Annex C
PERCEPTION OF SCRATCHES

High-Pressure Decorative Laminate has long been recognized as a durable high-performance surfacing material. The resistance of the HPDL surface to scratching is an important performance property of the material. Unfortunately, there is a lack of a single adequate method for quantifying this property. Distinguishing the difference between the material property of resistance to producing a given scratch, and the aesthetic property of visibility of a scratch (scratch perception) is difficult. Given a set of HPDL with the same physical resistance to scratching, the perception of the scratches is primarily a function of color (lightness – measured by the tristimulus Y value, and to some degree hue -- H*), surface features (gloss and texture), and viewing geometry. Generally, darker laminates tend to show scratches more than light ones, higher gloss laminates tend to show scratches more than low gloss ones, and smoother laminates tend to show scratches more than more textured ones.

Several methods for producing scratches on HPDL have been used. The protocol in LD-3 (3.7) for producing scratches on HPDL uses the corner of a glass microscope slide as the scratch tool. The scratch tool is held in a specified geometry relative to the sample. The scratch is made by moving the sample in a straight line while the scratch tool is in contact with the sample surface. Various loads can be applied to the scratch tool to produce differing sizes of scratches. This more closely approximates materials likely to produce scratches in service than other methods. The scratch tool is low cost, has consistent geometry and is readily available. The viewing geometry is controlled, improving the reproducibility of the scoring of the test samples. The method evaluates the perception of scratches made with various loads. The method does not directly evaluate the ability of a laminate to resist scratching. The difference between the ability of various laminates to resist scratching may be able to be evaluated by this method if color, gloss and surface texture is the same for the laminates being compared. The method does a good job of evaluating which laminates have a greater tendency to show scratches (scratch perception).

Scratch perception depends on color, pattern, gloss, and texture of the HPDL surface. The perception of a given scratch can be visualized as following a multidimensional response surface. Quantification of this response surface is in progress. Preliminary evaluation of data from a study to evaluate the effects of color lightness, gloss, and texture on scratch perception is reported here.

The effect of color lightness and hue on scratch perception was studied using a set of HPDL samples having similar gloss (10-20) and surface texture (matte texture) from different manufacturers. The samples were solid colors (gray, blue, green, red, and yellow) in a range of lightness values (tristimulus – Y value = 5 to 80). The scratch response as a function of lightness was similar for the various hues, and did not differ between manufacturers. The relationship of perceivable scratch as a function of the measured Y value is shown in Figure C-1. Scratches are easier to perceive as the surface gets darker (Y value decreases).

The effect of gloss on scratch perception was studied using a set of HPDL samples having similar texture (matte texture), a range of lightness values (tristimulus – Y value = 5 to 80) and a range of gloss values (4 to 115). The samples were solid color gray scale ranging from white to black. The scratch response as a function of lightness (Y value) was determined for each gloss level and is summarized in Figure C-2. Scratches are easier to perceive on surfaces with higher gloss values.

The effect of surface texture on scratch perception was studied using a set of HPDL samples having a range of textures: smooth (mirror finish), low texture (satin or furniture finish), matte texture, and high texture (crystal finish). The samples represented a range of lightness values (tristimulus – Y value = 5 to

80) and a range of gloss values (4 to 115). The samples were solid color gray scale ranging from white to black. The scratch response as a function of lightness (Y value) and gloss was determined for each surface texture and are summarized in Figure C-3. Scratches are more easier to perceive on smoother, lower textured surfaces.

One attempt to visualize the effects of gloss and lightness on scratch perception is presented in Figure C-4. For any particular level of scratching (higher load gives more severe scratch) the dark areas of the figure represent the portion of the gloss-lightness sample space where scratches produced at that load would be expected to be visible. The lighter shaded areas of the figure represent the portion of the gloss-lightness sample space where scratches produced at that load may be visible. The non-shaded areas of the figure represent the portion of the gloss-lightness sample space where scratches produced at that load would not be expected to be visible. Again, scratches are harder to see on lighter, lower gloss samples.

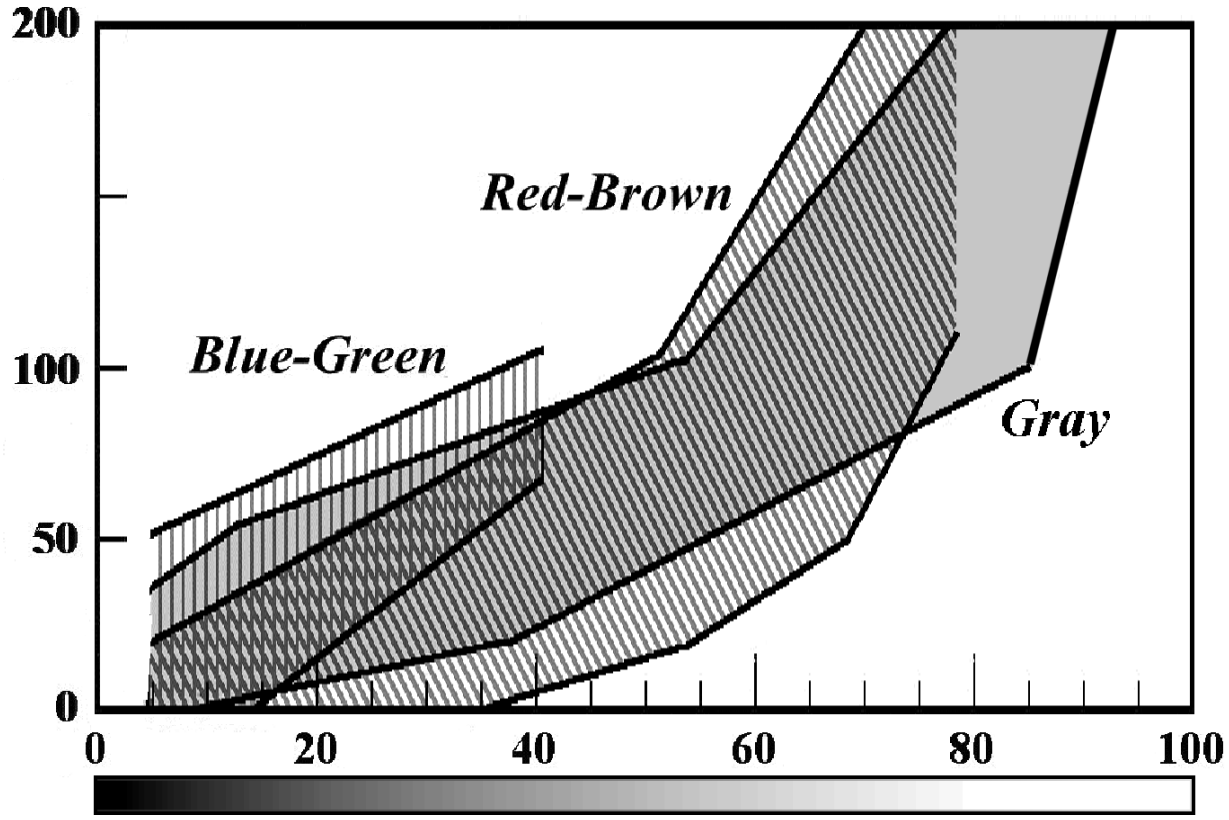

Figure C-1
RELATION OF SCRATCH PERCEPTION TO LIGHTNESS AND HUE OF HPDL

NOTE—This figure represents scratch perception data from a set of HPDL samples in which hue and lightness varied and gloss and surface texture were held constant. Differences in hue have little or no effect on the perception of scratches on HPDL. Differences in the lightness (tristimulus - Y value) have a noticeable effect on the perception of scratches on HPDL. It is more difficult to see scratches on lighter HPDL.

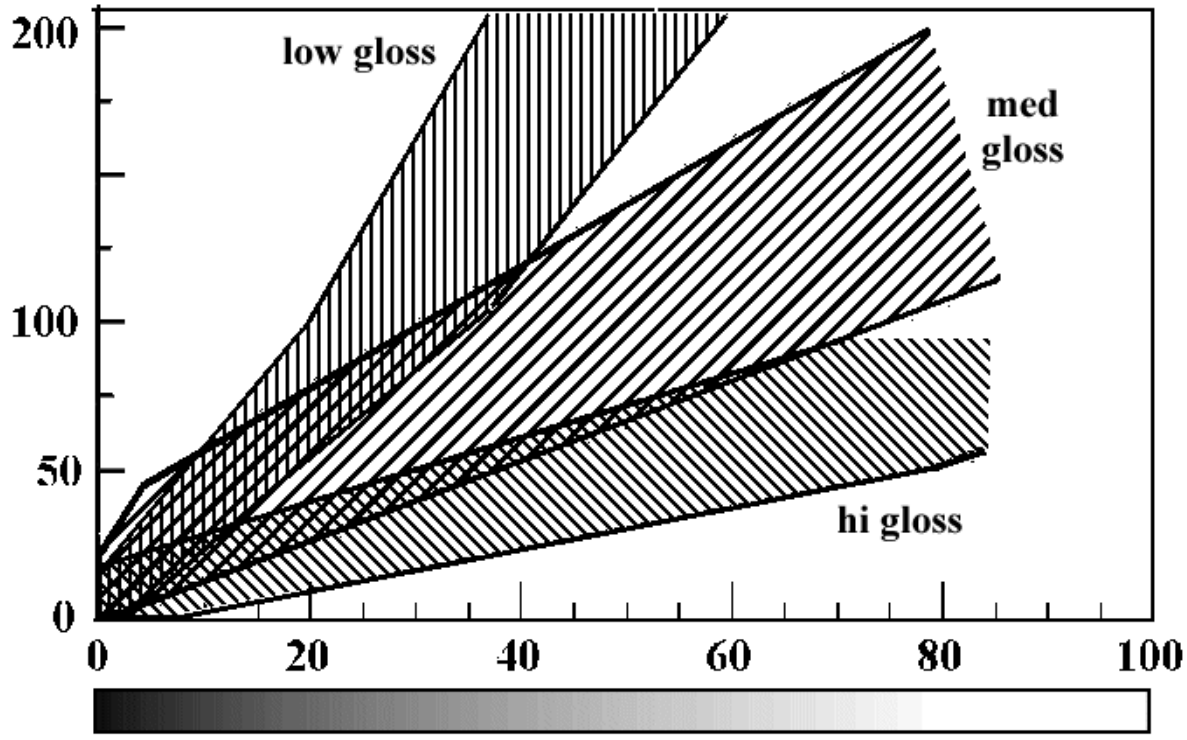

Figure C-2
RELATION OF SCRATCH PERCEPTION TO LIGHTNESS AND GLOSS OF TEXTURED FINISH HPDL

NOTE—This figure represents scratch perception data from a set of HPDL samples in which gloss and lightness varied and hue (grey) and surface texture (textured finish) were held constant. Differences in the lightness (tristimulus - Y value) have a noticeable effect on the perception of scratches on HPDL. It is more difficult to see scratches on lighter HPDL. Differences in the gloss also have an effect on the perception of scratches on HPDL. It is more difficult to see scratches on lower gloss HPDL, and easier to see scratches on higher gloss HPDL.

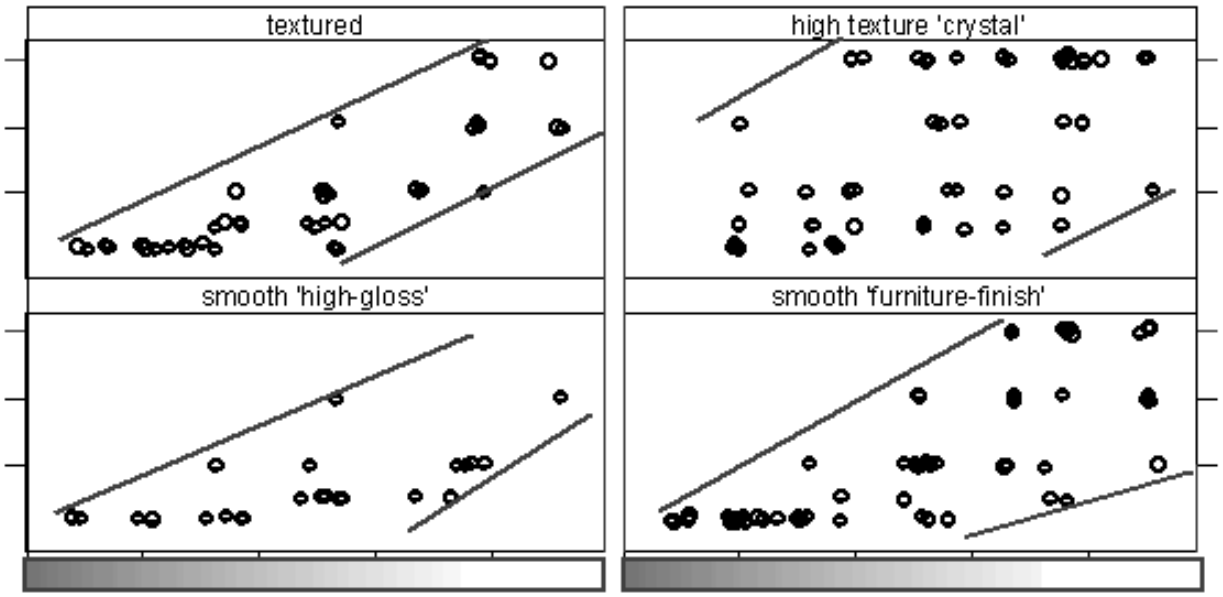

Figure C-3
RELATION OF SCRATCH PERCEPTION TO LIGHTNESS AND TEXTURE OF HPDL

NOTE—This figure represents scratch perception data from a set of HPDL samples in which texture and lightness varied, and hue (grey) was held constant. Differences in the lightness (tristimulus - Y value) have a noticeable effect on the perception of scratches on HPDL. It is more difficult to see scratches on lighter HPDL regardless of the surface texture. Differences in surface texture of the HPDL also have an effect on the perception of scratches on HPDL. It is easier to see scratches on smoother (lower texture) HPDL. Very high surface texture (crystal finishes) on HPDL tends to obscure the relationship of lightness and scratch perception.

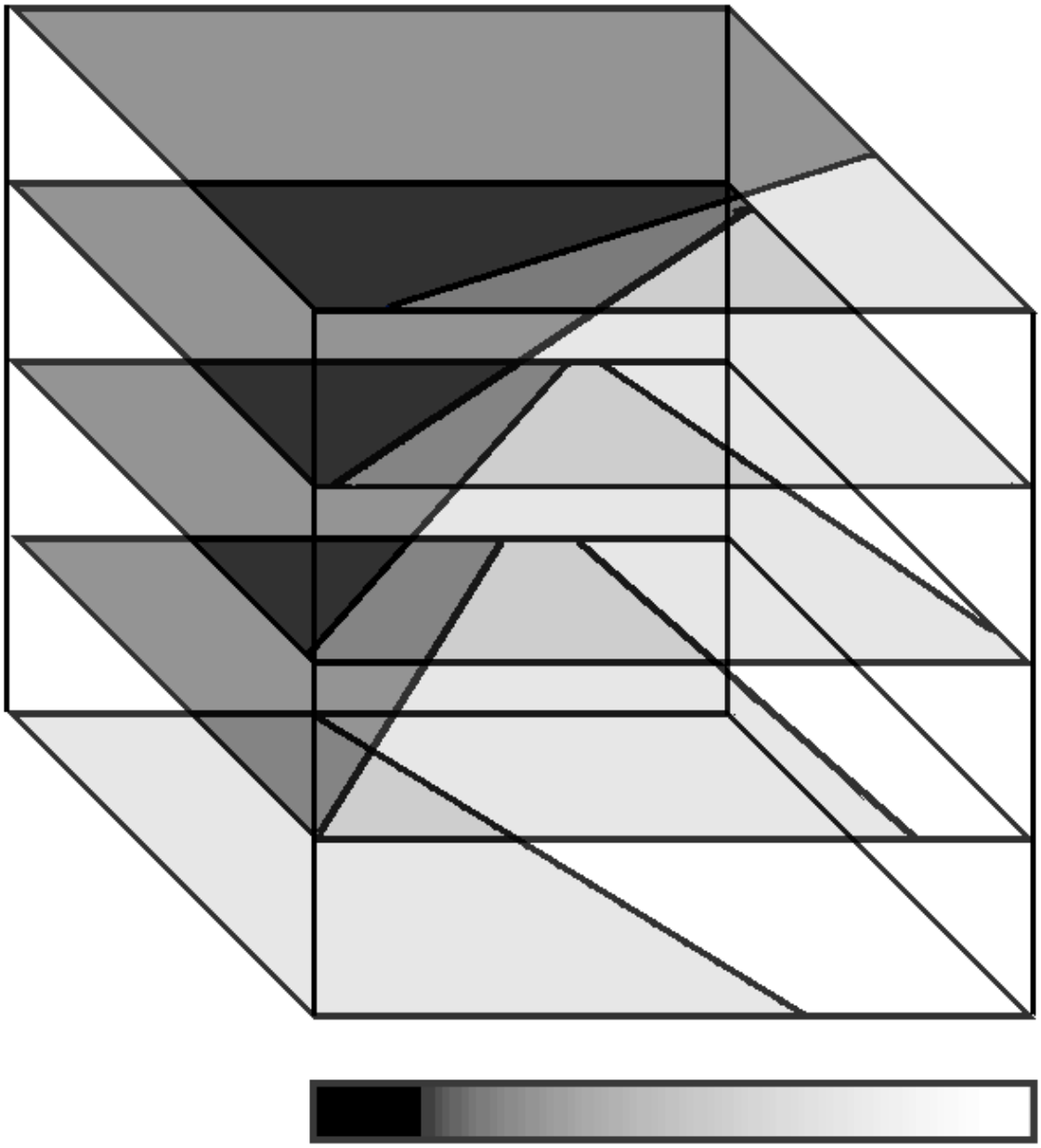

Figure C-4
RELATION OF SCRATCH PERCEPTION TO LIGHTNESS AND GLOSS OF HPDL

NOTE—This figure represents scratch perception data from a set of HPDL samples in which gloss and lightness were varied. It provides another means of visualizing the relation of scratch perception to lightness (tristimulus - Y value) and gloss of the HPDL. For scratches produced at any particular load (scratch resistance value) the part of the lightness-gloss sample space in which the scratch would always be expected to be seen is shaded dark. The lighter shaded areas represent lightness-gloss combinations in which the scratch would sometimes be seen. The unshaded areas represent lightness-gloss combinations in which the scratch would not be expected to be seen. It is easier to see scratches on darker and higher gloss HPDL.