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Laboratory #: 477252-08
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Attention: Gary Stroven
Specimen: Surestep

TEST REPORT

RE: LIGHT AVAILABILITY TESTING OF SURESTEP DOCK PANEL AT 18 INCHES AND FIVE (5) FEET ABOVE GROUND LEVEL

1.0 INTRODUCTION

JIMDI requested the assistance of Cambridge Materials Testing Limited (CMTL) to estimate the amount of sunlight that would be available under a four (4) foot by four (4) foot section of dock surfaced with their Surestep dock panels. The amount of available light under the dock is an important factor with regard to the sustainability of plant and animal life under dock structures, which is directly proportional to the dimensions of the openings on the submitted panels.

JIMDI supplied four dock panels that measured one (1) foot by four (4) foot in size. The sections were fastened to an assembled four (4) foot by four (4) foot 2x6 pressure treated frame using 8x2 pressure treated deck screws.

A graph extrapolating the expected light availability over the dock height range of 0 to 60 inches is provided in this report.

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2.0 BACKGROUND

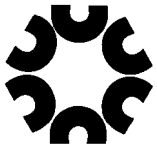
Two routes for sunlight to irradiate the area under the four (4) foot by four (4) foot dock section were considered by CMTL.

Surface Light - light which passed through the slots on the surface of dock

- the slots accounted for a reported 34% of the dock surface.
- surface light passed through the slots and created a Partially Illuminated Area (PIA) under the dock.
- the PIA consisted of illuminated and dark shadow areas corresponding to the Surestep dock panel.
- the pressure treated frame supporting the dock panels created bands of frame shadow which occupied part of the area under the dock.
- the PIA covered 100% of the area under the dock when the light source was directly overhead at 90°, minus the Frame Shadow Area (FSA).
- as the sun moved from 90° to higher or lower incident light angles the PIA cast by the dock surface covered progressively less area under the dock.
- the FSA also changed with the incident light angle.
- eventually at very low and very high incident light angles the PIA and FSA under the dock became zero.

Edge Light - light which strikes the edge plane of the dock

- incident light at angles below 90° illuminated the area under the edge of the dock
- the percentage of area illuminated from the side plane increased from zero for incident light close to 90° to 100% for low and high incident angles



3.0 TEST PROCEDURE

For light availability testing the four (4) foot by four (4) foot dock surface was supported at 18 inches and separately at five (5) feet above ground level. A set of four (4) 150 Watt (120 Volt) incandescent floodlights were sequentially positioned at the following incident light angles: 90°, 75°, 60°, 45°, 30°, 20°, 10° and 0° relative to the midpoint of the dock section at ground level. The light source at 90° was intended to simulate sunlight at noon. The light source at 0° was intended to simulate either sunrise or sunset.

At each incident light angle the width of the area under the dock illuminated by Edge Light was measured in inches. This length was used to calculate the **Edge Light Area**. The light intensity in the Edge Light Area was the same with and without the dock in place and was assigned as 100%.

Light Availability due to Edge Light was calculated as edge light area divided by the total area at 90°.

Light passing through the openings in the Surestep dock panel created a Partially Illuminated Area (PIA) under the dock. The PIA was calculated as the total area minus the zero light area due to the frame effect.

At each incident light angle a Minolta Autometer IV F light meter was used to measure the light intensity at ground level at the midpoint of the dock section with and without the dock in place. The readings with the dock in place were measured as the average between the illuminated and shadow areas.

The reading with the dock in place was divided by the reading without the dock to calculate the light intensity ratio. The distance of the light source from the midpoint of the dock was kept constant for the measurements at each incident angle.

Light Availability due to Surface Light was calculated as the PIA multiplied by the average light intensity ratio.

Total Light Availability was calculated as the Light Availability due to Edge Light plus the Light Availability due to Surface Light.

Frame Shadow Area was calculated as the zero light area due to frame effect multiplied by the average light intensity ratio.

Total Average Light Availability (%) from 0° to 90° was calculated by subtracting the Frame Shadow Area (FSA) from the average of the Total Light Availability.

Note: The measurements for total average light availability were performed from 0° to 90°, but would be considered identical from 90° to 180°, thereby simulating the sunrise and sunset.



4.0 RESULTS

The measurements and calculations for estimating the total average light availability under the Surestep dock panels are summarized in Tables 1 and 2. The averaged light availability measured was:

18" Dock Height	53%
60" Dock Height	82%

A graph extrapolating the expected light availability over the dock height range of 0 to 60 inches is provided below.

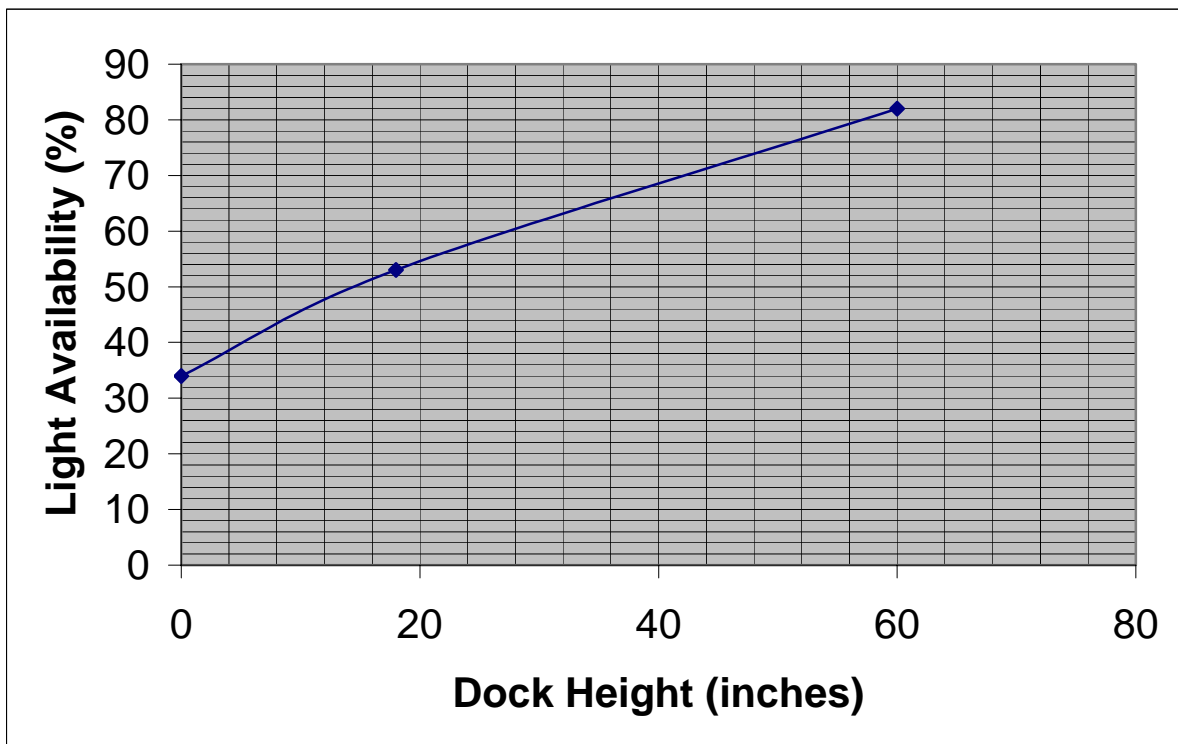




Table 1
Light Availability – Surestep Dock Panel
18 inch dock height

Incident Light Angle (degrees of light source)	0	10	20	30	45	60	75	90
Surface Light								
Total Shadow Area	0%	0%	41%	67%	79%	88%	93%	100%
length (in)	0	0	19.5	32	38	42	44.5	48
width (in)	48	48	48	48	48	48	48	48
area (in ²)	0	0	936	1536	1824	2016	2136	2304
Zero Light Area - frame effect	0%	0%	34%	33%	23%	15%	12%	9%
length (in)	0.0	0.0	16.0	15.0	9.0	5.0	3.0	1.5
width (in)	48	48	48	48	48	48	48	48
area (in ²)	0.0	0.0	778.5	771.0	519.0	351.0	268.5	211.5
Partially Illuminated Area	0%	0%	7%	33%	57%	72%	81%	91%
Light Intensity (Lx) - without dock	0	0	0	1400	1600	1700	1700	1900
Light Intensity (Lx) - with dock	0	0	0	370	490	520	690	740
Light Intensity Ratio	0	0	0	26	31	31	41	39
Light Availability Due to Surface Light	0%	0%	0%	9%	17%	22%	33%	35%
Edge Light								
Edge Illumination (inches)	48.0	48.0	28.5	16.0	10.0	6.0	3.5	0.0
length (in)	48.0	48.0	28.5	16.0	10.0	6.0	3.5	0.0
width (in)	48	48	48	48	48	48	48	48
area (in ²)	2304	2304	1368	768	480	288	168	0
Light Availability Due to Edge Light	100%	100%	59%	33%	21%	13%	7%	0%
Total Light Availability	100%	100%	59%	42%	38%	35%	40%	35%
Total Average Light Availability	53%							
illuminated area	56%							
frame effect	0.0%	0.0%	0.0%	8.8%	6.9%	4.7%	4.7%	3.6%
frame effect area	3.6%							

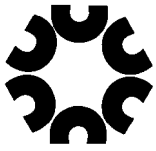


Table 2
Light Availability – Surestep Dock Panel
5 foot dock height

Incident Light Angle (degrees of light source)	0	10	20	30	45	60	75	90
Surface Light								
Total Shadow Area	0%	0%	0%	0%	0%	38%	69%	100%
length (in)	0	0	0	0	0	18	33	48
width (in)	48	48	48	48	48	48	48	48
area (in ²)	0	0	0	0	0	864	1584	2304
Zero Light Area - frame effect	0%	0%	0%	0%	0%	10%	8%	0%
length (in)	0.0	0.0	0.0	0.0	0.0	4.0	2.0	0.0
width (in)	48	48	48	48	48	48	48	48
area (in ²)	0.0	0.0	0.0	0.0	0.0	234.0	189.0	0
Partially Illuminated Area	0%	0%	0%	0%	0%	27%	61%	100%
Light Intensity (Lx) - without dock	0	0	0	1400	1600	1700	1700	1900
Light Intensity (Lx) - with dock	0	0	0	370	490	520	640	740
Light Intensity Ratio	0	0	0	26	31	31	38	39
Light Availability Due to Surface Light	0%	0%	0%	0%	0%	8%	23%	39%
Edge Light								
Edge Illumination (inches)	48.0	48.0	48.0	48.0	48.0	30.0	15.0	0.0
length (in)	48.0	48.0	48.0	48.0	48.0	30.0	15.0	0.0
width (in)	48	48	48	48	48	48	48	48
area (in ²)	2304	2304	2304	2304	2304	1440	720	0
Light Availability Due to Edge Light	100%	100%	100%	100%	100%	63%	31%	0%
Total Light Availability	100%	100%	100%	100%	100%	71%	54%	39%
Total Average Light Availability	82%							
illuminated area	83%							
frame effect	0.0%	0.0%	0.0%	0.0%	0.0%	3.1%	3.1%	0.0%
frame effect area	0.8%							



Figure 1 – Schematic of Test Procedure for Light Availability

