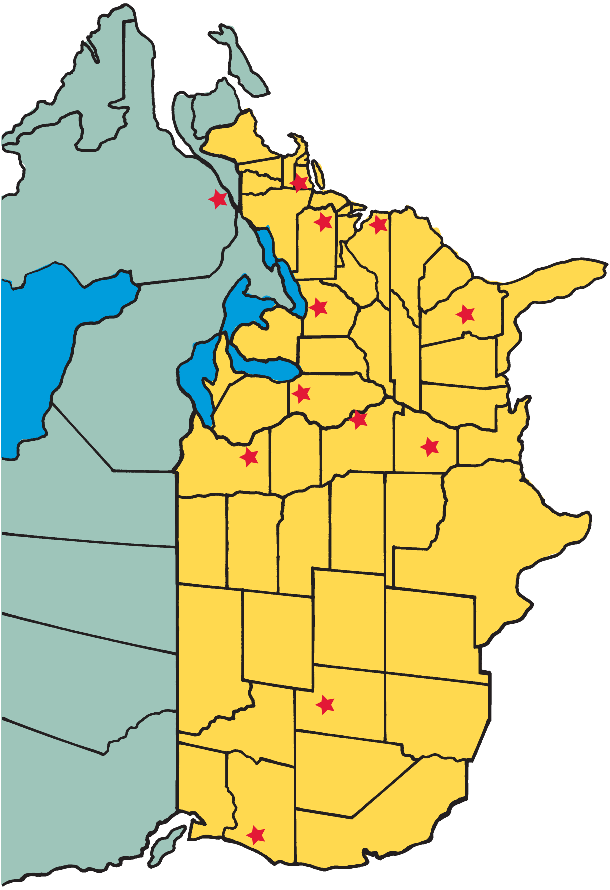
emtek™

HEAVY EQUIPMENT MAT

FIELD GUIDE

Anthony Hardwood Composites

North American Rental Inventory Locations



- Sheridan, Arkansas
- Collins, Ohio
- Westfield, Massachusetts
- St. Felix, Quebec, Canada
- Salt Lake City, Utah
- Albany, Oregon
- Suffolk, Virginia
- Bethlehem, Pennsylvania
- St. Louis, Missouri
- Rockford, Illinois
- St Paul, Minnesota
- Macon, Georgia

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1. Purpose of Field Guide

The purpose of this field guide is to help field personnel choose the correct ***emtek***® mat for different site conditions. The Field Guide lay-out is intended to be a simple and quick reference. It addresses typical access situations that a contractor might be confronted with. The Field Guide provides some basic techniques for estimating soil conditions and loads. The mats you will find recommended here have been specified using the ***emtek***® Design Guide.

2. Not Intended For

This Field Guide is not be a substitution for an understanding of the Design Guide, but rather a useful tool to approximate mat sizes for typical equipment and ground conditions. All matting requires attention to safety and environmental issues, but some situations are routine and others are critical. The Field Guide is meant for the routine applications. Critical applications such as: bridging, buried utilities, areas of historical significance, crane loading and protected environmental areas require more detailed specification. The Design Guide can be used for these applications or unique applications can be specified by ***emtek***® engineers.

3. How to Use This

The Field Guide follows a four step process that will guide the contractor to some effective mat choices. The process is similar to the routine questions that the contractor considers with any construction project:

1. Where is the job? - Ground Conditions - Using some easy field methods the contractor can assess the strength of the soil in the access area.

2. What equipment will be used? - Loads - Simple formulas aid the contractor in determining the maximum loads that the mats will need to support.

3. What type of access is needed? - Mat 'TYPE' - A series of questions help guide the contractor to the correct matting technique.

4. What size mat? - Mat selection - Based on information gathered in steps 1-3 above mat recommendations are shown in chart form for selection.

4. Ground Conditions

Estimating how much weight (load) the ground can support at the project site can be done with the table below. The numbers are based on a 200lb person with a size 10 shoe.

Ground Condition Estimate		
Standing on one Foot You Sink Up To	**Depth in Inches**	**Soil Grade (SGM)**
Shin	6.9	1
Ankle	2.3	3
Over Sole of Shoe	1.4	5

Further analysis may be required of exceptionally poor sites. You can use a piece of plywood to do this. The chart below shows the amount of deflection plywood would have with a 200 lb. person.

Size of Plywood	Depth in Inches	Soil Grade (SGM)
2' x 2'	0.1	3
2' x 2'	0.2	2
2' x 2'	0.3	1
2' x 2'	0.7	0.5
2' x 2'	1.4	0.25
2' x 2'	2.8	0.125

Notes:

5. Loads

Loads are separated between equipment with tracks and equipment with axles (wheels). The charts below will help determine the Load Conditions for mat selection.

*****Important:** If significant redundant loading such as heavy traffic flow is expected then the KSF value should be doubled.

KSF Value						
Equipment with Tracks						
Operating Weight with Load	**Approximate Track Lengths**					
	8	**11**	**13**	**15**	**19**	**21**
20,000	2	1	1	1	1	1
35,000	3	2	2	2	1	1
50,000	4	3	2	2	2	2
85,000	6	4	4	3	3	3
115,000	8	6	5	4	4	3
135,000	9	7	6	5	4	4
155,000	10	8	6	6	5	4
190,000	12	9	8	7	5	5
240,000	15	11	10	8	7	6
Equipment with Axles						
Operating Weight with Load	**Number of Axles**					
	2	**3**	**4**	**5**	**6**	**7**
8,000	1	1	1	1	1	1
12,000	2	1	1	1	1	1
20,000	2	2	1	1	1	1
40,000	4	3	2	2	2	2
60,000	6	4	3	3	2	2
80,000	8	6	4	4	3	3
120,000	12	8	6	5	4	4
160,000	16	11	8	7	6	5
220,000	21	14	11	9	7	6

Notes:

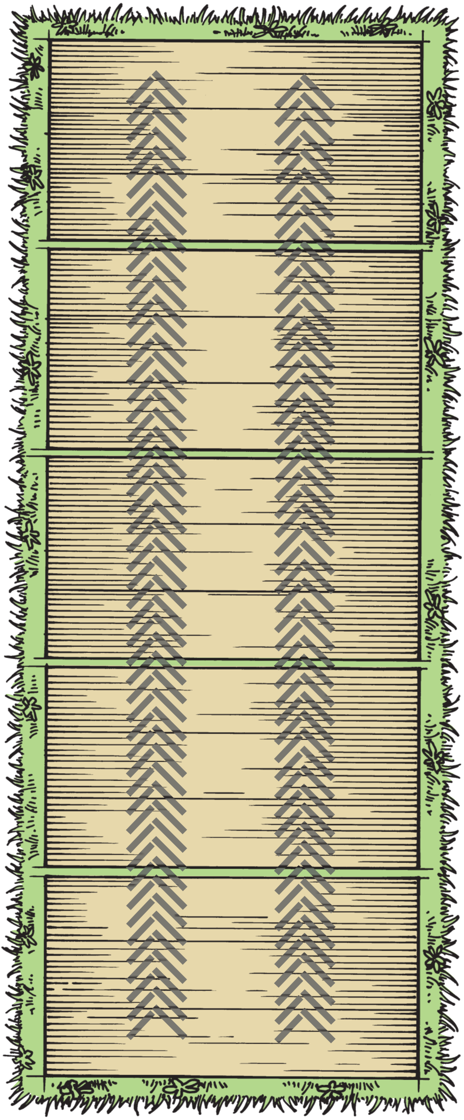
a. Mat Selection

i. Using the SGM value and KSF Value found on the previous pages, we can now select the proper ***emtek***® Mat and Matting Type. The Matting Type refers to different techniques for laying mats that allow the contractor to provide access in increasingly poor soil or higher loads, or both. Browsing ahead at the pictures on the following pages you can see the various techniques. Moving from Type I to Type III the mats are trying to distribute the equipment loads over a greater area and therefore either reducing pressure or increasing the allowable loads.

ii. Start with the Type I chart since this will provide the most economical solution for access. If the chart does not specify a thickness but rather another Type (T-II or T-III) then refer to the next set of tables that is labeled with the Type indicated. Notice that the Type III tables are divided into two tables based on the distance placed between the mats. If the section of the chart that corresponds to the SGM and KSF value that you have estimated simply shows “x” then it will be necessary to contact ***emtek***® engineers for a nonstandard solution.

iii. If this process results in the use of a Type II or Type III solution then it will be necessary to also specify the proper deck thickness. This table can be found after the ‘Type’ tables and is labeled Minimum Deck Thickness. You will need the KSF value from the Loads table to find the proper deck thickness.

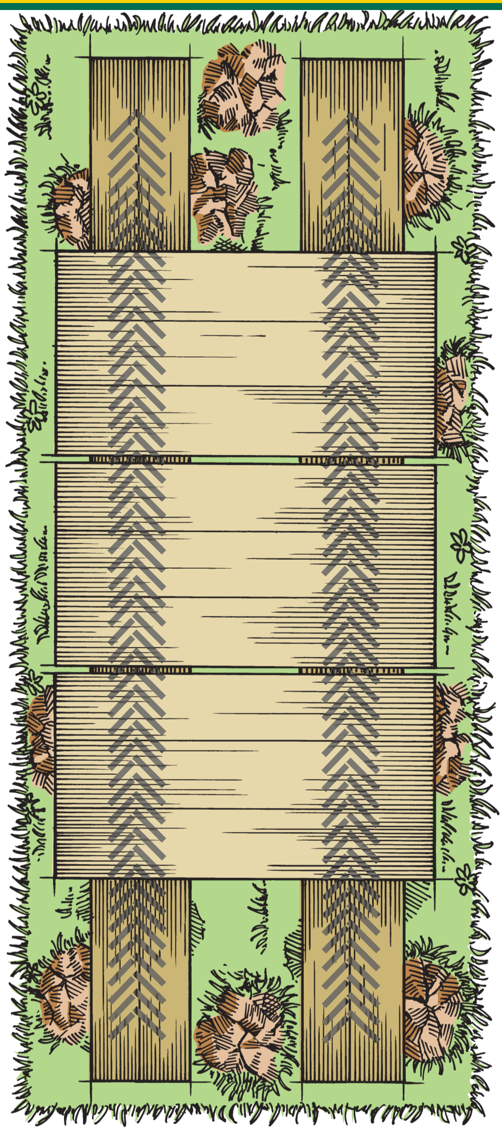
Notes:



Type I: This technique is the most typically found on job sites in which the mats are simply laid directly on the ground perpendicular to traffic. In this case the site conditions are generally uniform and the mat can lay flat on the surface below. The length of the mat in the Type I application determines the width of the road.

Type I			
Minimum Mat Thickness			
KSF	**SGM**		
	1	**3**	**5**
1	2.75	2.75	2.75
2	2.75	2.75	2.75
3	2.75	2.75	2.75
4	4.5	2.75	2.75
5	T-II	2.75	2.75
6	T-II	2.75	2.75
7	T-III	3.5	2.75
8	T-III	3.5	3.5
9	T-III	4.5	3.5
10	T-III	4.5	3.5
11	T-III	5.5	4.5
12	T-III	6.5	4.5
13	T-III	7.5	4.5
14	T-III	T-II	5.5
15	T-III	T-II	5.5
16	T-III	T-II	5.5
17	T-III	T-II	5.5
18	T-III	T-III	6.5
19	T-III	T-III	6.5
20	T-III	T-III	7.5
21	T-III	T-III	7.5

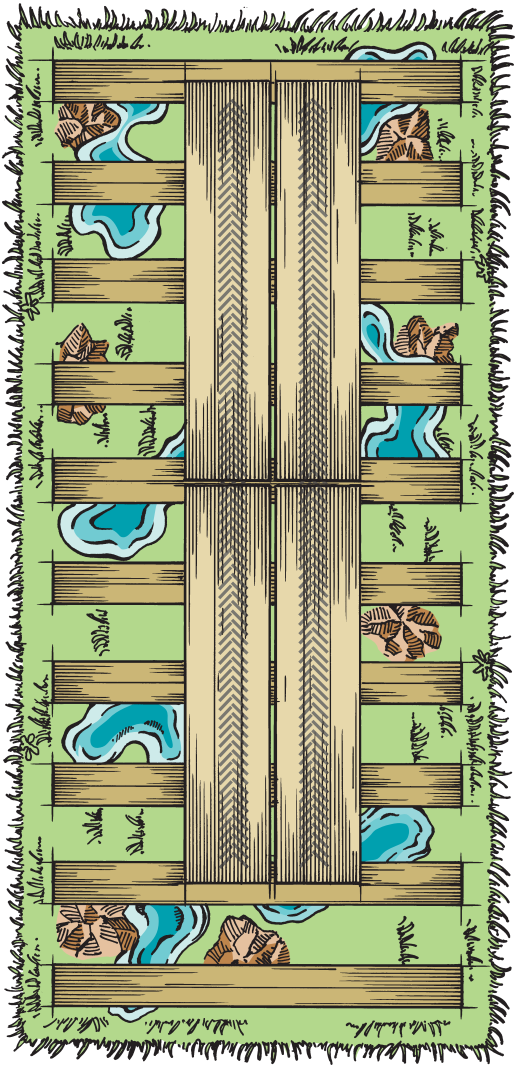
Notes:



Type II: This technique is used in areas that have nonuniform site conditions. This means high and low spots typically one to two feet apart of varying soil strength. This matting 'Type' is typically made up of two components: Stringers and Decking. The stringers bridge across the terrain variations and the decking provides a solid road surface. Type II matting technique should be used in areas that variations in soil conditions within 20' is driving up mat thickness.

Type II			
Minimum Parallel Component Thickness			
KSF	**SGM**		
	1	**3**	**5**
1	T-I	T-I	T-I
2	T-I	T-I	T-I
3	T-I	T-I	T-I
4	T-I	T-I	T-I
5	6.5	T-I	T-I
6	7.5	T-I	T-I
7	T-III	T-I	T-I
8	T-III	T-I	T-I
9	T-III	T-I	T-I
10	T-III	T-I	T-I
11	T-III	T-I	T-I
12	T-III	T-I	T-I
13	T-III	T-I	T-I
14	T-III	5.5	T-I
15	T-III	5.5	T-I
16	T-III	6.5	T-I
17	T-III	6.5	T-I
18	T-III	T-III	T-I
19	T-III	T-III	T-I
20	T-III	T-III	T-I
21	T-III	T-III	T-I

Notes:



Type III: This technique is used in areas that have extremely poor soil conditions. Typically this means it is very difficult to walk the access area. Generally foot access requires hip-waders. Construction is made up two components: bars and runners. The bars run perpendicular to the traffic and cover a large area to develop enough support to distribute equipment loads. Type III matting technique should be used in areas that Type I matting would generally submerge under equipment loads.

Type III (40'-L, 9'-OC)			
Minimum Perpendicular Component Thickness			
KSF	SGM		
	1	3	5
1	T-I	T-I	T-I
2	T-I	T-I	T-I
3	T-I	T-I	T-I
4	T-I	T-I	T-I
5	T-II	T-I	T-I
6	T-II	T-I	T-I
7	5.5	T-I	T-I
8	5.5	T-I	T-I
9	6.5	T-I	T-I
10	7.5	T-I	T-I
11	x	T-I	T-I
12	x	T-I	T-I
13	x	T-I	T-I
14	x	T-II	T-I
15	x	T-II	T-I
16	x	T-II	T-I
17	x	T-II	T-I
18	x	7.5	T-I
19	x	7.5	T-I
20	x	7.5	T-I
21	x	7.5	T-I

Notes:

Type III (40'-L, 4'-OC)

Minimum Perpendicular Component Thickness

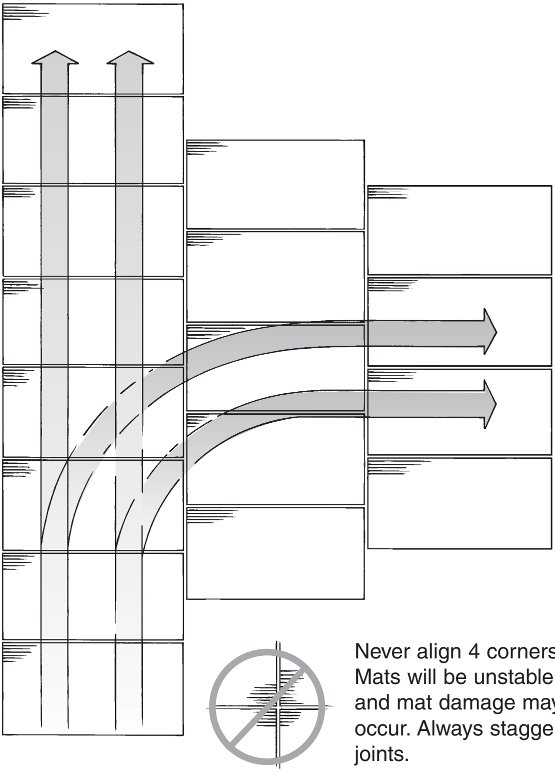
KSF	SGM		
	1	3	5
1	T-I	T-I	T-I
2	T-I	T-I	T-I
3	T-I	T-I	T-I
4	T-I	T-I	T-I
5	T-II	T-I	T-I
6	T-II	T-I	T-I
7	5.5	T-I	T-I
8	5.5	T-I	T-I
9	5.5	T-I	T-I
10	6.5	T-I	T-I
11	6.5	T-I	T-I
12	6.5	T-I	T-I
13	6.5	T-I	T-I
14	6.5	T-II	T-I
15	6.5	T-II	T-I
16	6.5	T-II	T-I
17	6.5	T-II	T-I
18	7.5	7.5	T-I
19	7.5	7.5	T-I
20	7.5	7.5	T-I
21	x	7.5	T-I

Notes:

Type II and III	
Minimum Deck Thickness	
KSF	**Thickness**
1	2.75
2	2.75
3	2.75
4	2.75
5	2.75
6	3.5
7	3.5
8	4.5
9	4.5
10	4.5
11	4.5
12	5.5
13	5.5
14	5.5
15	5.5
16	5.5
17	5.5
18	5.5
19	6.5
20	6.5
21	6.5

Note: If the estimated KSF value was double for redundant loading it should be reduced back to its original single factor value for deck thickness specification.

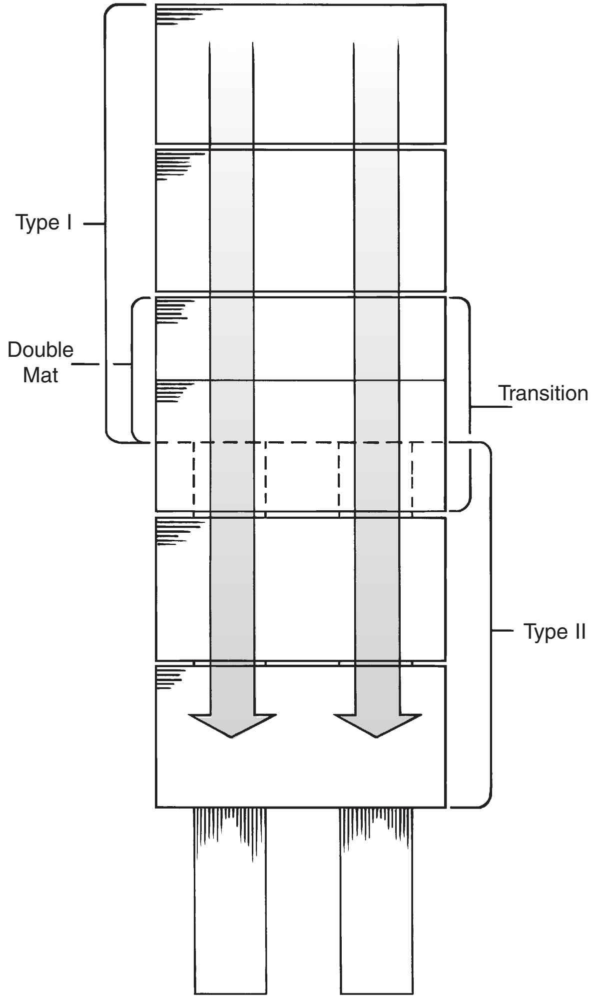
TYPE I TURNOUT DETAIL

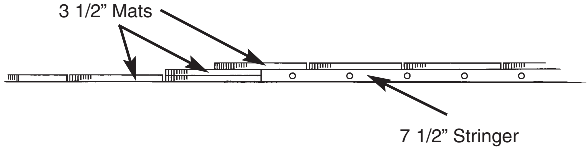


Never align 4 corners. Mats will be unstable and mat damage may occur. Always stagger joints.

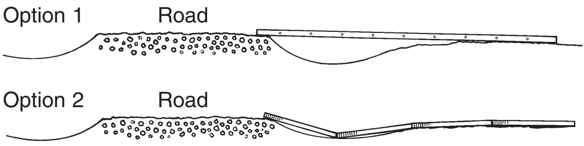
Notes:

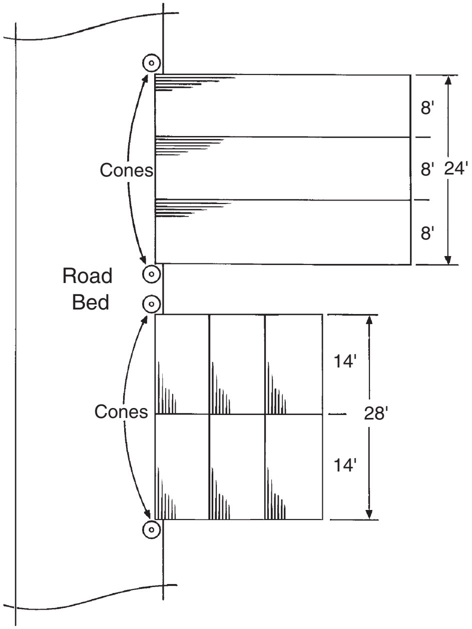
TYPE I MAT ROAD
TO TYPE II MAT ROAD

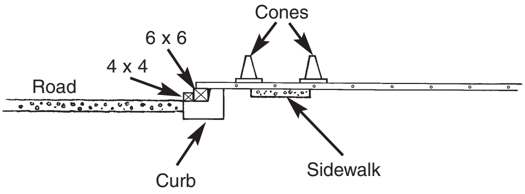




PERMANENT ROAD TO A MAT ROAD

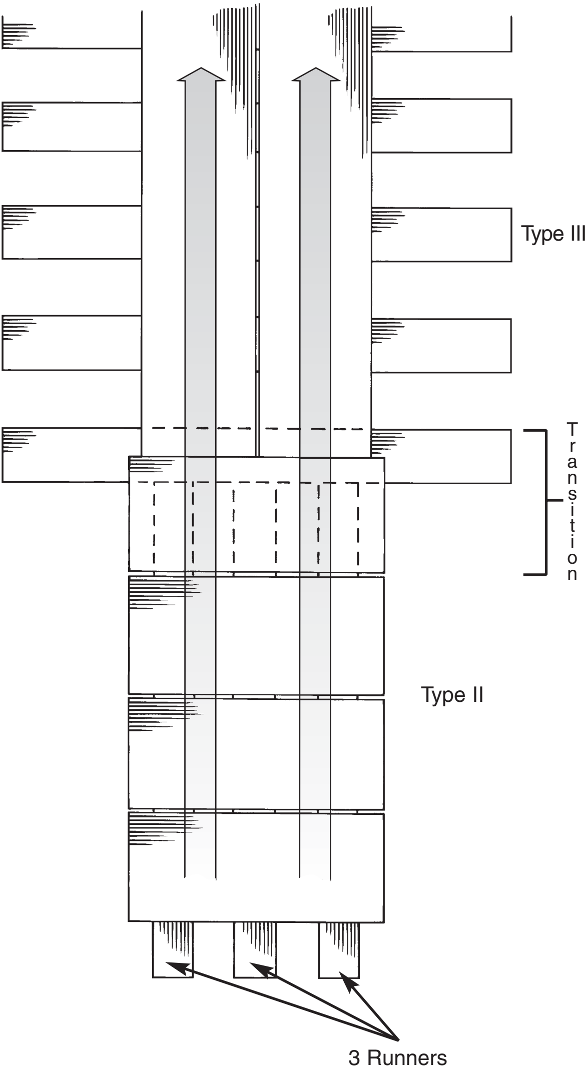




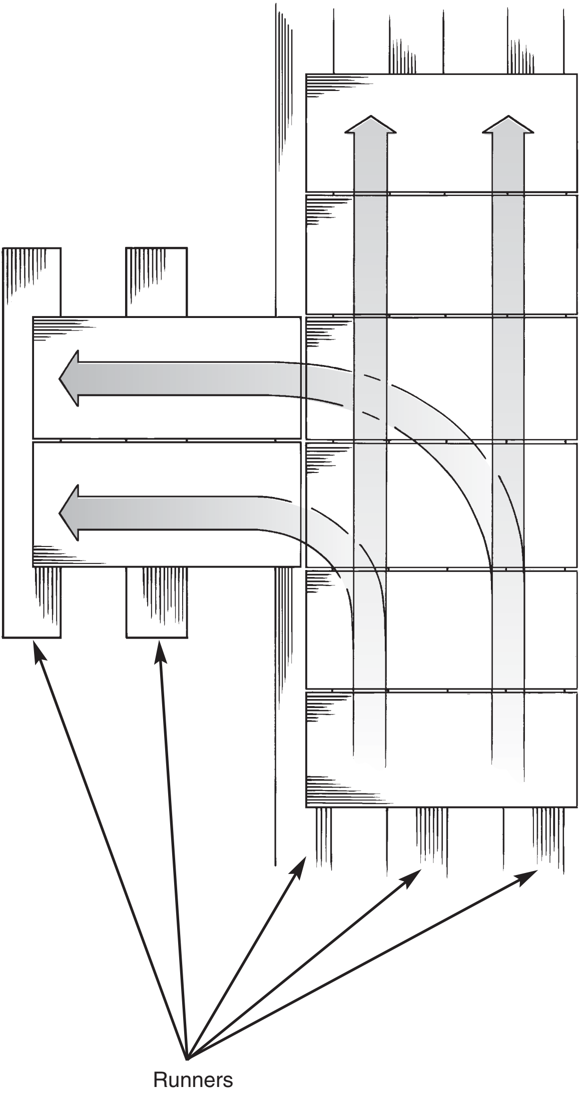


MAT OVER CURB

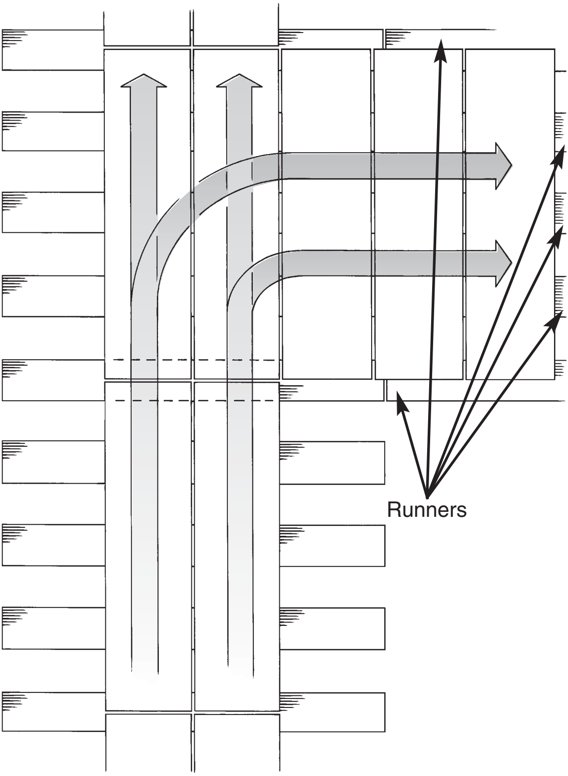
TYPE II MAT ROAD
TO TYPE III MAT ROAD



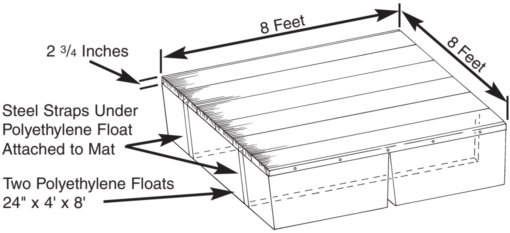
TYPE II TURNOUT DETAIL



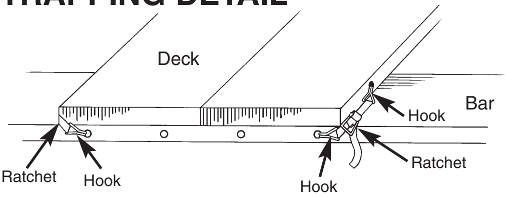
TYPE III TURNOUT DETAIL



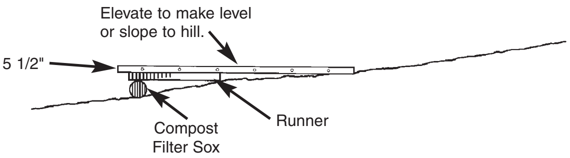
FLOATING ROAD MAT DETAILS



TYPE III DECK TO BAR STRAPPING DETAIL

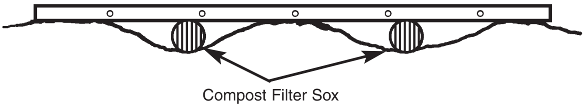


SIDE HILL SLOPES

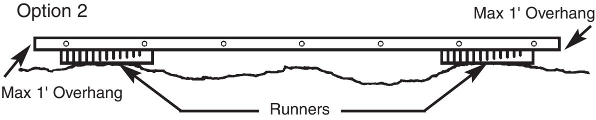


ROAD RUT CONDITIONS

Option 1

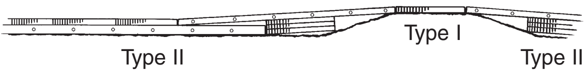


Option 2

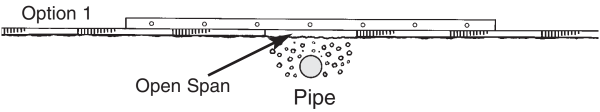


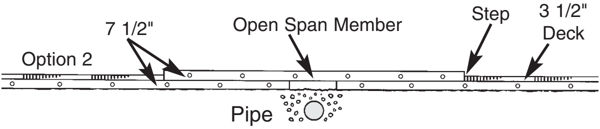
Option 3

ELEVATED OBSTACLE



CROSSING BURIED PIPE

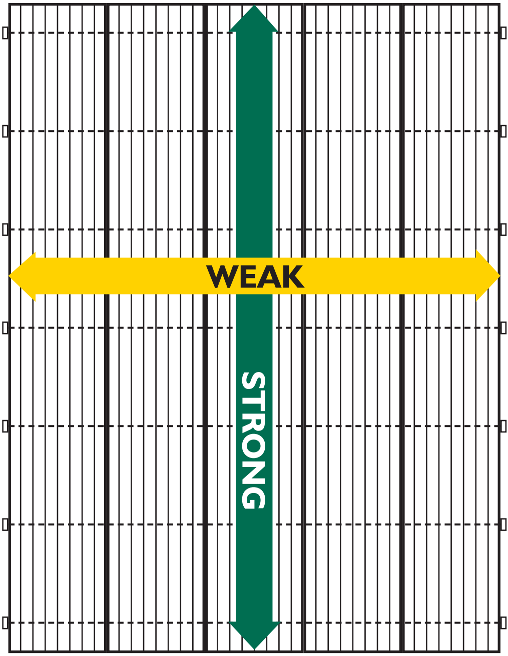




Pipeline Crossing *Max Equipment Load 100,000 lb			
Pipe Diameter	Pipe Depth	Open Span	EMTEK Center Span Member Thickness
8"	2'	5'	5.5"
8"	3'	7'	6.5"
8"	4'	9'	7.5"
8"	5'	11'	DOUBLE - 7.5"
8"	6'	13'	DOUBLE - 7.5"
12"	2'	5'	5.5"
12"	3'	7'	6.5"
12"	4'	9'	7.5"
12"	5'	11'	DOUBLE - 7.5"
12"	6'	13'	DOUBLE - 7.5"
18"	2'	6'	6.5"
18"	3'	8'	7.5"
18"	4'	10'	7.5"
18"	5'	12'	DOUBLE - 7.5"
18"	6'	14'	TRIPLE - 6.5"
24"	2'	6'	6.5"
24"	3'	8'	7.5"
24"	4'	10'	7.5"
24"	5'	12'	DOUBLE - 7.5"
24"	6'	14'	TRIPLE - 6.5"
36"	2'	7'	6.5"
36"	3'	9'	7.5"
36"	4'	11'	DOUBLE - 7.5"
36"	5'	13'	DOUBLE - 7.5"
36"	6'	15'	TRIPLE - 7.5"

Mat Mechanics

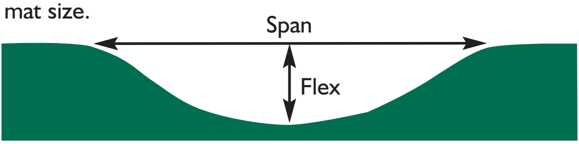
emtek® mats are designed to distribute loads in a specific manner. It is important to know the directional characteristics of the mat. This will help field personnel make decisions when met with variations in site conditions such as: ruts, ditches, mounds, stumps, and sand.



The contractor has two choices when encountering a depression (ditch, hole, etc,):

1. Lay the mat in the weak direction through the depression and let the mat flex to the ground.
2. Lay the mat in the strong direction and span the depression.

The Flex and Span Tables on page 14 show the allowable level of flex and span assuming 27,000 lb axle load for each mat size.



WARNING: Charts on the next page are meant **ONLY** for small depression crossings and are not intended to be design criteria for bridging. Bridge applications should be reviewed directly with ***emtek***® personnel.

Cont'd from page 21

Flex (Weak Direction)		
Thickness (In)	**Span (Ft)**	**Flex (Ft)**
2.75	2	0.4
2.75	4	0.9
2.75	6	1.3
2.75	8	1.7
3.5	2	0.4
3.5	4	0.7
3.5	6	1.1
3.5	8	1.4
4.5	2	0.3
4.5	4	0.6
4.5	6	0.9
4.5	8	1.1
5.5	2	0.2
5.5	4	0.5
5.5	6	0.7
5.5	8	1.0
6.5	2	0.2
6.5	4	0.4
6.5	6	0.6
6.5	8	0.8

Span (Strong Direction)	
Thickness (In)	**Max Span (Ft) for 27,000 lb. Axle Load**
2.75	1.5
3.5	2.5
4.5	4
5.5	6
6.5	7
7.5	8

Weight Chart

The ***emtek***® product has an average weight of 52 pounds per cubic foot. Weight can vary up to10% based on time exposed to water.

Thickness (In)	Width (Ft)	Length (Ft)	Weight (Lbs)
2.75	8	12	1144
2.75	8	14	1335
2.75	8	16	1525
3.5	8	12	1456
3.5	8	14	1699
3.5	8	16	1941
4.5	8	12	1872
4.5	8	14	2184
4.5	8	16	2496
5.5	4	16	1525
5.5	4	18	1716
5.5	4	20	1907
5.5	4	36	3432
5.5	8	14	2669
5.5	8	18	3432
6.5	4	20	2253
6.5	4	30	3380
6.5	4	40	4507
7.5	4	20	2600
7.5	4	30	3900
7.5	4	40	5200

Notes:

Buoyancy Chart

The ***emtek***® product has an average buoyancy of 12 pounds per cubic foot. This chart shows the amount of buoyancy for each size mat. This is important when trying to tie down mats to prevent floating. Buoyancy can vary up to 20% based on time exposed to water.

Thickness (In)	Width (Ft)	Length (Ft)	Buoyancy (Lbs)
2.75	8	12	264
2.75	8	14	308
2.75	8	16	352
3.5	8	12	336
3.5	8	14	392
3.5	8	16	448
4.5	8	12	432
4.5	8	14	504
4.5	8	16	576
5.5	4	16	352
5.5	4	18	396
5.5	4	20	440
5.5	4	36	792
5.5	8	14	616
5.5	8	18	792
6.5	4	20	520
6.5	4	30	780
6.5	4	40	1040
7.5	4	20	600
7.5	4	30	900
7.5	4	40	1200

Matting Terms

For the sake of using this guide and discussing job requirements we need to speak the same language. Here are some common terms that we will use to describe the use of mats.

Air-Bridge – This term is used to describe an access crossing over a buried utility (pipeline, electrical conduit, fiber optic cable, etc); whereby there is actually air space between the bottom of the runner or stinger and the ground directly above the buried utility.

Bars – Load carrying members that run perpendicular to traffic and are used to distribute load under a Runner, such as in a Type III mat system (other???)

Curbing – Guide components found at the edge of a bridge or access road.

Decking – Members that run perpendicular to traffic and distribute load to multiple Stringers.

Geotextiles – Permeable fabrics which, when used in association with soil, have the ability to separate, filter, reinforce, protect, or drain.

Ground Conditions – The condition of the terrain that we plan to cross with mats. Described in terms of SGM.

ISPM 15 – International Standards for Phytosanitary Measures. This is the internationally accepted standard that govern the movement of wood based materials for import and export.

Loads – The anticipated weight of equipment traveling across the mats.

Matting Type – Labels for different Types (I,II,III) of matting techniques used to create access.

Piers – A built up section of mats that is used to elevate the road surface above a water line or other obstruction.

Rigmat – Generally this is a term for a mat with a steel frame surrounding it.

Cont'd on page 26

Cont'd from page 25

Runners – Load carrying members that run parallel to traffic but do not have a deck such as the smaller bridges and runner system.

Shims – Load carrying members that are used to raise the height of the travel surface and are generally only in compression.

Soil Anchors – Cabled components that are driven into the ground and then used to hold down the mats in areas of water flow. These have rated capacities when installed correctly.

Stringers – Load carrying members that run parallel to traffic and are used under a deck, such as in a bridge or Type II mat system.

USDA-APHIS – The US Department of Agriculture - Animal Plant Health Inspection Service is the governing body in the US that enforces ISPM 15.

Wetlands – Wetland areas common to New England and common to Massachusetts include, but are not limited to, the following:

Forested Wetlands – Forested wetlands are wetlands that are dominated by trees that are 20 feet or taller. These wetlands are typically drier with standing water typically occurring during periods of high precipitation, seasonally high groundwater, snow-melt, and runoff (e.g., early spring through mid-summer). Tree species typical of this type of wetland include red maple (Acer rubrum) and eastern hemlock (Tsuga canadensis). "Pit and mound" topography is common in forested wetlands, where mature trees grow on the higher and drier mounds and obligate wetland species are found in the lower pits.

Scrub-Shrub Wetlands – Scrub-shrub wetlands are dominated by woody vegetation less than 20 feet tall, and may include peat bogs. Typical bog species include leatherleaf (Chamaedaphne calyculata), cotton grasses (Eriophorum sp), cranberry (Vaccinium macrocarpon, V. oxycoccus), and black spruce (Picea marina). Other non-bog scrub-shrub wetlands are characterized by buttonbush (Cephalanthus occidentalis), alders (Alnus sp), dogwoods (Cornus sp), and arrowwoods (Viburnum sp).

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Marshes – Marshes are dominated by erect, herbaceous vegetation and appear as grasslands or stands of reedy growth. These wetlands are commonly referred to by a host of terms, including marsh, wet meadow, fen. These areas are flooded all or most of the year and, in New England, tend to be dominated by cattails (Typha sp).

Wet Meadows – Typical wet meadow species include grasses such as bluejoint (Calamagrostis canadensis) and reed canary grass (Phalaris arundinacea), sedges (Carex sp) and rushes (Juncus sp), and various other forbs such as Joe-Pye-weeds (Eupatorium sp) and asters (Aster sp).

Streams – A stream is any natural flowing body of water that empties to any ocean, lake, pond or other river. Perennial streams, or rivers, have flows throughout the year. Intermittent streams do not have surface flows throughout the year, though surface water may remain in isolated pockets.

Vernal Pools – Vernal pools are typically contained basin depressions lacking permanent aboveground outlets. These areas fill with water with the rising water table of fall and winter and/or with the meltwater and runoff of winter and spring snow and rain. The pools contain water for a few months in the spring and early summer. Due to periodic drying cycles, vernal pools do not support breeding fish populations and can thus serve as breeding grounds for a variety of amphibians, including some rare and protected species of frogs and salamanders.

Notes:

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