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**NATIONAL BUREAU OF STANDARDS REPORT**

5148

SIMULATED PERFORMANCE TESTS OF  
ADDITIONAL BITUMINOUS PROTECTED METALS

by

William C. Cullen



**U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS**

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Floor, Roof and Wall Coverings Section  
Building Technology Division

Sponsored by  
Office of the Chief of Engineers  
Department of the Army

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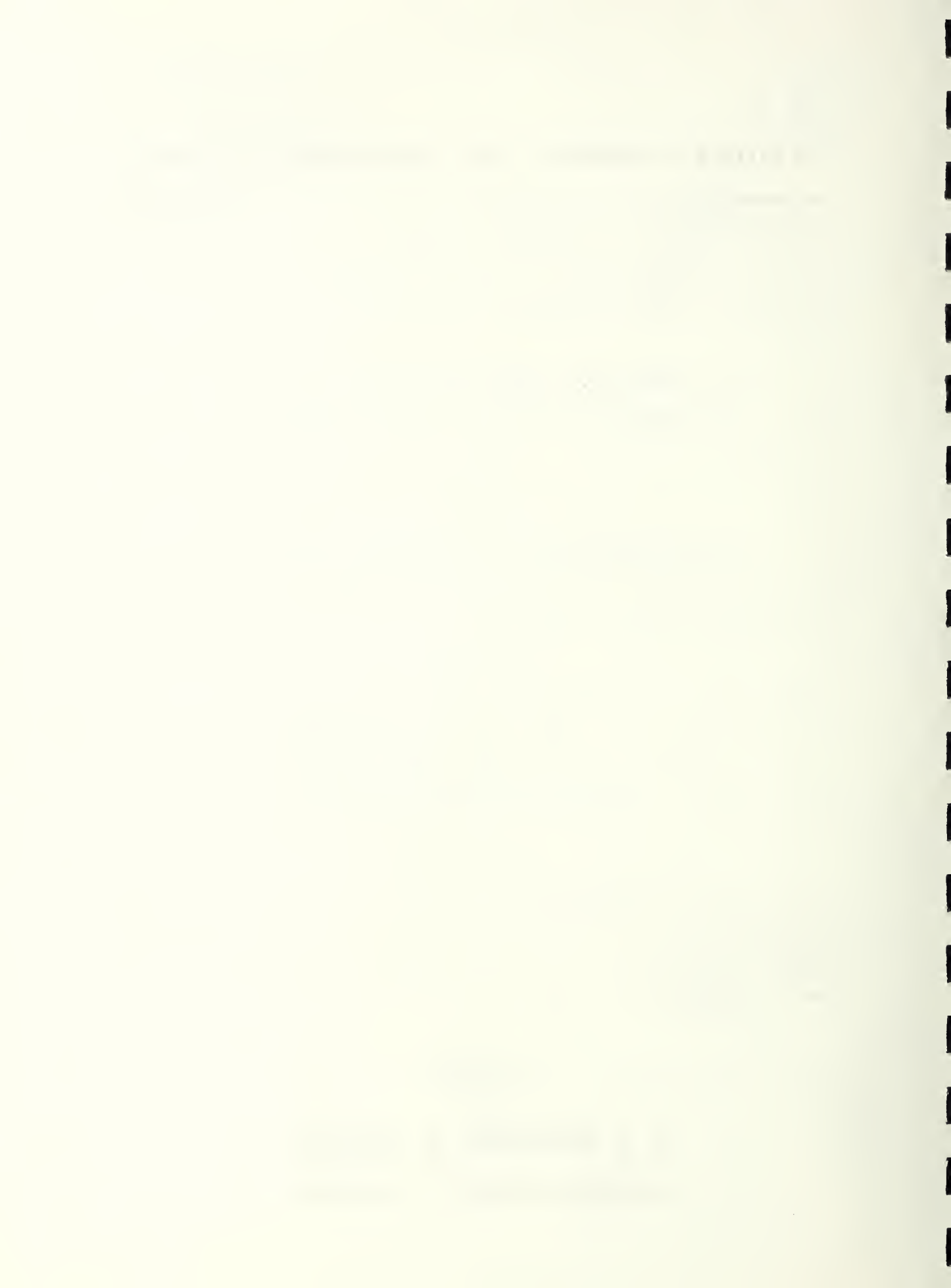
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ABSTRACT

Simulated performance tests were made on four bituminous protected metals representative of the product of three manufacturers. The tests included resistance to salt spray after shatter, accelerated durability, and shatter at low temperatures.

One product (Color Galbestos) was rated as having performed good or very good in all of the tests.

It is questionable whether the four materials should be compared directly with each other since one is of a distinctly different type from the other three.

\*\*\*\*\*

1. INTRODUCTION

Under letter of authorization dated 17 April 1956, reference ENGES, comparative simulated service tests were performed for the Office of the Chief of Engineers, Department of the Army. Samples, representing the products of the three manufacturers as reported in NBS Report No. 4963, "Simulated Performance Tests of Bituminous Protected Metals", December 14, 1956, were subjected to salt spray, accelerated durability, and low temperature shatter tests.

The tests reported in the previous series were repeated, with one major exception. In accordance with instructions from the Corps of Engineers, the salt spray and fog tests were performed on the specimens which had been subjected to the low-temperature shatter tests.



For the resistance to flame spread test, refer to NBS Report No. TG10210-1992:FP-3390, "Report of Flame Spread Tests on Protected Metals", dated 15 January 1957.

## 2. MATERIALS

Materials were obtained by the Office of the Chief of Engineers. The materials submitted were as follows:

1. Plasteel, Maroon, Plasteel Products Corporation.
2. Galbestos, Maroon, coated one side, H. H. Robertson Co.
3. Galbestos, Maroon, coated both sides, H. H. Robertson Co.
4. Color Galbestos, Grey, coated one side, H. H. Robertson Co.
5. Color Galbestos, Grey, coated both sides, H. H. Robertson Co.
6. Steelbestos, Maroon, coated one side, American Steel Band Co.
7. Steelbestos, Maroon, coated both sides, American Steel Band Co.

## 3. TEST PROCEDURES

The test procedures were essentially the same as those described in NBS Report 4963 dated 14 December 1956.

## 4. SUMMARY OF RESULTS

### 4.1 Salt-Spray (Fog) Test After Shatter

See NBS Report 4963 for the significance of this test.

The results of the salt spray tests after shatter, after 45 days exposure, are reported in Table 1.\* To avoid repetition, only the results on the specimens subjected to the -30°F shatter test are reported. Generally, the results of the 0°F tests were similar, but somewhat less severe.

\*Tables are attached to this report as Appendix A.





Plasteel, Maroon.

The resistance of this product to the salt spray tests after shatter was poor. After 24 hours exposure, the specimens showed severe corrosion in the area where the metal core was exposed in the shatter test. The entire specimens were rust stained within 10 days of exposure, resulting from the corrosion at the edges and around the point of impact.

The most pronounced effect appeared to be on the adhesion of the coating to the basis metal. Loss of adhesion had occurred on 100% of the exposure side and on 98% of the reverse side.

Surface rusting was evident on an area of approximately 70% of the metal core. However, the only area showing any appreciable penetration of the corrosion into the metal was where the basis metal was exposed around the point of impact.

Galbestos, Maroon.

This product showed good resistance to the salt-spray tests after shatter. Several small areas of zinc chloride deposits and a few pin-point areas of rust were the only deteriorative effects that were noted after 45 days of exposure.

There appeared to be a slight loss of adhesion between the weather coat and the asbestos felt layer. However, this loss of adhesion was probably a result of the shatter test. The adhesion of the felt to the metal was excellent even after 45 days of exposure.

No rusting or other corrosion was evident on the metal core even beneath the rust spots on the surface.

Color Galbestos, Grey.

The condition of this product after the test indicated that its resistance to the salt-spray test was equally as good as the maroon Galbestos. A few pin-point rust spots were observed on the surface of the specimens which indicated the presence of pinholes. A slight loss of adhesion between the weather coating and the felt was observed, but this probably resulted from the shatter tests.



There was no loss of adhesion between the felt and the basis metal and there was no evidence of corrosion on the basis metal.

#### Steelbestos, Maroon.

The resistance of this product to the salt-spray test was generally poor. Rust stains around the point of impact and a few pin-point rust spots were evident after 18 days of exposure.

Loss of adhesion between the felt and the metal core was severe on both specimens, ranging from 85% to 98% on the exposure surface and 95% to 100% on the reverse surface.

The metal core showed surface rust on 40 to 50% of the specimen. However, this corrosion showed no appreciable penetration into the metal.

#### 4.2 Results of Accelerated Durability Tests

Refer to NBS Report 4963 for the significance of this test.

The results of exposure after 500 and 1000 hours are reported in Table 2. Because of the similarity of the behavior of the specimens of each product, regardless of whether they were single coated or double coated or whether the edges were sealed or not sealed, each product is treated collectively, both in the table and in the summary that follows.

The accelerated durability tests will be continued until the specimens have a total exposure time of approximately 2000 hours. Therefore, the results of the inspection for loss of adhesion and corrosion will be reported in a supplementary report.

#### Plasteel, Maroon.

This product exhibited no external effects from the exposure, except for some loss of mica flakes with a subsequent lightening in color. The resistance of this product to the accelerated durability test was very good.



Galbestos, Maroon.

The failures exhibited by four specimens of this product were similar in nature, but not always in degree. There was a marked color change from a glossy, dark maroon color to a dull, light maroon color, observed within the 500-hour exposure period, which probably resulted from the severe chalking of the protective weather coat. Pin-point pits and hair-line cracks up to 1/4 in. in length appeared within the 500-hour exposure period. The cracking progressed as the exposure time increased and at the 1000-hour inspection it could be classified as severe. The resistance of this product to the accelerated durability test was rated as poor, based on the failure of the protective weather coat. Although this failure may not contribute to the failure of the basis metal because of the other components of the protective system, it is conceivable that it will require costly maintenance, if only for appearance sake.

Color Galbestos, Grey.

Three of the four specimens which were exposed gave similar results. However, on one specimen (coated two sides and edges sealed), moderate to severe blistering developed in the weather coat during the first 100 hours of exposure. This blistering in turn developed into moderate cracking during the 500- to 1000-hour exposure period.

No appreciable color change was evident after 1000 hours of exposure. However, slight pin-point pits had appeared.

Slight hair line cracks (just visible to the naked eye) were observed on all specimens at the 1000-hour inspection.

Disregarding the blistering and cracking which were apparent on only one of four specimens, the resistance of this material to accelerated weathering test was rated as good.

Steelbestos, Maroon.

There was a marked color change in this material, similar to that reported for the Maroon Galbestos. Severe checking of the anti-stick coating and severe chalking were noted after the 500-hour exposure. Slight hair line cracks developed



during the 500- to 1000-hour exposure. The resistance of this product to the accelerated durability test was rated as fair.

#### 4.3 Results of Low-Temperature Shatter Tests

For the significance of this test refer to NBS Report 4963.

The results of the low-temperature shatter tests are reported in Table 3.

The results of the shatter tests at 0°F were similar in nature to those at -30°F, but a little less severe. Therefore, only the shatter tests at -30°F are reported.

##### Plasteel, Maroon.

The shatter resistance of this product was rated as poor. Two serious deficiencies were noted upon impact of the steel ball at low temperatures. One was the actual loss of the protective coating which exposed the metal core, while the other was the loss of bond between the coating and the metal in a much larger area, which in turn rendered the coating susceptible to some secondary force which could easily remove the protective coating.

##### Galbestos, Maroon.

This product exhibited no appreciable effect from the shatter test except a slight loss of adhesion between the weather coat and the asbestos felt. The resistance of the material to the test was very good.

##### Color Galbestos, Grey.

Slight cracking of the weather coat was apparent both on the exposure and on the reverse surfaces of the protective coating. Otherwise the material performed equally as well as the maroon Galbestos. Therefore, it was rated as very good.

##### Steelbestos, Maroon.

The resistance of this material to the shatter test was fair. Loss of adhesion between the felt and the metal core in a small area around the point of impact was the serious type of failure noted on the specimens of this product.







## 5. CONCLUSIONS

The performance ratings, based exclusively on the results of the laboratory tests, are as follows:

### Salt-Spray Resistance After Shatter

Color Galbestos	-	Very Good
Galbestos	-	Very Good
Steelbestos	-	Poor
Plasteel	-	Poor

### Resistance to Accelerated Durability

Plasteel	-	Very Good
Color Galbestos	-	Good
Steelbestos	-	Fair
Galbestos	-	Poor

### Resistance to Low-Temperature Shatter

Galbestos	-	Very Good
Color Galbestos	-	Very Good
Steelbestos	-	Fair
Plasteel	-	Poor

The color Galbestos was the only material that was rated as either good or very good in the three tests. However, the cracking that appears to be developing after 1000 hours of exposure may be significant.

It is questionable whether the four materials should be compared directly with each other since one is of a distinctly different type from the other three.

Neither the contents of this report nor the fact that the tests were made by the National Bureau of Standards shall be used for advertising or promotional purposes.



APPENDIX A - TABLES.



TABLE 1. RESULTS OF SALT-SPRAY TESTS AFTER SHATTER.

Material	Exterior Surface	Basis Metal
Plasteel	<ol style="list-style-type: none"> <li>100% of surface rust stained.</li> <li>Loss of adhesion of felt to metal on 100% of exposure surface and on 98% of reverse surface.</li> </ol>	<ol style="list-style-type: none"> <li>Moderate to severe corrosion where exposed at point of impact.</li> <li>Slight rusting at edges.</li> </ol>
Galbestos (Single- and double-coat.)	<ol style="list-style-type: none"> <li>Few pin-point rust spots on surface.</li> <li>Slight loss of adhesion between weather coat and felt at point of impact.</li> </ol>	<ol style="list-style-type: none"> <li>No corrosion of basis metal.</li> </ol>
Steelbestos (Single- and double-coat.)	<ol style="list-style-type: none"> <li>Pin-point rust spots over surface of panel.</li> <li>Rust stains at point of impact.</li> <li>Loss of adhesion between felt and metal on 85% of exposure side and 100% of reverse side on single-coat specimen.</li> <li>Loss of adhesion between felt and metal on 98% of exposure side and 95% on reverse side of double-coat specimen.</li> </ol>	<ol style="list-style-type: none"> <li>Slight corrosion at and beneath the point of impact.</li> <li>Slight rusting around the edges of the specimens.</li> </ol>
Color Galbestos	<ol style="list-style-type: none"> <li>Few pin-point rust spots on surface of panel.</li> <li>Slight loss of adhesion between weather coat and felt at point of impact.</li> </ol>	<ol style="list-style-type: none"> <li>No corrosion of basis metal.</li> </ol>



TABLE 2. RESULTS OF ACCELERATED TEST FOR DURABILITY

Material	500-Hour Exposure	1000-Hour Exposure
Plasteel	<ol style="list-style-type: none"> <li>1. Color change to a lighter maroon.</li> <li>2. Loss of mica flakes.</li> </ol>	<ol style="list-style-type: none"> <li>1. No apparent change from the 500-hour inspection.</li> </ol>
Galbestos (Single- and double-coat.)	<ol style="list-style-type: none"> <li>1. Fading from a glossy, dark maroon to a dull, light maroon.</li> <li>2. Moderate to severe chalking.</li> <li>3. Pin-point pitting.</li> <li>4. Hair line cracks up to 1/4 in. in length.</li> </ol>	<ol style="list-style-type: none"> <li>1. Fading, chalking and pitting as at 500-hour inspection.</li> <li>2. Moderate to severe cracking of weather coating over most of surface.</li> </ol>
Steelbestos (Single- and double-coat.)	<ol style="list-style-type: none"> <li>1. Fading from a glossy, dark maroon to a dull, light maroon.</li> <li>2. Moderate chalking.</li> <li>3. Moderate to severe checking.</li> </ol>	<ol style="list-style-type: none"> <li>1. Hair line cracking developed.</li> <li>2. Fading, chalking and checking as at the 500-hour inspection.</li> </ol>
Color Galbestos (Single- and double-coat.)	<ol style="list-style-type: none"> <li>1. Slight pitting.</li> <li>2. Slight loss of gloss, but no appreciable color change.</li> <li>3. Moderate blistering between felt and weather coating noted on double-coated, sealed-edge specimen only.</li> </ol>	<ol style="list-style-type: none"> <li>1. Slight hair line cracking up to 1/4 in. on three specimens.</li> <li>2. Severe cracking of weather coating on the double-coated, sealed-edge specimen.</li> </ol>





TABLE 3. LOW-TEMPERATURE SHATTER TESTS AT -30°F.

Material	Shatter, sq.in. Weather Side	Loosening, sq.in. Weather Side	Reverse Side	Reverse Side	
Plasteel	3.7	1.2	1.0	10	1. Bond between coating and metal lost.
Galbestos	0	0	0	0	1. Slight loss of adhesion between weather coat and felt. 2. Flaking of anti-stick coating extending 4-1/2 in. from point of impact.
Steelbestos	0	1.2	1.0	1.0	1. Flaking of surface coating from asbestos felt in an area 1/2 in. in diameter. 2. Flaking of anti-stick coating extending 4 in. from point of impact.
Color Galbestos	0	0	0	0	1. Slight loss of adhesion between weather coat and felt. 2. Cracking of weather coat at point of impact on both exposure and reverse sides.



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