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# International Co-Operative Programme on Effects on Materials, including Historic and Cultural Monuments

## Evaluation of decay of painted systems for wood, steel and galvanized steel after 4 years exposure

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# Summary

The results of the 4 years of exposure of the paint systems for steel and wood is presented. The 1 and 2 year results are included for interpretation purposes.

The damages observed were still mainly related to the deterioration parameters general appearance, dirt, chalking and fungus, and for steel damage around an artificial cut. The effect of the local environment on the performance and the lifetime of paint systems can be observed in the figures in Annex 1. By linear regression analysis it is observed that the pollutant influence of $SO_2$ dominates the damage around the artificial cut. Pollutants also effect the parameter dirt.

For chalking and fungus the meteorological parameters sunhours, precipitation and time of wetness (TOW) increase with increasing deterioration. $SO_2$ reduces the fungus growth for all paint systems.

# International Co-Operative Programme on Effects on Materials, including Historic and Cultural Monuments

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## 1. Introduction

Airborne acidifying pollutants are known to be one major cause of corrosion of different materials including the extensive damage that has been observed on historic and cultural monuments. In order to fill some important gaps of knowledge in this field the executive Body for the Convention on Long-range Transboundary Air Pollution decided to launch an international co-operative programme within the United Nations Economic Commission for Europe (UN ECE). The programme started in September 1987 and involves exposure at 39 test sites in 12 European countries and in the United States and Canada.

The aim of the programme is to perform a quantitative evaluation of the effect of sulphur pollutants in combination with $NO_X$ and other pollutants as well as climatic parameters on the atmospheric corrosion of important materials. For this purpose measurements of gaseous pollutants, precipitation and climate parameters have been initiated at or nearby each test site, together with evaluation of corrosion of the exposed test materials at each site.

A Task Force is organizing the programme with Sweden as lead country and the Swedish Corrosion Institute serving as the Main Research Centre. Sub-centres in different countries have been appointed, each responsible for their own materials group. The materials groups are:

**Structural metals**, including steel, weathering steel, zinc and aluminium (Sub-centre responsible for evaluation: National Research Institute for Protection of Materials, Prague, The Czech Republic), copper and cast bronze (Bayerisches Landesamt für Denkmalpflege, Munich, Germany).

**Stone materials**, including Portland limestone and White Mansfield dolomitic sandstone (Building Research Establishment, Department of Environment, Watford, United Kingdom).

**Paint coatings**, including coil coated steel with alkyd melamine, steel with silicon alkyd paint, wood with alkyd paint system and wood with primer and acrylate (Norwegian Institute for Air Research, Lillestrøm, Norway).

**Electric contact materials**, including nickel, copper, silver and tin as coupons; Eurocard connectors of different performance classes (Swedish Corrosion Institute and Royal Institute of Technology, Stockholm, Sweden).

Environmental data storing, reporting and evaluation are the responsibility of the Norwegian Institute for Air Research.

The aim of this report is to present results of the painted systems withdrawn after 4 years of exposure. Some statistical treatments trying to evaluate the connection between the decay of the paint systems and environmental factors have been performed.

## 2. Materials

The paint systems tested were:

- Coil coated steel panels with alkyd melamine (30 µm zinc + 20 µm alkyd melamine). System G.
- Steel panels coated with two layer silicon alkyd (80 µm). System H.
- Wood panels coated with two alkyd paint layers. System I.
- Wood panels coated with primer and acrylate (opaque stain). System K.

## 3. Evaluation

The evaluation has followed the available ASTM standards and ISO standards and the ASTM rating numbers from RN=10 to RN=0 are used. Annex 2 gives a description of the different standards used. The types of damages evaluated are: General appearance, dirt, chalking, fungus, flaking, cracking, checking and gloss. For the paint-systems for metals damages around an artificial cut through the paint were evaluated. The results of the evaluation for one, two and four years are given in Annex 1. Some adjustments have been made in the evaluation of fungus and dirt for the second year since a better microscopic technique has been adapted. By the new technique it is easier to distinguis the black mildew from black dirt. The technique makes use of a transmission microscope after transferring the surface layer to a transparent tap. Through this microscope the dirt will still be black, but the mildew will be shown as brown spots.

The evaluation systems used in the ASTM and ISO standards for paint systems define parameters which may turn up to be visually connected. The general appearance results, which in our terms are an overall description of the visual impression, are so far more effected by the fungus results than by the other parameters evaluated. Chalking may reduce the impression of dirt to some degree because of the white deterioration products formed on the surface.

After four years the main changes for the paint systems are still found for the parameters general appearance, dirt, chalking, gloss and fungus. Effects along the cut in the steel systems also occurs. An evaluation of the damage around the cut in the paint film on the painted steel panels by using the Swedish standard SS184219 has been introduced for the four years exposures. The standard expresses the damage as spread from the cut in millimeter and gives result easier to treat statistically. Very little of flaking, cracking and checking are observed. In the following pages the paint systems for steel and wood are discussed separately.

# 4. The series: coil coated steel with alkyd melamine (G) and steel panel with silicon alkyd (H)

The test panels of these paint systems have a horizontal cut on the front surface. Type G has alkyd malamine on the front side only, but the H-type has silicon alkyd on both sides.

The panels at sites no. 34 and 35 have been placed with the front side down. The parameter "gen.app." therefore has been neglected for both systems, because facing the cut downwards makes it difficult to compare the front side with those at the other test sites. For the H-panels with the same paint system on both sides, the parameters were evaluated on the side facing up. The evaluation of damage in cut was neglected for the fourth year.

For the G-panels, coil coated alkyd malamine at site 34 and 35 with the specified coating only on the side facing down, none of the results will be comparable with the panels from the other test sites. For the fourth year no evaluation of the panels has been carried out.

## 4.1. Parameters general appearance and dirt

Since these parameters are well correlated, the results are commented in the same paragraph.

### *4.1.1. Type G*

There are still 6 sites with RN=9 for general appearance after 4 years, for dirt there even are 2 sites with a visual appearance of 9.5. The lowest rating for general appearance is given to the Norwegian industrial test site NO22 RN=5 and for dirt to the urban site Rome in Italy ITA13 with RN=6.5.

Chalking and natural washing seem to effect the evaluation of the general appearance and dirt parameters considerably after 4 years.

### *4.1.2. Type H*

For general appearance two rural sites had the highest ratings after 4 years, Toledo SPA33 and Lahemaa EST35 with RN=9.0. Most effected were the panels at the industry sites CS3, and USA39 (both RN=4.0).

The panels with silicon alkyd seem to be less dirty after 4 years than after 2 years of exposure, mainly because increased chalking was observed.

## 4.2. Chalking

Fig. 1.1 and 1.2 show a significant increase in chalking from previous years. Particularly alkyd melamine (type G) was effected and has reached the limit for the evaluation method, but also the silicon alkyd showed strong chalking. For the evaluation after four years the same flexible tape (Scotch electric insulating tape, black) was used as for the second year's evaluation.

#### *4.2.1. Type G*

After 4 years 33 panels had reached R=1.0 or 0.5. The best result was observed at the industry site Kopisty (CS3) with a rating of RN=3.0.

#### *4.2.2. Type H*

All the panels showed substantial chalking after four years, but generally less than for the G-panels. 16 of the sites had a rating of 1.0 or lower. The highest rating RN=6.0 was observed at Kopisty (CS3) and Moscow (RUS34).

### 4.3. Fungus

The results of the evaluation of the fungi are shown in fig. 1.3 and 1.4. No identification of the types has been done so far. Silicon alkyd is more effected by fungi than alkyd melamine.

#### *4.3.1. Type G*

After four years fungi were observed on 24 panels, and ITA14 (Casaccia) and ITA16 (Venice) got the lowest rating with RN=6.

#### *4.3.2. Type H*

28 panels were fungus infected after four years. The lowest RN after four years had the rural site SWE26 (Aspvreten) with RN=4.5.

### 4.4. Flaking, cracking and checking

There are no remarks made with reference to these parameters after 4 years.

### 4.5. Damage located in and near cut

The type of damages codes B/b blistering, F/f flacking and rust should not be compared from one year to the next. This is because these parameters are not fixed with numbers but are more subjective. The damage according to ASTM will be comparable to the Swedish standard SS184219. However, the results from the Swedish standard should be easier to use in an equation since the results are given in millimeter instead of rating numbers. Particularly the steel system without zinc (H) showed attack in the cut, but all panels were effected after four years. Fig. 1.5 and 1.6 show the results for the first, second and fourth year for damages along the cut after ASTM ratings. Fig. 1.7 gives the results for system H after four years from an evaluation with the SS standard.

The strongest effects are observed at the industry sites, particularly for system H. However, even the rural sites in Scandinavia have significant corrosion around the cut.

# 5. The series: Wood panel with alkyd paint (I) and with primer and acrylate (K)

## 5.1. General appearance

After four years most panels had a reduced general appearance. The interpretation of general appearance scale has been to give a general description of the visual performance, and particularly the alkyd system had a reduced impression.

The main effects observed are chalking and fungus. Dirt and fungus will often be the dominating parameters for determining of the RN for general appearance.

### *5.1.1. Type I*

After four years of exposure three panels still have got the RN=10, that is the rural site SPA33 and the cities Madrid (SPA31) and Oslo (NOW21). Lowest RN had: ITA16 (RN=2.0), and NL18 (RN=4.0). The worst appearance was associated with fungi attack. The improvement in the general appearance observed at some test sites is due to chalking effects which reduce the black impression on the surface.

### *5.1.2. Type K*

Three panels have RN=10 after 4 years: SWE25, SPA33 and CAN37. The general good appearance observed seems to be caused by the chalking of the paint system.

## 5.2. Chalking

Chalking had increased considerably with time, and after two years all the panels were effected by chalking, type K more than type I after two years, but in the same magnitude after four years. This is showed in fig. 1.8 and 1.9. Due to the structure of the wood surface the scale acts differently for wood than for metals.

### *5.2.1. Type I*

After four years all panels have a rating between 4 and 7. Best rating RN=7 was observed in Moscow and Chatteringshaw Loch. The worst rating observed was RN=4 which appeared on 7 test sites.

### *5.2.2. Type K*

Some of the panels had less chalking after 4 years than after 2. However, the general picture is that chalking has reached the same level for the alkyd and the acrylate paints.

9 sites have got RN=4 and most sites have rating of 7.5 or less, only test site CS1 is outside this range with a rating number RN=9.5.

## 5.3. Fungus

The result of the evaluation of fungi is shown in fig. 1.10 and 1.11. The alkyd paint system was much more attacked by fungi than the acrylate system.

### *5.3.1. Type I*

After four years of exposure fungus was observed at 28 test sites. The panels in Venice (ITA16) were worst both after one, two and four years (RN=2.0). The fungi found were always of the dark surface type (mildew).

### *5.3.2. Type K*

After four years of exposure fungi were only observed on 15 panels. The lowest rating was given to the panels in Venice RN=4.0.

## 6. Statistical analysis

### 6.1. Selection of parameters

The deterioration parameters used for evaluation, were fungus, chalking, dirt, and cut damages for the painted metal systems. It was shown that dirt and general appearance had good correlation and general appearance was dropped in the statistical analysis performed.

### 6.2. Linear regression analysis

The rating numbers of dirt, chalking, fungus, and cut damage were statistically analyzed by linear regression with a selective group of environmental factors. For damage around the cut the correlation was also performed by using the Swedish standard SS184219, where the results are given in millimeter spread from the cut. In Table 1 the parameters used in the different analysis are listed.

*Table 1: Parameters used in the regression analysis.*

| Painted wood panels - system I and K | |
|---|---|
| Deterioration parameter | Selected environmental parameters |
| Fungus | TOW[1)], mm[2)], $NH_4^+$, $NO_3^-$, $SO_2$, mm · $NH_4^+$, mm · $NO_3^-$ |
| Chalking | Sunhours, $SO_2$, TOW · $SO_2$ |
| Dirt | $NO_2$, $SO_2$ |
| **Painted steel panels - system G and H** | |
| Fungus, dirt and chalking | Like painted wood |
| Damage around cut, both ASTM and SS standards | $SO_2$, TOW · $SO_2$ , TOW, mm, pH, Cl, TOW · Cl |

1) TOW = mean of 4 year results presented at % of hours with TOW through the year.
2) mm = mm per year expressed as monthly mean.
3) Sun = % of sunhours per year.

In Table 2 the results of the analysis which have given correlation above 90% level of significance for some of the paint systems are listed. Since the deterioration parameters are evaluated as rating numbers, no linear equation is given. Still the correlation coefficient values are able to describe the best correlations between environmental impact and deterioration parameters.

*Table 2: Correlation with deterioration.*

| Damage | Paint system | No. of observations 4 years | Environmental factors | Correlation for 4 year's results |
|---|---|---|---|---|
| CUT | Silicon alkyd on steel (H) | 37 | $SO_2$ mean | R = -0.64 ** |
| | | 32 | TOW (mean) x $SO_2$ | R = -0.57 ** |
| | | 37 | pH mean | R = +0.24 |
| | Alkyd melamine on galv. steel (G) | 37 | $SO_2$ mean | R = -0.30 * |
| | | 36 | mm mean | R = -0.35 ** |
| | | 37 | pH mean | R = +0.55 ** |
| FUNGUS | Silicon alkyd on steel (H) | 32 | % TOW | R = -0.27 |
| | | 36 | mm (mean) | R = -0.32 * |
| | | 39 | $SO_2$ (mean) | R = +0.21 |
| | Alkyd melamine on galv. steel (G) | 32 | % TOW | R = -0.29 (*) |
| | | 36 | mm (mean) | R = -0.43 ** |
| | | 39 | $SO_2$ (mean) | R = +0.41 ** |
| | Alkyd on wood (I) | 32 | % TOW | R = -0.40 ** |
| | | 36 | mm (mean) | R = -0.36 ** |
| | | 39 | $SO_2$ (mean) | R = +0.37 ** |
| | Acrylate on wood (K) | 32 | % TOW | R = -0.15 |
| | | 36 | mm (mean) | R = -0.34 *(*) |
| | | 39 | $SO_2$ (mean) | R = +0.21 |
| DIRT | Silicon alkyd on steel (H) | 37 | $SO_2$ (mean) | R = -0.35 ** |
| | | 37 | $NO_2$ (mean) | R = -0.38 ** |
| | Alkyd melamine on galv. steel (G) | 37 | $SO_2$ (mean) | R = -0.65 ** |
| | | 37 | $NO_2$ (mean) | R = -0.51 ** |
| | Alkyd on wood (I) | 37 | $SO_2$ (mean) | R = -0.23 |
| | | 37 | $NO_2$ (mean) | R = -0.03 |
| | Acrylate on wood (K) | 37 | $SO_2$ (mean) | R = -0.31 * |
| | | 37 | $NO_2$ (mean) | R = -0.27 * |
| | | 2 years | | |
| CHALKING | Silicon alkyd on steel (H) | 24 | % sun hours | R = -0.21 |
| | | 37 | $SO_2$ (mean) | R = +0.45 ** |
| | Alkyd melamine on galv. steel (G) | 24 | % sun hours | R = -0.23 |
| | | 37 | $SO_2$ (mean) | R = +0.47 ** |
| | Alkyd on wood (I) | 24 | % sun hours | R = -0.16 |
| | | 37 | $SO_2$ (mean) | R = -0.20 |
| | Acrylate on wood (K) | 24 | % sun hours | R = -0.12 |
| | | 37 | $SO_2$ (mean) | R = -0.26 |

** 5% level of significance, 25 observations R > 0.40, 30 observations R > 0.36, 40 observations R > 0.31

* 10% level of significance, 25 observations R > 0.34, 30 observations R > 0.31, 40 observations R > 0.26

Note: Since the deterioration increases with decreasing rating number, "minus" before the correlation means increasing deterioration with increasing concentration of pollutants.
For pH "plus" before the correlation, means that lower pH (higher acidity) gives increased deterioration.
5% level of significance means max. 5% probability of making wrong conclusions by using this statistical method.

In Table 3 the equation and correlation coefficient for the regression analysis of spread from the cut against environmental factors are given. For the evaluation of the cut by using the Swedish standard, the figures are given as a millimeter scale and an equation can be given.

*Table 3: Correlation with damage near a cut (SS 184219 evaluation).*

| Paint system | No. of observations 4 years | Environmental factors | Best equation 4 year's result | Correlation for 4 year's results |
|---|---|---|---|---|
| Silicon alkyd on steel (H) | 37<br>32 | $SO_2$ mean<br>TOW (mean) x $SO_2$ | L = 0.69 + 0.18 ($SO_2$)<br>L = 1.67 + 0.005 ($SO_2$ · TOW)<br>L = mm spread from the cut | R = +0.69 **<br>R = +0.45 ** |

** 5% level of significance, 25 observations R > 0.40, 30 observations R > 0.36, 40 observations R > 0.31

* 10% level of significance, 25 observations R > 0.34, 30 observations R > 0.31, 40 observations R > 0.26

Note: For increasing deterioration with increasing concentrations the correlation should have positive sign since the SS standard gives the results in mm spread from the cut.

### 6.3. Coil coated galvanized steel with alkyd melamine (G)

The results after 4 years exposures were correlated with the environmental data shown in Table 1 and the more interesting results are given in Table 2

For damage around the cut, the reduced performance observed had a significant correlation with pollutant parameters like $SO_2$, TOW x $SO_2$ and pH in precipitation. Pollutants had also the same effect on the dirt performance. Both $SO_2$ and $NO_2$ had a high correlation coefficient with the dirt factor.

Fungus and chalking seems to be more effected by meteorological parameters. The fungus growth increase with increased amount of TOW (time of wetness) and millimeter precipitation. $SO_2$ has the opposite effect, which is expected since $SO_2$ normally reduce the fungus activity particularly for the surface type observed.

The chalking correlation was made with the 2 year results since the 4 year results had reached the limit of the evaluation method used. Hours with sun correlates best with the increased chalking, but the correlation was below the 90% level of significance. It is interesting to observe that $SO_2$ seems to reduce the chalking on both paint systems for the metal surfaces.

### 6.4. Steel paints with silicon alkyd (H)

The four year results for damage around the cut were also evaluated according to the Swedish standard SS 184219, where the spread from the cut in millimeter is the evaluation criteria. For this reason we have also given the best equations for the correlation between the damage and the environmental parameters in Table 3. The correlation coefficients calculated according to ASTM and SS are close to the same value as expected. Highest correlation is observed for $SO_2$ and TOW x $SO_2$.

The other deterioration parameters have correlations with the environment which are comparable with system (G). However, most of the correlation coefficients have lower values, lower level of significance.

### 6.5. Wood panels with alkyd paint (I)

Fungus is the dominating deterioration parameter for alkyd paint and is best explained with the parameters mm precipitation and TOW. The effect of $SO_2$ for the paint system for wood is reduced growth with increased amount of $SO_2$.

For the parameters chalking and dirt the correlation with the environmental parameters tested is not so good. One reason could be that the painted wood surface has a rough appearance and will therefore be more difficult to evaluate according to the ASTM standard. The more open paint structure used for systems for wood also make difficulties for the visual evaluation system. However, one interesting difference is observed for the chalking compared with the metal paint system, $SO_2$ seems to increase the chalking for alkyd on wood, but had the opposite effect on alkyd melamine.

### 6.6. Wood panels with primer and acrylate paint (K)

The acrylate system has the same level of significance for the parameter tested as the alkyd on wood. However, the trends seems to be comparable. $SO_2$ has a negative effect on chalking also for acrylate. Dirt is effected by $SO_2$ and $NO_2$, and fungus is mainly effected by mm precipitation.

## 7. Discussion

From the figures in Annex 1, we can observe that the local environment must have a great effect on the performance and the lifetime of all paint systems. For all years there are big differences in the rating number for all parameters used in the statistical analysis, and the pattern is very much the same for all years.

Chalking has reached the detection limits for the metal paint systems. The less chalking reported on the wood systems could be caused by the roughness of the surface and not by the paint systems. It is also possible that the chalking on the wood paint systems easier will be washed away with the rain.

The development of fungus is higher for alkyd on wood than on any of the other systems. This seems to be linked to the sensitivity of that system to the TOW (time of wetness) parameter.

In the database we can observe that some of the deterioration parameters are effected by different groups of environmental parameters. The most obvious case is the fungus results from Toledo and Kopisty, both with hardly no fungus. In Kopisty this is strongly connected to the high $SO_2$ concentration in the air, but in Toledo with low $SO_2$ concentration the low fungus growth is caused by the dry and hot climate. Other combination of effect which is not so obvious, can be hidden in the database.

It is possible that other types of statistical treatment like principal component analysis could improve the interpretation of the database and will be included in future statistical treatment.

# Annex 1

## Figures and Tables

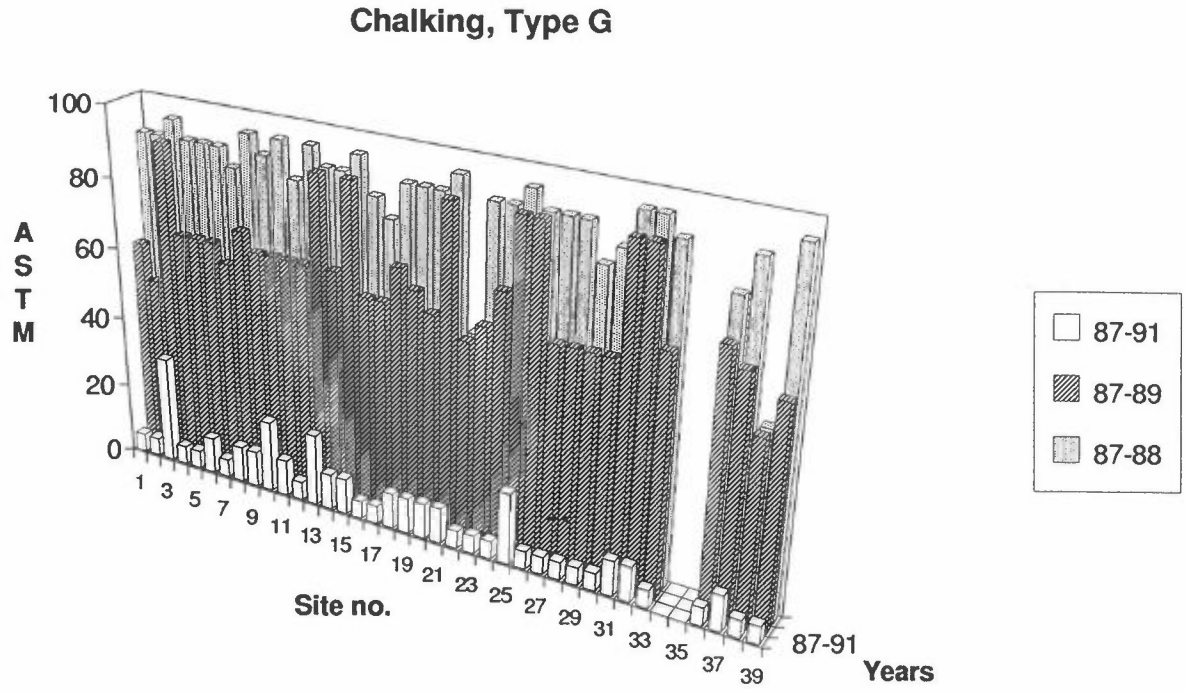


*Figure 1.1: Chalking results for alkyd melamine paint after 1, 2 and 4 years.*

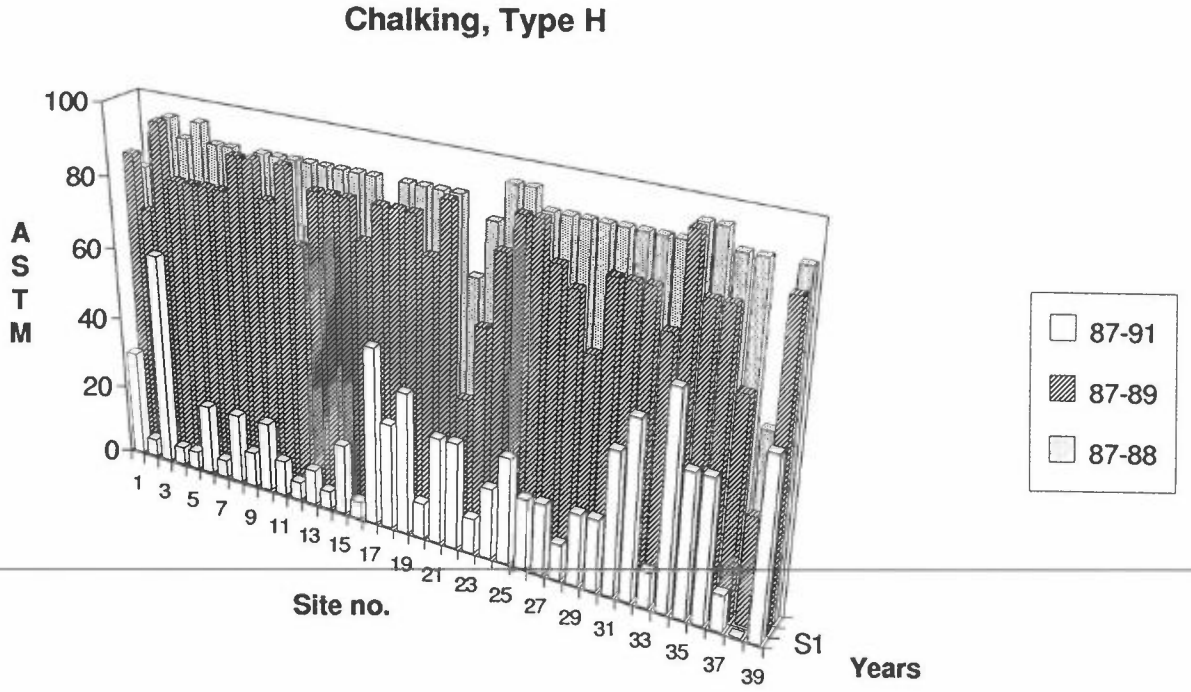


*Figure 1.2: Chalking results for silicon alkyd paint after 1, 2 and 4 years.*

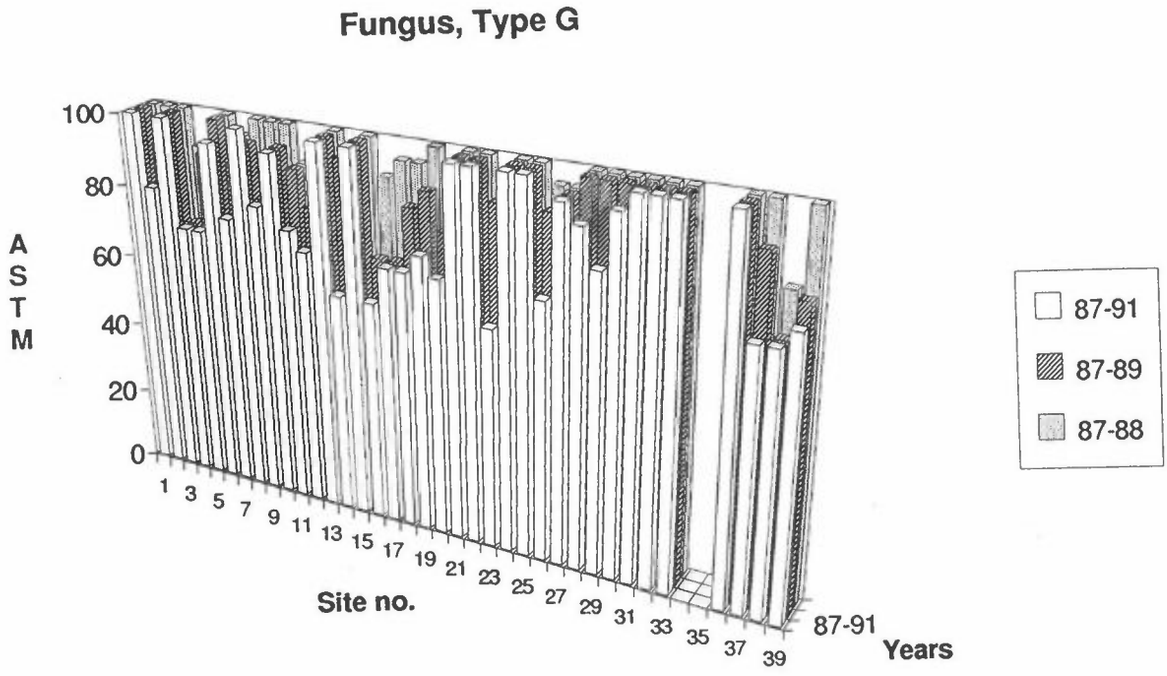


*Figure 1.3: Fungus results for alkyd melamine paint after 1, 2 and 4 years.*

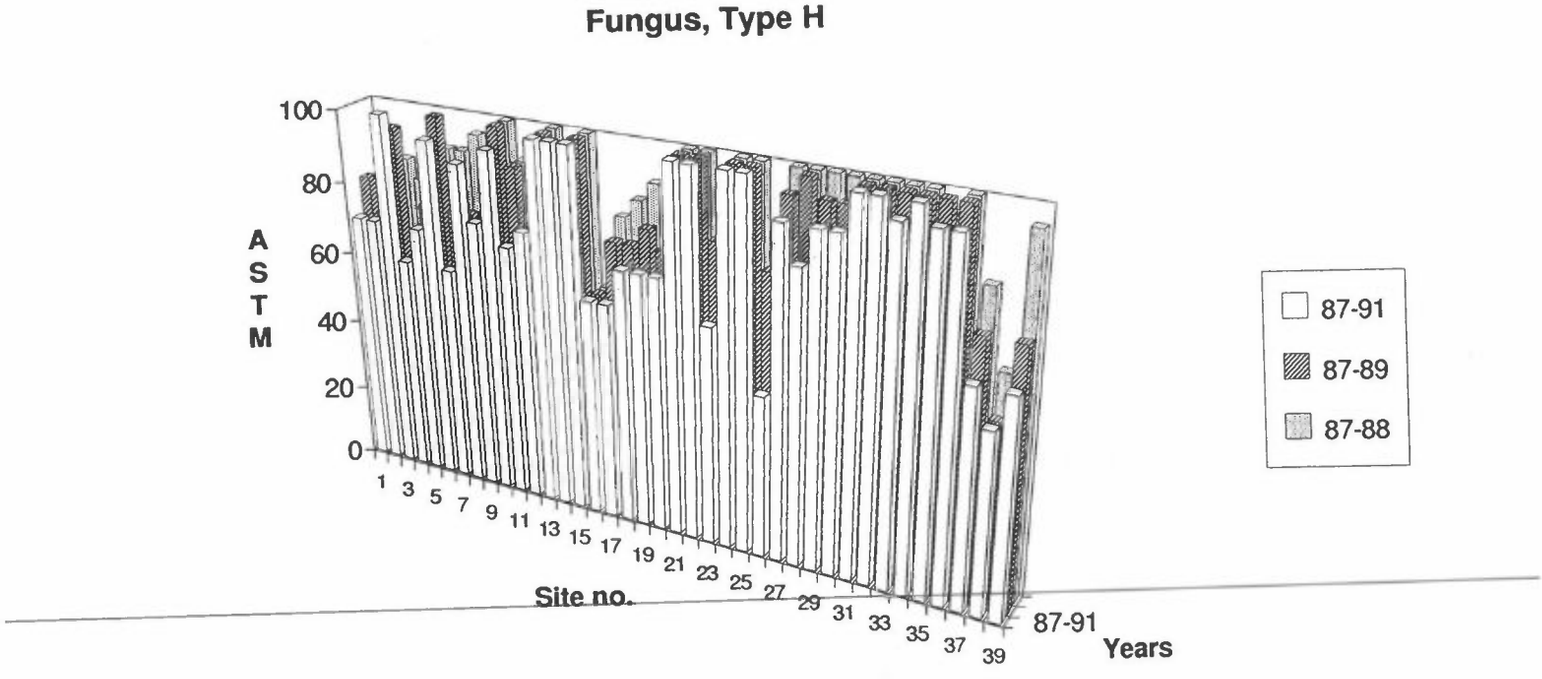


*Figure 1.4: Fungus results for silicon alkyd paint after 1, 2 and 4 years.*

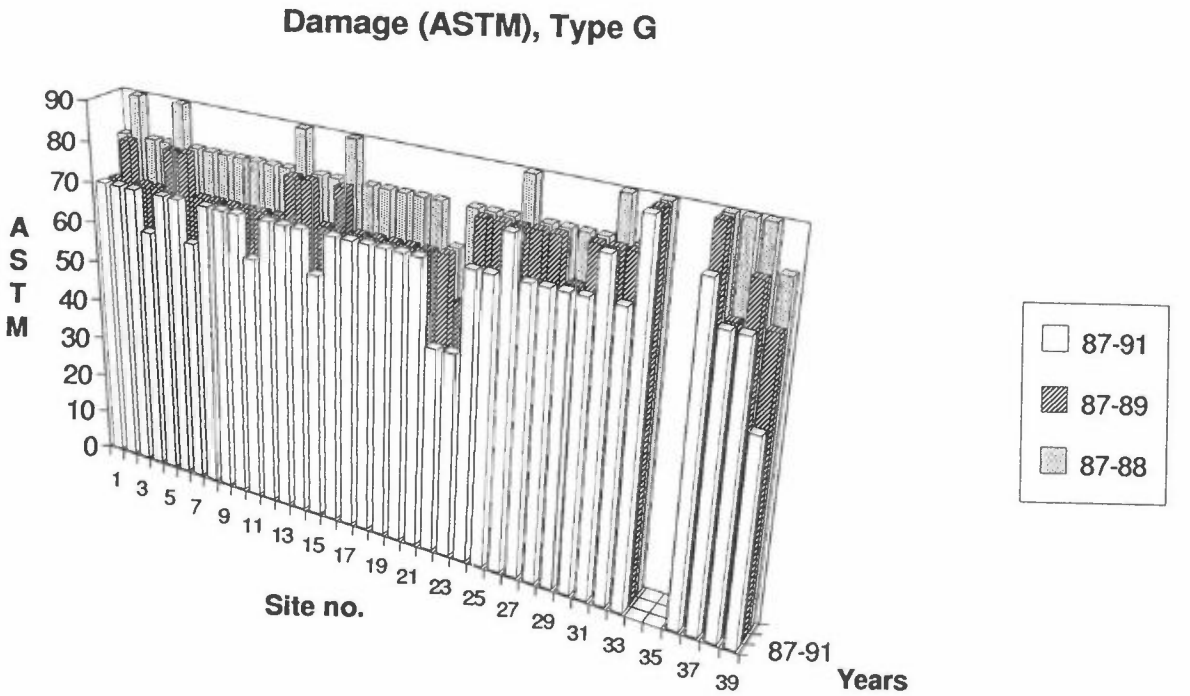


*Figure 1.5: Results of the damage in and near the cut for alkyd melamine paint after 1, 2 and 4 years.*

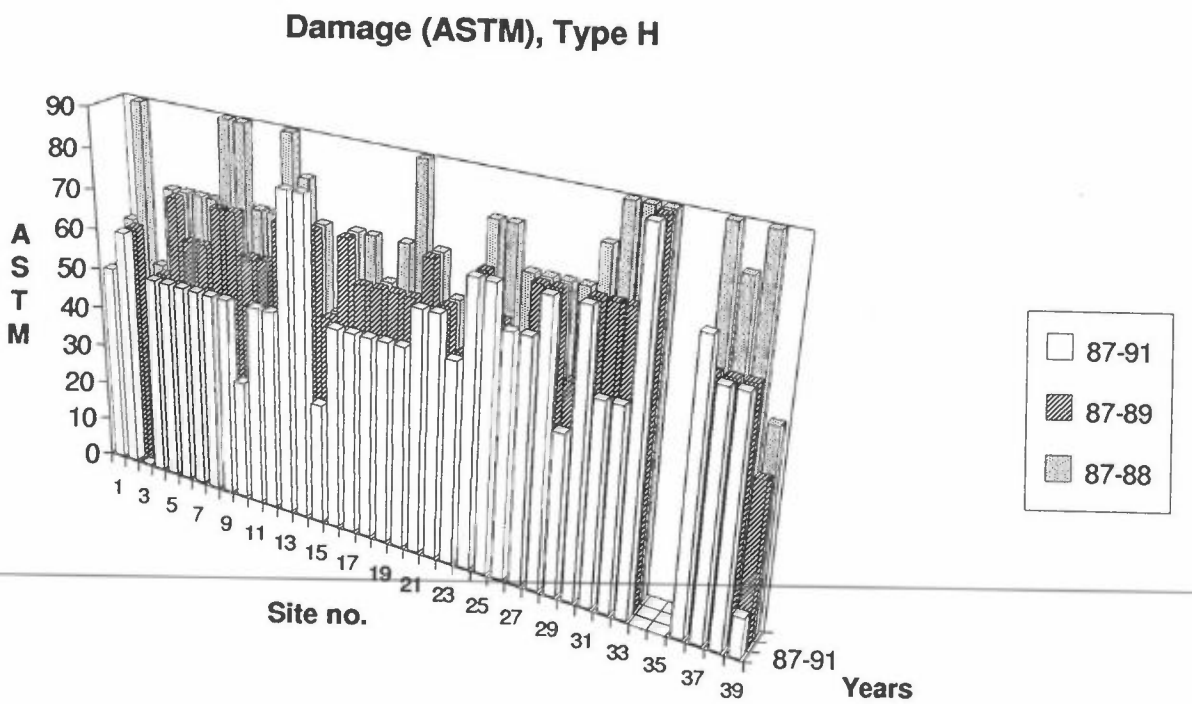


*Figure 1.6: Results of the damage in and near the cut for silicon alkyd paint after 1, 2 and 4 years.*

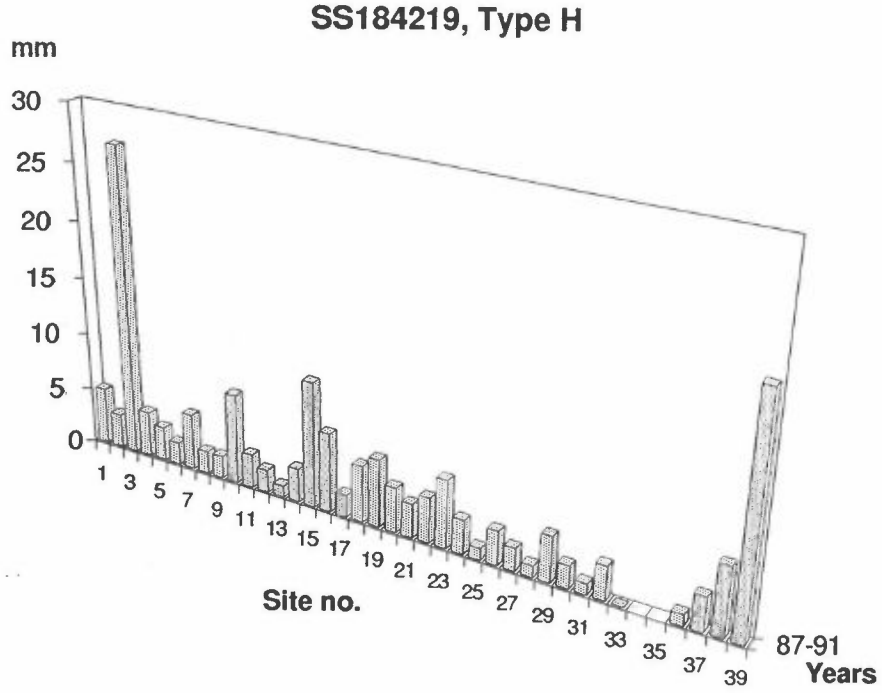


*Figure 1.7: Results of the damage in and near the cut for silicon alkyd paint after 4 years evaluated after the Swedish standard SS 184219.*

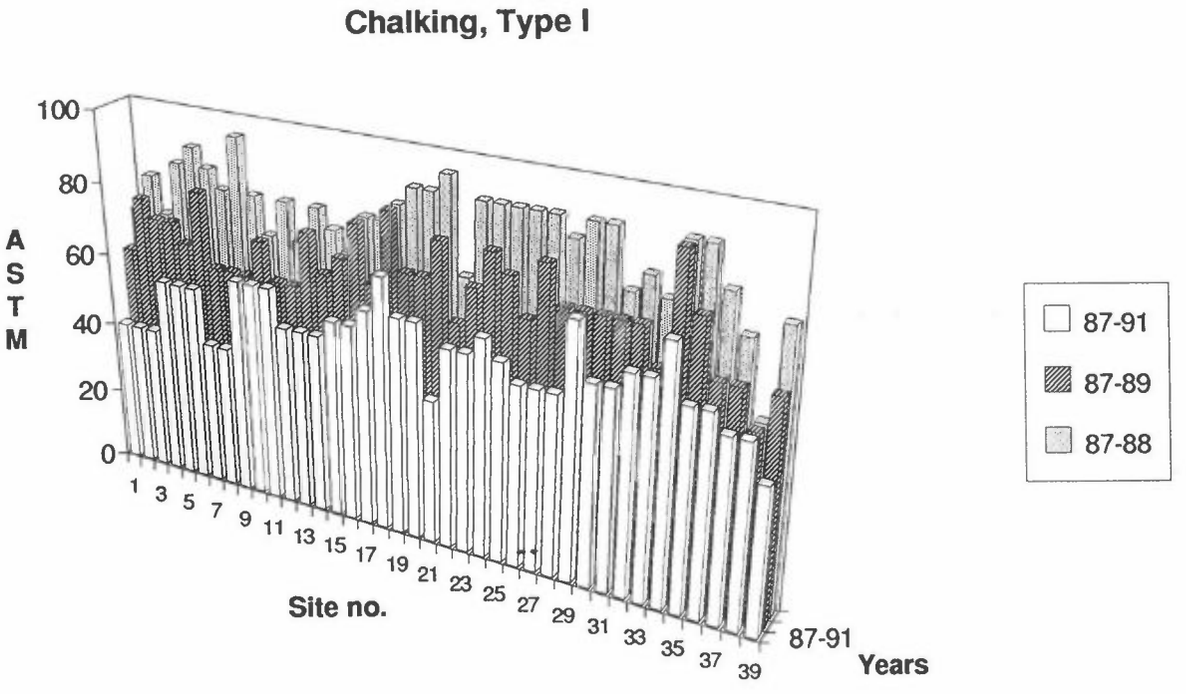


*Figure 1.8: Chalking results for alkyd paint on wood after 1, 2 and 4 years.*

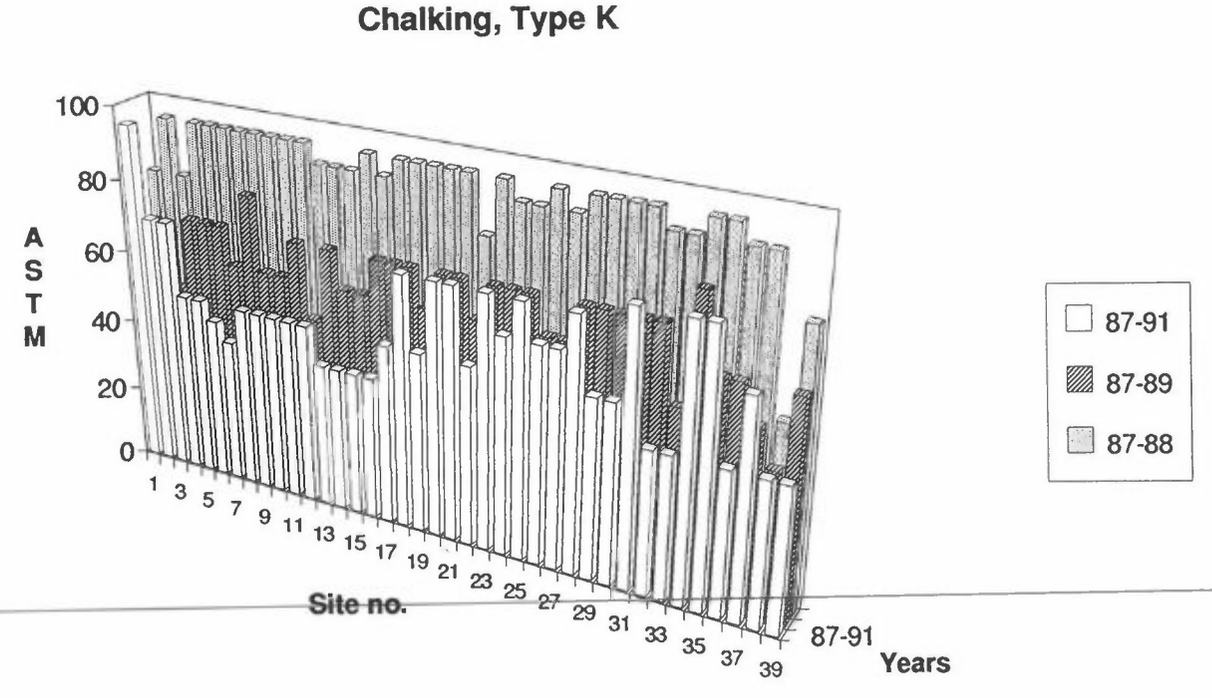


*Figure 1.9: Chalking results for acrylate opaque stain on wood after 1, 2 and 4 years.*

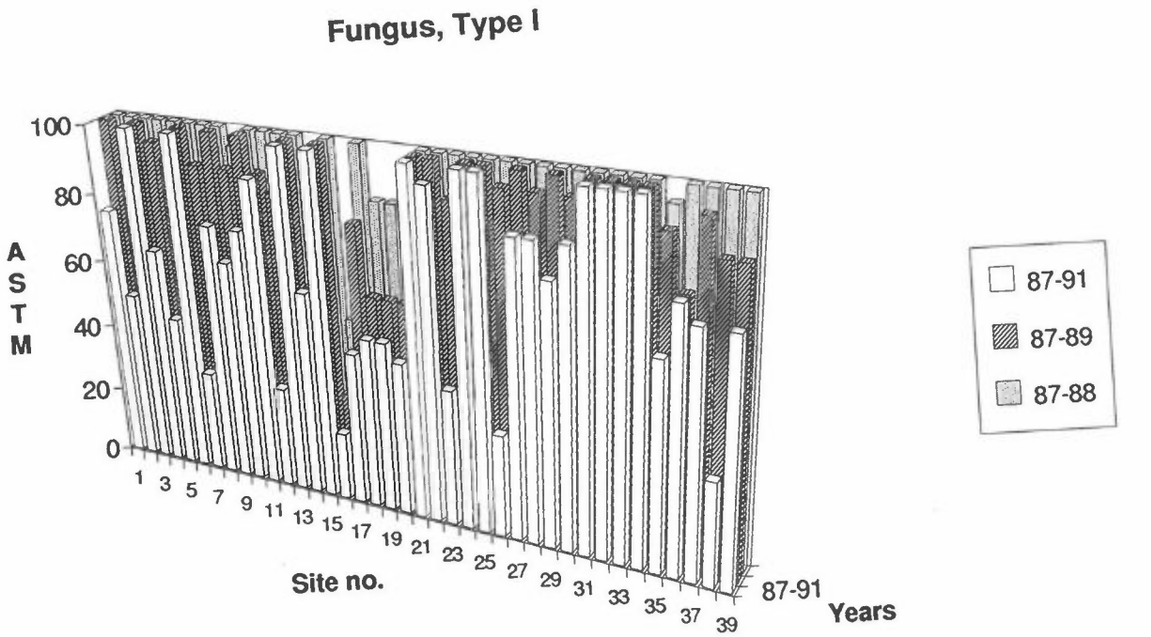


*Figure 1.10: Fungus results for alkyd paint after 1, 2 and 4 years.*

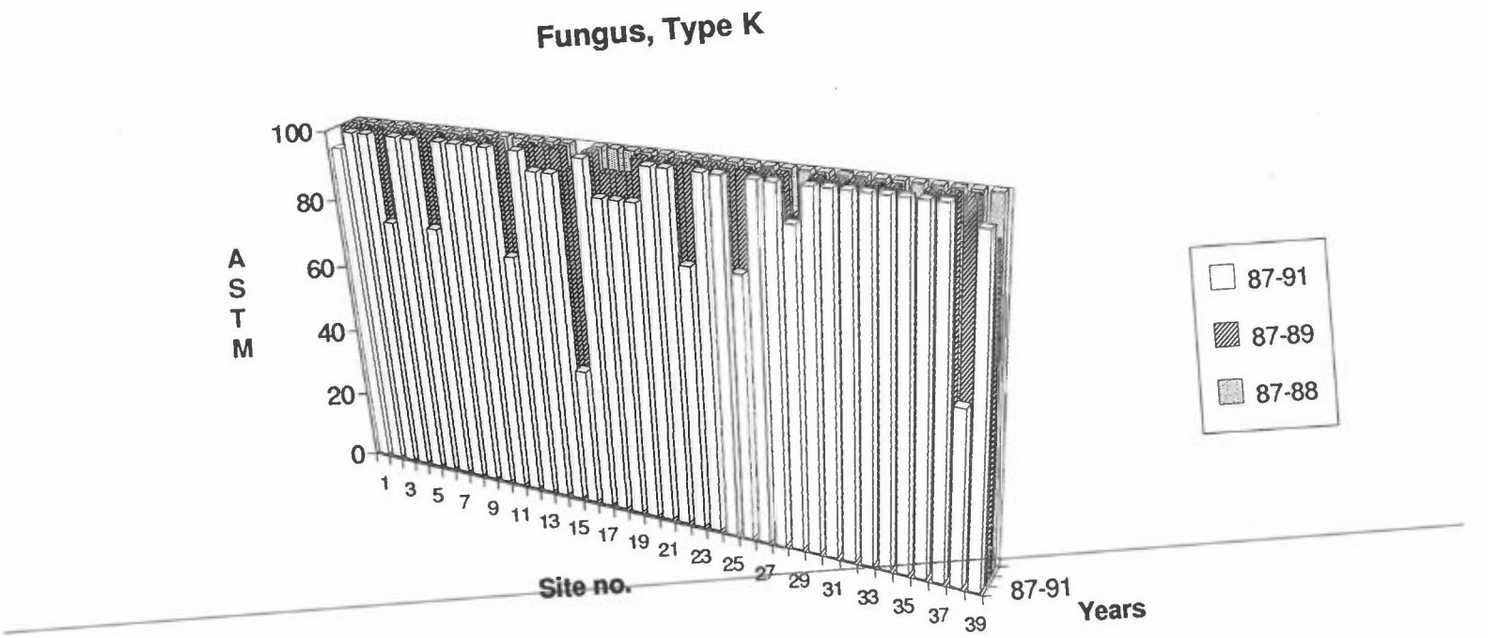


*Figure 1.11: Fungus results for acrylate opaque stain after 1, 2 and 4 years.*

*Table 1.1: The results of 1 year's exposure of coil coated steel with alkyd melamine coating.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G 1 | 87/88 | 9.0 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 8.0 | 26.0 | 34.0 | | | |
| G 2 | 87/88 | 8.5 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 9.0 | 23.0 | 26.0 | | | |
| G 3 | 87/88 | 8.0 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 8.0 | 25.0 | 40.0 | | | 10.0 |
| G 4 | 87/88 | 8.5 | 8.5 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 8.0 | 31.0 | 37.0 | | | |
| G 5 | 87/88 | 8.5 | 7.5 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 9.0 | 29.0 | 34.0 | | | |
| G 6 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 31.0 | 37.0 | | | |
| G 7 | 87/88 | 9.0 | 9.0 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 29.0 | 34.0 | | | |
| G 8 | 87/88 | 8.5 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | (r) | | 8.0 | 31.0 | 36.0 | | | |
| G 9 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | (r) | | 8.0 | 26.0 | 32.0 | | | |
| G10 | 87/88 | 8.5 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 26.0 | 31.0 | | | |
| G11 | 87/88 | 8.5 | 7.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 23.0 | 27.0 | | | |
| G12 | 87/88 | 9.0 | 9.0 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 30.0 | 36.0 | | | |
| G13 | 87/88 | 7.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 9.0 | 17.0 | 38.0 | | | |
| G14 | 87/88 | 8.5 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 22.0 | 37.0 | | | |
| G15 | 87/88 | 7.0 | 6.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 27.0 | 39.0 | | | 10.0 |
| G16 | 87/88 | 6.5 | 6.0 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 9.0 | 19.0 | 37.0 | | | |
| G17 | 87/88 | 8.0 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 8.0 | 25.0 | 30.0 | | | |
| G18 | 87/88 | 7.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | | r | | 8.0 | 32.0 | 37.0 | | | |
| G19 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 8.0 | 27.0 | 31.0 | | | |
| G20 | 87/88 | 9.0 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 26.0 | 31.0 | | | |
| G21 | 87/88 | 8.5 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 8.0 | 29.0 | 35.0 | | | |
| G22 | 87/88 | 7.5 | 9.0 | 5.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | (r) | | 7.0 | 12.0 | 9.0 | | | 10.0 |
| G23 | 87/88 | 8.0 | 9.5 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | f | r | | 8.0 | 30.0 | 30.0 | | | 10.0 |
| G24 | 87/88 | 9.0 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | (r) | | 8.0 | 32.0 | 37.0 | | | |
| G25 | 87/88 | 8.0 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | (r) | | 8.0 | 34.0 | 38.0 | | | |
| G26 | 87/88 | 9.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 9.0 | 33.0 | 37.0 | | | |
| G27 | 87/88 | 8.0 | 8.5 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 27.0 | 33.0 | | | |
| G28 | 87/88 | 9.5 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 27.0 | 30.0 | | | |
| G29 | 87/88 | 8.0 | 9.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 8.0 | 20.0 | 20.0 | | | |
| G30 | 87/88 | 9.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 23.0 | 26.0 | | | |
| G31 | 87/88 | 8.0 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 9.0 | 24.0 | 36.0 | | | |
| G32 | 87/88 | 7.5 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 24.0 | 36.0 | | | |
| G33 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 9.0 | 23.0 | 30.0 | | | |
| G34 | 87/88 | | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 10.0 | 27.0 | 35.0 | | | |
| G35 | 87/88 | 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | (r) | | 10.0 | 36.0 | 38.0 | | | |
| G36 | 87/88 | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 9.0 | 19.0 | 32.0 | | | |
| G37 | 87/88 | 9.5 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 9.0 | 29.0 | 33.0 | | | |
| G38 | 87/88 | 9.5 | 9.0 | 5.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | f | (r) | | 9.0 | 10.0 | 12.0 | | | 10.0 |
| G39 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 8.0 | 29.0 | 34.0 | | | 10.0 |

*Table 1.2: The results of 1 year's exposure of steel panels with silicon alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H 1 | 87/88 | 6.0 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 6.0 | 60.0 | 77.0 | 67.0 | 76.0 | 6.0 |
| H 2 | 87/88 | 7.0 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 55.0 | 65.0 | 74.0 | 78.0 | |
| H 3 | 87/88 | 5.0 | 7.0 | 9.5 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 5.0 | 49.0 | 82.0 | 67.0 | 77.0 | 6.0 |
| H 4 | 87/88 | 7.0 | 8.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 63.0 | 78.0 | 67.0 | 75.0 | |
| H 5 | 87/88 | 7.0 | 7.0 | 9.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 61.0 | 69.0 | 71.0 | 75.0 | |
| H 6 | 87/88 | 7.0 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 7.0 | 64.0 | 76.0 | 65.0 | 75.0 | 6.0 |
| H 7 | 87/88 | 6.5 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 60.0 | 71.0 | 67.0 | 73.0 | 5.0 |
| H 8 | 87/88 | 7.5 | 6.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 66.0 | 78.0 | 68.0 | 74.0 | |
| H 9 | 87/88 | 7.5 | 6.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 9.0 | 62.0 | 73.0 | 70.0 | 76.0 | |
| H10 | 87/88 | 6.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 7.0 | 60.0 | 72.0 | 63.0 | 72.0 | 5.0 |
| H11 | 87/88 | 7.0 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 55.0 | 66.0 | 63.0 | 70.0 | |
| H12 | 87/88 | 8.0 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | | R | | 9.0 | 63.0 | 68.0 | 70.0 | 74.0 | |
| H13 | 87/88 | 6.5 | 5.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | R | | 8.0 | 37.0 | 70.0 | 57.0 | 61.0 | |
| H14 | 87/88 | 7.0 | 6.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 45.0 | 65.0 | 56.0 | 69.0 | |
| H15 | 87/88 | 5.0 | 5.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | bB | f | R | | 5.0 | 58.0 | 74.0 | 65.0 | 71.0 | 5.0 |
| H16 | 87/88 | 5.0 | 4.0 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 7.0 | 34.0 | 60.0 | 59.0 | 71.0 | |
| H17 | 87/88 | 6.5 | 7.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 57.0 | 66.0 | 64.0 | 70.0 | |
| H18 | 87/88 | 5.5 | 9.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 6.0 | 62.0 | 70.0 | 65.0 | 69.0 | |
| H19 | 87/88 | 5.5 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 59.0 | 66.0 | 63.0 | 68.0 | |
| H20 | 87/88 | 7.0 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 57.0 | 66.0 | 66.0 | 71.0 | |
| H21 | 87/88 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 62.0 | 77.0 | 62.0 | 73.0 | |
| H22 | 87/88 | 6.0 | 7.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 6.0 | 40.0 | 35.0 | 71.0 | 75.0 | 6.0 |
| H23 | 87/88 | 5.5 | 9.0 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | bB | f | R | | 6.0 | 55.0 | 63.0 | 67.0 | 72.0 | 6.0 |
| H24 | 87/88 | 7.0 | 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 8.0 | 65.0 | 70.0 | 69.0 | 73.0 | |
| H25 | 87/88 | 7.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 8.0 | 69.0 | 75.0 | 63.0 | 70.0 | |
| H26 | 87/88 | 7.0 | 9.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 66.0 | 71.0 | 67.0 | 71.0 | |
| H27 | 87/88 | 7.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 56.0 | 64.0 | 61.0 | 70.0 | |
| H28 | 87/88 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 59.0 | 62.0 | 67.0 | 69.0 | |
| H29 | 87/88 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 52.0 | 53.0 | 70.0 | 72.0 | |
| H30 | 87/88 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 8.0 | 56.0 | 61.0 | 68.0 | 75.0 | |
| H31 | 87/88 | 7.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 48.0 | 75.0 | 65.0 | 74.0 | |
| H32 | 87/88 | 6.5 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 9.0 | 52.0 | 69.0 | 63.0 | 77.0 | |
| H33 | 87/88 | 8.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | rR | | 9.0 | 51.0 | 62.0 | 66.0 | 72.0 | |
| H34 | 87/88 | | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | R | | 9.0 | 60.0 | 76.0 | 59.0 | 78.0 | |
| H35 | 87/88 | | 9.0 | 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 66.0 | 72.0 | 61.0 | 74.0 | |
| H36 | 87/88 | 7.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 37.0 | 71.0 | 59.0 | 74.0 | |
| H37 | 87/88 | 7.5 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 8.0 | 60.0 | 65.0 | 70.0 | 72.0 | |
| H38 | 87/88 | 6.5 | 9.0 | 5.0 | 6.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 9.0 | 23.0 | 25.0 | 65.0 | 72.0 | 6.0 |
| H39 | 87/88 | 5.0 | 8.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | bB | f | R | | 5.0 | 53.0 | 63.0 | 70.0 | 73.0 | 5.0 |

*Table 1.3: The results of 1 year's exposure of wood with alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I 1 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I 2 | 87/88 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| I 3 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| I 4 | 87/88 | 8.0 | 8.0 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| I 5 | 87/88 | 8.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.2 | | | | |
| I 6 | 87/88 | 8.0 | 8.0 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| I 7 | 87/88 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| I 8 | 87/88 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| I 9 | 87/88 | 9.0 | 9.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.9 | | | | |
| I10 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I11 | 87/88 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 3.2 | | | | |
| I12 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| I13 | 87/88 | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.3 | | | | |
| I14 | 87/88 | 5.5 | 7.5 | 7.5 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| I15 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I16 | 87/88 | 5.0 | 7.0 | 8.0 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I17 | 87/88 | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| I18 | 87/88 | 9.0 | 9.0 | 8.5 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.3 | | | | |
| I19 | 87/88 | 9.0 | 9.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| I20 | 87/88 | 9.0 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| I21 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I22 | 87/88 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I23 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.5 | | | | |
| I24 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.1 | | | | |
| I25 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.2 | | | | |
| I26 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.9 | | | | |
| I27 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.7 | | | | |
| I28 | 87/88 | 9.0 | 9.0 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| I29 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.9 | | | | |
| I30 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| I31 | 87/88 | 9.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 3.1 | | | | |
| I32 | 87/88 | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| I33 | 87/88 | 9.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| I34 | 87/88 | 8.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| I35 | 87/88 | 9.0 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.3 | | | | |
| I36 | 87/88 | 8.5 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.5 | | | | |
| I37 | 87/88 | 9.5 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| I38 | 87/88 | 9.5 | 9.5 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I39 | 87/88 | 9.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |

*Table 1.4: The results of 1 year's exposure of wood with alkylate opaque stain.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K 1 | 87/88 | 8.5 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.7 | | | | |
| K 2 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 5.6 | | | | |
| K 3 | 87/88 | 8.5 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K 4 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K 5 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| K 6 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K 7 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.6 | | | | |
| K 8 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.6 | | | | |
| K 9 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K10 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K11 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K12 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.3 | | | | |
| K13 | 87/88 | 7.5 | 7.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K14 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K15 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K16 | 87/88 | 7.5 | 7.5 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K17 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K18 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| K19 | 87/88 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| K20 | 87/88 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K21 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.3 | | | | |
| K22 | 87/88 | 8.5 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K23 | 87/88 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 5.4 | | | | |
| K24 | 87/88 | 8.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.3 | | | | |
| K25 | 87/88 | 7.5 | 7.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| K26 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 5.0 | | | | |
| K27 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| K28 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K29 | 87/88 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| K30 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K31 | 87/88 | 8.5 | 8.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K32 | 87/88 | 7.5 | 7.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| K33 | 87/88 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.7 | | | | |
| K34 | 87/88 | 7.5 | 7.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K35 | 87/88 | 9.0 | 9.0 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.6 | | | | |
| K36 | 87/88 | 8.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K37 | 87/88 | 9.5 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K38 | 87/88 | 9.5 | 9.5 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K39 | 87/88 | 8.5 | 8.5 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |

*Table 1.5: The results of 2 year's exposure of coil coated steel with alkyd melamine coating.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G 1 | 87/89 | 9.0 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | 7.0 | 9.7 | 6.2 | | | |
| G 2 | 87/89 | 8.0 | 8.5 | 5.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 4.3 | 3.5 | | | 10.0 |
| G 3 | 87/89 | 8.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | 7.0 | 21.0 | 31.0 | | | 10.0 |
| G 4 | 87/89 | 8.0 | 7.5 | 6.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | | | | 7.0 | 13.0 | 12.0 | | | |
| G 5 | 87/89 | 8.5 | 9.0 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 12.0 | 11.0 | | | |
| G 6 | 87/89 | 8.5 | 9.5 | 6.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | | | 8.0 | 12.0 | 11.0 | | | |
| G 7 | 87/89 | 9.0 | 9.5 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 7.6 | 3.8 | | | |
| G 8 | 87/89 | 7.5 | 8.0 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | f | (r) | | 7.0 | 17.0 | 18.0 | | | |
| G 9 | 87/89 | 8.0 | 8.5 | 6.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | (b) | | | | 7.0 | 8.1 | 6.8 | | | |
| G10 | 87/89 | 7.5 | 8.0 | 6.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | r | | 7.0 | 24.0 | 28.0 | | | |
| G11 | 87/89 | 8.5 | 8.5 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | | | 7.0 | 6.4 | 4.2 | | | |
| G12 | 87/89 | 9.0 | 9.5 | 6.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | | f | | | 7.0 | 9.4 | 6.1 | | | |
| G13 | 87/89 | 7.0 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | f | r | | 8.0 | 12.0 | 21.0 | | | |
| G14 | 87/89 | 8.5 | 9.0 | 6.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | | | 8.0 | 12.0 | 14.0 | | | |
| G15 | 87/89 | 7.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 7.0 | 17.0 | 21.0 | | | 10.0 |
| G16 | 87/89 | 8.0 | 6.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | | | 8.0 | 9.8 | 11.0 | | | 10.0 |
| G17 | 87/89 | 8.0 | 8.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 7.0 | 7.2 | 4.3 | | | |
| G18 | 87/89 | 7.0 | 7.0 | 7.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | b | | r | | 7.0 | 17.0 | 15.0 | | | |
| G19 | 87/89 | 8.0 | 8.0 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 7.0 | 8.9 | 6.2 | | | |
| G20 | 87/89 | 9.0 | 9.0 | 6.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | | f | | | 7.0 | 6.6 | 4.0 | | | |
| G21 | 87/89 | 8.0 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | | | 7.0 | 22.0 | 23.0 | | | |
| G22 | 87/89 | 6.0 | 10.0 | 5.5 | 10.0 | 9.5 | 10.0 | 10.0 | | | (b) | f | r | | 7.0 | 2.0 | 2.3 | | | 10.0 |
| G23 | 87/89 | 8.0 | 10.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 6.0 | 5.7 | 4.6 | | | 10.0 |
| G24 | 87/89 | 9.0 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | | | 8.0 | 15.0 | 13.0 | | | |
| G25 | 87/89 | 8.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | f | | | 8.0 | 27.0 | 3.0.0 | | | |
| G26 | 87/89 | 8.0 | 9.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 21.0 | 2.0.0 | | | |
| G27 | 87/89 | 8.0 | 8.0 | 6.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | | | 8.0 | 5.7 | 4.0 | | | |
| G28 | 87/89 | 9.0 | 9.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 7.1 | 4.8 | | | |
| G29 | 87/89 | 8.0 | 9.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | r | | 7.0 | 2.4 | 2.4 | | | 10.0 |
| G30 | 87/89 | 9.0 | 9.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | | | 8.0 | 4.9 | 3.4 | | | |
| G31 | 87/89 | 8.0 | 9.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | 8.0 | 19.0 | 19.0 | | | |
| G32 | 87/89 | 7.5 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 8.0 | 15.0 | 17.0 | | | |
| G33 | 87/89 | 9.0 | 9.5 | 6.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | (f) | | | 9.0 | 6.7 | 8.2 | | | |
| G34 | 87/89 | | 7.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | (r) | | 1.0.0 | | | 27.0 | 35.0 | |
| G35 | 87/89 | | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | 1.0.0 | | | 36.0 | 37.0 | |
| G36 | 87/89 | 8.0 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | | | 9.0 | 15.0 | 19.0 | | | |
| G37 | 87/89 | 9.0 | 10.0 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | (r) | | 7.0 | 5.4 | 5.7 | | | |
| G38 | 87/89 | 8.0 | 8.5 | 5.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | | f | r | | 8.0 | 1.7 | 3.7 | | | 10.0 |
| G39 | 87/89 | 8.0 | 8.0 | 6.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | | f | r | | 7.0 | 8.5 | 8.5 | | | 10.0 |

*Table 1.6: The results of 2 year's exposure of steel panels with silicon alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H 1 | 87/89 | 6.0 | 7.5 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 5.0 | 46.0 | 47.0 | 64.0 | 69.0 | 5.5 |
| H 2 | 87/89 | 7.0 | 8.0 | 7.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 21.0 | 16.0 | 67.0 | 70.0 | |
| H 3 | 87/89 | 4.5 | 6.0 | 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | B | | R | | 3.0 | 42.0 | 65.0 | 63.0 | 69.0 | 5.5 |
| H 4 | 87/89 | 5.5 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 5.0 | 47.0 | 46.0 | 59.0 | 67.0 | 5.5 |
| H 5 | 87/89 | 7.0 | 8.0 | 8.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 48.0 | 35.0 | 64.0 | 67.0 | |
| H 6 | 87/89 | 7.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 47.0 | 45.0 | 61.0 | 69.0 | 5.5 |
| H 7 | 87/89 | 6.0 | 7.5 | 8.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | B | | R | | 6.0 | 44.0 | 38.0 | 58.0 | 65.0 | 5.0 |
| H 8 | 87/89 | 7.0 | 6.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 54.0 | 56.0 | 61.0 | 69.0 | |
| H 9 | 87/89 | 6.0 | 6.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 45.0 | 41.0 | 58.0 | 69.0 | |
| H10 | 87/89 | 6.0 | 7.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 6.0 | 48.0 | 58.0 | 56.0 | 60.0 | 5.5 |
| H11 | 87/89 | 6.5 | 7.0 | 9.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 45.0 | 40.0 | 57.0 | 68.0 | |
| H12 | 87/89 | 7.5 | 8.0 | 7.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 32.0 | 23.0 | 63.0 | 68.0 | |
| H13 | 87/89 | 6.5 | 5.5 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 7.0 | 24.0 | 37.0 | 54.0 | 68.0 | |
| H14 | 87/89 | 7.0 | 7.5 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 35.0 | 37.0 | 55.0 | 63.0 | |
| H15 | 87/89 | .5.0 | 6.0 | 8.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 5.0 | 46.0 | 49.0 | 59.0 | 69.0 | 5.0 |
| H16 | 87/89 | .5.0 | 8.0 | 7.5 | 6.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 7.0 | 29.0 | 22.0 | 51.0 | 58.0 | |
| H17 | 87/89 | 6.5 | .5.0 | 8.5 | 7.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 6.0 | 43.0 | 34.0 | 51.0 | 63.0 | |
| H18 | 87/89 | 5.5 | 6.0 | 8.5 | 7.5 | 10.0 | 10.0 | 10.0 | | | B | | R | | 6.0 | 46.0 | 48.0 | 54.0 | 63.0 | |
| H19 | 87/89 | 5.5 | 6.0 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 6.0 | 42.0 | 39.0 | 49.0 | 59.0 | |
| H20 | 87/89 | 7.0 | 8.0 | 7.5 | 7.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 38.0 | 32.0 | 56.0 | 65.0 | |
| H21 | 87/89 | 7.0 | 8.5 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 53.0 | 53.0 | 58.0 | 71.0 | |
| H22 | 87/89 | 6.0 | 9.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 6.0 | 12.0 | 84 | 64.0 | 67.0 | 5.5 |
| H23 | 87/89 | 5.5 | 8.5 | 6.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 5.0 | 24.0 | 21.0 | 57.0 | 60.0 | 5.5 |
| H24 | 87/89 | 7.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 49.0 | 45.0 | 64.0 | 73.0 | |
| H25 | 87/89 | 7.0 | 8.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | f | R | | 6.0 | 59.0 | 60.0 | 58.0 | 69.0 | |
| H26 | 87/89 | 6.5 | 8.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | B | | R | | 5.0 | 57.0 | 58.0 | 62.0 | 66.0 | |
| H27 | 87/89 | 7.0 | 8.5 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 41.0 | 37.0 | 61.0 | 65.0 | |
| H28 | 87/89 | 7.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 36.0 | 27.0 | 64.0 | 67.0 | |
| H29 | 87/89 | 6.5 | 9.0 | 6.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | B | | R | | 5.0 | 13.0 | 10.0 | 62.0 | 66.0 | |
| H30 | 87/89 | 7.0 | 8.0 | 8.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | R | | 7.0 | 37.0 | 27.0 | 63.0 | 68.0 | |
| H31 | 87/89 | 7.0 | 8.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 7.0 | 50.0 | 49.0 | 65.0 | 71.0 | |
| H32 | 87/89 | 6.5 | 6.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 7.0 | 37.0 | 43.0 | 61.0 | 71.0 | |
| H33 | 87/89 | 8.5 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | r | | 9.0 | 31.0 | 23.0 | 56.0 | 62.0 | |
| H34 | 87/89 | | 6.5 | 9.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | R | | 8.0 | 52.0 | 67.0 | 63.0 | 74.0 | |
| H35 | 87/89 | | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | bB | (f) | R | | 5.0 | 40.0 | 37.0 | 65.0 | 68.0 | |
| H36 | 87/89 | 7.0 | 7.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | R | | 6.0 | 31.0 | 46.0 | 62.0 | 69.0 | |
| H37 | 87/89 | 7.0 | 9.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 24.0 | 15.0 | 68.0 | 73.0 | |
| H38 | 87/89 | 6.5 | 7.0 | 3.0 | .5.0 | 10.0 | 10.0 | 10.0 | | | bB | | R | | 6.0 | 5.0 | 735 | 6.06 | 5.0 | 5.0 |
| H39 | 87/89 | .5.0 | 6.0 | 8.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | B | | R | | 4.0 | 25.0 | 35.0 | 62.0 | 68.0 | 5.0 |

*Table 1.7: The results of 2 year's exposure of wood panels with alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I 1 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I 2 | 87/89 | 9.0 | 9.0 | 7.5 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| I 3 | 87/89 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I 4 | 87/89 | 9.5 | 9.5 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I 5 | 87/89 | 9.0 | 9.0 | 6.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| I 6 | 87/89 | 9.5 | 9.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I 7 | 87/89 | 8.0 | 8.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I 8 | 87/89 | 9.5 | 9.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| I 9 | 87/89 | 9.0 | 9.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I10 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.1 | | | | |
| I11 | 87/89 | 9.0 | 9.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| I12 | 87/89 | 9.0 | 9.0 | 6.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| I13 | 87/89 | 6.0 | 6.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| I14 | 87/89 | 5.0 | 9.0 | 6.5 | 6.0 | 10.0 | 9.5 | 10.0 | | | | | | | | 2.1 | | | | |
| I15 | 87/89 | 9.5 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I16 | 87/89 | 3.0 | 9.0 | 8.0 | 3.0 | 10.0 | 6.0 | 10.0 | | | | | | | | 1.8 | | | | |
| I17 | 87/89 | 8.0 | 9.0 | 6.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| I18 | 87/89 | 5.0 | 9.0 | 8.5 | 6.0 | 10.0 | 8.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I19 | 87/89 | 6.0 | 9.0 | 7.0 | 6.0 | 10.0 | 9.5 | 10.0 | | | | | | | | 3.0 | | | | |
| I20 | 87/89 | 5.0 | 9.0 | 7.0 | 6.0 | 10.0 | 9.5 | 10.0 | | | | | | | | 2.8 | | | | |
| I21 | 87/89 | 9.5 | 9.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I22 | 87/89 | 9.5 | 9.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I23 | 87/89 | 9.0 | 9.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I24 | 87/89 | 9.5 | 9.5 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.9 | | | | |
| I25 | 87/89 | 9.0 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| I26 | 87/89 | 8.0 | 8.0 | 6.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I27 | 87/89 | 9.0 | 9.0 | 8.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 3.0 | | | | |
| I28 | 87/89 | 9.5 | 9.5 | 7.0 | 9.5 | 10.0 | 9.5 | 10.0 | | | | | | | | 2.9 | | | | |
| I29 | 87/89 | 9.5 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| I30 | 87/89 | 9.5 | 9.5 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| I31 | 87/89 | 9.5 | 9.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I32 | 87/89 | 6.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I33 | 87/89 | 10.0 | 10.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I34 | 87/89 | 7.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| I35 | 87/89 | 8.0 | 8.0 | 7.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| I36 | 87/89 | 6.0 | 6.0 | 6.0 | 7.5 | 10.0 | 9.0 | 10.0 | | | | | | | | 2.3 | | | | |
| I37 | 87/89 | 10.0 | 10.0 | 6.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| I38 | 87/89 | 9.0 | 9.0 | 5.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| I39 | 87/89 | 9.0 | 9.0 | 6.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |

*Table 1.8: The results of 2 year's exposure of wood panels with acrylate opaque stain.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K 1 | 87/89 | 8.0 | 8.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K 2 | 87/89 | 8.0 | 8.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K 3 | 87/89 | 8.0 | 8.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K 4 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K 5 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| K 6 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.5 | | | | |
| K 7 | 87/89 | 9.0 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K 8 | 87/89 | 8.0 | 8.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K 9 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K10 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.8 | | | | |
| K11 | 87/89 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K12 | 87/89 | 10.0 | 10.0 | 5.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K13 | 87/89 | 6.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| K14 | 87/89 | 9.0 | 9.0 | 6.0 | 10.0 | 9.5 | 10.0 | 9.5 | | | | | | | | 2.4 | | | | |
| K15 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K16 | 87/89 | 7.0 | 7.0 | 7.0 | 9.5 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.7 | | | | |
| K17 | 87/89 | 7.0 | 7.0 | 7.0 | 10.0 | 10.0 | 10.0 | 9.5 | | | | | | | | 2.8 | | | | |
| K18 | 87/89 | 8.0 | 8.0 | 7.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K19 | 87/89 | 8.0 | 8.0 | 6.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K20 | 87/89 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K21 | 87/89 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| K22 | 87/89 | 9.0 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K23 | 87/89 | 10.0 | 10.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.9 | | | | |
| K24 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.6 | | | | |
| K25 | 87/89 | 8.0 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K26 | 87/89 | 9.0 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| K27 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K28 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K29 | 87/89 | 9.0 | 9.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.1 | | | | |
| K30 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.2 | | | | |
| K31 | 87/89 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K32 | 87/89 | 6.0 | 6.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| K33 | 87/89 | 9.0 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K34 | 87/89 | 7.0 | 7.0 | 8.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K35 | 87/89 | 9.0 | 9.0 | 6.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.6 | | | | |
| K36 | 87/89 | 8.0 | 8.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K37 | 87/89 | 10.0 | 10.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K38 | 87/89 | 10.0 | 10.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K39 | 87/89 | 8.0 | 8.0 | 6.0 | 9.0 | 10.0 | 10.0 | 9.0 | | | | | | | | 2.4 | | | | |

*Table 1.9: The results of 4 year's exposure of coil coated steel with alkyd melamine coating.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G 1 | 87/91 | 8.0 | 8.5 | 0.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 2.5 | | | | 10.0 |
| G 2 | 87/91 | 8.0 | 9.0 | 0.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 2.0 | | | | 10.0 |
| G 3 | 87/91 | 7.5 | 7.0 | 3.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 9.0 | | | | 10.0 |
| G 4 | 87/91 | 6.0 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 6.0 | 2.2 | | | | |
| G 5 | 87/91 | 9.0 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 2.2 | | | | |
| G 6 | 87/91 | 9.0 | 9.0 | 1.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 7.0 | 2.3 | | | | |
| G 7 | 87/91 | 6.5 | 9.0 | 0.5 | 7.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 6.0 | 2.2 | | | | |
| G 8 | 87/91 | 6.5 | 9.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 7.0 | 4.6 | | | | |
| G 9 | 87/91 | 8.0 | 9.0 | 1.0 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 7.0 | 2.1 | | | | |
| G10 | 87/91 | 7.5 | 8.0 | 2.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | | | 7.0 | 6.9 | | | | |
| G11 | 87/91 | 7.0 | 8.0 | 1.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 6.0 | 2.2 | | | | |
| G12 | 87/91 | 6.0 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | | r | | 7.0 | 2.3 | | | | |
| G13 | 87/91 | 6.0 | 6.5 | 2.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | (r) | | 7.0 | 6.0 | | | | |
| G14 | 87/91 | 7.0 | 9.0 | 1.0 | 6.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | (r) | | 7.0 | 3.2 | | | | |
| G15 | 87/91 | 8.0 | 8.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 6.0 | 4.4 | | | | 10.0 |
| G16 | 87/91 | 6.0 | 9.0 | 0.5 | 6.0 | 10.0 | 10.0 | 10.0 | | | b | | | | 7.0 | 2.3 | | | | 10.0 |
| G17 | 87/91 | 7.5 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | | | 7.0 | 2.5 | | | | |
| G18 | 87/91 | 8.0 | 9.0 | 1.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 7.0 | 4.5 | | | | |
| G19 | 87/91 | 9.0 | 9.0 | 1.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | (r) | | 7.0 | 2.4 | | | | |
| G20 | 87/91 | 6.0 | 9.0 | 1.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | (f) | (r) | | 7.0 | 2.0 | | | | |
| G21 | 87/91 | 7.5 | 9.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | f | (r) | | 7.0 | 4.1 | | | | |
| G22 | 87/91 | 5.0 | 9.0 | 0.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | fF | r | | 5.0 | 1.7 | | | | 10.0 |
| G23 | 87/91 | 7.5 | 9.0 | 0.5 | 6.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | r | | 5.0 | 1.9 | | | | 10.0 |
| G24 | 87/91 | 9.0 | 9.5 | 0.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 7.0 | 2.6 | | | | |
| G25 | 87/91 | 7.5 | 9.0 | 2.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | | | 7.0 | 7.6 | | | | |
| G26 | 87/91 | 7.5 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 8.0 | 3.7 | | | | |
| G27 | 87/91 | 8.0 | 9.0 | 0.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | b | | | | 7.0 | 2.0 | | | | |
| G28 | 87/91 | 9.0 | 9.5 | 0.5 | 9.0 | 10.0 | 10.0 | 10.0 | | | b | | (r) | | 7.0 | 2.2 | | | | |
| G29 | 87/91 | 9.0 | 9.5 | 0.5 | 8.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 7.0 | 1.7 | | | | |
| G30 | 87/91 | 7.0 | 9.0 | 0.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | (b) | (f) | | | 7.0 | 2.0 | | | | |
| G31 | 87/91 | 7.0 | 9.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | (f) | | | 8.0 | 5.9 | | | | |
| G32 | 87/91 | 8.0 | 8.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | b | | r | | 7.0 | 4.6 | | | | |
| G33 | 87/91 | 7.0 | 9.0 | 0.5 | 10.0 | 10.0 | 10.0 | 9.0 | | | | (f) | | | 9.0 | 2.7 | | | | |
| G34 | 87/91 | | | | | | | | | | | | | | | | 26.0 | | | |
| G35 | 87/91 | | | | | | | | | | | | | | | | 26.0 | | | |
| G36 | 87/91 | 8.0 | 9.0 | 0.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 8.0 | 4.0 | | | | |
| G37 | 87/91 | 7.5 | 9.0 | 1.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | | (r) | | 7.0 | 2.0 | | | | |
| G38 | 87/91 | 6.5 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | | (b) | f | r | | 7.0 | 1.5 | | | | 10.0 |
| G39 | 87/91 | 6.0 | 9.0 | 0.5 | 7.5 | 10.0 | 10.0 | 10.0 | | | (b) | fF | rR | | 5.0 | 2.4 | | | | 10.0 |

*Table 1.10: The results of 4 year's exposure of steel panels with silicon alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H 1 | 87/91 | 6.5 | 8.0 | 3.0 | 7.0 | 10.0 | 10.0 | 10.0 | | 5.0 | b | | R | | 5.0 | 13.0 | | 52.0 | | 8.0 |
| H 2 | 87/91 | 7.0 | 9.0 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | 3.0 | b | | R | | 6.0 | 4.4 | | 46.0 | | |
| H 3 | 87/91 | 4.0 | 7.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 27.0 | B | F | R | | 0.0 | 17.0 | | 48.0 | | 6.5 |
| H 4 | 87/91 | 7.0 | 9.0 | 0.5 | 6.0 | 10.0 | 10.0 | 10.0 | | 4.0 | B | | R | | 5.0 | 4.8 | | 45.0 | | 7.0 |
| H 5 | 87/91 | 7.5 | 8.5 | 0.5 | 7.0 | 10.0 | 10.0 | 10.0 | | 3.0 | b | | R | | 5.0 | 4.3 | | 42.0 | | |
| H 6 | 87/91 | 7.5 | 8.5 | 2.0 | 9.5 | 10.0 | 10.0 | 10.0 | | 2.0 | B | | R | | 5.0 | 7.7 | | 47.0 | | 7.0 |
| H 7 | 87/91 | 7.0 | 9.0 | 0.5 | 6.0 | 10.0 | 10.0 | 10.0 | | 5.0 | B | | R | | 5.0 | 7.9 | | 43.0 | | 7.0 |
| H 8 | 87/91 | 8.0 | 9.0 | 2.0 | 9.0 | 10.0 | 10.0 | 10.0 | | 2.0 | bB | | R | | 5.0 | 20.0 | | 50.0 | | |
| H 9 | 87/91 | 7.0 | 7.5 | 1.0 | 7.5 | 10.0 | 10.0 | 10.0 | | 2.0 | B | | R | | 5.0 | 9.5 | | 41.0 | | |
| H10 | 87/91 | 6.0 | 7.0 | 2.0 | 9.5 | 10.0 | 10.0 | 10.0 | | 8.0 | B | | R | | 3.0 | 13.0 | | 42.0 | | 8.0 |
| H11 | 87/91 | 6.5 | 6.0 | 1.0 | 7.0 | 10.0 | 10.0 | 10.0 | | 3.0 | bB | | R | | 5.0 | 8.0 | | 44.0 | | |
| H12 | 87/91 | 6.5 | 8.5 | 0.5 | 7.5 | 10.0 | 10.0 | 10.0 | | 2.0 | bB | | R | | 5.0 | 4.0 | | 43.0 | | |
| H13 | 87/91 | 6.5 | 5.0 | 1.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 1.0 | b | | R | | 8.0 | 8.3 | | 45.0 | | |
| H14 | 87/91 | 7.0 | 6.0 | 0.5 | 10.0 | 10.0 | 10.0 | 10.0 | | 3.0 | b | | R | | 8.0 | 8.7 | | 35.0 | | |
| H15 | 87/91 | 6.0 | 7.5 | 2.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 11.0 | B | | R | | 3.0 | 13.0 | | 45.0 | | 7.5 |
| H16 | 87/91 | 6.5 | 9.0 | 0.5 | 6.0 | 10.0 | 10.0 | 10.0 | | 7.0 | B | | R | | 5.0 | 7.8 | | 37.0 | | |
| H17 | 87/91 | 6.5 | 8.0 | 5.0 | 6.0 | 10.0 | 10.0 | 10.0 | | 2.0 | b | | R | | 5.0 | 16.0 | | 29.0 | | |
| H18 | 87/91 | 6.0 | 6.0 | 3.0 | 7.0 | 10.0 | 10.0 | 10.0 | | 5.0 | B | | R | | 5.0 | 17.0 | | 25.0 | | |
| H19 | 87/91 | 6.0 | 8.5 | 4.0 | 7.0 | 10.0 | 10.0 | 10.0 | | 6.0 | B | | R | | 5.0 | 13.0 | | 26.0 | | |
| H20 | 87/91 | 7.0 | 8.5 | 1.0 | 7.0 | 10.0 | 10.0 | 10.0 | | 4.0 | bB | | R | | 5.0 | 7.7 | | 36.0 | | |
| H21 | 87/91 | 7.5 | 9.5 | 3.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 3.0 | bB | | R | | 6.0 | 16.0 | | 48.0 | | |
| H22 | 87/91 | 7.0 | 9.5 | 3.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 4.0 | B | | R | | 6.0 | 4.4 | | 39.0 | | 6.5 |
| H23 | 87/91 | 5.0 | 9.0 | 1.0 | 6.0 | 10.0 | 10.0 | 10.0 | | 6.0 | B | | R | | 5.0 | 3.3 | | 27.0 | | 8.0 |
| H24 | 87/91 | 8.5 | 9.5 | 2.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 3.0 | b | | R | | 7.0 | 10.0 | | 48.0 | | |
| H25 | 87/91 | 8.5 | 9.0 | 3.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 1.0 | b | | R | | 7.0 | 23.0 | | 46.0 | | |
| H26 | 87/91 | 6.0 | 9.0 | 2.0 | 4.5 | 10.0 | 10.0 | 10.0 | | 3.0 | B | | R | | 6.0 | 11.0 | | 44.0 | | |
| H27 | 87/91 | 7.0 | 9.0 | 2.0 | 9.0 | 10.0 | 10.0 | 10.0 | | 2.0 | bB | | R | | 6.0 | 6.1 | | 19.0 | | |
| H28 | 87/91 | 7.0 | 9.5 | 1.0 | 8.0 | 10.0 | 10.0 | 10.0 | | 1.0 | b | | R | | 7.0 | 6.4 | | 12.0 | | |
| H29 | 87/91 | 5.0 | 9.0 | 2.0 | 9.0 | 10.0 | 10.0 | 10.0 | 8F | 4.0 | B | | R | | 4.0 | 3.6 | | 38.0 | | |
| H30 | 87/91 | 7.0 | 8.0 | 2.0 | 9.0 | 10.0 | 10.0 | 10.0 | | 2.0 | b | | R | | 7.0 | 7.6 | | 46.0 | | |
| H31 | 87/91 | 7.5 | 8.5 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 1.0 | b | | R | | 5.0 | 13.0 | | 51.0 | | |
| H32 | 87/91 | 67 | 7.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | 3.0 | bB | | R | | 5.0 | 13.0 | | 45.0 | | |
| H33 | 87/91 | 9.0 | 9.5 | 1.0 | 9.5 | 10.0 | 10.0 | 10.0 | | 0.0 | (b) | | r | | 9.0 | 7.6 | | 45.0 | | 8.0 |
| H34 | 87/91 | 8.0 | 8.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 29.0 | | 51.0 | | |
| H35 | 87/91 | 9.0 | 9.0 | 4.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 4.3 | | 47.0 | | |
| H36 | 87/91 | 7.0 | 8.0 | 4.0 | 9.5 | 10.0 | 10.0 | 10.0 | | 1.0 | b | | R | | 7.0 | 6.7 | | 41.0 | | |
| H37 | 87/91 | 7.0 | 9.0 | 1.0 | 6.0 | 10.0 | 10.0 | 10.0 | | 3.0 | bB | | R | | 6.0 | 4.2 | | 43.0 | | |
| H38 | 87/91 | 7.0 | 9.0 | 0.0 | 5.0 | 10.0 | 10.0 | 10.0 | | 6.0 | bB | | R | | 6.0 | 2.1 | | 31.0 | | 8.0 |
| H39 | 87/91 | 4.0 | 9.0 | 5.0 | 6.0 | 10.0 | 10.0 | 10.0 | | 20.0 | b | | R | | 1.0 | 5.0 | | 46.0 | | 8.0 |

*Table 1.11: The results of 4 year's exposure of wood panel with alkyd paint.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I 1 | 87/91 | 5.0 | 5.0 | 4.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| I 2 | 87/91 | 6.0 | 8.0 | 4.0 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| I 3 | 87/91 | 7.0 | 9.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| I 4 | 87/91 | 6.0 | 9.0 | 5.5 | 6.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| I 5 | 87/91 | 5.0 | 8.0 | 5.5 | 4.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I 6 | 87/91 | 9.0 | 9.0 | 5.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I 7 | 87/91 | 5.0 | 9.0 | 4.0 | 3.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.5 | | | | |
| I 8 | 87/91 | 9.0 | 9.0 | 4.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| I 9 | 87/91 | 7.0 | 8.0 | 6.0 | 6.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| I10 | 87/91 | 8.0 | 9.0 | 6.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| I11 | 87/91 | 8.0 | 8.0 | 6.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.5 | | | | |
| I12 | 87/91 | 4.0 | 9.0 | 5.0 | 3.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| I13 | 87/91 | 8.0 | 8.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.8 | | | | |
| I14 | 87/91 | 7.0 | 8.0 | 5.0 | 6.0 | 10.0 | 9.0 | 10.0 | | | | | | | | 1.5 | | | | |
| I15 | 87/91 | 9.5 | 9.0 | 5.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| I16 | 87/91 | 2.0 | 9.0 | 5.5 | 2.0 | 10.0 | 9.0 | 10.0 | | | | | | | | 0.9 | | | | |
| I17 | 87/91 | 4.0 | 9.0 | 6.0 | 4.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.6 | | | | |
| I18 | 87/91 | 3.0 | 9.0 | 7.0 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.5 | | | | |
| I19 | 87/91 | 5.0 | 9.0 | 6.0 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| I20 | 87/91 | 4.0 | 9.0 | 6.0 | 4.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.4 | | | | |
| I21 | 87/91 | 10.0 | 10.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I22 | 87/91 | 8.5 | 8.5 | 5.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| I23 | 87/91 | 4.0 | 9.0 | 5.5 | 4.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| I24 | 87/91 | 8.5 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| I25 | 87/91 | 8.5 | 8.5 | 5.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| I26 | 87/91 | 5.0 | 9.0 | 5.0 | 3.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.7 | | | | |
| I27 | 87/91 | 9.0 | 9.0 | 5.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| I28 | 87/91 | 8.0 | 8.5 | 5.0 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I29 | 87/91 | 6.0 | 9.0 | 7.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I30 | 87/91 | 9.0 | 9.0 | 5.5 | 8.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| I31 | 87/91 | 10.0 | 10.0 | 5.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| I32 | 87/91 | 7.5 | 7.5 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.8 | | | | |
| I33 | 87/91 | 10.0 | 10.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| I34 | 87/91 | 7.5 | 7.5 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| I35 | 87/91 | 5.5 | 8.0 | 5.5 | 6.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| I36 | 87/91 | 5.5 | 5.5 | 5.5 | 7.5 | 10.0 | 5.0 | 10.0 | | | | | | | | 1.6 | | | | |
| I37 | 87/91 | 6.0 | 8.5 | 5.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| I38 | 87/91 | 5.0 | 8.0 | 5.0 | 3.0 | 10.0 | 9.0 | 10.0 | | | | | | | | 1.3 | | | | |
| I39 | 87/91 | 6.0 | 9.0 | 4.0 | 7.0 | 10.0 | 9.5 | 10.0 | | | | | | | | 2.1 | | | | |

*Table 1.12: The results of 4 year's exposure of wood panels with acrylate opaque stain.*

| Site | Year | Gen. appearance | Dirt | Chalking | Fungus | Flaking | Cracking | Checking | | | Damage located in and near cut | | | | | Glass | | | | Adhesion |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| K 1 | 87/91 | 8.5 | 8.5 | 9.5 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K 2 | 87/91 | 9.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K 3 | 87/91 | 8.5 | 8.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| K 4 | 87/91 | 8.5 | 9.0 | 5.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K 5 | 87/91 | 9.5 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.0 | | | | |
| K 6 | 87/91 | 9.5 | 9.0 | 4.5 | 10.0 | 10.0 | 10.0 | 9.0 | | | | | | | | 3.2 | | | | |
| K 7 | 87/91 | 9.0 | 9.0 | 4.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K 8 | 87/91 | 9.5 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.5 | | | | |
| K 9 | 87/91 | 9.5 | 10.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.4 | | | | |
| K10 | 87/91 | 9.5 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K11 | 87/91 | 9.5 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K12 | 87/91 | 8.5 | 9.0 | 5.0 | 7.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K13 | 87/91 | 8.0 | 7.5 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.7 | | | | |
| K14 | 87/91 | 9.0 | 9.0 | 4.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K15 | 87/91 | 9.5 | 8.5 | 4.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| K16 | 87/91 | 4.0 | 8.0 | 4.0 | 4.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K17 | 87/91 | 9.0 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K18 | 87/91 | 8.0 | 7.5 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.4 | | | | |
| K19 | 87/91 | 8.5 | 7.5 | 5.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.8 | | | | |
| K20 | 87/91 | 8.5 | 8.0 | 7.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K21 | 87/91 | 9.5 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.8 | | | | |
| K22 | 87/91 | 9.5 | 9.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.0 | | | | |
| K23 | 87/91 | 9.0 | 9.0 | 7.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K24 | 87/91 | 9.5 | 10.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 3.3 | | | | |
| K25 | 87/91 | 10.0 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K26 | 87/91 | 8.5 | 9.0 | 6.0 | 7.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K27 | 87/91 | 9.5 | 9.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.6 | | | | |
| K28 | 87/91 | 9.5 | 9.0 | 7.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K29 | 87/91 | 8.5 | 9.0 | 5.0 | 9.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.1 | | | | |
| K30 | 87/91 | 9.5 | 10.0 | 5.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K31 | 87/91 | 9.5 | 9.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K32 | 87/91 | 8.5 | 8.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| K33 | 87/91 | 10.0 | 10.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.3 | | | | |
| K34 | 87/91 | 9.5 | 9.5 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K35 | 87/91 | 10.0 | 10.0 | 7.5 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.7 | | | | |
| K36 | 87/91 | 9.5 | 9.0 | 4.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K37 | 87/91 | 10.0 | 10.0 | 6.0 | 10.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |
| K38 | 87/91 | 8.0 | 9.0 | 4.0 | 5.0 | 10.0 | 10.0 | 10.0 | | | | | | | | 1.9 | | | | |
| K39 | 87/91 | 9.5 | 9.0 | 4.0 | 9.5 | 10.0 | 10.0 | 10.0 | | | | | | | | 2.2 | | | | |

# Annex 2

## Paint evaluation

# 1. General comments to the evaluation

The evaluation has followed international standards where standards have been available. All evaluations were made from three parallels.

We have chosen to follow the ASTM-standards since their standards cover most of the parameters evaluated. Even when ISO-standards were available the similar ASTM-standards were preferred. The ISO-standards were used for some rating with a transformation to the 1-10 scale. The transformation is shown in Table 1.

*Table 1:*

| Rating ASTM | Rating ISO | Intensity of change |
|---|---|---|
| 10 | 0 | Unchanged |
| 9 | 1 | Very slight |
| 8 | | |
| 7 | 2 | Slight |
| 6 | | |
| 5 | 3 | Moderate (reparation may be needed) |
| 4 | | |
| 3 | 4 | Considerable |
| 2 | | |
| 1 | 5 | Severe |

Some of the columns give descriptions of the deterioration pattern seen and special scales are made for these columns.

Since nearly all evaluations made for paint systems to some degree will be subjective, we have made coloured photo-standards for the rating using a selection of the exposed samples. The same series of samples will always be used and extensions will be made if necessary. This is done to prevent movements and changes in the rating scale.

# 2. Comments to the scheme

## Column 1

Countries which participate in the project.

## Column 2

Number-code for the test sites.

## Column 3

***General appearance (ASTN D 1150-55)***

In this report the rating shall give information about the overall picture of the test samples. To interpret the rating of the general appearance consideration must be taken to the rest of the evaluations made. At rating 5 action for special treatment or repainting may be taken. After one year of exposure there was a strong

connection between general appearance and dirt, and after two years with dirt or fungus.

Note that interpolation like 9.5. 8.5 and so on is used for the rating.

### Column 4

***Dirt (ASTM D 3719-87)***

Photo-standards have been made for all four paint systems. It is sometimes difficult to distinguish between dirt and fungus since the fungus is of the black surface type. After we have started to use a transparent tape for moving a sample from the paint surface to a glass plate and use the microscope, distinguishing between fungus and dirt has become much easier.

### Column 5

***Chalking (ASTM 4214-82 and ISO 4628/6)***

The test is made by use of tape (Scotch Magic no. 810). The tape (ca. 5 cm) was pressed against the painted surface and pulled off again. By sticking the tape on a black cardboard the chalking appeared and a reference system was made. When the rating 1 is reached, the tape cannot receive more "chalking", but the chalking, may still grow deeper in the surface of the sample. The second year we have used a black electrotape Scotch Super 88 sticked to a transparent plastic card, since we wished to have a more flexible tape for the test of the wood panels.

The results from the paint system G were used as a standard.

### Column 6

***Fungus (ASTM D 3274-82 and ASTM D 4610-86)***

The fungus-hyphae are small and we have made a special evaluation rating for inspection in the microscope.

Magnification used: 10-20
Inspected area: approximately 1.0 $cm^2$

| Rating | Description of attack |
|---|---|
| 10 | No attack |
| 9.5 | 2-3 places with traces of fungus-hyphae |
| 9 | Traces of fungus-hyphae several places |
| 8 | Fungi in about 50% of the inspected areas |
| 7 | Fungi can be seen in almost 100% of the areas |
| 6 | Fungi all over the sample. Moderate amounts |

### Column 7-9

***Flaking (ASTM D 772-86 and ISO 4628/5)***
***Cracking (ASTM D 661-86 and ISO 4628/4)***
***Checking (ASTM D 660-44 and ASTM D 660/87)***

Some wood panels show types of checking, long line and sigmoid types, the sigmoid type is marked by "sig" in column 22. The damage may be difficult to observe without the use of microscope.

### Column 10-11

The columns are free.

Possible use is ***blistering (ISO-4628/2) and rusting (ISO- 4628/3).***

### Column 12

Used only for painted metals.

***Blistering near cut***: Special scale.

| Rating | Defects |
|---|---|
| Open space | No blisters |
| (b) | Few blisters |
| b | Moderate amount |
| bB | Considerable amount |
| B | The area dominated by blisters |

### Column 13

Used only for painted metals.

***Flaking near cut:*** Special scale.

| Rating | Defects |
|---|---|
| Open space | No flacking |
| (f) | Slight flacking |
| f | Moderate flacking |
| fF | Considerable flacking |
| F | The area dominated by flacking |

As a part of the evaluation of flacking, tape (Scotch Ruban Adhesif) was used to pull off the flacked area around the cut.

### Column 14

Used only for painted metals.

***Rust in cut:*** Special scale.

| Rating | Defects |
|---|---|
| Open space | No rust |
| (r) | Slight corrosion |
| r | Moderate corrosion |
| rB | Considerable corrosion |
| R | Severe corrosion |

### Column 15

Used only for painted metals.

*Damage area*: Not used.

Plan is made to measure the damage area around cut by use of image analysis.

### Column 16

Used only for painted metals.

*Damage (ASTM D 1654-79a)*

Recording of loss of paint as mean creepage in mm from the cut. Differences in the corrosion attack are often seen and notes are often given in column 22 (notes). The codes used are:

| | |
|---|---|
| d = discontinuous: | Damages around the cut with parts without damages. |
| s = spotty: | Occasional damages around the cut. |

### Column 17-20

*Gloss*

Gloss instrument used: Glossmaster/Erichsen.

Measurements of the light reflection in % at $60^{\circ}$ angle.

Measurements were made both unwashed and washed. The washing was done by water and synthetic soap using paper towel for washing and drying.

For the painted steel systems, G and H, the results given are the mean value of three measurements. For the painted wood systems, I and K, the results given are the middle value of three measurements.

### Column 21

*Adhesion (Cross-cut ISO 2409)*

The cross-cut was only used for the painted metals. The adhesion test was only made with panels from the most deteriorated places.

Reference values for unexposed paints were (in ASTM-ratings):

| | | |
|---|---|---|
| Material G | Coil coated galvanized steel | = 10 |
| Material H | Silicon alkyd | = 6 |

Adhesion test on painted wood was not successful. Pull off test like ASTM D 4541 always gave adhesion failure in the wood in stead of in the interface between paint and wood.

**Column 22**

NOTES: The numbers refer to the actual column.

Codes used for the second year evaluation are:

rw = flow of rust water from the cut
sig. = (see column 7-9)
d = (see column 16)
s = (see column 16)

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TITLE

Evaluation of decay of painted systems for wood, steel and galvanized steel after 4 years exposure

PROJECT LEADER

J.F. Henriksen

NILU PROJECT NO.

O-8208

AUTHOR(S)

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CLASSIFICATION *

A

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ABSTRACT

The results of the 4 years of exposure of the paint systems for steel and wood is presented. The 1 and 2 year results are included for interpretation purposes.

The damages observed were still mainly related to the deterioration parameters general appearance, dirt, chalking and fungus, and for steel damage around an artificial cut. The effect of the local environment on the performance and the lifetime of paint systems can be observed in the figures in Annex 1. By linear regression analysis it is observed that the pollutant influence of $SO_2$ dominates the damage around the artificial cut. Pollutants also effect the parameter dirt.

For chalking and fungus the meteorological parameters sunhours, precipitation and time of wetness (TOW) increase with increasing deterioration. $SO_2$ reduces the fungus growth for all paint systems.

NORWEGIAN TITLE

| DESCRIPTORS | | |
|---|---|---|
| Environment | Paint | Deterioration |

ABSTRACT (in Norwegian)

* *Classification*

- *A Unclassified (can be ordered from NILU)*
- *B Restricted distribution*
- *C Classified (not to be distributed)*