	2.0	10.0
30		2.75	7.5	2.0	9.7	6.8	1.5	7.5	6.3	1.5	7.2
		3.5	10.4	**2.6**	13.0	12.9	**2.5**	12.4	8.4	1.7	8.2
		5.5	16.4	**3.7**	18.1	15.9	**3.8**	18.9	18.2	**2.1**	10.3
	2.0 Defl. Limit	2.75	7.8	2.0	10.0	8.2	2.0	10.0	6.3	1.5	7.2
		3.5	8.0	2.0	10.0	8.9	2.0	10.0	7.4	1.7	8.2
		5.5	9.1	2.0	10.0	11.8	2.0	10.0	14.2	2.0	10.
20		2.75	7.7	2.0	11.8	6.7	1.4	6.9	6.0	1.4	6.9
		3.5	10.4	**2.6**	13.2	9.8	1.9	8.3	8.2	1.6	6.3
		5.5	15.9	**3.5**	17.4	19.0	**3.2**	16.0	14.2	2.0	9.7
	2.0 Defl. Limit	2.75	7.7	2.0	9.7	6.7	2.0	6.9	6.0	2.0	6.9
		3.5	8.0	2.0	9.7	9.8	2.0	9.7	8.2	2.0	8.3
		5.5	9.0	2.0	9.7	11.8	2.0	9.7	14.2	2.0	9.7

Notes for Load Tables and Determining Loads: Reference page 7.

Table II
Load Criteria (offset loading)

Load Per Linear Foot Of Width, K = Kip = 1,000 Lbs

Length Feet		Thickness Inches	Load Case 4 P Load Kips	Load Case 4 Defl. Inches	Load Case 4 Bearing PSI	Load Case 5 P Load Kips	Load Case 5 Defl. Inches	Load Case 5 Bearing PSI	Load Case 6 P Load Kips	Load Case 6 Defl. Inches	Load Case 6 Bearing PSI
Uniform Bearing On Soil Type "1"											
40		2.75	3.4	**3.9**	3.9	4.5	**4.0**	4.0	4.7	**4.0**	4.0
		3.5	3.7	**4.0**	4.0	4.7	**4.0**	4.0	4.9	**4.0**	4.0
		5.5	3.9	**4.0**	4.0	5.1	**4.0**	4.0	4.4	**4.0**	3.8
	2.0 Defl. Limit	2.75	1.7	2.0	2.0	2.3	2.0	2.0	2.4	2.0	2.0
		3.5	1.9	2.0	2.0	2.4	2.0	2.0	2.5	2.0	2.0
		5.5	2.0	2.0	2.0	2.6	2.0	2.0	2.2	2.0	1.9
30		2.75	3.4	**4.0**	4.0	4.4	**4.0**	4.0	4.7	**4.0**	4.0
		3.5	3.7	**4.0**	4.0	4.6	**4.0**	4.0	4.9	**4.0**	4.0
		5.5	3.8	**4.0**	4.0	4.6	**4.0**	4.0	4.3	**4.0**	3.8
	2.0 Defl. Limit	2.75	1.7	2.0	2.0	2.2	2.0	2.0	2.4	2.0	2.0
		3.5	1.9	2.0	2.0	2.3	2.0	2.0	2.5	2.0	2.0
		5.5	1.9	2.0	2.0	2.3	2.0	2.0	2.2	2.0	1.9
20		2.75	3.2	**4.0**	4.2	3.8	**4.0**	4.2	2.7	**4.0**	3.5
		3.5	3.4	**4.0**	4.2	4.1	**4.0**	4.2	3.4	**4.0**	4.2
		5.5	3.1	**4.0**	4.2	3.8	**4.0**	4.2	3.1	**4.0**	4.2
	2.0 Defl. Limit	2.75	1.6	2.0	2.1	1.9	2.0	2.1	15.3	2.0	2.1
		3.5	1.7	2.0	2.1	2.0	2.0	2.1	7.4	2.0	2.1
		5.5	1.5	2.0	2.1	1.9	2.0	2.1	18.8	2.0	2.1
Uniform Bearing On Soil Type "3"											
40		2.75	6.7	**2.8**	8.3	6.2	**2.1**	6.2	5.6	1.9	5.7
		3.5	9.1	**3.6**	10.8	8.8	**2.7**	7.9	8.2	**2.4**	7.2
		5.5	11.6	**4.0**	11.9	14.6	**4.0**	11.9	14.2	**4.0**	11.4
	2.0 Defl. Limit	2.75	4.8	2.0	6.0	6.0	2.0	6.0	5.6	1.9	5.7
		3.5	5.1	2.0	6.0	6.7	2.0	6.0	6.8	2.0	6.0
		5.5	5.8	2.0	6.0	7.4	2.0	6.0	7.2	2.0	5.9
30		2.75	6.7	**2.8**	8.4	6.3	**2.1**	910	15.3	1.9	5.7
		3.5	9.1	**3.7**	10.9	6.4	**2.8**	8.3	8.1	**2.4**	7.2
		5.5	11.4	**4.0**	11.9	14	**4.0**	11.9	14	**4.0**	11.8
	2.0 Defl. Limit	2.75	4.8	2.0	6.0	6.0	2.0	6.0	5.6	1.9	5.7
		3.5	5.0	2.0	6.0	4.7	2.0	6.0	6.8	2.0	6.0
		5.5	5.7	2.0	6.0	7.0	2.0	6.0	7.0	2.0	5.9
20		2.75	6.8	**2.9**	9.0	6.1	**2.2**	6.9	6.5	**2.7**	8.3
		3.5	9.9	**4.0**	11.8	9.0	**2.9**	9.0	9.7	**3.4**	10.4
		5.5	10.3	**4.0**	11.8	12.4	**4.0**	11.8	10.1	**4.0**	11.8
	2.0 Defl. Limit	2.75	4.7	2.0	6.3	5.5	2.0	6.3	4.8	2.0	6.3
		3.5	4.9	2.0	6.3	6.1	2.0	6.3	5.7	2.0	6.3
		5.5	5.1	2.0	6.3	6.2	2.0	6.3	5.0	2.0	6.3
Uniform Bearing On Soil Type "5"											
40		2.75	7.5	2.0	9.7	6.8	1.5	7.5	6.3	1.5	7.2
		3.5	10.3	**2.6**	12.6	9.7	1.9	9.3	8.8	1.8	8.5
		5.5	18.4	**4.0**	20.0	18.9	**3.2**	15.9	18.6	**3.0**	14.9
	2.0 Defl. Limit	2.75	7.5	2.0	9.7	6.8	1.5	7.5	6.3	1.5	7.2
		3.5	8.2	2.0	10.1	9.7	1.9	9.3	8.8	1.8	8.5
		5.5	9.2	2.0	10.0	11.9	2.0	10.1	12.6	2.0	10.0
30		2.75	7.5	2.0	9.7	6.8	1.5	7.5	15.3	1.5	7.2
		3.5	10.3	**2.6**	12.8	10.0	2.0	9.7	8.8	1.8	8.5
		5.5	17.6	**3.9**	19.4	18.8	**3.3**	16.3	18.3	**3.0**	14.9
	2.0 Defl. Limit	2.75	7.5	2.0	9.7	6.8	1.5	7.5	6.3	1.5	7.2
		3.5	8.1	2.0	10.1	10.0	2.0	9.7	8.8	1.8	8.5
		5.5	9.1	2.0	10.1	11.6	2.0	10.0	12.3	2.0	10.0
20		2.75	7.4	2.0	9.7	6.7	1.6	7.6	6.9	1.8	9.0
		3.5	11.4	**2.8**	13.9	9.9	2.0	9.7	10.0	**2.1**	10.4
		5.5	17.1	**4.0**	20.1	18.9	**3.6**	18.1	17.1	**4.0**	20.1
	2.0 Defl. Limit	2.75	7.4	2.0	9.7	6.7	2.0	7.6	6.9	2.0	9.0
		3.5	8.1	4.0	9.7	9.9	4.0	9.7	9.5	4.0	9.7
		5.5	8.5	2.0	9.7	10.5	2.0	9.7	8.5	2.0	9.7

Notes for Load Tables and Determining Loads: Reference page 7.

NOTES FOR LOAD TABLES

1. In each mat length section, the first two rows indicate deflections up to 4" (in bold) if acceptable. The last two rows reflects deflection of no more than 2".

2. Loads listed are based on a uniform soil bearing analysis using a simplified elastic soil procedure where the soil is assumed to act as a line of springs spaced one foot apart along the length with resistance directly proportional to settlement. (Similar to the subgrade modulus procedures for slab and paving design, except, with higher deflections allowed).

Type "1" (SGM-1) soil has a spring constant of 144 pounds per square foot, per inch settlement. Type "3" (SGM-3) soil has a spring constant of 432 pounds per square foot, per inch of settlement. Type "5" (SGM-5) soil has a spring constant of 720 pounds per square foot, per inch of settlement.

3. Loads listed in Table 7 are based on normal simple span beam design methods. Adequate bearing must be provided at the ends to support the loads.

4. Load duration - Loads listed in all tables are based on a stress increase of 1/3 (33 1/3%) for short duration loading. Where stresses govern the load, applied long term loads should be reduced accordingly and as much as 1/3 less for long term loading or frequent cycles of loading.

5. Load distribution - Load Tables are based on a unit width one foot wide perpendicular to the length. Loads can be assumed distributed over more than one foot depending on the type of load and loading conditions.

6. Edge loading - Load cases 4, 5, & 6 as shown in the load diagrams, are based on off-center loading. Under edge loading conditions the unloaded end of the member will deflect upward and should be considered when using edge loading.

Determining Loads

Load tables are subject to interpretation and use for a variety of conditions. For load cases where uniform bearing is used: first the soil strength should be estimated and then using the tables for the various soil types and the load case that compares closest to the load conditions, the thickness and length can be selected; alternatively, for an existing thickness and length the estimated load resistance can be determined from the Tables.

Soil Type "1" (SGM-1) is soft soil and in theory a 200 lb person standing on a one foot by one foot ($1ft^2$) block would settle into the surface 1 3/8".

For Soil Type "3" (SGM-3) the same 200 lbs on a one foot square would settle 7/16".

For Soil Type "5" (SGM-5) the same 200 lbs on a one foot square would settle 1/4"±.

For estimating soil strength using simplified bearing tests as described above, results should be based on incremental loads. Divide the resulting pressure in pounds per square inch by the settlement, and the results averaged to determine an estimated SGM.

For areas where geotechnical reports are required the geotechnical engineering should be requested to provide an estimated bearing capacity of the bearing strata, and if practical, in the form of subgrade modulus for settlement estimated in the range of one to two inches.

emtek Design Properties

F_b = 4123 psi
F_V = 379 psi
} W/ 1.33 Load Duration Factor

$E = 1.6\ (10)^6$ psi

Unit Section Properties

Thickness	A In^2	I In^4	S In^3	M_A K-Ft	V_A K
2.75"	33	20.797	15.13	5.197	8.339
3.5"	42	42.875	24.50	8.418	10.613
5.5"	66	166.375	60.50	20.787	16.676

Note: The affective thickness in the table is 2.75", 3.5", 5.5", the actual thickness is 3", 4", 6".

$A = t(b)$ $\quad I = \frac{bt^3}{12}$ $\quad S = \frac{bt^2}{6}$ $\quad M_A = F_bS$ $\quad V_A = \frac{F_V\ A}{1.5} \sim \left(\frac{FV\ lb}{Q}\right)$

K = KIP = 1000 lbs

M_A = Allowable Moment W/1.33 Load Duration Factor

V_A = Allowable Shear W/1.33

NOTES & CALCULATIONS

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