Matrax Rig Mat Load Capacity Comparison Study

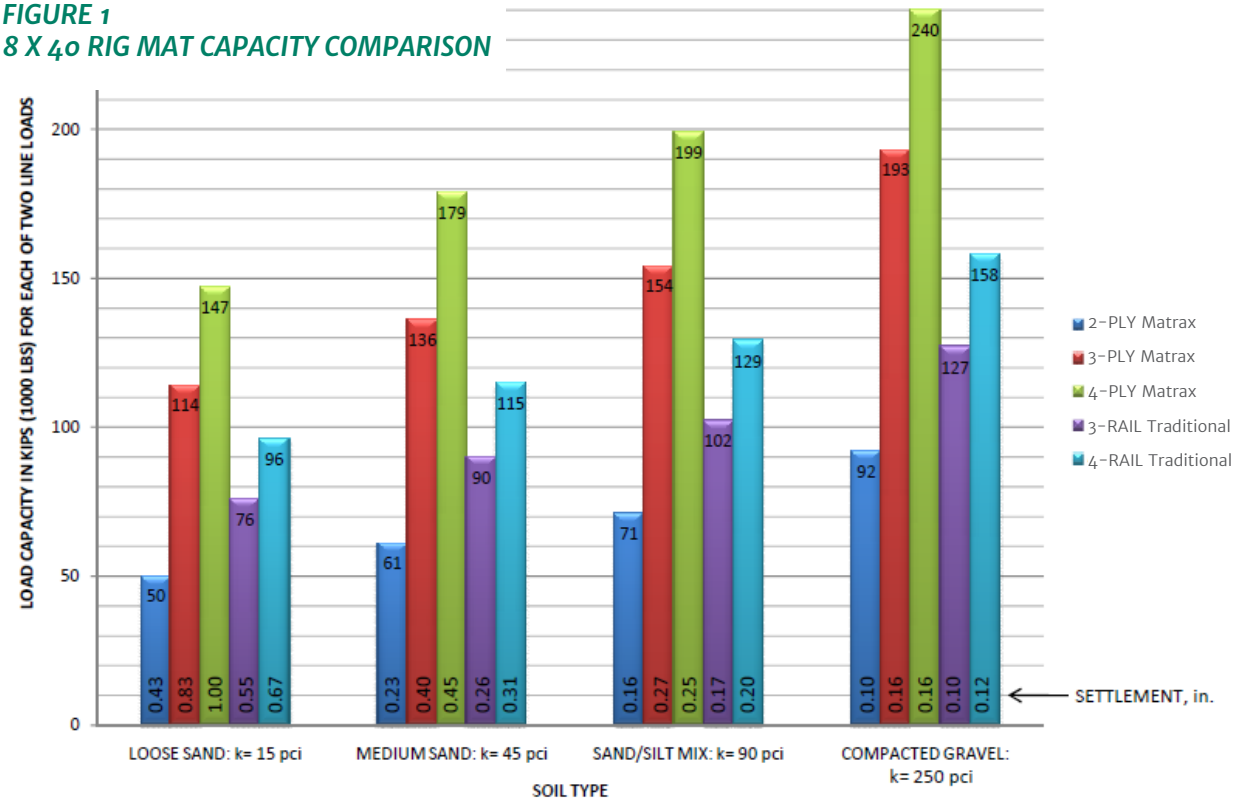
SUMMARY

This report establishes the load carrying capacity of various mats. The applied load consists of a pair of line loads extending across the full 8 foot width of the mat. These line loads are 9 feet apart, i.e. center to center, simulating a tracked vehicle. The loads have been analyzed in two different positions relative to the end of the mat. The controlling position is when the loads are at mid-length along the mat. Three mat lengths were considered, 20', 30' and 40'. The length of the mat had virtually no effect on the load carrying capacity.

The assumed soil is a loose (not compact) granular sandy composition with a modulus of subgrade reaction of 15 pci. This represents a fairly compressible soil. Prepared subgrades that were mechanically compacted, such as a building site, would have a value in the range of 250 to 400 pc.

Figure 1 demonstrates that a 4.5" (3-ply) Matrax rig mat is stronger than a 6" 3-rail traditional rig mat. The multi-ply design along with the use of high strength 65 ksi steel gives the product its superior strength at a lighter weight. A 4.5" thick x 8' x 40' mat will weigh 2,500 pounds less per mat with its traditional 40' mat counterpart weighing in at a whopping 8,900 pounds.

FIGURE 1
8 X 40 RIG MAT CAPACITY COMPARISON



MAT TYPES

The three Matrax products in this analysis are:

- 2-ply glulam with custom side channels and standard hot-rolled I-shaped interior beams. Total thickness is 3".
- 3-ply glulam with custom side channels and standard hot-rolled wide flange interior beams. Total thickness is 4.5".
- 4-ply glulam with custom side channels and standard hot-rolled wide flange interior beams. Total thickness is 6".

The two "traditional" products in this analysis are:

- 3-rail standard hot-rolled wide flanges. Spaces between the steel beams are fitted with noncontinuous wood panels. The wood helps to distribute the load but does not contribute to the overall strength of the mat. This wood is considered "non-structural". Total thickness is 6".
- 4-rail mat. Similar to the 3-rail but has an additional steel beam.

LOAD CAPACITY COMPARISON CHART

Figure 1 demonstrates the load capacity for each of the five mat types grouped by the three lengths. The load value in each of the bars is the total for one line load (vehicle track). The mat is actually supporting two such loads. The analysis clearly identifies Matrax's 3- and 4-ply mats are superior to the traditional mats.

PROPERTIES OF THE ASSEMBLED MAT

Figure 2 depicts the structural properties of each mat type used in the load capacity comparison study. The tables include the physical description as well as the rigidity and strength calculations.

FIGURE 2: ASSEMBLED MAT STRUCTURAL PROPERTIES

MATRAX ENGINEERED RIG MAT DESIGN

MAT	ITEM	QTY	%FORCE	SHEAR	MOMENT	SHEAR, k	MOMENT, ft-k
2-PLY				77.36	37.56		
	Channel	2	25.0	19.34	9.39	41.40	12.90
	Beam	2	19.7	15.24	7.40	30.00	7.40
	Glulam	3	55.3	42.78	20.77	42.78	23.25
3-PLY				123.22	100.40		
	Channel	2	18.9	23.29	18.98	87.75	20.48
	Beam	2	29.0	35.73	29.12	46.40	27.80
	Glulam	3	52.1	64.20	52.31	64.17	52.31
4-PLY				169.23	150.15		
	Channel	2	22.0	37.23	33.03	117.00	40.70
	Beam	2	32.5	55.00	48.80	55.00	48.80
	Glulam	3	45.4	77.00	68.32	85.56	93.00

TRADITIONAL RIG MAT DESIGN

MAT	ITEM	QTY	%FORCE	SHEAR	MOMENT	SHEAR, k	MOMENT, ft-k
3-RAIL				82.50	68.00		
	SIDE BM	2	66.7	55.03	45.36	55.00	45.40
	MID BM	1	33.3	27.47	22.64	27.50	22.70
	WOOD	-					
4-RAIL				110.00	90.53		
	SIDE BM	2	50.0	55.00	45.27	55.00	45.40
	MID BM	2	50.0	55.00	45.27	55.00	45.40
	WOOD	-					

MOMENT CAPACITY OF CUSTOM ROLLED SHAPES

This data show the calculations to determine the bending moment capacity of the custom side channels. The formulas used are taken from the American Institute of Steel Construction (AISC) publication 360-05; commonly known as the "steel code". Using the AISC code is conservative since it is meant for buildings where human safety is of utmost importance. A mat supported at grade is considerably less critical.

COMPONENT ANALYSIS

This data demonstrates how the maximum load was determined. Both shear and moment forces are considered, however, as expected, shear never controls. This table contains, for each of the five mat types:

> The percentage of the load carried by each element based on relative stiffness.
> The shears and moments actually in the mats.
> The shear and moment capacities and,
> The demand ratios. This is a ratio of the actual load to the allowable load. (In other words, the demand on the structural element. When this ratio is 1.0 the element is fully stressed.)

ALLOWABLE LOADS

In addition to the allowable line loads at 9-foot centers, the table includes the deflection (settlement), the shears and moments as well as the maximum soil pressure under the mat. Note that the soil pressure under the mat will not be uniform and these values represent the peak pressure directly below the wheel or track.

This analysis is limited to one soil type and one loading condition. On the job site there are any number of soil types and loading conditions. The calculations do provide comparisons to the different mat constructions. As the soil and loading types change the allowable loads will change (increase or decrease) however the relative capacities between the types of mats will remain unchanged. It is important to note that all of the items considered in these calculations have a linear relationship to the value of the load.