Engineered Wood Fiber Accessibility Testing

Review and Analysis of Preliminary Results

8/20/2013

Henderson Consulting Services, Inc.

Introduction

The adoption of the Americans with Disabilities Act Accessibility Guidelines (ADAAG), including those for Play Areas, by the Department of Justice (DOJ), with compliance required by March 2012, sparked a great deal of interest in, and some concerns about, playground surface accessibility by users, suppliers and other stakeholders.

In response to this interest and concern, the National Center on Accessibility (NCA) undertook a study to evaluate the accessibility of various playground surfaces over a multiyear period. (*A Longitudinal Study of Playground Surfaces to Evaluate Accessibility)* One year findings from this study were published in May 2011.

Engineered wood fiber (EWF) was one of the surfaces evaluated in the study. In this study, EWF exhibited some shortcomings in compliance with Americans with Disabilities Accessibility Guidelines (ADAAG) for accessible routes. EWF failed to comply with one of the four accessible route requirements measured (running slope, cross slope, change in level and openings in the surface) in slightly more than 50% of the inspection observations (average failure rate of 2.16 out of 4). The study also found that EWF stability, measured with a rotational penetrometer, was less than that of the unitary surfaces tested, although such a result was to be expected for a loose fill surface. (EWF firmness was equivalent to that of poured-in-place rubber but less than that of rubber tile.)

However the NCA report also noted that none of the EWF surfaces tested had been installed according to the supplier's installation instructions[1]. This raised the question as to whether the shortcomings in EWF accessibility identified in the study were due to the nature of the surface or simply the result of improper installation. In order to answer this question, a study of the accessibility of EWF surfaces which were properly installed according to supplier's instructions was initiated by the International Playground Equipment Manufacturers Association (IPEMA). This paper will review the preliminary findings from this study.

Preliminary Study Results

Three EWF playgrounds, in New York, Maryland, and Utah, were evaluated according to the criteria used in NCA study. The playgrounds were installed according the suppliers installation instructions and maintained by the playground operators. Two of the three received no further maintenance prior to testing, while the EWF surface at the Utah playground was tamped in three locations (of seven tested) which were not properly compacted.

The playgrounds were evaluated for compliance with ADAAG accessible route requirements and for firmness and stability. Detailed reports on these inspections are contained in the Appendix of this paper.

[1] IPEMA recommended EWF Installation Instructions can be found at http://www.ipema.org/news_articles/11/EWF_Mmaint_Install_Position_Statement.pdf

Accessible Route Compliance

As noted above, the playground surfaces were tested for compliance with four ADAAG accessible route requirements: running slope of 1:16 (6.25%) or less; cross slope of 1:48 (2.08%) or less; no abrupt changes in level of 0.50" or more and no openings greater than 0.50" in diameter.

Compliance with these requirements was evaluated at five locations on the Maryland playground, six locations on the New York playground and seven locations on the Utah playground. Results of this evaluation are shown in Tables A1, A2 and A3 in the Annex of this report.

Overall ADAAG accessible route compliance at the three playgrounds is summarized in Table 1 below:

Table 1
ADAAG Accessible Route Compliance
Clarksburg Elementary/Ridge Road Park/Bellevue Neighborhood Park

	Running Slope	Cross Slope	Change in Level	Openings in Surface	All Requirements
Number of observations	18	18	18	18	72
Number compliant	16	15	17	18	66
Percent compliant	89	83	94	100	92

The table reveals a limited number of deficiencies and fairly high level of compliance with all four requirements, ranging from 83% for cross slope to 100% for openings in the surface. Overall compliance for all four requirements was 92%, a significant improvement over the 46% compliance rate in the NCA study.

In addition, at the Clarksburg Elementary, MD, playground, shortcomings in running slope and change in level were quickly and easily corrected with light maintenance.

These preliminary results indicate that properly installed and maintained EWF playground surfaces can offer a high degree of ADAAG accessible route compliance.

Surface Firmness and Stability

As noted in the introduction, the NCA study also measured the firmness and stability of various types of playground surfaces using a rotational penetrometer. (For more information on the rotational penetrometer and its use in measuring surface firmness and stability see *Accessible Exterior Surfaces Technical Article*, by Beneficial Designs, available at www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm)

The mean EWF surface firmness value reported in the NCA study, somewhat surprisingly for a loose-fill surface, was superior to that for hybrid surfaces (i.e. a unitary top layer over a loose-fill base) and equal to that of poured-in-place rubber.

The mean NCA value for EWF stability was well above that for hybrid and unitary surfaces. (A higher value meaning deeper penetration of the wheelchair caster into the surface and thus lower stability.) This is to be expected as rotational penetrometer (RP) stability testing involves the turning of the wheelchair caster, thus dislodging loose fill surfaces such EWF.

The preliminary study, therefore, also included firmness and stability testing using a rotational penetrometer. Firmness and stability readings were taken at each playground location where accessible route requirements were tested. The results of this testing (reported as RP firmness and stability values) are show in Tables A1 through A3 in the Annex of this report.

Statistics for these findings are shown in Table 2 below.

Table 2
Rotational Penetrometer Firmness and Stability
Clarksburg Elementary/Ridge Road Park/Bellevue Neighborhood Park

	Firmness (Inches)	Stability (Inches)
Moderately Firm or Stable [1]	≤ 0.50	≤ 1.00
Mean [2]	0.36	0.73
Median [2] (midpoint)	0.36	0.75
Minimum [2]	0.22	0.44
Maximum [2]	0.43	0.99

[1] Recommended performance requirements for firmness and stability, *Accessible Exterior Surfaces Technical Article*, available at www.accessboard.gov/research/Exterior%20Surfaces/exteriorsarticle.htm.

[2] Of tests at eighteen (18) locations.

Average values for firmness and stability from the preliminary study are fairly close to those in the NCA study (Firmness of 0.36" vs. 0.342" in the NCA study. Stability of 0.73" vs. 0.782" in the NCA study). The range of preliminary study firmness and stability values is somewhat narrower than the NCA range, not surprising as the preliminary study sample size is much smaller.

Of most importance, however, is that the mean firmness and stability values found in the preliminary study were less than the maximum values of 0.50" for moderate firmness and 1.00" for moderate stability proposed in the *Accessible Exterior Surfaces* report. Maximum firmness and stability values found in the preliminary study (0.43" and 0.99", respectively), were also lower than the allowable maximum values.

These preliminary results indicate that properly installed and maintained engineered wood fiber surfaces provide acceptable firmness and stability for wheelchairs and other mobility aides.

Conclusions

The results of this preliminary study of EWF accessibility show that engineered wood fiber surfaces, when properly installed and maintained, offer a high level of compliance with ADAAG accessible route requirements, and one certainly much improved over that of the improperly installed EWF surfaces evaluated in the NCA study. The firmness and stability of the correctly installed and maintained EWF playgrounds, as measured with the rotational penetrometer, comfortably exceeded the performance values for acceptable firmness and stability.

It is recognized that the current study, involving only three playgrounds, is somewhat limited. Further testing on applicable playgrounds is planned to confirm these conclusions.

ANNEX
SUMMARY OF ACCESSIBILITY TESTING RESULTS

Clarksburg Elementary School
Clarksburg, MD

Ridge Road Park
Greenburgh, NY

Bellevue Neighborhood Park
Draper, UT

Table A1
Clarksburg Elementary School
Clarksburg, MD

Location on Playground	Running Slope, Percent	Cross Slope, Percent	Changes in Level, Inches	Openings in Surface, Diameter, Inches	Firmness,[1] Inches	Stability,[1] Inches
ADAAG Requirements	≤ 6.25	≤ 2.08	≤ 0.50	≤ 0.50	≤ 0.50[2]	≤ 1.00[2]
Playground Entrance	1	0.5	None	None	0.39	0.77
Slide Exit Area	2	1	1[3]	None	0.43	0.90
Transfer Platform #1 Transfer Space	7[4]	0	None	None	0.38	0.77
Transfer Platform #2 Transfer Space	0	2	None	None	0.38	0.76
Next to Balance Beam	10[5]	1	None	None	0.43	0.80

[1] Displacement using rotational penetrometer. See *Accessible Exterior Surfaces Technical Article*, available at www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm.

[2] Recommended performance specifications for firmness and stability in *Technical Article* referenced in Footnote 1.

[3] Backfilled with EWF to level EWF surrounding wear mat with wear mat.

[4] Corrected in 0% by adding and leveling EWF.

[5] Running slope ≤ 2% after EWF added and leveled.

Table A2
Ridge Road Park
Greenburgh, NY

Location on Playground	Running Slope, Percent	Cross Slope, Percent	Changes in Level, Inches	Openings in Surface, Diameter, Inches	Firmness,[1] Inches	Stability,[1] Inches
ADAAG Requirements	≤ 6.25	≤ 2.08	≤ 0.50	≤ 0.50	≤ 0.50[2]	≤ 1.00[2]
Playground Entrance	3.5	0	None	None	0.35	0.59
Accessible Route #1	0	0	None	None	0.42	0.74
Slide Exit Area #1	0.9	0.9	None	None	0.38	0.68
Climbing Pole Access/Egress Area	3.5	3.5	None	None	0.33	0.54
Accessible Route #2	0	3.5	None	None	0.36	0.65
Slide Exit Area #2	1.75	3.5	None	None	0.39	0.44

[1] Displacement using rotational penetrometer. See *Accessible Exterior Surfaces Technical Article*, available www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm.

[2] Recommended performance specifications for firmness and stability in *Technical Article* referenced in Footnote 1.

Table A3
Bellevue Neighborhood Park
Draper, UT

Location on Playground	Running Slope, Percent	Cross Slope, Percent	Changes in Level, Inches	Openings in Surface, Diameter, Inches	Firmness,[1] Inches	Stability,[1] Inches
ADAAG Requirements	≤ 6.25	≤ 2.08	≤ 0.50	≤ 0.50	≤ 0.50[2]	≤ 1.00[2]
Playground Entrance	2.5	0.9	None	None	0.36	0.74
North Side Transition Platform[3]	0.1	0.1	None	None	0.33	0.82
East Side Transition Platform	1.7	1.2	None	None	0.34	0.83
Accessible Route Slide to Climber	0.4	1.8	None	None	0.34	0.63
Under Toddler Swings	0.2	0.1	None	None	0.22	0.55
Under Swings Next to Wear Mat[3]	2.3	0.1	None	None	0.35	0.95
Large Slide Exit[3]	0.7	0.1	None	None	0.29	0.99

[1] Displacement using rotational penetrometer. See *Accessible Exterior Surfaces Technical Article*, available www.access-board.gov/research/Exterior%20Surfaces/exteriorsarticle.htm.

[2] Recommended performance specifications for firmness and stability in *Technical Article* referenced in Footnote 1.

[3]Surface tamped prior to testing

APPENDIX
ACCESSIBILITY TEST RESULTS

Clarksburg Elementary School
Clarksburg, MD

Ridge Road Park
Greenburgh, NY

Bellevue Neighborhood Park
Draper, UT

ZEAGER

Quality, Integrity & Innovation.

September 04, 2012

Reference : Accessibility testing – Clarksburg Elementary School

Original Installation : August 2011 / gravel drainage system installed / Engineered wood fiber installed with water and compaction as recommended by manufacturer of EWF.

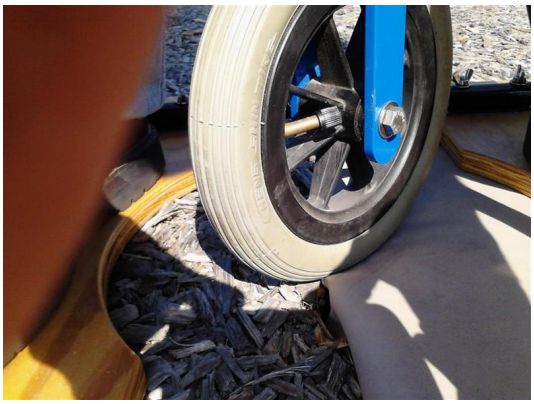
Maintenance performed before testing – None

1st Test area:
Location: Entry to play area just off of asphalt.
Preparation to surfacing : None

Rotational Penetrometer Readings : Firm- .39 Stability - .77
Running Slope reading :– 1% Cross slope reading: - .5%
Change in level : None Gaps : None

2nd Test area:
Location: First slide exit – beside mat.
Preparation to surfacing : None

Rotational Penetrometer Readings : Firm- .43 Stability - .90
Running Slope reading :– 2% Cross slope reading: - 1%
Change in level : Yes (between mat and surface-see picture) Gaps : None



Note: Even with the change in level, the mat was pliable and when pressure was applied by the wheel of the Rotational Penetrometer (approx 48lbs) it compressed down to level with the surrounding surface. (see above picture) This would simulate a child rolling over this area with little effort between the surface and the wear mat.


(Picture after backfilling around mat)

However, we did backfill around the mat to bring this area into compliance. Also double checked the running and cross slopes again.

3rd Test area:
Location: Near 1st transition platform.
Preparation to surfacing : None


Rotational Penetrometer Readings : Firm- .38 Stability - .77
Running Slope reading : 7% Cross slope reading: - 0%
Change in level : None Gaps : None

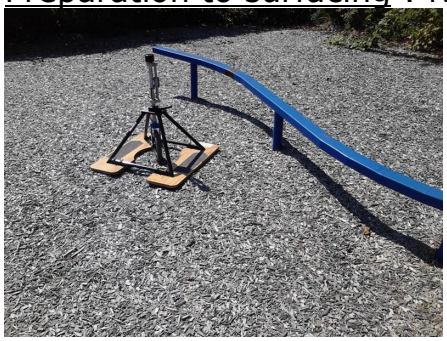

Maintenance: The running slope was corrected to 0% by adding wood fiber below platform.

4th Test area:
Location: Second transition platform.
Preparation to surfacing : None

Rotational Penetrometer Readings : Firm- .38 Stability - .76
Running Slope reading : 0% Cross slope reading: - 2%
Change in level : None Gaps : None

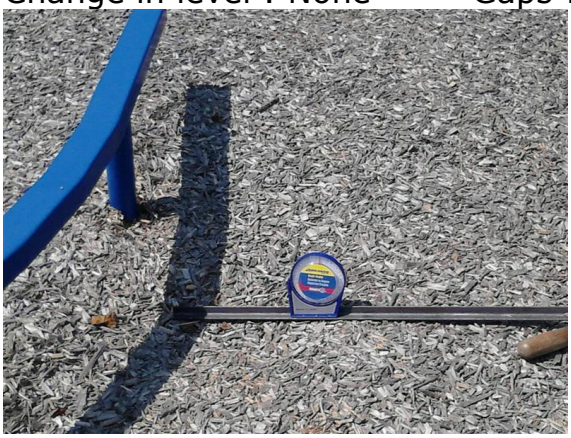
Pictures of area 4 = cross slope and running slope measurements.

5th Test area:
Location: Balance beam area.
Preparation to surfacing : None



Picture: Balance beam area.

Location 5- readings:
Rotational Penetrometer Readings : Firm- .43 Stability -.80
Running Slope reading : 10% Cross slope reading: 1%
Change in level : None Gaps : None

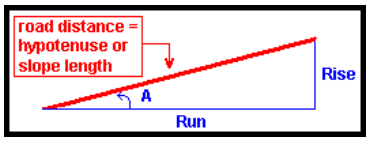



Running slope area needed maintenance. Cross slope was fine.

Running slope measured within 2% after backfilling area with wood fiber.

Note: The use of an angle finder was for economical purposes. Angle measurements were calculated in slope% using the following equation:

1 in (1 ÷ tan (A))



Example : 3 degree = 1 /.052408 = (19.08 / 1) * 100 = 5.24% slope

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Peggy Payne & Associates, Inc. dba
TOTAL RECREATION MANAGEMENT SERVICES
146 Broadway
Hawthorne, NY 10532
Phone: 914-747-3237
Fax: 914-747-3965
E-mail: trms395@aol.com
ppaplay@aol.com

Margaret A. Payne, C.P.S.I.
Janet P. Kuney, C.P.S.I.

Accessibility Review- Fibar Engineered Wood Fiber

Test Date: October 5, 2012
Test Location: Greenburgh, NY
Surface Tested: Fibar Engineered Wood Fiber
Installation: Installed according to manufacturer's instructions
Temperature: 79 degrees
Conditions: Dry; Sunny
Play Surface Depth: 12 inches

Fibar Engineered wood fiber was tested for accessibility at the above location. There were a total of six different areas tested on the playground. A hand diagram showing the play area and location of the six test areas is attached. Each area was tested for Firmness & Stability, cross slope and running slope at the entranceway and within the playground. The surface was also tested for openings for elevated ramps and accessible platforms at ground level and vertical change in height.

Margaret A. (Peggy) Payne
President - Total Recreation Management Services October 5, 2012

Test Details:

Area 1: Entranceway to the playground.
Area 2: An accessible route within the playground
Area 3: Area at the base of a slide
Area 4: Area near the base of a sliding pole
Area 5: Another accessible route within the playground
Area 6: Area at the base of a slide with a FibarMat wear mat on top of the surface

Firmness & Stability

Each of the six areas was tested for firmness and stability of ground and floor surfaces using a Rotational Penetrometer manufactured by Beneficial Designs, Inc. The average value was determined for both Firmness and Stability. The preliminary performance values for firmness and stability are:

- **Firmness:** Less than or equal to 0.5 inch of penetration
- **Stable:** Less than or equal to 1.0 inch of penetration

Accessible Route within the Playground and Entrance Point

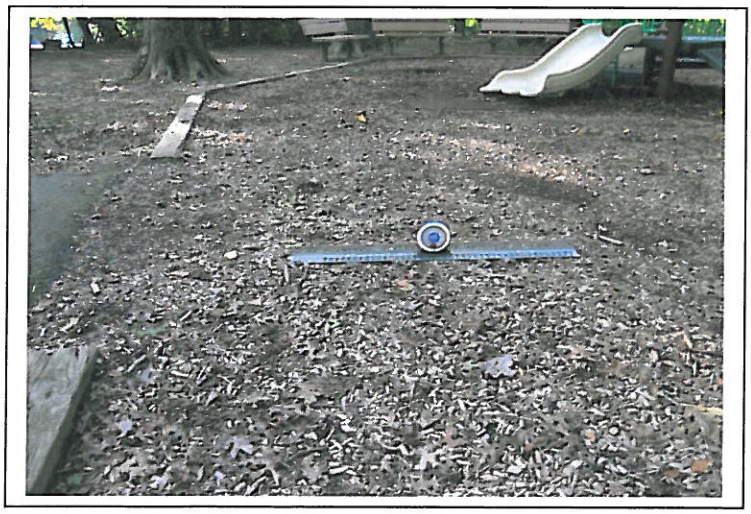
Each of the six areas was tested for running slope and cross slope using a magnetic angle-measuring protractor attached to a metal bar. The maximum running slope within the playground is 1:16 (6%) and the maximum cross slope is 1:48 (2%).

Ramp & Accessible Platform Openings

Elevated ramps and accessible platforms at ground level were tested for openings that were greater than ½" and a vertical change in level less than ¼" up to ½" with a 2:1 beveled edge.

Before testing, the tire pressure on the recoding wheel was set to 36 psi. The accessible route to the playground is an asphalt path from the parking lot.

Area 1: Entranceway to the playground

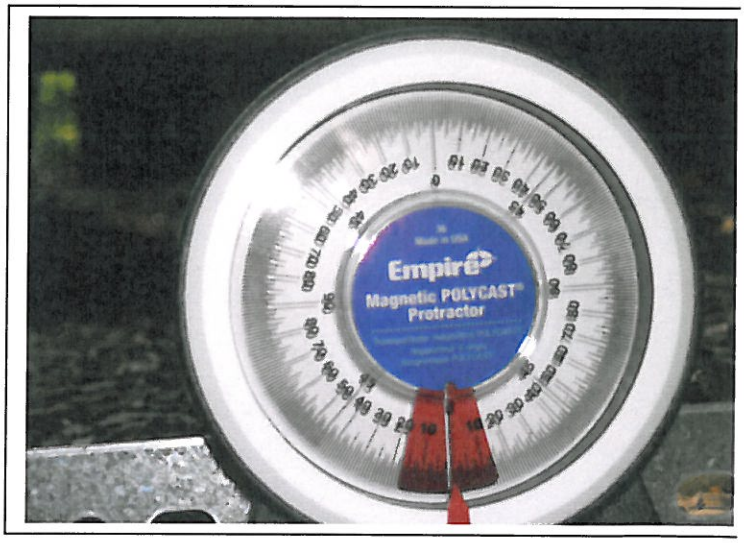


Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.35	.59	3.5%	0%	None	None	None

Area 2: An accessible route within the playground

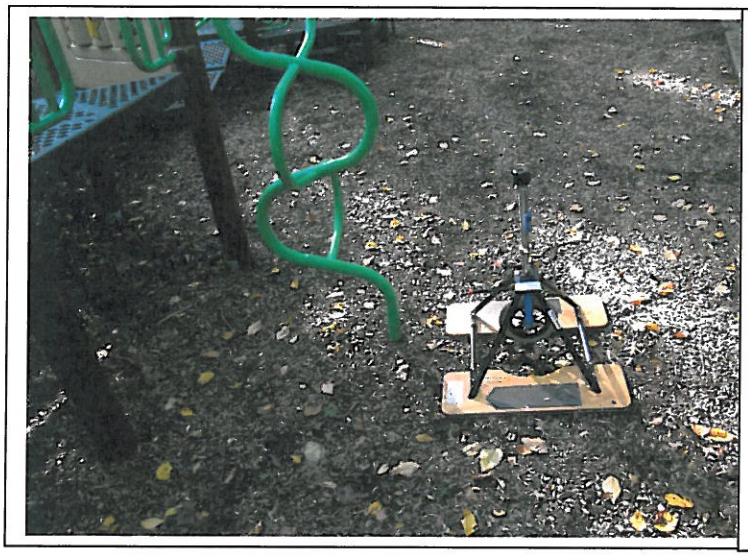
Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.42	.74	0 %	0 %	None	None	None

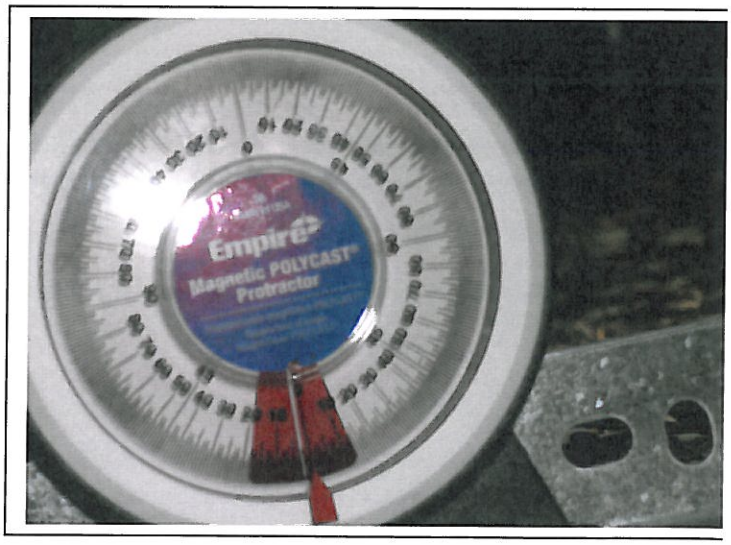
Area 3: Area at the base of a slide



Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.38	.68	0.9%	0.9%	None	None	None

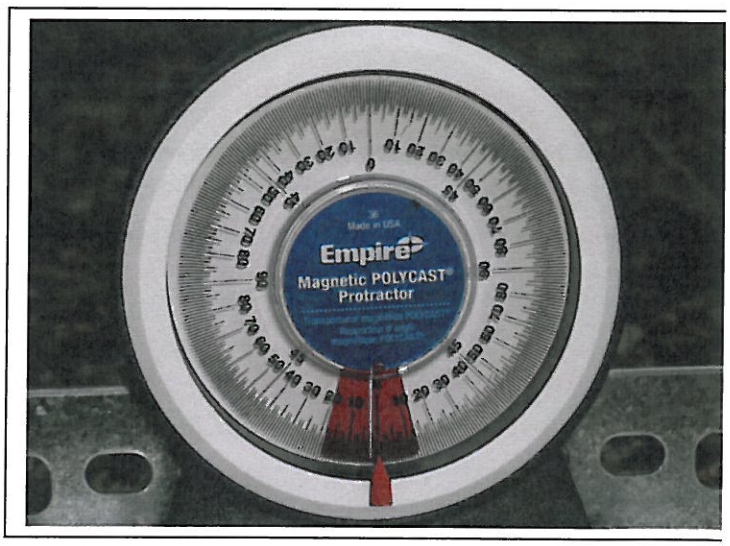
Area 4: Area near the base of a sliding pole





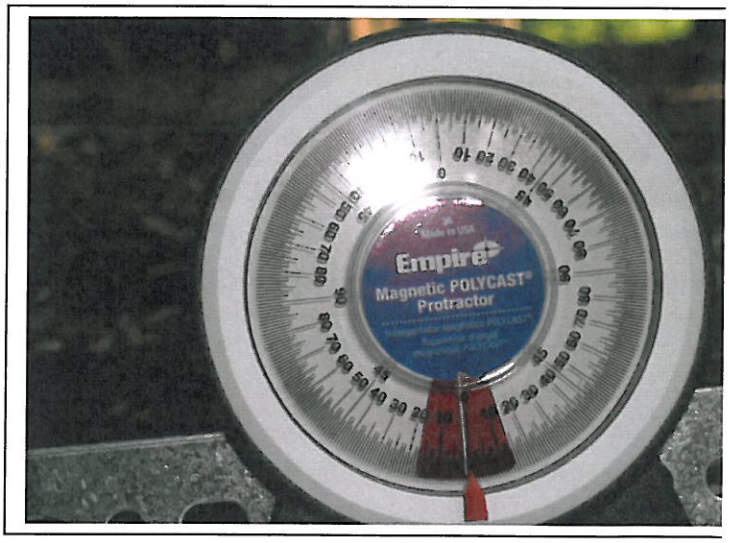
Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.33	.54	3.5%	3.5%	None	None	None

Area 5: Another accessible route within the playground



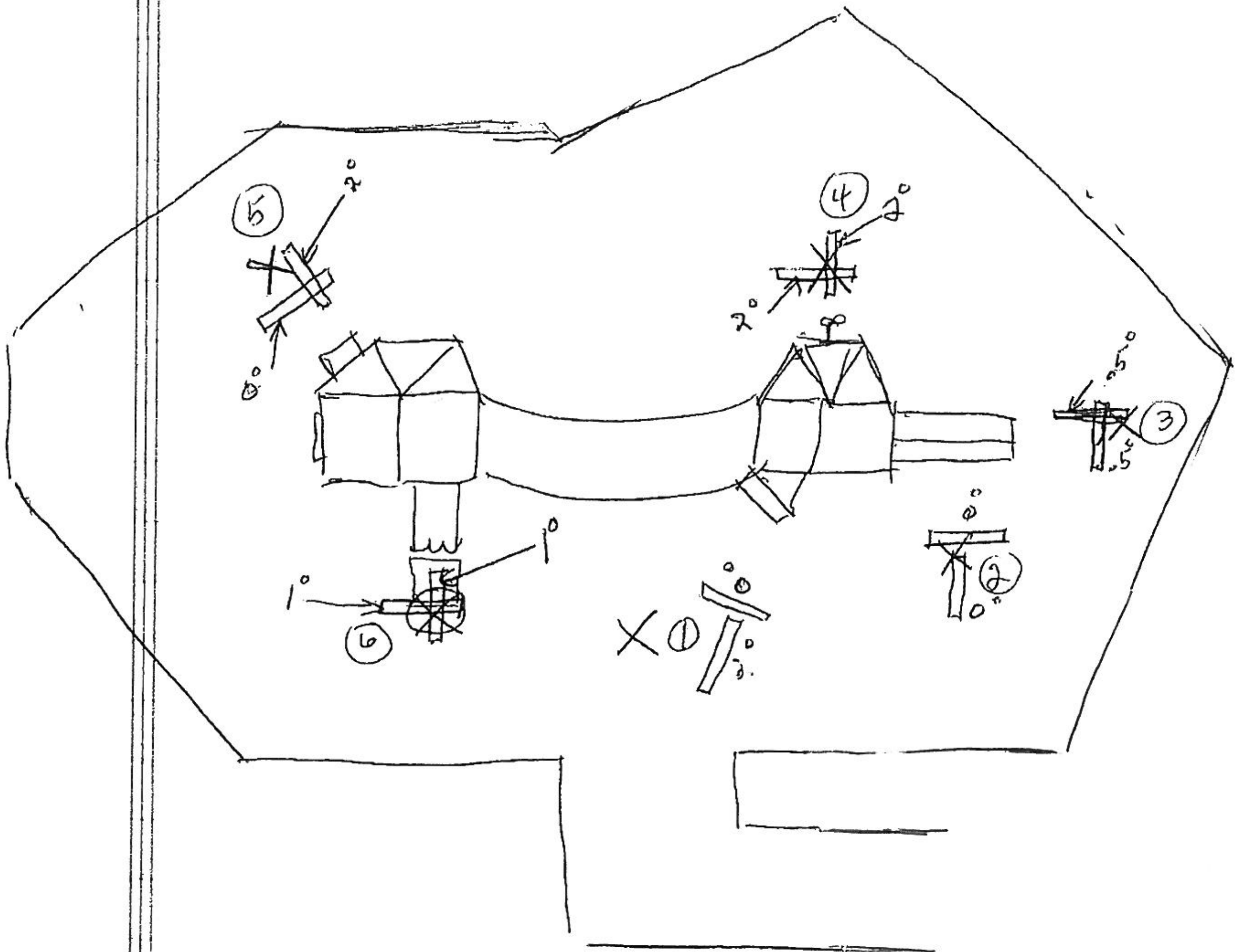
Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.36	.65	0 %	3.5%	None	None	None

Area 6: Area at the base of a slide with a FibarMat wear mat on top of the surface



Firmness	Stability	Running Slope	Cross Slope	Change in Level	Openings	Surface Prep
.39	.44	1.75 %	3.5%	None	None	None

The FibarMat is a 3'x'3' wear mat with a beveled edge. The FibarMat was installed on top of the surface, recessed in the Fibar Engineered wood fiber. This is in accordance with Fibar's installation instructions.



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Department of Landscape Architecture and Environmental Planning

June 04, 2013

Accessibility testing with Sof' Solutions
Bellevue Neighborhood Park Playground Surface, Draper, UT

Product: Sof'Fall – Engineered Wood Fiber

Original Installation: September 2012
Wood fiber installed at a depth of 12"

Depth of surfacing at time of testing: 9" – 11"

Rotational penetrometer readings are in inches. Slope and cross-slope readings are by percent slope. No changes in level or gaps were observed.

Test Sites:

4005 Old Main Hill
Logan, Utah 84322-4005

Phone: 435 797-0500
Fax: 435 797-0503

1st Test Area:

Location: Entry to play area from concrete walkway adjacent North-west picnic pavilion

Maintenance prior to testing: None

Rotational Penetrometer Readings: Firmness - 0.36 Stability - 0.74

Slope: 2.5 Cross-Slope: 0.9

2nd Test Area:

Location: North side of transition platform

Maintenance prior to testing: Surface tamped

Rotational Penetrometer Readings: Firmness - 0.33 Stability - 0.82

Slope: 0.1 Cross-Slope: 0.1

3rd Test Area:

Location: East side of transition platform

Maintenance prior to testing: None

Rotational Penetrometer Readings: Firmness – 0.34 Stability – 0.83

Slope: 1.7 Cross-Slope: 1.2

4th Test Area:

Location: Path between monkey bars and slide

Maintenance prior to testing: None

Rotational Penetrometer Readings: Firmness – 0.34 Stability – 0.63

Slope: 0.4 Cross-Slope: 1.8

5th Test Area:

Location: Under toddler swings

Maintenance prior to testing: None

Rotational Penetrometer Readings: Firmness – 0.22 Stability – 0.55

Slope: 0.2 Cross-Slope: 0.1

6th Test Area:

Location: Under swings next to near surface mat

Maintenance prior to testing: Surface tamped

Rotational Penetrometer Readings: Firmness – 0.35 Stability – 0.95

Slope: 2.3 Cross-Slope: 0.1

7th Test Area:

Location: Large slide exit

Preparation to surfacing: Surface tamped

Rotational Penetrometer Readings: Firmness – 0.29 Stability – 0.99

Slope: 0.7 Cross-Slope: 0.1