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Project Summary

Galvanized Steel – National Distribution Study

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The full report describes a field survey done to observe the extent and application of barge galvanized steel in the United States. For purposes, of the analysis, the conterminous 48 states were grouped into four regions. Industrial and rural areas were considered in the study which examined galvanized steel applications of roofing, siding, gutters and flashing, transmission line towers, fencing, pole line hardware, guardrails, and storage facilities. A field survey was conducted in four cities thought to be representative of each region for visual inventory. In-house surveying was then performed using aerial photography corresponding to the areas visited and relevant land use data to calculate surface area of the observed galvanized steel. Extrapolation to entire metropolitan areas was done through the land use statisticcs. Estimates of galvanized steel surface in non-residential urban areas from the survey observations are 9.2×10^4 m^2 for Cleveland, 53.8×10^4 m^2 for Atlanta, 38.6×10^4 m^2 for Dallas, and 256.8×10^4 m^2 for Sacramento.

This Project Summary was developed by EPA's Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

A field survey was done to determine the extent that bare galvanized steel is used in the United States. Galvanized steel is widely used for roofing, siding, gutters, flashings, tramsmission line towers, fencing, telephone pole hardware, guardrails and storage facilities such as sheds and warehouses. The survey was done in four cities which were selected as representative of the four major geographic regions of the United States. The four cities and the regions they represented are: Cleveland, OH (Northeast), Atlanta, GA (Southeast), Dallas, TX (Central) and Sacramento, CA (West). In the survey, the surface area of the galvanized steel used in buildings, towers, poles, fences and guardrails was determined.

An initial selection of ground survey areas was made from groupings of industrial land use near the downtown area and groupings of mixed industrial/commercial or commercial land use in the suburbs. In Atlanta, where no large industrial concentration existed, only mixed industrial/commercial sections were visited.

Sections of 2 or 3 blocks to be canvassed were selected upon arrival within the survey area. Any structure sighted with a galvanized coating was sketched. Galvanizing was identified from the material's characteristic coloring and granular appearance of the surface zinc crystals. The structure's position was noted in relation to adjacent landmarks and, if access was possible, a photograph was taken along with a meter rod for scaling. If not accessible, the structure height was estimated and noted on the sketch.

The emphasis was to cover as many blocks as possible at the expense of missing small amounts. USGS topographical maps were obtained in each city to confirm exact building location. The sketch and photo were used to show which surfaces of the

building were galvanized as well as building dimensions. All blocks visited were counted as part of the area surveyed, regardless of whether or not galvanized steel was found.

Surface areas of galvanized steel were calculated using the field notes and photographs. Aerial photographs were viewed under magnification to locate the structure within the survey area and obtain roof dimensions. These amounts, by application, were multiplied by land use area within the metropolis to obtain a total for each land use category.

Galvanized steel usage on farms was recorded by number of farms instead of land use since a count of the number of farms for 1985 was available. In this survey, farm fencing was not considered; the fence category for farms refers to formed sheet- metal gates.

Extrapolation to entire metropolitan areas was done through land use statistics. Estimates of galvanized steel surface in non- residential urban areas from the survey observations are 9.2×10^4 m^2 for Cleveland, 53.8×10^4 m^2 for Atlanta, 38.6×10^4 m^2 for Dallas, and 256.8×10^4 m^2 for Sacramento.

A comparison was made between the results of this survey and those of two other surveys of the material. One was performed by TRC Environmental Consultants and the other by the U.S. Army Corps of Engineers, Cold Regions Research Environmental Laboratory (CRREL). The results of the CRREL survey were summarized by Haynie (Personal Communication, 1988) and were used in the report.

A t-test procedure was used to evaluate difference of means between surface areas surveyed for roofing, siding, fencing and "other" applications and two other earlier surveys (CRREL and TRC) covering rural and industrial areas. With the exception of farm fencing, no significant difference was found at the 90% confidence level between sample means. However, the Aerocomp values tended to be lower; partly due to the survey method, which sometimes overlooked small surfaces. On fencing, the CRREL survey recorded plane surfaces, whereas Aerocomp calculated the actual wire surface of fencing. As noted earlier, perimeter fencing on farms was not included in the Aerocomp survey, so that a significant difference exists for this application.

A survey was made of highway departments of the 48 states to obtain guardrail and fencing mileage. Responses varied markedly. Some states had the figures readily available whereas others had never made a survey. Totals for highway guardrail were received from 27 states, having a mean of 2694.5 km of guardrail with a standard deviation of 2312.4 km. Predictor variables tested for each region were population, highway length, state area, land profile, and average elevation of the state's highest and lowest points. Only the Northeast region showed some correlation with population. For other regions, no predictor proved significantly better than a linear average.

The figures for fencing were even less extensive than those for guardrails. Highway fencing lengths were received from 17 states with a mean of 3275.3 km and a standard deviation of 3594.4 km. The same predictor variables used for the guardrail estimate were attempted. However, only state area was significant, at the 50% significance level. So, an average of the fence values was used for the estimate.

A small number of street fixtures in Cleveland were galvanized poles; wooden or painted poles predominated. Allpole fixtures in Dallas and Atlanta were painted or wooden. In downtown Sacramento it was observed that a large number of street fixtures were galvanized.

Literature searches were made to estimate transmission tower galvanized steel surface. The Directory of Electric Utilities supplied a sum of line length nationally. Torpey and Lipfert in Methods for Estimating Materials in Infrastructure sampled typical transmission lines, giving an estimate of the mean circuits per line and percentage of steel towers. This report gave a mean of the surface area per tower resulting in regional estimates of galvanized steel surface area in m^3 on transmission towers as follows Northeast Region, 66.5×10^6, Southeast 62.2×10^6, Central 25.2×10^6, West 44.0×10^6.

Comparison was made with transmission line length in New York from Torpey's work. The estimated length of transmission lines for all utilities in New York from the Directory of Electric Utilities is 15,245 miles and a total number of transmission towers in New York was 57,925. This compares with 54,000 structures for New York in the Torpey report.

An additional dataset was obtained from Haynie on residential housing. Galvanized steel amounts for both multi-family and single family homes were extracted from this dataset. These studies sought to estimate the distribution of exterior building materials in residential areas by sampling in these cities and comparing between the cities for usage trends. The samples were taken from single and multi-family housing units, and the materials surveyed included paint, masonry, stone, galvanized surfaces, galvanized fencing, and a few other miscellaneous materials. The average amount of external galvanizing found per building was 0.90 m^2 for single family dwellings and 0.07 m^2 for multi-family dwellings.

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The complete report, entitled "Galvanized Steel - National Distribution Study," (Order No. PB 90-215 799/AS; Cost: $17.00, subject to change) will be available only from:
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