

CLEANING LABORATORY EVALUATION SUMMARY

SCL #: 2006
 DateRun: 06/30/2006
 Experimenters: Jason Marshall
 ClientType: Consultant
 ProjectNumber: Project #1
 Substrates: Wood
 PartType: Coupon
 Contaminants: Coatings
 Cleaning Methods:

Analytical Methods: Performance Test, Visual

Purpose: To evaluate impact resistance for various floor finishes

Experimental Procedure: The moisture content at the time of testing will influence results due to the hygroscopic nature of the base materials. Therefore, efforts must be taken to ensure that the moisture content and temperature remain constant during the evaluation period. Ideally, the sample floor should be kept at 65+/-1% relative humidity and 68+/-6 F. During laboratory testing, conditions were 64% relative humidity and the temperature was ~74 F.

Sample Preparation

The flooring material supplied was Hardwood flooring made from Red Oak. The boards were ¾" thick, 2 ¼" wide and cut into 8" sections.

Three coupons were coated with a supplied floor finish according to the manufacturers' specifications. The finish was applied using a 1" Pure Bristle 1500 paint brush. To ensure proper coating application rates, the coatings were applied via pipettes to surface. Three coats were used for each floor finish as this was common number of coating layers suggested by the various manufacturers.

The first two coatings were allowed to dry for 2 hours prior to the application of the next coat. The second coat for the current process was allowed to dry overnight before the application of final coat. The Completed coupons were allowed to sit for a minimum period of 24 hours before performance evaluations were conducted.

Falling-Ball Indentation

This test is designed to obtain a measure of the resistance of a flooring finish to impacts from dropped objects. Four drops were made for each coupon for a total of twelve drops per finish. Each drop was made at a 6" intervals starting at 6" and ending at 72". The ball used for the drops was a 440-C stainless steel 2" diameter ball, grade 100. The dropping apparatus used is shown in Figure 2. Carbon paper was placed on the coupon surface to assist in determining where the indentation was made.

Figure 2. Dropping Apparatus

The same Brown & Sharpe Micrometer was used to measure the indentations to the coated coupons. A plot was made of the height of drop and residual indentation and the slope of the best fit line was calculated. From the plots, the intercept of the height of drop at 72" was recorded as the index of indentation resistance. Results for each finish were compared each other.

Results: Impact depth was calculated by subtracting the average initial coating thickness from the thickness measured at the point of impact for each drop height. The initial average coating thickness was calculated from the three initial coating measurements made for each coupon.

*Due to the construction of the floor boards and the location of the impact from the ball, additional baseline readings had to be recorded for certain areas on the coupons. These values are designated by the coupon number and "A" (alternate).

| | Coated Thickness | | | Drop Height | | | | | | | | | | | |
|--------|------------------|--------|--------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| Coupon | Middle | End 1 | End 2 | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 1 | 0.7512 | 0.7498 | 0.7549 | 0.7437 | | | 0.7320 | | | | | | | | |
| 1A | 0.6755 | 0.6770 | 0.6693 | | 0.6717 | 0.6554 | | | | | | | | | |
| 2 | 0.7535 | 0.7566 | 0.7560 | | | | | 0.7397 | 0.7288 | | | | | | |
| 2A | 0.6751 | 0.6699 | 0.6811 | | | | | | | 0.6518 | 0.6486 | | | | |
| 3 | 0.7588 | 0.7609 | 0.7585 | | | | | | | | | | 0.7227 | | |
| 3A | 0.6767 | 0.6722 | 0.6776 | | | | | | | | | 0.6549 | | 0.6470 | 0.63 |
| 4 | 0.7648 | 0.7702 | 0.7655 | | | 0.7521 | 0.7491 | | | | | | | | |
| 4A | 0.6727 | 0.6742 | 0.6751 | 0.6720 | 0.6667 | | | | | | | | | | |
| 5 | 0.7560 | 0.7582 | 0.7601 | | | | | 0.7518 | 0.7266 | | 0.7176 | | | | |
| 5A | 0.6707 | 0.6682 | 0.6744 | | | | | | | 0.6543 | | | | | |

CLEANING LABORATORY EVALUATION SUMMARY

| | | | | | | | | | | | | | | | |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|------|
| 6 | 0.7548 | 0.7591 | 0.7598 | | | | | | | | | 0.7359 | 0.7291 | 0.7208 | 0.71 |
| 6A | 0.6702 | 0.6714 | 0.6685 | | | | | | | | | | | | |
| 7 | 0.7575 | 0.7555 | 0.7611 | | 0.7508 | | 0.7264 | | | | | | | | |
| 7A | 0.6580 | 0.6719 | 0.6549 | 0.6541 | | 0.6501 | | | | | | | | | |
| 8 | 0.7427 | 0.7477 | 0.7460 | | | | | 0.7350 | | 0.7255 | | | | | |
| 8A | 0.6627 | 0.6676 | 0.6661 | | | | | | 0.6449 | | 0.6407 | | | | |
| 9 | 0.7548 | 0.7574 | 0.7547 | | | | | | | | | | | 0.7252 | |
| 9A | 0.6748 | 0.6772 | 0.6682 | | | | | | | | | 0.6461 | 0.6449 | 0.6378 | 0.63 |
| 10 | 0.7456 | 0.7467 | 0.7503 | 0.7435 | 0.7391 | 0.7287 | 0.7203 | | | | | | | | |
| 10A | 0.6778 | 0.6830 | 0.6750 | | | | | | | | | | | | |
| 11 | 0.7582 | 0.7613 | 0.7652 | | | | | | 0.7317 | | 0.7311 | | | | |
| 11A | 0.6709 | 0.6683 | 0.6807 | | | | | 0.6653 | | 0.6477 | | | | | |
| 12 | 0.7657 | 0.7644 | 0.7653 | | | | | | | | | | 0.7431 | | |
| 12A | 0.6860 | 0.6844 | 0.6856 | | | | | | | | | 0.6539 | | 0.6483 | 0.63 |
| 13 | 0.7501 | 0.7471 | 0.7470 | 0.7487 | 0.7455 | 0.7373 | 0.7312 | | | | | | | | |
| 13A | 0.6667 | 0.6700 | 0.6685 | | | | | | | | | | | | |
| 14 | 0.7582 | 0.7575 | 0.7539 | | | | | 0.7385 | 0.7316 | | 0.7287 | | | | |
| 14A | 0.6870 | 0.6822 | 0.6837 | | | | | | | 0.6737 | | | | | |
| 15 | 0.7471 | 0.7448 | 0.7484 | | | | | | | | | | | 0.7231 | 0.71 |
| 15A | 0.6744 | 0.6721 | 0.6682 | | | | | | | | | 0.6458 | 0.6429 | | |

Calculated Impact Depths

| Coating | Coupon | Drop Height | | | | | | | | | | | |
|---------|--------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| | | 6 | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| CP | 1 | 0.0112 | 0.0053 | 0.0201 | 0.0178 | | | | | | | | |
| | 2 | | | | | 0.0163 | 0.0272 | 0.0233 | 0.0265 | | | | |
| | 3 | | | | | | | | | 0.0227 | 0.0361 | 0.0297 | 0.0420 |
| MCP | 4 | 0.0031 | 0.0075 | 0.0127 | 0.0164 | | | | | | | | |
| | 5 | | | | | 0.0083 | 0.0316 | 0.0164 | 0.0384 | | | | |
| | 6 | | | | | | | | | 0.0239 | 0.0307 | 0.0340 | 0.0413 |
| BO | 7 | 0.0008 | 0.0103 | 0.0079 | 0.0291 | | | | | | | | |
| | 8 | | | | | 0.0110 | 0.0212 | 0.0172 | 0.0269 | | | | |
| | 9 | | | | | | | | | 0.0221 | 0.0233 | 0.0370 | 0.0421 |
| BW | 10 | 0.0068 | 0.0112 | 0.0169 | 0.0264 | | | | | | | | |
| | 11 | | | | | 0.0154 | 0.0335 | 0.0232 | 0.0302 | | | | |
| | 12 | | | | | | | | | 0.0317 | 0.0222 | 0.0377 | 0.0461 |
| Blank | 13 | -0.0017 | 0.0015 | 0.0128 | 0.0159 | | | | | | | | |
| | 14 | | | | | 0.0154 | 0.0223 | 0.0133 | 0.0288 | | | | |
| | 15 | | | | | | | | | 0.0224 | 0.0253 | 0.0240 | 0.0313 |

Graphs for each product are shown in Figure 2

From the graphs, slopes were calculated and the index was calculated for the interception point for 72". The lower the index, the less the indentation and the better the coating's resistance.

Product Slope of Best Fit Line Index of Indentation Resistance

| Uncoated | | 0.196 | | | |
|----------|------------------------|---------------------------------|------|--------|----|
| Product | Slope of Best Fit Line | Index of Indentation Resistance | Rank | x | y |
| CP | 1714.8 | 0.0420 | 4 | 0.0419 | 72 |
| MCP | 1692.1 | 0.0426 | 3 | 0.0425 | 72 |
| BO | 1791 | 0.0402 | 5 | 0.0402 | 72 |
| BW | 1560.4 | 0.0461 | 2 | 0.0461 | 72 |
| Blank | 2138 | 0.0337 | 1 | 0.0336 | 72 |

Summary:

Conclusion:

The Bona Water based coating mix had the lowest index of indentation for the coated boards followed by the modified current practice.

The uncoated wood samples had a lower index of indentation than any of the coated samples. The coating thicknesses were easier to displace by the steel ball than the hard wood surface was.