

## ASTM F 1951-14 Surface Testing Report

Standard Specification for Determination of Accessibility of  
Surface Systems Under and Around Playground Equipment

### SUMMARY OF RESULTS

Beneficial Designs, Inc. received a surfacing sample from **TRUEGRID Permeable Pavers** classified as subsurface structure with the brand name **TrueGrid Pro Plus**. This sample of TrueGrid Pro Plus **met** the maneuverability performance requirements of ASTM F 1951-14.



Report prepared by:

Peter Axelson, Testing Supervisor

7 June 2019

Date

---

### TEST SPECIMEN

Manufacturer **TRUEGRID Permeable Pavers**  
Name **TrueGrid Pro Plus**

Type subsurface structure  
Source  
Mfr's lot no. 011902080  
Date of manufacture  
Thickness 2

### TEST DATE

30 May 2019

### TESTING CONDITIONS

Surface temperature 70 deg F  
Atmospheric temperature 63 deg F  
Relative humidity 35 %

### INSTALLATION, LEVELING & COMPACTION

Excavate test bed area to 10 inches below grade, Fill excavated area with 5 to 6 inches of #2 road base, Rake until level, Compact to a depth of 4 inches, add 5 to 6 inches of #2 road base, compact to a total road base depth of 8 inches, Place Truegrid product on top of compacted #2 road base, Fill grid with 3/4 crushed washed angular stone, Rake to fill evenly to top of grid, Rake excess stone off of grid.

### TEST WHEELCHAIR & RIDER

Manufacturer Sunrise Medical/Quickie  
ID no. none  
Model Quickie II  
Weight 31.5 lb.

Weight of test wheelchair rider 165 lb.  
Front-to-rear weight distribution  
of wheelchair-rider system 40% - 60 %

## WHEELCHAIR WORK MEASUREMENT METHOD RESULTS

### Straight Propulsion on TrueGrid Pro Plus

	Work per meter (N*m)	Trial Time (sec)
Trial 1	29.4	6.2
Trial 2	36.7	6.8
Trial 3	29.1	6.4
Trial 4	24.3	6.4
Trial 5	26.6	6.4

**Average work per meter (n=3) 28.4 N\*m**

### Turning on TrueGrid Pro Plus

	Work per meter (N*m)	Trial Time (sec)
Trial 1	17.7	6.0
Trial 2	22.7	6.4
Trial 3	27.4	6.1
Trial 4	22.5	6.0
Trial 5	22.8	6.7

**Average work per meter (n=3) 22.7 N\*m**

### Straight Propulsion on 7.1% Ramp\*

	Work per meter (N*m)	Trial Time (sec)
Trial 1	75.8	7.5
Trial 2	77.0	7.7
Trial 3	74.5	7.5
Trial 4	75.6	8.0
Trial 5	69.9	7.9

**Average work per meter (n=3) 75.3 N\*m**

### Turning on 7.1% Ramp\*

	Work per meter (N*m)	Trial Time (sec)
Trial 1	53.3	6.5
Trial 2	53.3	7.1
Trial 3	55.7	6.9
Trial 4	50.2	7.6
Trial 5	53.8	7.2

**Average work per meter (n=3) 53.5 N\*m**

\* Hard smooth surface with grade of 7.1+/-0.2% (1:14)

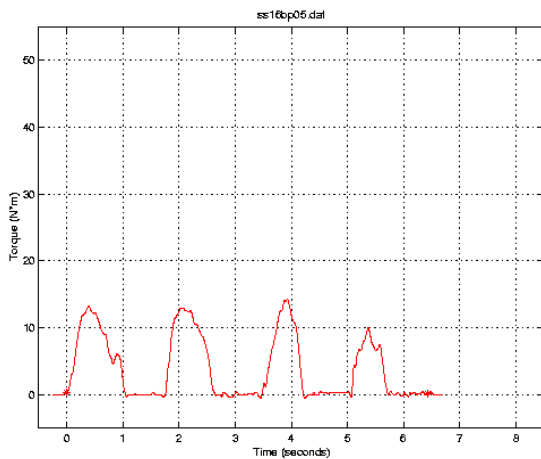
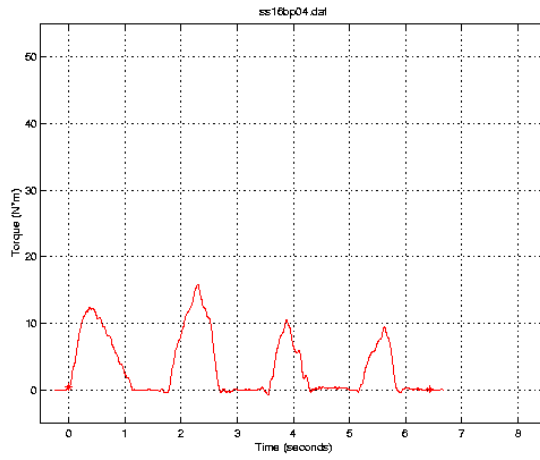
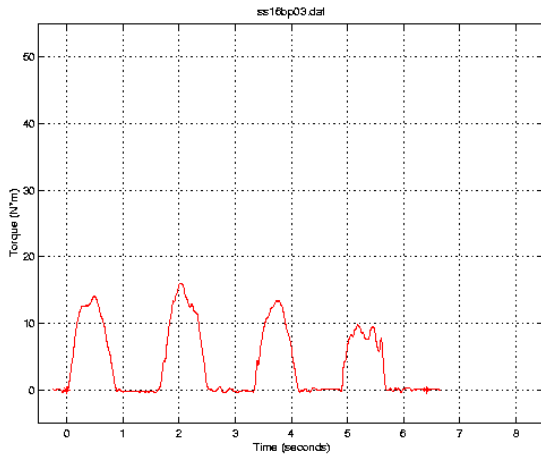
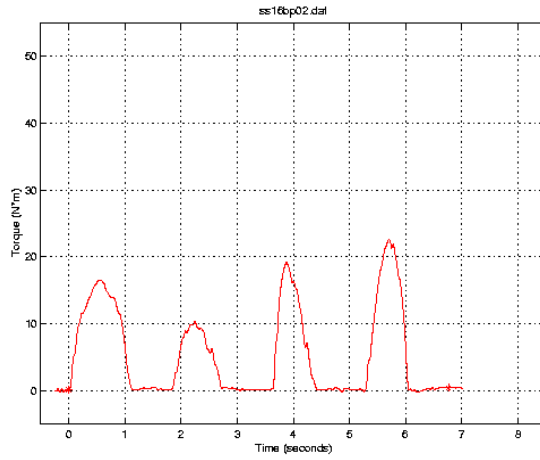
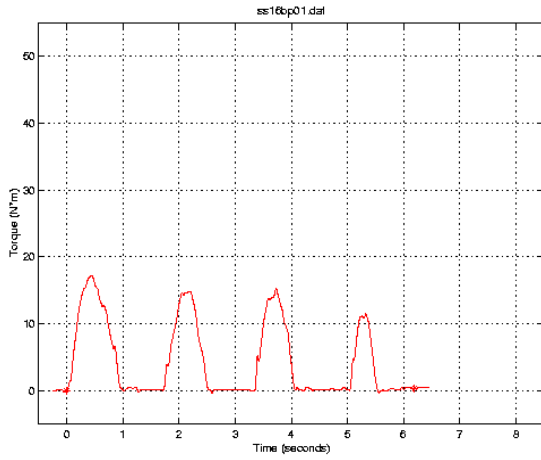
**Straight Propulsion Work Ratio 0.377**

**Turning Work Ratio 0.424**

Work ratio = Avg work on surface/Avg work on 7.1% ramp. If both the straight propulsion and turning work ratios are less than 1.00, the surface system meets the performance requirements of F 1951.

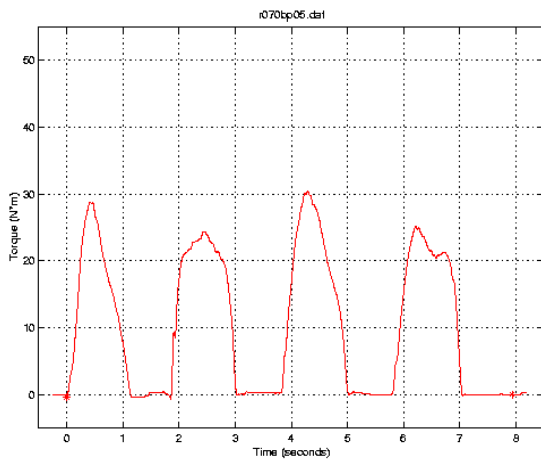
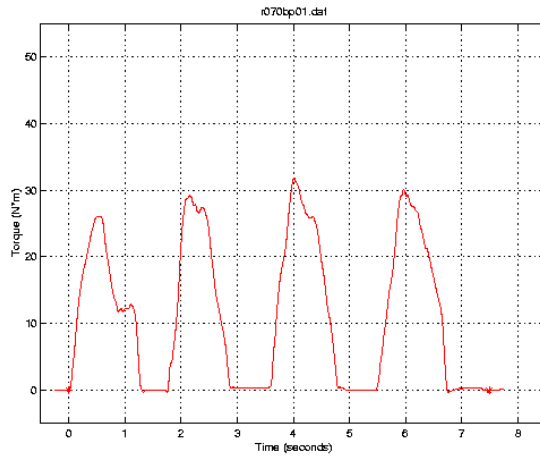
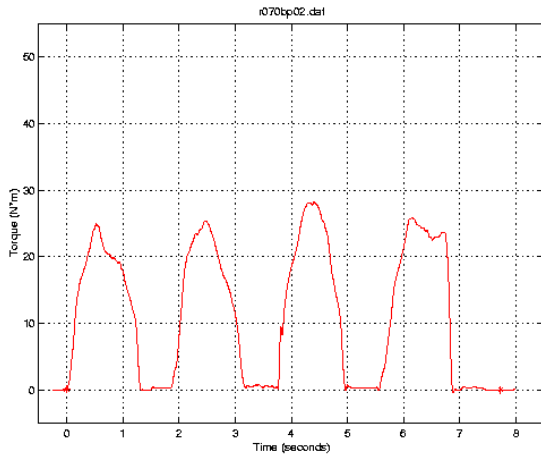
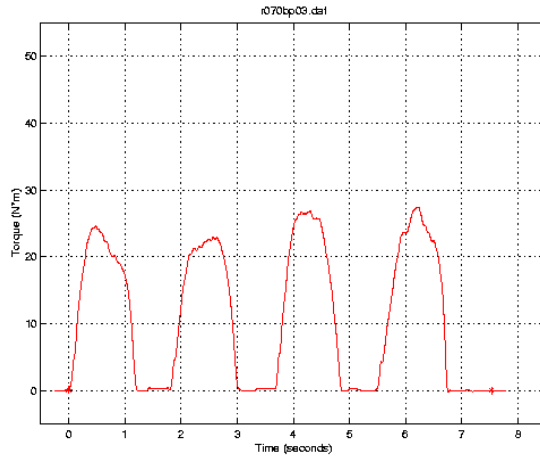
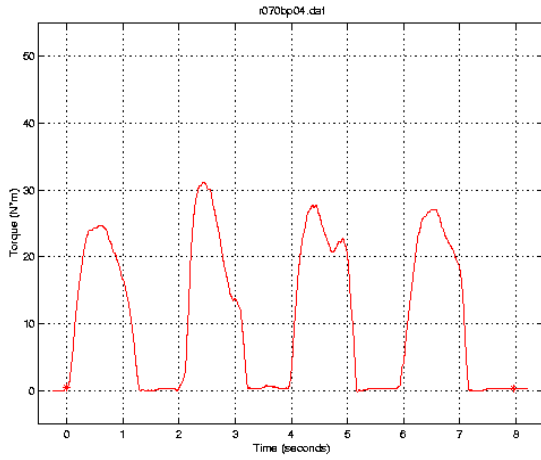
# ASTM F1951 – 08 Part 6: Wheelchair Work Measurement Method – Straight Propulsion

## TrueGrid – TrueGrid Pro Plus

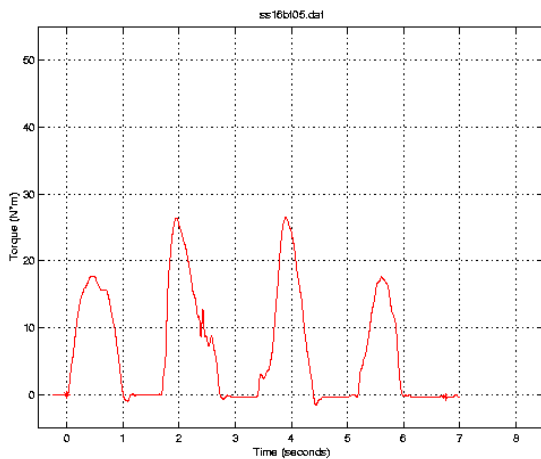
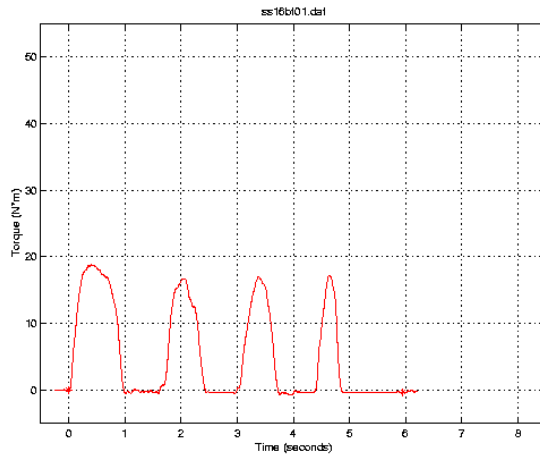
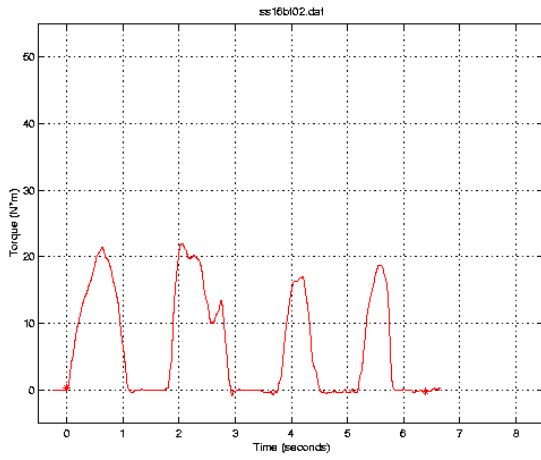
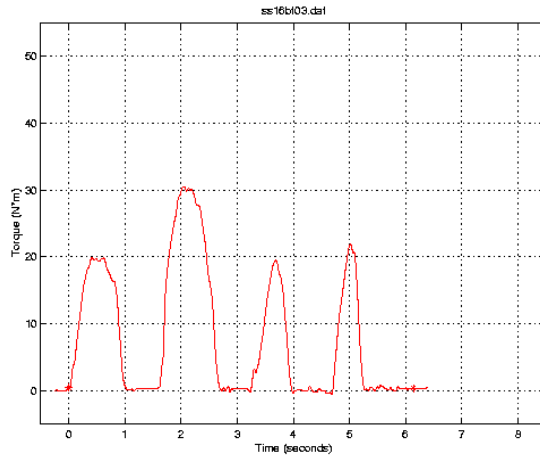
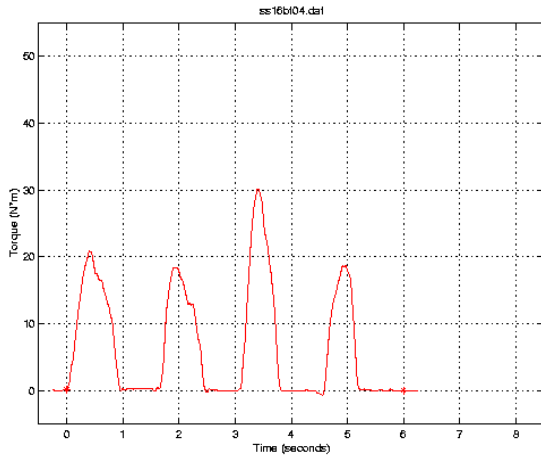


# ASTM F1951 – 08 Part 6: Wheelchair Work Measurement Method – Straight Propulsion

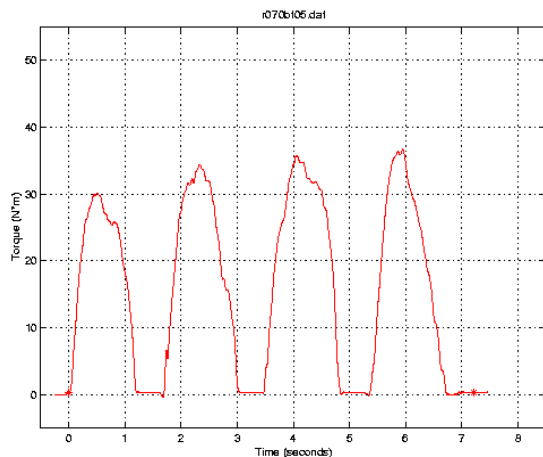
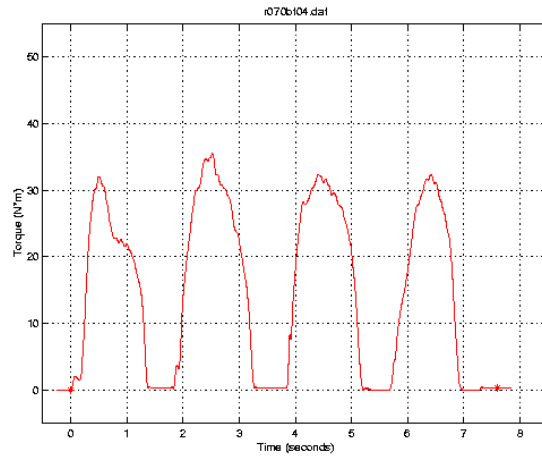
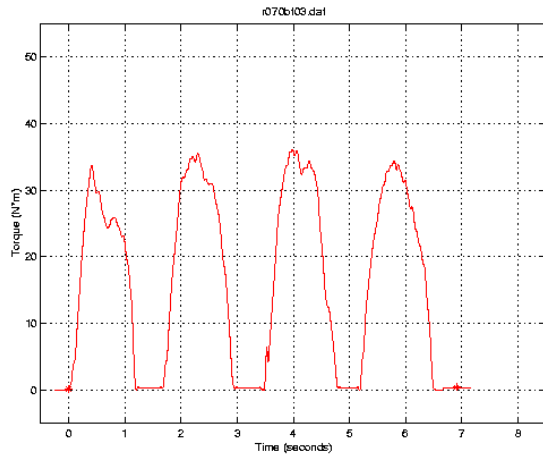
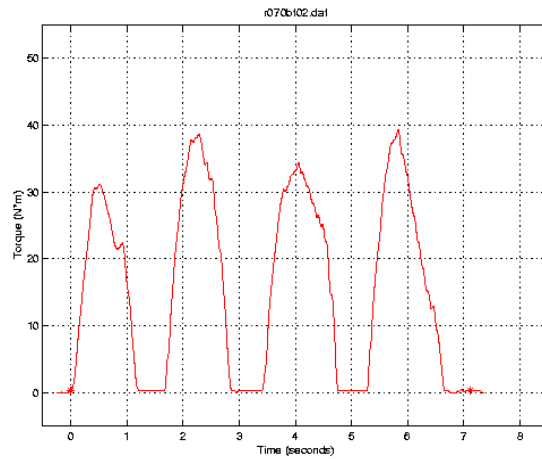
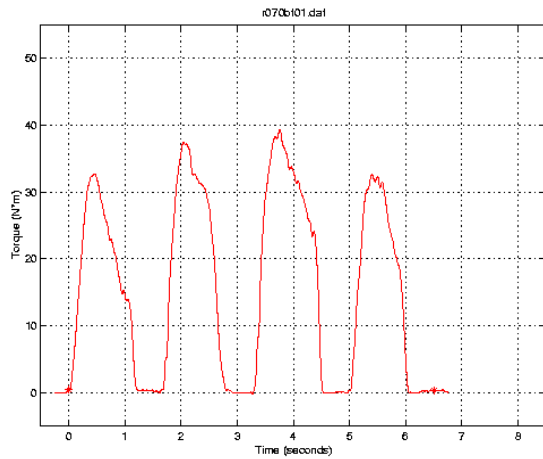
Hard, smooth surface with a grade of  $7.1 \pm 0.2\%$  (1:14)



# ASTM F1951 – 08 Part 7: Wheelchair Work Measurement Method – Turning TrueGrid – TrueGrid Pro Plus



# ASTM F1951 – 08 Part 7: Wheelchair Work Measurement Method – Turning Hard, smooth surface with a grade of $7.1 \pm 0.2\%$ (1:14)



# Rotational Penetrometer Surface Testing Report

RESNA Surface – Section 1: Test Method for Firmness and Stability  
(Working Draft 2000-11-20)

Test Institution		Rotational Penetrometer	
Name	<u>Beneficial Designs, Inc.</u>	Manufacturer	<u>Beneficial Designs, Inc.</u>
Address	<u>2240 Meridian Blvd., Suite C</u> <u>Minden, NV 89423</u>	Serial number: BDRP-	<u>100</u>
Phone / Fax	<u>ph 775.783.8822/fax 775.783.8823</u>	Date of last calibration	<u>2019-05-15</u>
Operator	<u></u>	Tire pressure set at 36 psi. on	<u>2019-05-30</u>
Data recorder	<u></u>	by <u>S. Schnorbus</u>	Temp. °F <u>67°</u>

Date & Time of Test		Testing Conditions	
Date	<u>2019-05-30</u>	Temperature °F	<u>67°</u>
Time	<u>2:50 pm</u>	Relative Humidity %	<u>41%</u>
If the temperature is more than 10 °F different than the temperature at the tire pressure check, re-inflate tire before starting to test.			

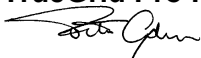
Test Surface		Test Results			
Manufacturer	<u>TrueGrid</u>	Record readings to nearest hundredth of an inch (0.000).			
Name	<u>TrueGrid Pro Plus</u>	<b>Trial</b>	<b>Slope (%)</b>	<b>Firmness (in)</b>	<b>Stability (in)</b>
Type	<u>Subsurface Structure</u>	1	<u>0.2</u>	<u>0.2115</u>	<u>0.2515</u>
Source	<u></u>	2	<u>0.3</u>	<u>0.2065</u>	<u>0.2415</u>
Date of mfr	<u></u>	3	<u>0.2</u>	<u>0.3025</u>	<u>0.3220</u>
Depth	<u>2 inch over 8 inch</u>	4	<u>0.4</u>	<u>0.1555</u>	<u>0.2325</u>
Slope	<u>0.4%</u>	5	<u>0.3</u>	<u>0.2360</u>	<u>0.2675</u>
Location	<u>Beneficial Designs, Inc.</u>	<b>Avg.</b>		<b>0.2224</b>	<b>0.2630</b>
	<u>Minden, NV</u>	<b>SD</b>		<u>0.0535</u>	<u>0.0354</u>

Procedures used to install, compact and/or level prior to testing: Excavate test bed area to 10 inches below grade, Fill excavated area with 5 to 6 inches of #2 road base, Rake until level, Compact to a depth of 4 inches, add 5 to 6 inches of #2 road base, compact to a total road base depth of 8 inches, Place Truegrid product on top of compacted #2 road base, Fill grid with 3/4 crushed washed angular stone, Rake to fill evenly to top of grid, Rake excess stone off of grid

Method of stabilizing the surface reference plates: The test operator stood on the surface reference plates.

## Summary of Results

Beneficial Designs, Inc. received a surfacing sample from **TrueGrid** with the brand name **TrueGrid Pro Plus**. This sample of **TrueGrid Pro Plus** had a **firmness** of **0.2224 in.** and **stability** of **0.2630in.**

Report prepared by:   
Peter Axelson, Testing Supervisor

7 June 2019  
Date