Establishing a flatness and shape fairness criterion

Introduction

Architectural panels commonly suffer from insufficient surface flatness, or from undesirable shape distortion. Although these problems may not be visible under most conditions, they may become evident when light from the sun or from concentrated and powerful artificial lighting sources reaches the surface of panels at low raking angles.

Unsightly bowing, warping or oil canning, which may result from a variety of causes are difficult to measure and quantify. Therefore, project specifications frequently lack clarity in this regard, or they do not address this issue. In view of this lack of a clear criterion of acceptance, Kreysler & Associates has established a simple test to evaluate the quality of surfaces in terms of flatness. This test permits assessing the acceptability of panels during the quality assurance inspections of panels.

Factors that affect the visibility of waviness in panel surface

In a panel that has a smooth surface, sharply delineated shadows begin visible when the light beams become tangent to the surface, and they increase as the light strikes the surface at shallower angles. In such panels and under sunny conditions, the transition between periods of time when shadows are visible and when they are not is very brief. See SK-106.

In panels that have a textured surface, the problem is compounded by the addition of tiny areas that are not lit even though the surface of the panels receives light at steeper angles. In these cases, the depth and sharpness of the texture, especially in lightly pigmented panels can creates relatively dark areas for extended periods of time. See SK-107.

Determining a criterion of acceptability

The goal in establishing a criterion of acceptability was to minimize the duration of the period of time when panel waviness might be visible. It was arbitrarily set at 15 minutes for smooth surface panels, understanding that waviness in textured panels may be visible for longer periods of time. This duration may be adjusted at will.

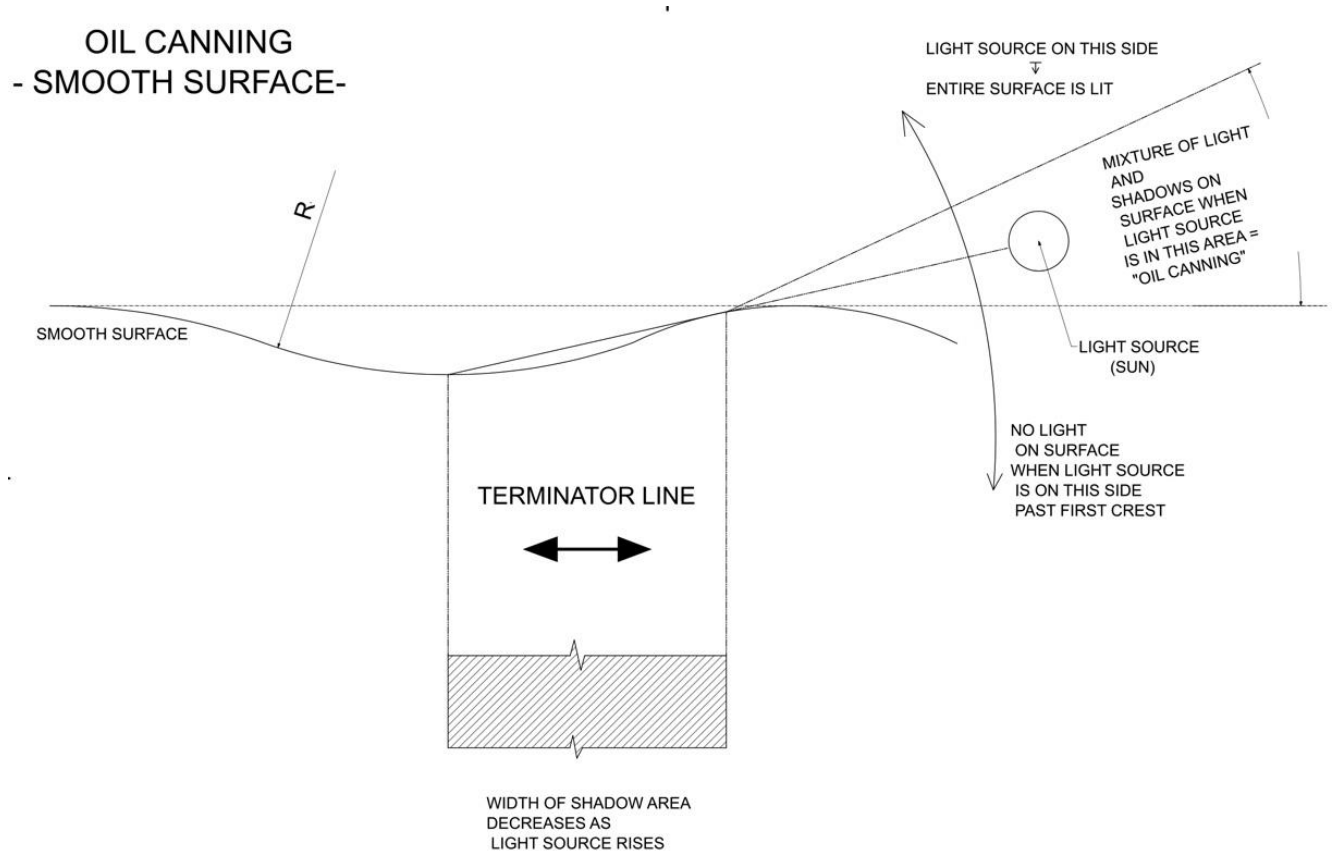
Since shadows begin to appear when the light beams become tangent to the surface of the panels, the depth of the waves relative to the distance between crests is a governing factor.

Assuming that the section of panel surface undulates in a series of arcs of circles, the relationship between the depth of the waves and the distance between consecutive crests can be quantified as shown in SK-108.

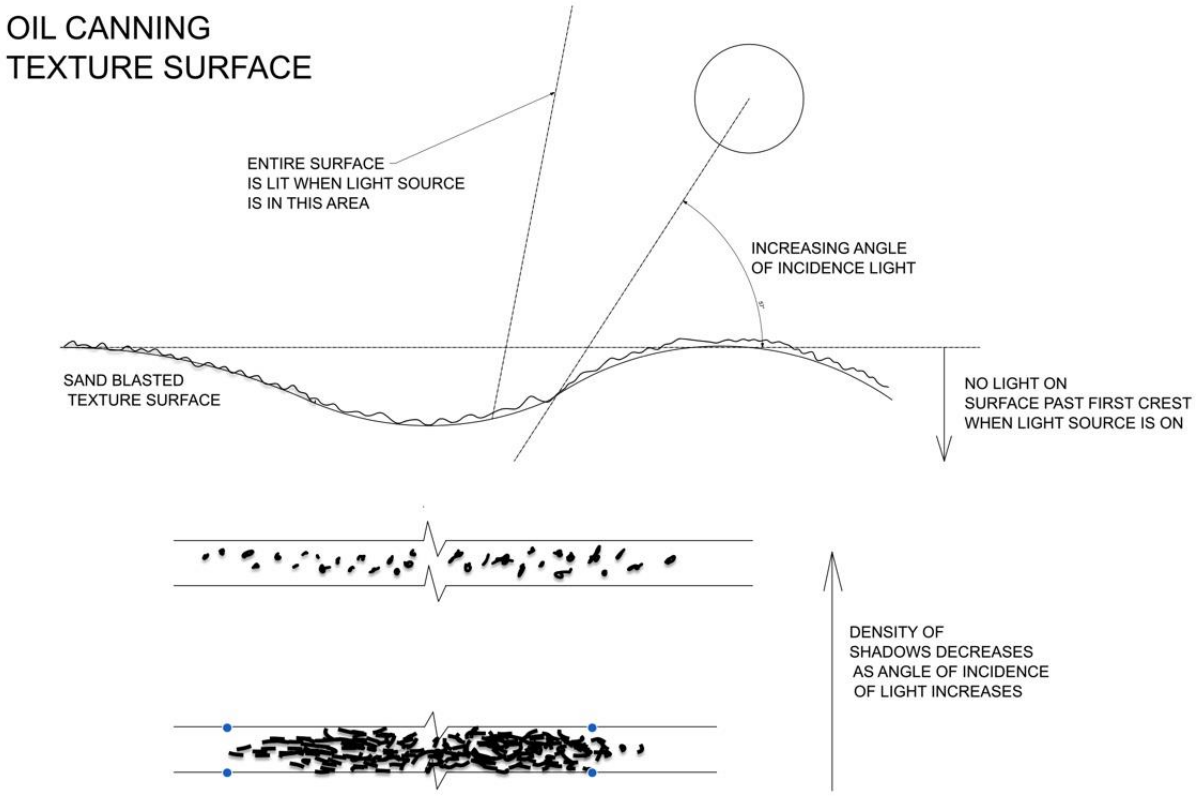
Based on this established criterion, simple rulers and depth gauges can be used to determine whether the surface of a panel is sufficiently close to being flat in order to be deemed acceptable. Evidently, this criterion may be adjusted to be more stringent, if necessary or desirable.

Additional comments

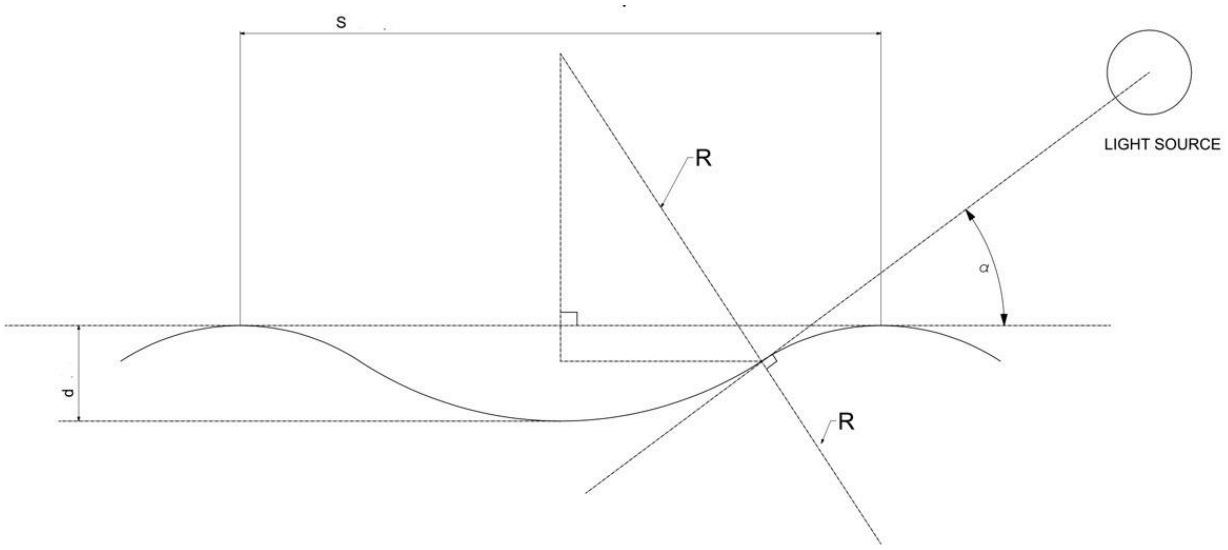
This method permits the examination of the surface of panels by focusing on their most critical areas and by taking in account the actual lighting conditions at the project site. Unlike flatness criteria that have been established for metal plates, such as those set arbitrarily for given metal thicknesses (i.e. ASTM A480), for concrete slabs (FF values), or other standards, this approach focuses on aesthetic considerations and not on the nature of the materials and processes that may be used in the fabrication of the panels. In addition, this is not a statistical approach, such as the FF numbers, and it allows focusing on the most critical areas of panels while keeping the project conditions under consideration.



Description Oil Canning Smooth Surface	Scale No	Kreysler and Associates
Date:	Sheet No- SK-106	



Description Oil Canning Smooth Surface	Scale No	Kreysler and Associates
Date:	Sheet No- SK-107	



- ASSUME ALL ARCS OF CIRCLE w/ RADIUS = R
- α , ANGLE OF INCIDENCE OF LIGHT AT BEGINNING/END OF VISIBILITY OF OIL CANNING
-S = SPAN BETWEEN BUMPS
-d = DEPTH OF VALLEY

Description Oil Canning Smooth Surface	Scale No	Kreysler and Associates
Date:	Sheet No- SK-108	

$\frac{R-\frac{d}{2}}{R} = cos\alpha$ → d = 2R(1-cosα) → 1

$\frac{\frac{S}{4}}{R} = sin\alpha$ → R = $\frac{S}{4sin\alpha}$ → 2

1 and 2 become → $d = S(\frac{1-cos\alpha}{2sin\alpha})$ = S*k

$$\frac{d}{S} = k = f(\alpha)$$

If oil canning to be limited to 15 min (smooth surfaces),

$\alpha = \frac{15°}{4} = 3.75°$ → k = 0.0164

d = 0.0164