

### TuffTrak XL Ground Protection Mats Installation Instructions

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### 1. OVERVIEW

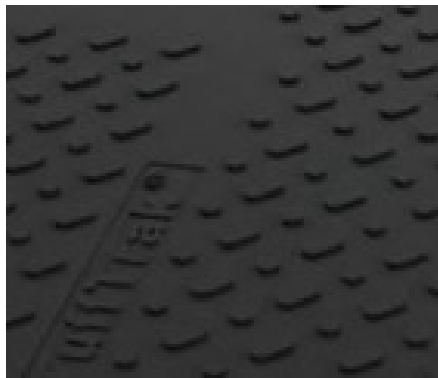
TuffTrak® XL composite mats provide temporary access and ground protection enabling safe movement and access for site personnel, vehicles and equipment. The mats are a one piece compression molded design which delivers key advantages and benefits.

#### TUFFTRAK XL:

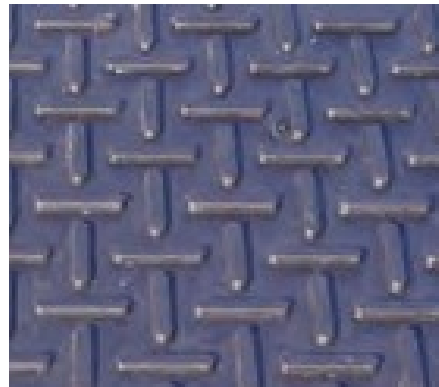
- Will flex to existing ground contours - this minimizes any ground preparation prior to installation.
- Solid one piece compression molded design
  - Can be washed and cleaned more thoroughly than 'multi-part' composite mats.
  - Cannot be punctured like 'hollow' cellular core mats - this avoids intake of excess water or contaminants.  
This will also reduce cross contamination between sites and extra weight from liquids within the mat.
- No rotting, delamination or separation as with 'multi-part' mats.
- Premium 100% recycled black High Density Polyethylene (HDPE) with UV protection.

## TuffTrak XL Ground Protection Mats Installation Instructions - continued

- Effective across a wide range of weather conditions, temperatures, soil types and ground conditions.
- Reversible dual profiled surface provide excellent traction - a more aggressive and unique 'chevron traction®' grip for vehicles and equipment and a low profile grip for site personnel.
- Can be used in different configurations to make roadways, pads, passing places or turning areas.



CHEVRON TRACTION® SURFACE



LOW PROFILE' GRIP

## 2. ENVIRONMENTAL AND CORPORATE SUSTAINABILITY

Compared to other matting systems TuffTrak XL helps protect the environment and supports corporate sustainability objectives:

- 100% recycled Polyethylene means reduced carbon emissions during manufacture compared to virgin materials.
- 100% recyclable at end of a long usable life.
- Zero risk of puncturing reducing the risk of cross contamination.
- Lighter weight compared to other composite, rubber or wooden mats:
- More mats (and usable surface area) per truck
- Reduces the number of trucks required for temporary access and ground protection projects
- Reduces fuel costs
- Reduces carbon emissions
- Reduces noise impact on local communities.

### 3. SPECIFICATION

- Solid one piece design.
- Quality batch control / mat identification.
- 13 ft. 5 in. x 6 ft. 8 in. x 1.85 in.
- Weight: 794 lbs.
- Materials: premium 100% recycled black High Density Polyethylene or High Molecular Weight Polyethylene with UV protection.
- Reversible dual profiled surfaces provide excellent traction - a more aggressive and unique 'chevron traction®' grip for vehicles and equipment and a low profile grip for site personnel.
- ACME 'drop-in' hex head bolt connection with a choice of connection straps.



### 4. TRANSPORT, HANDLING, STORAGE, CLEANING AND MAINTENANCE

Site personnel involved in maneuvering TuffTrak XL during transport, storage or handling should use Personal Protective Equipment and comply with all Health & Safety requirements at depot or projects sites.

In particular correct procedures should be adopted when handling / lifting TuffTrak XL. It is advised that each TuffTrak XL is moved and lifted with suitable equipment by a two man team.

#### 4.1. TRANSPORT

TuffTrak XL is loaded on to pallets in stacks of 5 mats (gross weight / pallet - 4,300 lbs approx.). It is important to stack mats carefully and to align the edges of the mats, stacking neatly while in storage and during transport by truck or container.

Depending on the load capacity of the forklift or crane being used, it is recommended that a maximum of one pallet of 5 mats is lifted at any time. Extended forklift forks are highly recommended for the safe handling of mats and that sections be picked up from the long side of the pallet when loading onto flatbeds or transporting on-site.

The load capacity of flatbed trucks in the United States is limited to approximately 48,000 lbs. This allows for the transportation as follows:

- 40 ft ISO Container - 50 New TuffTrak XL mats
- Flatbed Truck (Palletized) - 55 TuffTrak XL mats (11 pallets - 2 stacks of 5 pallets plus 1)
- Flatbed Truck (Non Palletized) - 60 TuffTrak XL mats (max - dependent upon condition of mats -clean / amount of mud on mats)

## TuffTrak XL Ground Protection Mats Installation Instructions - continued

NOTE: Always use heavy duty ratchet straps to secure pallets on a flatbed trailer. Please check individual State Highway regulations when transporting TuffTrak XL.

- TuffTrak XL should be loaded / unloaded by fully qualified fork drivers using extended forks.
- Pallets, strapping and any other packaging materials should be disposed of responsibly.



### 4.2. HANDLING AND STORAGE

#### 1. PALLETS AND STRAPPING

- New TuffTrak XL are delivered with five mats strapped to each pallet - mats are first strapped together before being double strapped to the pallet for transportation.
- For onward transportation to site it is important to ensure that the five mats remain strapped together. This will prevent loose mats sliding across one another when being lifted and moved by forks.
- Please note this is only required when the mats are completely new; until deployed all new composite mats are slick and can easily slide. (Once the mats have been used on one or two projects this characteristic disappears.)

#### 2. STACKING AND STORAGE

- After every job TuffTrak XL should always to be stacked upside down to allow the TuffTrak XL 'memory' to return the mats to their original shape.
- TuffTrak XL should be stacked on pallets with 5 mats on each pallet, with no part of the TuffTrak XL extending over the pallet edge.
- TuffTrak XL can be stored on their pallets and can be stacked on top of each other (maximum height of pallets determined by load capacity of equipment used.)

NOTE: All connector straps should be removed and stored during de-installation, before the mats are cleaned and stored.

### 4.3 CLEANING AND MAINTENANCE

After the mats have been taken up following project completion, no specialist equipment is required to clean TuffTrak XL. Mats can be cleaned using pressure washes and cold water. If heavily muddied, excess mud can be brushed off before being pressure washed.

Cleaning of the mats and disposal of any surplus soils or surface contaminants should be undertaken responsibly and in accordance with site or regulatory requirements.

After cleaning ensure that all TuffTrak XL are stored upside down, allowing the 'memory' to return to the mats to their original shape.

## 5. SITE ANALYSIS AND PREPARATION

In accordance with standard operating and installation procedures it is recommended that careful site analysis and an operational and physical evaluation is undertaken, to determine how best to use TuffTrak XL on each project.

Key considerations include:

- Ground conditions (CBR Value) - soil type (sand, clay, wetlands, peat, arable), softness, profile, including undulation, concentration of plants, shrubs, tree roots, stumps, ditches or dikes.
- Types, sizes and weights of vehicles and equipment to be used.
- Duration of the project – including any weather implications (e.g. rainfall or temperature) associated with seasonal changes during long term projects.
- Movement requirements of equipment and vehicles in creating roadways, pads, turning and passing places.

NOTE: A physical site visit before delivery and installation of mats should **ALWAYS** be undertaken. Please contact us if you require any assistance.

## TEMPERATURE VARIATION CONSIDERATIONS

Generally most composites including Polyethylene are extremely strong, tough and flexible. However, when temperatures significantly decrease the mechanical properties of Polyethylene changes, becoming more rigid.

Subject to consideration about ground conditions and type of application TuffTrak XL can confidently be expected to operate successfully down to -20 to -60°F.

Guidance on the spacing that should be left between TuffTrak XL before they are connected. The amount of spacing will depend on the month and season and is based on the lowest to highest temperature that may occur during the time TuffTrak XL are being used. As such it is recommended that mats are connected at the full extent provided by the connector, leaving a maximum gap of approx. 0.8" / 20mm allowing for expansion of the mats at the higher temperature. (Refer to section 6.2 of this guide for details on connection of TuffTrak XL mats)

## 6. INSTALLATION / DEPLOYMENT / CONNECTION / MAT CONFIGURATION, MAT CLEANING AND GEOTEXTILES

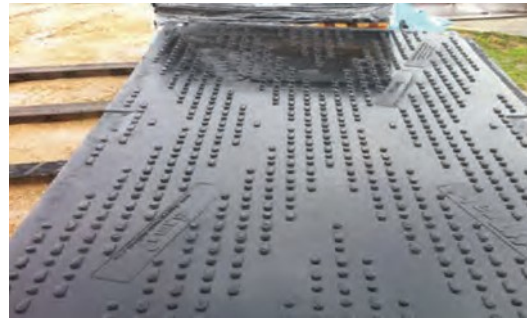
### 6.1. INSTALLATION / DEPLOYMENT

Before installation it is important that site operators become familiar with safe handling procedures. Experience shows that different operators can develop their own safe handling methods. In general:

- At site, the strapping around the five mats should be cut (and discarded responsibly) when the pallets are placed on the ground.



## TuffTrak XL Ground Protection Mats Installation Instructions – continued



- Mats should be approached, handled and picked up from the long side 'on' (see below)
- If using forks the uppermost mat should be nudged and slightly lifted so that a block of timber can be centrally placed between the uppermost mat and the mat below.
- Using the forks, the top mat is lowered onto the block of wood.
- The full length of the extended forks are then inserted under the top mat for safe lifting and moving the mat into position.



Depending on available site equipment, experienced operators can also use hydraulic grabs to lift and position mats before connection:

- After removal of the strapping (outlined above) all five mats can be picked up by the grab.
- The five mats are placed long side 'on' and subsequent and adjacent to the last installed mat.
- Four mats are picked up and placed long side 'on' and adjacent to the previously installed mat.
- This sequence is repeated until all mats are placed.
- The grab can be used to nudge the mats into the require position before connection.



## 6.2. CONNECTION

TuffTrak XL are fitted with four ACME threaded connection inserts one in each corner. Mats are connected using spring steel or other connection straps, secured into position using ACME 'drop-in' hex head bolts and bolt. Mats should be connected so that the straps are at their full extent; this results in a 20mm gap between mats.

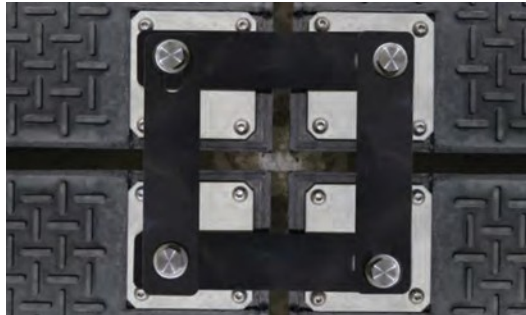
Bolts can be tightened using a portable power tool fitted with a socket driver (1/2" socket).

Tighten bolts to hand tight (max of 50lbs/ft torque) - this will secure the mats but enable movement when the mats expand or contract due to temperature changes.

It is recommended that periodic inspection is undertaken during a project to check bolts and connections.

NOTE: Like all matting systems, it is recommended that TuffTrak XL should ALWAYS be connected using the recommended connector strap(s).





### 6.3. NORMAL OPERATING PERFORMANCE OF TUFFTRAK XL

TuffTrak XL's performance capabilities allow for deployment over varied ground conditions as they adapt to the contours of the ground. However, care must be taken not to lay mats over aggressive obstacles such as rocks or tree stumps, as damage to the mats may result. Images below show typical and normal performance and behavior of TuffTrak XL.







NOTE: TuffTrak XL are made from 100% recycled black Polyethylene which is a thermoplastic material that expands or contracts according to increases or decreases in temperature. Allowance should be made for this during installation by leaving sufficient gaps between adjacent mats and by not 'over-tightening' connection bolts. (Refer to section 5 and 6.2 of this guide.)

#### 6.4. MAT CONFIGURATION

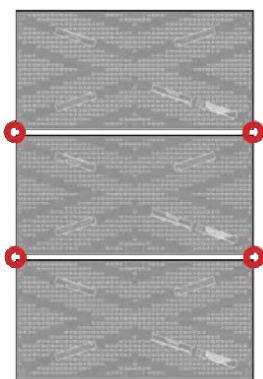
TuffTrak XL are reversible and can be interconnected with either the chevron grip® or low profile grip surface facing upwards, depending on the application, type of vehicle and equipment or personnel moving across the mats.

These two different surfaces can be installed on a mixed basis. Unless you wish to select one of the mat surfaces for a particular application, it does not matter if mats are laid with a mix of both surface types uppermost.

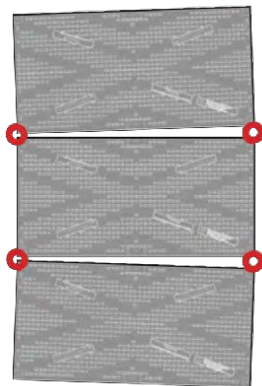
TuffTrak XL can be installed in a variety of different configuration layouts:  
(Refer to section 6.2 of this guide.)

- To create temporary roadways (13'5" width)
- To create large working areas or pads.

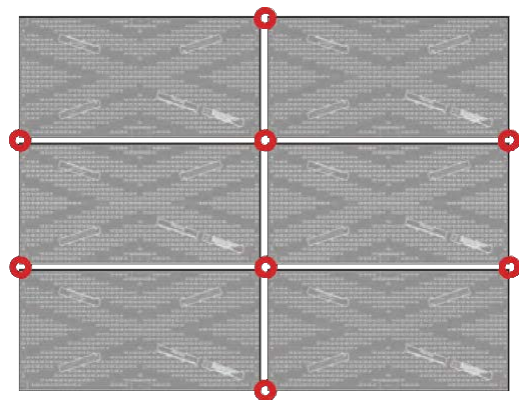
NOTE: When delivered new from the factory TuffTrak XL are palletized with the low profile surface upwards.



13.5' Roadway



13.5' Roadway Turn



Linear Configuration / Working Areas  
or Pads

NOTE: Please ensure that mats are connected with standard straps on inside edge of turn. Optional longer straps are available for outer edge connection. (Refer to section 6.2 of this guide)

## 6.5 GEOTEXTILES AND PUMPING

Mud and soil can be transferred from operating vehicles and equipment onto mat surfaces as they move from areas where there is no mat protection. The excellent chevron traction® design of TuffTrak XL means that a high degree of safe passage for personnel, vehicles and equipment can continue even with surplus mud and soil on the mat surfaces.

If it is known that site and ground conditions are, or will be, very wet and muddy it is recommended that a geotextile material is first placed under the TuffTrak XL. The geotextile does not impact the normal connection of TuffTrak XL and the mats are installed and connected in the standard way.

Geotextile will provide a cost-effective barrier between the ground and the mats preventing water and wet mud being pushed up onto the mat surfaces (pumping).

## 6.6 MAT CLEANING

Depending on site conditions occasional surface cleaning of mats may be required during deployment. This can be carried out using pressure washer or other washing / cleaning equipment.

At the end of the project it is recommended that, where practical, the mats are cleaned on site prior to loading on to trucks.



## 7. OPERATING LIMITATIONS / 7.1. MAT PROTECTION: STEEL TRACKED VEHICLES

In order to minimize damage to any matting system, including TuffTrak XL, and as a basic and important rule of thumb, it is recommended that the movement of steel tracked vehicles and equipment over mats is limited or carefully controlled.

If steel tracked vehicles or equipment are to be moved over TuffTrak XL (or other matting system) it is essential that;

- TuffTrak XL's are deployed with the low profile surface upwards and the steel tracked vehicles and equipment ONLY move in a simple FORWARD or REVERSE direction and AT SLOW SPEED.

- Steel tracked vehicles or equipment **SHOULD NEVER TURN OR SLIDE ON** TuffTrak XL (and other matting systems)
- To deliver full protection when running steel tracked vehicles or equipment over TuffTrak XL (and other matting systems) thick rubber sheets can be placed over the TuffTrak XL

NOTE: Protecting mats is a mandatory requirement where TuffTrak XL is on rental. Greatmats does not accept responsibility for damage to TuffTrak XL caused by steel tracked vehicles or equipment.

## 7.2. SPEED LIMIT

TuffTrak XL are designed for the safe movement of personnel, vehicles and equipment over many different ground conditions and in all types of weather. To ensure the maximum safety for personnel and performance of TuffTrak XL, vehicles and equipment **MUST NOT EXCEED 5 MPH**. This is a strict speed limit which should be observed **AT ALL TIMES**.

## 7.3. SITE TRACKWAY MAINTENANCE

When TuffTrak XL are connected, using the method previously outlined in this document, it is advised that during the length of the project both the condition of the trackway and the tightness of the bolts are inspected on a regular basis. To ensure optimal performance, where necessary bolts should be tightened to hand tight (max 50 lbs/ft torque) allowing the connectors to move as mat expands and contract as temperature fluctuates.

## APPENDIX A - GROUND AND ENVIRONMENTAL CONDITIONS

### A.1. LOAD BEARING CONDITIONS (CBR)

The purpose of using TuffTrak XL is to help improve the load bearing capacity of the underlying soil to enable the movement of vehicles and equipment over soil conditions that would otherwise lead to the vehicles and equipment sinking into the ground.

The California Bearing Ratio (CBR) was originally developed for measuring the load-bearing capacity of soils used for building roads and today continues to be commonly used to characterize the load bearing capacity of ground conditions.

CBR is essentially a measure of the 'strength' of the ground; the firmer the soil / sub-grade, the higher the CBR rating and its load bearing capacity. A CBR of 3, for example, equates to tilled farmland, a CBR of about 5 equates to turf or moist clay, while moist sand may have a CBR of 10 (<http://www.pavementinteractive.org/article/subgrade>).

High quality crushed rock has a CBR over 80. The standard material for this test is crushed California limestone which has a value of 100.

### A.2. FINITE ELEMENTAL ANALYSIS

To provide guidance on how mats may perform on ground having different load bearing potential calculations or CBR values calculations are undertaken using Finite Elemental Analysis (FEA) modeling. FEA has been undertaken to calculate mat deflection when loads are applied to a contact area measuring 20" x 10" at the center of the mat.

Deflection has been calculated for different ground types having CBR values between 0.5 to 100. The CBR values are then converted to an equivalent stiffness or 'Young's Modulus' (E). For the purposes of undertaking the FEA the following empirical formula is used:

$$E_{cbr} = 17.62 \text{ MPa} \cdot \text{CBR}^{0.64}$$

Shear modulus is calculated as 70% of E.

Simulations were run to determine the maximum loading that would take stress in the material up to 10 MPa (50% of the theoretical yield, i.e. a factor of safety of 2).

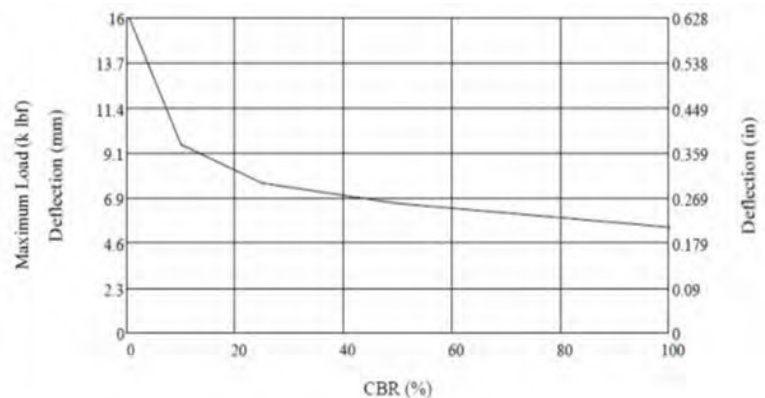
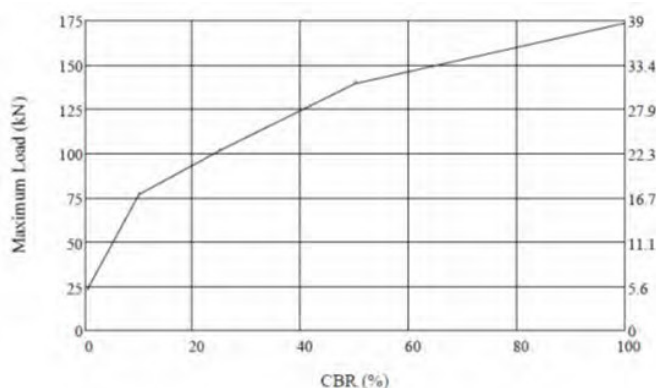
With reference to the table below at a CBR value of 25, for example, the maximum loading (with a factor of safety of 2) that can be applied to the contact area at the center of the mat is 23,000 lb force (or 102kN). At this load value the mat deflection is calculated to be 0.30 inches (or 8mm).

CBR	CBR GROUND TYPE	LOAD BEARING CAPACITY	LOAD (kN)	LOAD (lbf X 10 <sup>3</sup> )	DEFLECTION (mm)	DEFLECTION (in.)
10	Clay Soil	Poor - Medium	77	17	10	0.38
25	Sandy Soil	Good	102	23	8	0.30
50	Crushed Stone LD	Excellent	139	31	7	0.26
100	Crushed Stone HD	Excellent	174	39	5	0.21

1. Refer to Guide for Mechanistic-Empirical Design of New and Rehabilitated Pavement Structures. Final Document. Appendix CC-1: Correlation of CBR Values with Soil Index Properties. Prepared for National Cooperative Highway Research Program, Transportation Research Board, National Research Council. Submitted by ARA Inc. ERES Division, 505 West University Avenue, Champaign, Illinois 61820. March 2001.

*Note: This publication also provides information on CBR values relative to AASHTO soil classification and Unified Soil Classification.*

It should be noted that FEA is modeling process that has been used to simplistically simulate the interactions between a load contact area of specified size, the force applied to the contact area, the mat dimensions, the mat material mechanical properties (HDPE), ambient temperature (around 20oC) and ground type as described by CBR value. FEA has not been used to simulate soil properties such as soil particle sizes, voids between soil particles, cohesiveness, soil density and soil moisture content, all of which can vary within and between soil types and sites and can determine the performance of the mat on the ground. Therefore the presented results should be used for guidance only and are to be used in conjunction with knowledge gained from direct field and project experience.





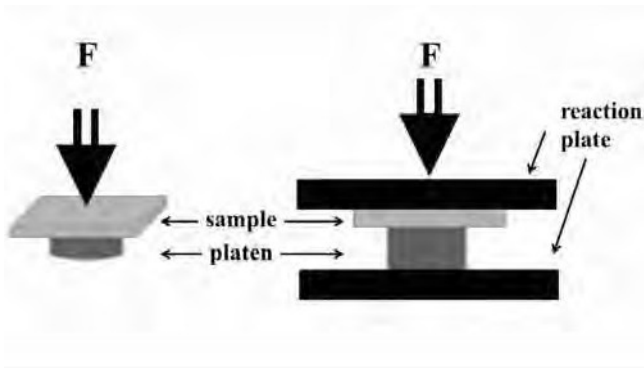
## APPENDIX B - TESTING

### B.1.

The solid construction provides excellent strength through the whole of the mat. Testing at the UK National Physical Laboratory (to BS EN 124: 1994) showed that TuffTrak XL can be subjected to compressive forces up to 700,000 pounds without breaking or cracking.

Using a steel 10" diameter plate and applying increasing force to a mat sample the surface structure nubs (1/4" height) were compacted at about 1800psi pressure. Compaction into the core of the mat sample continued to about 8500psi when the deflection was 0.7 inches.

This laboratory test demonstrates the compressive strength of the solid mat material but it should be noted that this does not equate to the pressure that can be applied to the mat on all types of, particularly softer, ground conditions.



This guide is based on numerous projects undertaken globally, and across a wide range of ground and weather conditions.

These recommendations will provide a safer and more effective temporary road or access area and an efficient and professional project.

For Health and Safety reasons and to maximize efficient performance, it is recommended that temporary access mats or matting systems should ALWAYS be connected.

Greatmats.com  
117 Industrial Ave  
Milltown, WI 54858  
877-822-6622  
Fax: 715-825-4928  
Info@greatmats.com  
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