A DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR PORTLAND MAINE COLD REGIONS RESEARCH AND ENGINEERING LAB HANOVER NH C J MERRY ET AL JUN 86 CREEL-SR-86-13 F/G 13/3
A description of the building materials data base for Portland, Maine

Carolyn J. Merry and Perry J. LaPotin
A building materials sampling program for the Portland, Maine, region was conducted in July and August 1984 to examine the types and amounts of building surface materials exposed to acid deposition. The stratified, systematic, unaligned random sampling approach was used to generate sample points across the six sampling frame areas. A minimum of 70 sample points was examined per sampling frame to yield a total sample size of 461 points. Building sizes, surface materials, roof characteristics, roof-mounted apparatus, chimneys, gutters, downspouts and fences were recorded. This report provides an initial summary of the data collected.
PREFACE

This report was prepared by Carolyn J. Merry, Research Physical Scientist, Earth Sciences Branch, Research Division, U.S. Army Cold Regions Research and Engineering Laboratory, and Perry J. LaPotin, Senior Programmer, Department of Physics and Astronomy, Dartmouth College, Hanover, New Hampshire. This research was funded under the U.S. Army Corps of Engineers Civil Works Remote Sensing Research Program, CWIS 32297, Demonstration of Satellite Digital Data in Corps Planning, Engineering and Operational Activities, in cooperation with the National Acid Precipitation Assessment Program run the the U.S. Environmental Protection Agency.

The authors extend their appreciation to Dr. Harlan McKim (CRREL), who was a co-investigator on this project, for his support and helpful technical discussions on the study; to William Porter, 1st Lt. Jeffrey Songco (CRREL), Celia Nawawi (Dartmouth College) and Thomas Johnson (U.S. Geological Survey) for assistance in gathering the building inventory data in Portland; to Doris French (Dartmouth College) for typing the data into the computer; to Sonya Travis (CRREL) and Celia Nawawi for coding the data from the worksheets and editing the Portland data base; and to Professor Thomas Adler (Thayer School of Engineering, Dartmouth College) and Dr. Harlan McKim for their technical reviews of this manuscript.

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A DESCRIPTION OF THE BUILDING MATERIALS DATA BASE FOR PORTLAND, MAINE

Carolyn J. Merry and Perry J. LaPotin

INTRODUCTION

Background

The Interagency Task Force on Acid Precipitation manages the National Acid Precipitation Assessment Program (NAPAP). There are ten Task Groups, one for each of the nine research areas in the National Program and one for international activities (Table 1). The goal of NAPAP is to develop and improve a data base that will help us understand the causes and effects of acid deposition and how it can be effectively managed. Our work on the acid rain program has been with the Environmental Protection Agency in support of Task Group G, which looks at Effects on Building Materials and Cultural Resources, as part of the ongoing effort to examine the type and magnitude of building materials exposed to acid deposition in the northeastern United States.

Table 1. The ten Task Groups within the National Acid Precipitation Assessment Program (after Interagency Task Force on Acid Precipitation 1984).

<table>
<thead>
<tr>
<th>Task group</th>
<th>Coordinating agency*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Natural sources</td>
</tr>
<tr>
<td>B</td>
<td>Man-made sources</td>
</tr>
<tr>
<td>C</td>
<td>Atmospheric processes</td>
</tr>
<tr>
<td>D</td>
<td>Deposition monitoring</td>
</tr>
<tr>
<td>E</td>
<td>Aquatic effects</td>
</tr>
<tr>
<td>F</td>
<td>Terrestrial effects</td>
</tr>
<tr>
<td>G</td>
<td>Effects on materials and cultural resources</td>
</tr>
<tr>
<td>H</td>
<td>Control technologies</td>
</tr>
<tr>
<td>I</td>
<td>Assessments</td>
</tr>
<tr>
<td>J</td>
<td>International activities</td>
</tr>
</tbody>
</table>

* NOAA - National Oceanic and Atmospheric Administration
DOE - Department of Energy
DOI - Department of Interior
EPA - Environmental Protection Agency
USDA - United States Department of Agriculture
DOS - Department of State
Objective

The purpose of this report is to present the data base of building materials collected for Portland, Maine (Fig. 1). This city was selected as it was similar in land area and population size to New Haven, Connecticut,* where similar data were collected. The data from New Haven and Portland can then be compared to see how well one city's characteristics could be extrapolated from the other city. Distribution summaries will be presented in the form of frequency tables, histograms and bar charts. In future reports the data will be analyzed to determine the suitability of various indicators in predicting the building materials distribution.

DESIGN OF THE FIELD SAMPLING PROGRAM

Sampling frame definition

The city of Portland, Maine, was subdivided into the sampling frames of Urban Central Business District (UCBD), Urban Livelihood, Industrial-Commercial (ULIC), Urban Multi-Family Residential (UMFR), Urban Single-Family Residential (USFR), Nonurban Suburbanizing (NSUB) and Nonurban Rural

Figure 2. Sampling frames for the Portland, Maine, area (map provided by J. Wray, Urban Geographer, U.S.G.S.).

(NRUR) (Fig. 2). Each sampling frame consists of a number of census tracts that have a commonality on the basis of population density, single-unit dwellings and land use (Rosenfield 1984). The two 1980 census variables were population density in persons per square kilometre and percent of dwelling units in one-unit structures. The three variables of land use (circa 1973) were percent of area with residential buildings, percent of area with nonresidential buildings and percent of area that is open land (Table 2). The water surface area within a tract was not considered. These data were used in the Statistical Analysis System (SAS) to group the tracts into sampling frames.*

Table 2. The U.S. Geological Survey land use and land cover categories (after Anderson et al. 1976 and Rosenfield 1984).

<table>
<thead>
<tr>
<th>Collapsed categories</th>
<th>Level I</th>
<th>Level II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built residential</td>
<td>1 Urban or builtup land</td>
<td>11 Residential</td>
</tr>
<tr>
<td>Built nonresidential</td>
<td>12 Commercial and services</td>
<td></td>
</tr>
<tr>
<td></td>
<td>13 Industrial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>14 Transportation, communications and utilities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15 Industrial and commercial complexes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>16 Mixed urban or builtup land</td>
<td></td>
</tr>
<tr>
<td></td>
<td>17 Other urban or builtup land</td>
<td></td>
</tr>
<tr>
<td>Open land, with buildings</td>
<td>2 Agricultural land</td>
<td></td>
</tr>
<tr>
<td></td>
<td>21 Cropland and pasture</td>
<td></td>
</tr>
<tr>
<td></td>
<td>22 Orchards, groves, vineyards, nurseries and ornamental horticultural areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23 Confined feeding operations</td>
<td></td>
</tr>
<tr>
<td></td>
<td>24 Other agricultural land</td>
<td></td>
</tr>
<tr>
<td>Open land, without buildings</td>
<td>3 Rangeland</td>
<td>31 Herbaceous rangeland</td>
</tr>
<tr>
<td></td>
<td>32 Shrub and brush rangeland</td>
<td>33 Mixed rangeland</td>
</tr>
<tr>
<td>Forest land</td>
<td>41 Deciduous forest land</td>
<td>42 Evergreen forest land</td>
</tr>
<tr>
<td></td>
<td>43 Mixed forest land</td>
<td></td>
</tr>
<tr>
<td>Omitted from analysis</td>
<td>5 Water</td>
<td>51 Streams and canals</td>
</tr>
<tr>
<td></td>
<td>52 Lakes</td>
<td>53 Reservoirs</td>
</tr>
<tr>
<td></td>
<td>54 Bays and estuaries</td>
<td></td>
</tr>
<tr>
<td>Open land, without buildings</td>
<td>6 Wetland</td>
<td>61 Forested wetland</td>
</tr>
<tr>
<td></td>
<td>62 Nonforested wetland</td>
<td></td>
</tr>
<tr>
<td></td>
<td>71 Dry salt flats</td>
<td></td>
</tr>
<tr>
<td></td>
<td>72 Beaches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>73 Sandy areas other than beaches</td>
<td></td>
</tr>
<tr>
<td></td>
<td>74 Bare exposed rocks</td>
<td></td>
</tr>
<tr>
<td></td>
<td>75 Strip mines, quarries and gravel pits</td>
<td></td>
</tr>
<tr>
<td></td>
<td>76 Transitional areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>77 Mixed barren land</td>
<td></td>
</tr>
</tbody>
</table>

Selection of sample points

The sample size of 70 was calculated previously from the Revere, Massachusetts, data base of buildings (Merry and LaPotin 1985a) by multiplying the minimum sample size determined from the cumulative multinomial distribution (30) by the design effect (2.34) from the Revere data (Rosenfield 1984).
The sample points were generated by the U.S. Geological Survey using a stratified, systematic, unaligned random sampling procedure. Previously, a similar sampling procedure (stratified, systematic, unaligned) was used by the U.S. Geological Survey for selecting samples for use in accuracy testing of the land use and land cover maps produced under the National Land Use and Land Cover Mapping Program (Ling and Rosenfield 1980). An advantage of the systematic sampling algorithm is that it distributes the sample units equitably over the entire sampling frame. In addition, sample points are area weighted, and proportionally allocated on the basis of area (Rosenfield 1984). Table 3 displays the total number of points that were generated for the Portland field survey program. The UTM coordinates for each sample point are shown in Appendix A.

Each sample point had a corresponding "footprint" or a given spatial area on the ground that had to be examined in the field. We used the same footprint areas as we had used in New Haven (Table 4) because of the unavailability of the 1980 census data at the time of the field work (see Merry and LaPotin [1985b] for a description of how the footprint size was determined). We felt that these values were reasonable to use since the two cities were comparable in land area and population density.*

Table 3. Number of sample points for the Portland, Maine, building materials inventory.

<table>
<thead>
<tr>
<th>Sampling frame</th>
<th>Number of points with buildings</th>
<th>Number of empty points</th>
<th>Total points</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCBD</td>
<td>42 (50%)</td>
<td>42 (50%)</td>
<td>84 (100%)</td>
</tr>
<tr>
<td>ULIC</td>
<td>59 (72%)</td>
<td>23 (28%)</td>
<td>82 (100%)</td>
</tr>
<tr>
<td>UMFR</td>
<td>44 (56%)</td>
<td>34 (44%)</td>
<td>78 (100%)</td>
</tr>
<tr>
<td>USFR</td>
<td>36 (49%)</td>
<td>38 (51%)</td>
<td>74 (100%)</td>
</tr>
<tr>
<td>NSUB</td>
<td>24 (34%)</td>
<td>46 (66%)</td>
<td>70 (100%)</td>
</tr>
<tr>
<td>NRUR</td>
<td>15 (20%)</td>
<td>58 (80%)</td>
<td>73 (100%)</td>
</tr>
<tr>
<td>Total</td>
<td>220 (48%)</td>
<td>241 (52%)</td>
<td>461 (100%)</td>
</tr>
</tbody>
</table>

Table 4. Footprint sizes for the Portland, Maine, sampling frames.

<table>
<thead>
<tr>
<th>Sampling frame</th>
<th>Footprint size (ft)</th>
<th>Footprint size (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UCBD</td>
<td>139</td>
<td>42</td>
</tr>
<tr>
<td>ULIC</td>
<td>144</td>
<td>44</td>
</tr>
<tr>
<td>UMFR</td>
<td>90</td>
<td>27</td>
</tr>
<tr>
<td>USFR</td>
<td>87</td>
<td>26</td>
</tr>
<tr>
<td>NSUB</td>
<td>364</td>
<td>111</td>
</tr>
<tr>
<td>NRUR</td>
<td>364</td>
<td>111</td>
</tr>
</tbody>
</table>

Field survey

The field program began in July 1984 and was completed within two months by two-person teams. One person normally recorded the dimensions and material types of the building; the other person took photographs of the building and used an optical rangefinder to determine its height.

The building worksheet was developed for a committee composed of representatives from CRREL, the EPA's Environmental Sciences Research Laboratory at Research Triangle Park and the U.S. Bureau of Standards. The worksheet form was designed to provide information on: the spatial location of the building in UTM coordinates; characteristics of the surrounding terrain in terms of census tract, land use type and sampling frame; dimensions and type of building; lot size dimensions; materials distribution percentages in the foundation, first story, and all above stories; and the surface area and material types for the roof, roof-mounted apparatus (vents, flues, stacks, skylights and flashing), chimneys, rain gutters, downspouts and fences. The worksheet used in the Portland field survey is shown in Appendix A. The worksheet was redesigned from the New Haven survey to allow more space for recording the data. Also, the column fields (from which the data variables were recorded) were placed on the worksheet to make it easier to code the data onto sheets for typing into the computer.
DATA DESCRIPTION

Each sample point was recorded on an individual data sheet during the survey. If the sample point was empty, the sections concerning description of the building were coded as zeros. If there was more than one building per sample point, a separate worksheet was completed for every building. These worksheets were used to develop a composite building. The composite worksheet represents the distribution of materials found for all the buildings in the footprint. The data were checked several times using the procedures described in Appendix A.

The variables assigned to the Portland field data are described in Appendix B. The frequency runs for the variables are organized by variable type (e.g., major classification, census tract data, general building description). The page formats are organized so that for each variable, numeric summaries are provided first (e.g., the labels for each value with frequency of occurrence and percent of the distribution), followed by graphic presentation (histogram or bar chart), and ending with statistical summaries (e.g., mean, mode, skewness and kurtosis). The sample size is presented at the bottom of each summary section, along with the number of missing observations. Each observation corresponds to a sample point within one of the six sampling frames in Portland. Figure 3 is an example of how the frequency runs are presented in Appendix B.

Certain variables in our data set describe the building material exposure and distribution, for example, exposed walls in footprint (EWIF) and average wall height (HT). The corresponding frequency runs for the building description variables are tabulated using the sample size of 220, where buildings were observed in the footprints (Table 3). All other variables not related to the building descriptions use the 461 total cases.

The column headings marked VALUE represent the actual observed value for the variable. Frequency (denoted FREQ) represents the number of cases falling within the category. Percent (PCT) and cumulative percent (CUM PCT) represent the percent of the total falling within the specified category and the running cumulative percent, respectively. The cumulative percent for the last category is always 100.

Analysis was done using the Statistical Package for the Social Sciences (SPSS) software on a VAX-11/785 minicomputer (Nie et al. 1975).
Figure 3. Sample page of frequency analysis data.

more in-depth discussion of the summary statistics can be found in most elementary applied statistics texts (see Snedecor and Cochran 1980).

DISCUSSION

The frequencies in Appendix B are separated into six sections. The Major Classification Variables section includes the distribution of land use designation (LU), sampling frame (SFRAME), sample point number (SPOINT) and census tract (TRACT) for the 461 total observations.

The land use classification for each sample point (LU) was based on its location within the digital land use data base from the Geographic
Information Retrieval and Analysis System (GIRAS) (Mitchell et al. 1977). The aerial photography used in GIRAS is dated from 1972-74 (Loelkes 1977). The minimum mapping unit for the land cover map is 10 acres (0.04 km$^2$) for the level II categories 11-17, 23-24, 51-54, 75 and urban occurrences of 76 (Table 2). The minimum mapping unit for the remaining level II categories was 40 acres (0.16 km$^2$).

About 30% of the sampled footprints in Portland fall within the residential land use class. Another 22% are within the commercial and services land use class, 19% are within the cropland category and 15% are within the transportation land use class. These four land uses make up 86% of the sampled footprints. Cumulative percents show that 81% of the sample points fall within the level I category of urban or built-up land, with the remaining 19% found within the level I category of agriculture.

The sampling frame (SFRAME) shows the distribution of footprints within a given sampling frame. The minimum number of sampled points for a given subcategory is 70, corresponding to the NSUB class. The horizontal bar chart for SFRAME illustrates the uniformity of the sampled distribution and shows that all sampling frames contain the minimum of 70 points.

The census tract (TRACT) variable represents the distribution of sampled footprints within a given tract. The majority (9%) of sample points are within census tract 15, which corresponds to the ULIC sampling frame (Fig. 2 and 4). Another 7% each were found within census tracts (3 and 41) located within UCBD and NRUR respectively. The remaining 77% of the sample points are distributed somewhat uniformly.

Appendix B also includes the available Census Tract Data from the U.S. Bureau of Census, and the land areas within five land use classes derived from the U.S. Geological Survey GIRAS data base (corresponding to the 50 sampled census tracts in Portland). There were eight variables, based on the 1980 census, coded into the Portland data base. Three of the variables included the total population in the census tract (POP), the total number of housing (dwelling) units in a census tract (DU), and the number of dwelling units in one-unit structures (UI). The U.S. Geological Survey combined several of the GIRAS land cover types into five land cover classes that included: the total land area (ALAND), the built residential land use (ABR), the built nonresidential land use (ABNR), the open land containing buildings (AOB) and the open land containing no buildings (AO). All land area values are in millions of square feet.
Figure 4. Census tracts for the Portland, Maine, area (after US Census Bureau 1980).

The tract population (POP) variable shows an average population per tract of 3041 persons. The range of population values found within the Portland tracts varies from 34 to over 11,250 people per census tract. The population distribution is skewed slightly to the right, with 75% of the tracts having population values of 3777 people and below.

The total dwelling units (DU) in a given tract varies from 19 to over 4467. The average number of units is 1273, with a similar median value of 1207 units. The average number of dwelling units in one-unit structures (U1) is 593, with a standard deviation of 669 units. Dwelling units range from 1 to 3139 per tract; 90% of the tracts contained 1591 one-unit structures or less.

The remainder of the census tract variables in Appendix B represent the millions of square feet of the total land coverage (ALAND) within the
built residential (ABR), built nonresidential (ABNR), open land with buildings (AOB) and open land without buildings (AO) categories (US Bureau of Census 1980). In comparing the medians of the above five variables, the majority of the land in Portland is in the category of open land without buildings (1.38 million ft$^2$). Overall, the least amount of land was found in the category of area open with buildings, whose median value was 0. The median area of built residential was 693,000 ft$^2$ per tract. A median value of 167,000 ft$^2$ per tract was categorized as built nonresidential.

The built residential category (ABR) includes the level II urban category, residential (see Table 2). The built nonresidential category (ABNR) includes the urban categories of commercial and services, industrial, transportation, communications and utilities, industrial and commercial complexes, and the mixed urban or builtup land. The open land with buildings category (AOB) includes the other urban or builtup land, and the entire level I agricultural land category. Open without buildings (AO) includes the level I categories of wetlands and barren land.

General Building Descriptions, including wall dimensions, are provided in Appendix B too. Frequencies are tabulated using the 220 cases where buildings were observed. Variables include the approximate age of the structure (AGE), exposed walls in the footprint (EWIF), average wall height (HT), lot size (LOT1 and LOT2), side dimensions (SIDE1 and SIDE2) and the building type (TYPE).

The first variable (AGE) represents the approximate age of the structure using the year 1900 as a base (e.g., 1984 is shown as 84, 1900 as zero, and 1801 as -99). Of the observed structures, 15% were built prior to 1900. The range in building age is 134 years; the mean construction date is 1938; the median construction date is 1944; and the most frequently observed construction date is 1884. The upper third of the building age distribution begins in 1964. The distribution of age is skewed left, reflecting the larger frequency of buildings built prior to 1900.

The exposed walls in footprint (EWIF) is the perimeter (in feet) of the building (or buildings) contained within the footprint. EWIF is recorded for use in calculating the area of building wall surfaces contained within the sampled footprint. Of the 220 structures sighted, 67% show EWIF values of 252 ft and below. The mean EWIF value is 228 ft, with a median value of 180 ft. The percentiles indicate that 10% of the observed structures display EWIF values greater than 407 ft.
The variable indicating average wall height in feet (HT) for a sampled structure is also provided in Appendix B. One quarter of the buildings are 8 ft or less in height. Cumulative percents show that the majority of observed wall heights are below 40 ft (86%). Using 12 ft per story as an average, we see that 11% of the observations are one-story structures, 46% are two-story structures (and below), and 86% are three-story structures (and below). Both mean (29 ft) and median values (25 ft) correspond to an average building size of over two stories. The standard deviation of 19 ft (1.5 stories) reflects the small variance of buildings found in Portland relative to the maximum observed height of 140 ft.

The lot size variables (LOT1 and LOT2) represent the respective length and width dimensions (in feet) of the plot of ground surrounding the sampled structure. The person on the survey team estimated the lot size in the field by using markers, such as fences and the proximity of adjacent buildings. The average lot dimension was 133 ft by 120 ft. The most frequently occurring lot dimension was 100 ft by 50 ft. The percentiles show that 90% of the lots were 260 ft long by 230 ft wide, and below. The overall range of lot dimensions was 570 ft.

The variables SIDE1 and SIDE2 are the respective length and width dimensions of the building in feet. The average building is 85 ft long and 73 ft wide. The median building is somewhat below the average size, with a 52-ft length and 40-ft width. The range of dimensions is 435 ft for SIDE1 and 540 ft for SIDE2. The most frequently occurring dimensions are 30 ft for SIDE1 and 20 ft for SIDE2. Both distributions are skewed to the right (skewness = 2.2 and 3.1) suggesting a greater frequency of smaller-sized buildings.

The building type classification (TYPE) is useful for determining the distribution of individual structures by usage. In the frequency distribution, 241 (52%) of the 461 sampled footprints had no structures (Table 3). Of the footprints containing buildings (220), 44% were found to be one-unit residential structures. The other significant building type was the other commercial buildings category (18%). The remaining building types represented 6% or less of the observations in any given usage class.

The Spatial Areas of Building Materials section follows. It presents the five composite building material classifications recommended by the
Interagency Task Force.* These areas represent square footage of building materials surface potentially exposed to acid deposition. The five composite building materials computed were painted materials (APAINT), mortar-masonry (AMORT), stone materials (ASTONE), galvanized metal (AGALV) and all other materials (AOTHER). From the original building worksheet (Appendix A), the 21 material types were aggregated into the five categories (Table 5).

For the area of painted materials (APAINT), 17% of the sampled structures have no painted wall surfaces. The average exposure of painted

Table 5. The 21 material types grouped into five material types.

<table>
<thead>
<tr>
<th>APAINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Painted wood (excl. stained)</td>
</tr>
<tr>
<td>Painted steel</td>
</tr>
<tr>
<td>Painted aluminum</td>
</tr>
<tr>
<td>Painted masonry</td>
</tr>
<tr>
<td>Painted concrete</td>
</tr>
<tr>
<td>Painted stucco</td>
</tr>
<tr>
<td>Painted other material</td>
</tr>
<tr>
<td>Painted other material (cannot identify)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AMORT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare brick</td>
</tr>
<tr>
<td>Bare block</td>
</tr>
<tr>
<td>Bare field stone</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AGALV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare galvanized steel</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ASTONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare marble</td>
</tr>
<tr>
<td>Bare limestone</td>
</tr>
<tr>
<td>Bare granite</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AOTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bare wood (incl. stained)</td>
</tr>
<tr>
<td>Bare concrete</td>
</tr>
<tr>
<td>Bare glass</td>
</tr>
<tr>
<td>Bare vinyl</td>
</tr>
<tr>
<td>Bare other material</td>
</tr>
<tr>
<td>Bare other material (cannot identify)</td>
</tr>
</tbody>
</table>

*Personal communication with F. Lipfert, Brookhaven National Laboratory, 1984.
materials in Portland is 3497 ft\(^2\) with a median exposure of 1917 ft\(^2\). The standard deviation of 6398 ft\(^2\) reflects an average range for painted exposure from a minimum of 0 ft\(^2\) to a maximum of 73,920 ft\(^2\). Percentiles suggest that 90% of the painted materials exposure is 7925 ft\(^2\) and below. The distribution is extremely skewed to the right (skewness = 7.0) and is far more peaked (kurtosis = 69.0) than a normal distribution with similar mean and standard error.

Areas of exposed mortar-masonry materials (AMORT) were observed for 113 structures, indicating that 49% of the footprints with buildings had no mortar-masonry exposure (i.e., of the total 220 sampled footprints, 51% had mortar-masonry walls). The mean mortar-masonry surface area (2766 ft\(^2\)) is higher than the median exposure (67 ft\(^2\)), reflecting the skew of the distribution to the right (skewness = 3.4). The range of mortar-masonry surface area is 37,320 ft\(^2\); however, the percentile values show that 75% of the structures have exposures ranging from nothing to 1836 ft\(^2\). Only 10% of the structures had exposures greater than 8535 ft\(^2\).

The exposure of bare stone materials (ASTONE) is very rare in the Portland sample. Cumulative frequencies show that 96% of the footprints with buildings have no exposed bare stone surfaces. The summary statistics show that buildings with exposed stone surfaces are on the average 184 ft\(^2\), with a standard deviation of 1824 ft\(^2\). The median and mode values were 0; the maximum exposed surface area was 21,900 ft\(^2\).

Very few structures (3%) have bare galvanized steel (AGLAV) exposure. Of the 220 footprints with buildings, 7 structures were composed of some bare galvanized steel. The summary statistics show a median and mode of 0, with a mean exposure of 136 ft\(^2\). The maximum exposed surface area was 16,250 ft\(^2\).

The fifth composite material class is the other materials category (AOTHER) that includes all other materials not classified into the above categories; 51% of the structures had some exposed materials falling into the AOTHER category. These surface areas are relatively continuous and nonclustering, with a uniform frequency distribution. The percentile values reflect the uniformity of the distribution for surface wall areas of 804 ft\(^2\) and below at the 75th percentile. The upper 10th percentile rises sharply to a maximum AOTHER exposure, for an individual building, of 36,000 ft\(^2\) (the histogram illustrates the sharp rise in values).
Appendix B includes a section called Roof Materials and Roof-Mounted Apparatus Items. The section presents exposed chimney area (CAREA), chimney material (CMAT), exposed roof area (ESAREA), roof material (ERMAT), roof slope (SLOPE) and the roof apparatus items for the observed buildings (ITEM1, APP, RMAT, ITEM2, APPSKY, SKYM, FLMAT, FLLG, APPFL).

The mean surface area of an observed chimney (CAREA) is 37 ft$^2$, with a standard deviation of 87 ft$^2$. The percentiles indicate that most chimneys are small, usually having less than 24 ft$^2$ of exposure (75%). Of the exposed chimneys, the majority are made of brick. The variable CMAT suggests that 85% (98 of the 115 sighted chimneys) were brick.

The exposed surface area of the roof (ESAREA) shows a wide range of values, from 0 ft$^2$ to 9999 ft$^2$. (One building did not have a roof as it was an old building that had recently been gutted by fire.) The mean surface area observed was 3887 ft$^2$, with the most frequently occurring roof size being greater than 9999 ft$^2$. The standard deviation was fairly high at 3457 ft$^2$. The percentile values indicate that 75% of the roof areas are less than 6410 ft$^2$.

The roof material (ERMAT) was predominantly asphalt shingle (55%), followed by tar (30%) and materials that could not be identified (8%). About 30% of the roofs were flat, rather than sloped (i.e., the SLOPE variable).

There were 40 occurrences of vents, flues and stacks (ITEM1); these items were principally (60%) bare aluminum (RMAT).

The field crews sighted six occurrences of skylights in Portland (ITEM2). The skylight framing material (SKYM) was equally divided among painted, bare galvanized, bare aluminum and other material types.

There were 37 occurrences of flashing material (FLMAT). Painted and bare aluminum were the predominant material types (FLMAT) (81% of the 37). The flashing length (FLLG) ranged from 1 ft to over 999 ft, the average being 53 ft. Flashings, however, were sighted on only 17% of the structures sampled.

Rain Gutters, Downspouts and Fences is the last section in Appendix B. Rain gutters (RGMAT) and downspouts (DSPOUT) were found on 90 structures. Most rain gutters and downspouts were painted. The average length of a rain gutter (RGUT) was 54 ft, and for a downspout (DSLENG) the average length was 26 ft. A standard deviation of 116 ft was observed for the rain gutters; the standard deviation was smaller for the downspouts, 46 ft.
There were 44 fences (FENCE) observed within the sampled footprints. The material types were principally bare galvanized chain link. The fence length (FLENG) varied from 5 to greater than 999 ft, and the height (FHT) varied from 2 to 8 ft.

CONCLUSIONS

A building materials sampling program for the Portland, Maine, area was conducted during July and August 1984. The stratified, systematic, unaligned random sampling procedure was applied to generate sample points across the six sampling frame areas. Using this procedure, we surveyed a total of 461 points with a minimum of 70 sample footprints per frame. A diversity of data was taken on building size and surface materials, roof characteristics and roof apparatus, chimneys, gutters, downspouts and fences. The Portland data are summarized according to overall material distribution by structure.

A summary of the composite material classes is provided in Table 6. Notice that 96% and 97% of the sampled structures showed no bare stone and bare galvanized steel exposure. Of the remaining three categories, mortar-masonry exposure and other material exposure were sighted on just under half of the sampled structures (49%). Median exposures suggest that APAINT accounts for the majority of exposure per structure in Portland. As was cited in the New Haven sample (Merry and LaPotin 1985b), the combined AGALV

Table 6. Summary statistics of the five composite material classes.

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<th>Median exposure (ft²)</th>
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and ASTONE categories are infrequently observed and should be reclassified to more adequately represent the exposure level by material class.

LITERATURE CITED


### APPENDIX A. DATA

Listing of UTM coordinates for each sample point in Portland, Maine

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<td>UTM East</td>
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<td>CENS</td>
<td>LU</td>
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<td>46</td>
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</table>

Building worksheet used in the Portland field sampling program

Revised 3 August 198_-

BUILDING INVENTORY WORKSHEET

________________________
Tract/MCD 1-3

________________________
Sampling frame 4

________________________
Sampling point number 5-7

________________________
USGS land cover type 8-9

________________________
Type of structure (circle one) 10-11

Residential building:
- Housing unit:
  - 1 unit detached 1
  - 1 unit attached 2
  - 2 units 3
  - 3 & 4 units 4
  - 5-9 units 5
  - 10-19 units 6
  - 20-49 units 7
  - 50 or more units 8

Nonhousekeeping (hotels, motels, dormitories, fraternity, nursing homes) 9

Nonresidential buildings:
- Office building 15
- Other commercial 16
- Industrial 17
- Hospital or institutional 18
- Religious 19
- Educational 20
- Other nonresidential 21
- Farm (nonresidential) 22
- Other (identify structure) 23

Cannot identify 24

22
Sketch of Building

(yr) Approximate age of building 12-14

ft, Wall height 15-17

ft, Side 1 of building 18-20

ft, Side 2 of building 21-23

ft, Lot size, side 1 24-26

ft, Lot size, side 2 27-29

ft, Exposed walls in footprint 30-32

Photo ID _________________________

Street address ___________________
### Walls

#### Painted Walls

<table>
<thead>
<tr>
<th>Material</th>
<th>Foundation</th>
<th>1st Story</th>
<th>All Stories above 1st</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wood (excl. stained)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Aluminum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Masonry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Stucco</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Other material (identify material)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Cannot identify</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

#### Bare Walls

<table>
<thead>
<tr>
<th>Material</th>
<th>Foundation</th>
<th>1st Story</th>
<th>All Stories above 1st</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Brick</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Block</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Field stone</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>12. Concrete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Marble</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Limestone</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Granite</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Galvanized steel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Wood (incl. stained)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Glass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Vinyl</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Other material (identify material)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Cannot identify</td>
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</table>

**Total**                                                                                       | 100 | 100 | 100
### ROOF

<table>
<thead>
<tr>
<th>Configuration (circle one):</th>
<th>(0) Sloped or (1) flat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of exposed surface</td>
<td>44.7 ft²</td>
</tr>
<tr>
<td>Exposed roof material (circle one):</td>
<td>(0) tar, (1) asphalt shingle, (2) wood, (3) painted metal, (4) bare galvanized, (5) tile, (6) slate, (7) copper, (8) other (identify material), (9) cannot identify.</td>
</tr>
<tr>
<td>Vents, Flues stacks (1)</td>
<td>Material (circle one):</td>
</tr>
<tr>
<td>Skylights (2)</td>
<td>Material (circle one):</td>
</tr>
<tr>
<td>Flashing (3)</td>
<td>Material (circle one):</td>
</tr>
</tbody>
</table>

### CHIMNEYS

| Material (circle one): | (1) painted, (2) brick, (3) stone, (4) other (identify material), (9) cannot identify |

### RAIN GUTTERS

| Material (circle one): | (1) bare galvanized, (2) vinyl, (3) painted, (4) copper, (5) other (identify material), (9) cannot identify |

### DOWNSPOUTS

| Material (circle one): | (1) bare galvanized, (2) vinyl, (3) painted, (4) copper, (5) other (identify material), (9) cannot identify |

### FENCES

| Material (circle one): | (1) bare galvanized chain link, (2) bare galvanized wire mesh, (3) painted, (4) brick, (5) block, (6) field stone, (7) unpainted wood, (8) other (identify material), (9) cannot identify |

| Length                  | 62-65 ft², Horizontal runs |
|                        | 67-69 ft, Vertical runs    |
|                        | 70 ft, horizontal runs     |
|                        | 71 ft, vertical runs       |
|                        | 72 ft, sum of heights for all downspouts |
|                        | 75 ft, Height              |
|                        | 76-78 ft                   |
|                        | 79-80 ft                   |
Procedures used to check the Portland data

The data were checked several ways to ensure that the data base was correct. A major check of the material type percentages and the EWIF value was done before printing a frequency run of the entire data set.

The percentage check done was to sum the percentage of material types for the three stories of the building. We needed to ensure that the sum of all material types was 100%. Also, during the same computer run, we checked to see that every building had a foundation. (In some cases, the field team had not recorded a foundation.) For these cases, the photo of the building was examined to determine the material type of the foundation. We assumed 12 ft for the first story component of the building. In addition, during the same computer run, we would print out cases where the building height was greater than 14 ft (assuming 2 ft for the foundation and 12 ft for the first story) and there were no percentages recorded for the second and above stories.

The EWIF value was also checked against the lot size and the building side dimensions. A printout of these values was obtained for every building. We assumed that the building sides were the square root of the exposed roof area and would check to make sure that the EWIF was not larger than the building sides. There was also a check to ensure that the building was not larger than the lot size dimensions.

Several hand calculations were done for the building surface areas and compared against the computer-calculated surface areas. These values had to be consistent for different types of materials for a given building. The frequency runs were checked for a number of items. The number of downspouts had to be the same as the number of rain gutters.

The empty footprints were noted for each sampling frame and verified against the number of buildings expected for each sampling frame.

The tally of land use and census tract numbers also had to be correct for each sampling frame. The number of roof areas had to equal the number of buildings.

The number of cases had to be the same for a given accessory. For example, the number of material types and the surface area values had to be the same for the variables of roofs, fences, downspouts, rain gutters and roof-mounted apparatus. Although not every building had all these compo-
ments, if the value was recorded, then each material type had to have a corresponding surface area.

Strange or unexpected numbers for all the variables encountered during editing of the data base were always doublechecked against the building worksheets. For example, the EWIF values were always fairly even in value or divisible by 5. Any unusual numbers or large numbers were doublechecked and verified during the editing process, not only for the EWIF, but for the other variables as well.
APPENDIX B. RESULTS OF THE FREQUENCY ANALYSIS

Description of the Portland data variables

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Brief description</th>
<th>Detailed description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LU</td>
<td>Land use</td>
<td>U.S. Geological Survey land use classification, where: 11 = residential, 12 = commercial and services, 13 = industrial, 14 = transportation, communications and utilities, 15 = industrial and commercial complexes, 16 = mixed urban or builtup land, 17 = other urban and or builtup land, 21 = cropland and pasture, 22 = orchard, groves, vineyards, nurseries and ornamental agricultural areas, 23 = confined feeding operations, 24 = other agricultural land, 31 = herbaceous rangeland, 32 = shrub and brush rangeland, 33 = mixed rangeland, 41 = deciduous forestland, 42 = evergreen forestland, 43 = mixed forestland, 51 = streams and canals, 52 = lakes, 53 = reservoirs, 54 = bays and estuaries, 61 = forested wetland, 62 = nonforested wetland, 71 = dry salt flats, 72 = beaches, 73 = sandy areas other than beaches, 74 = bare exposed rock, 75 = strip mines, quarries, and gravel pits, 76 = transitional areas, 77 = mixed barren land.</td>
</tr>
<tr>
<td>SFRAME</td>
<td>Sampling frame</td>
<td>Sampling frame, where: 1 = UCBD, 2 = ULIC, 3 = UMFR, 4 = USFR, 5 = NSUB, 6 = NRUR</td>
</tr>
<tr>
<td>SPOINT</td>
<td>Sample point number</td>
<td>Sampling point number within sampling frame.</td>
</tr>
<tr>
<td>TRACT</td>
<td>Census tract</td>
<td>Census tract number, see Figure 4.</td>
</tr>
<tr>
<td>POP</td>
<td>Tract population</td>
<td>Total population in census tract.</td>
</tr>
<tr>
<td>DU</td>
<td>Total dwelling units in tract</td>
<td>Total number of housing units in census tract.</td>
</tr>
<tr>
<td>UI</td>
<td>One-unit structures in tract</td>
<td>Number of dwelling units in one-unit structures in census tract.</td>
</tr>
<tr>
<td>ALAND</td>
<td>Area of land coverage</td>
<td>Total land area of census tract (millions of ft²).</td>
</tr>
<tr>
<td>ABR</td>
<td>Area of built residential</td>
<td>Land area of census tract in built residential (millions of ft²).</td>
</tr>
<tr>
<td>ABNR</td>
<td>Area of built nonresidential</td>
<td>Land area of census tract in built nonresidential (millions of ft²).</td>
</tr>
<tr>
<td>AOB</td>
<td>Area, open land with buildings</td>
<td>Land area of census tract in open with buildings (millions of ft²).</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>-----------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>AO</td>
<td>Area of open land without buildings</td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>Approx. age of structure</td>
<td></td>
</tr>
<tr>
<td>EWIF</td>
<td>Exposed wall in footprint</td>
<td></td>
</tr>
<tr>
<td>HT</td>
<td>Average wall height</td>
<td></td>
</tr>
<tr>
<td>LOT1</td>
<td>Lot size, side 1</td>
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<tr>
<td>LOT2</td>
<td>Lot size, side 2</td>
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<tr>
<td>SIDE1</td>
<td>Side 1 of bldg.</td>
<td></td>
</tr>
<tr>
<td>SIDE2</td>
<td>Side 2 of bldg.</td>
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</tr>
<tr>
<td>TYPE</td>
<td>Structure type-usage</td>
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<tr>
<td>APAIN</td>
<td>Area of painted surface</td>
<td></td>
</tr>
<tr>
<td>AMORT</td>
<td>Area of mortar-masonry surface</td>
<td></td>
</tr>
<tr>
<td>ASTONE</td>
<td>Area of stone surface</td>
<td></td>
</tr>
<tr>
<td>AGALV</td>
<td>Area of galvanized surface</td>
<td></td>
</tr>
<tr>
<td>AOTHER</td>
<td>Area of other materials</td>
<td></td>
</tr>
<tr>
<td>CAREA</td>
<td>Exposed chimney area</td>
<td></td>
</tr>
<tr>
<td>CMAT</td>
<td>Chimney material</td>
<td></td>
</tr>
<tr>
<td>ESAREA</td>
<td>Area of exposed roof</td>
<td></td>
</tr>
<tr>
<td>ER MAT</td>
<td>Roof material type</td>
<td></td>
</tr>
</tbody>
</table>

- **AO**: Area of open land without buildings (millions of ft²).
- **AGE**: Approximate age of the building. 1900 is the base year (year 0). To obtain age, add the value of 1900. Ages less than 1900 are coded as negative values.
- **EWIF**: Exposed walls (perimeter of the building) within a given footprint (ft).
- **HT**: Average building height (ft).
- **LOT1**: Lot size associated with sampling point, side 1 (ft).
- **LOT2**: Lot size associated with sampling point, side 2 (ft).
- **SIDE1**: Side dimension of the building (ft).
- **SIDE2**: Side dimension of the building (ft).
- **TYPE**: Structure type-usage, where: 0 = no building, 1 = 1 housing unit detached, 2 = 1 housing unit attached, 3 = 2 housing units, 4 = 3 to 4 housing units, 5 = 5 to 9 housing units, 6 = 10 to 19 housing units, 7 = 20 to 49 housing units, 8 = 50 or more housing units, 9 = nonhousekeeping (i.e., hotels, motels, dormitories, fraternity and sorority houses, nursing homes and similar facilities), 10 = office buildings, 11 = other commercial buildings, 12 = industrial buildings, 13 = hospital or institutional buildings, 14 = religious building, 15 = educational building, 16 = other nonresidential buildings, 17 = farm (nonresidential), 18 = other buildings, 19 = cannot identify building.
- **APAIN**: The total surface area (ft²) of a building having painted materials.
- **AMORT**: The total surface area (ft²) of a building having mortar and masonry materials.
- **ASTONE**: The total surface area (ft²) of a building having stone materials.
- **AGALV**: The total surface area (ft²) of a building having galvanized materials.
- **AOTHER**: The total surface area (ft²) of a building having all other materials.
- **CAREA**: Exposed surface area of chimney above roof (ft²).
- **CMAT**: Chimney material type, where: 0 = no chimney observed, 1 = painted, 2 = brick, 3 = stone, 4 = other chimney material, and 9 = cannot identify chimney material.
- **ESAREA**: Exposed roof area of building (ft²).
- **ER MAT**: Exposed roof material, where: 0 = tar, 1 = asphalt shingle, 2 = wood, 3 = painted metal, 4 = bare galvanized, 5 = tile, 6 = slate, 7 = copper, 8 = other roof material, 9 = cannot identify roof material.
<table>
<thead>
<tr>
<th><strong>SLOPE</strong></th>
<th>Indicator:</th>
<th>Roof configuration: 1 = sloped, 2 = flat.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ITEM1</strong></td>
<td>Number of roof apparatus items</td>
<td>Number of items of roof-mounted apparatus (vents, flues and stacks).</td>
</tr>
<tr>
<td><strong>APP</strong></td>
<td>Indicator: roof apparatus</td>
<td>Presence of roof-mounted apparatus (vents, flues, and stacks) where 1 = observed and 0 = not observed.</td>
</tr>
<tr>
<td><strong>RMAT</strong></td>
<td>Roof apparatus material</td>
<td>Material type of the roof-mounted apparatus (vents, flues and stacks), where: 1 = painted, 2 = bare galvanized, 3 = bare aluminum, 4 = other roof-mounted apparatus material, 9 = cannot identify roof-mounted apparatus material.</td>
</tr>
<tr>
<td><strong>ITEM2</strong></td>
<td>Number of skylights</td>
<td>Number of skylights observed.</td>
</tr>
<tr>
<td><strong>APPSKY</strong></td>
<td>Skylights</td>
<td>Presence of skylights, where: 1 = observed and 0 = not observed.</td>
</tr>
<tr>
<td><strong>SKYM</strong></td>
<td>Framing material of skylights</td>
<td>Framing material type of skylights, where: 1 = painted, 2 = bare galvanized, 3 = bare aluminum, 4 = other material type, and 9 = cannot identify material type.</td>
</tr>
<tr>
<td><strong>FLMAT</strong></td>
<td>Material type of flashing</td>
<td>Material type of flashing, where: 1 = painted, 2 = bare galvanized, 3 = bare aluminum, 4 = other material type, and 9 = cannot identify.</td>
</tr>
<tr>
<td><strong>FLLG</strong></td>
<td>Length of flashing</td>
<td>Length of flashing (ft).</td>
</tr>
<tr>
<td><strong>APPFL</strong></td>
<td>Flashing</td>
<td>Presence of flashing, where: 1 = observed, 0 = not observed.</td>
</tr>
<tr>
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<td>Rain gutter material</td>
<td>Rain gutter material type, where: 0 = no chimney observed, 1 = bare galvanized, 2 = vinyl, 3 = painted, 4 = copper, 5 = other rain gutter material, and 9 = cannot identify rain gutter material.</td>
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<td><strong>DSPOUT</strong></td>
<td>Material of downspout</td>
<td>Material type of downspouts, where: 0 = no downspout observed, 1 = bare galvanized, 2 = vinyl, 3 = painted, 4 = copper, 5 = other downspout material, and 9 = cannot identify downspout material.</td>
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<td>Fence type</td>
<td>Material type of fences, where: 0 = no fences observed, 1 = bare galvanized chain link, 2 = bare galvanized wire mesh, 3 = painted fence, 4 = brick, 5 = block, 6 = field stone, 7 = unpainted wood, 8 = other material type, and 9 = cannot identify fence material.</td>
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### Major classification variables

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**Diagram**

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M: MEAN 2637 000  MEDIAN 2637 000
V: VARIANCE 4713200 55
K: SKEWNESS 1 275
R: KURTOSIS 3 275
N: N 1000
P: P 100
Q: Q 100

PERCENTILE VALUE  PERCENTILE VALUE  PERCENTILE VALUE
10 10 22 22 33 33 44 44 55 55
20 20 44 44 66 66 88 88 100 100
30 30 66 66 99 99 122 122 144 144
40 40 88 88 122 122 144 144 166 166
50 50 100 100 122 122 144 144 166 166
60 60 122 122 144 144 166 166 188 188
70 70 144 144 166 166 188 188 210 210
80 80 166 166 188 188 210 210 232 232
90 90 188 188 210 210 232 232 254 254
100 100 210 210 232 232 254 254 276 276

VARIANCE  2637 000
STANDARD DEVIATION 55 000
SKEWNESS  1 275
KURTOSIS  3 275
Q 100
### Table: Frequency Distribution

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### Count of Values

The symbol equals approximately 200 occurrences.

### Summary Statistics

- **Mean:** 1207.00
- **Median:** 1207.00
- **Variance:** 635834.053
- **Skewness:** 1.213
- **Minimum:** 15.00

### Percentile Values

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</table>

### Notes

- The table shows a frequency distribution with values ranging from 19 to 117, each with varying frequency counts.
- The count symbolizes approximately 200 occurrences for each value.
- Summary statistics are provided, including mean, median, variance, skewness, and minimum.
- Percentile values for different percentiles are given, with specific values for 10th, 50th, and 90th percentiles.
### Table 1: Frequency Distribution of Values

<table>
<thead>
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<th>VALUE</th>
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<th>SUM</th>
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The symbol equals approximately 400 occurrences.

### Summary Statistics

- **Mean**: 5.93 ± 1.00
- **Median**: 5.50 ± 1.00
- **Variance**: 447.79 ± 167
- **Skewness**: 1.469
- **Minimum**: 1.000
- **Maximum**: 31.000

### Percentile Value

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### Missing Cases

- **Valid Cases**: 491
- **Missing Cases**: 0

38
### ALAND

#### AREA LAND COVERAGE

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<th>VALUE</th>
<th>FREQ</th>
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**COUNT**

Midpoint: One symbol equals approximately 400 occurrences

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**MEAN**

1.421

**STANDARD DEVIATION**

1.302

**VARIANCE**

1.796

**SKEWNESS**

2.816

**KURTOSIS**

1.421

**SUM**

1143.869

**MINIMUM**

0

**MAXIMUM**

22.576

**MEDIAN**

41.3

**RANGE**

1141.303

**PERCENTILE VALUE**

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**VALID CASES**

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**COUNT MIDPOINT ONE SYMBOL EQUALS APPROXIMATELY 400 OCCURRENCES**

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**HISTOGRAM FREQUENCY**

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**MISSING CASES**

| 0 |

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**VALUE LABEL**

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**VALID CUM PERCENT PERCENT PERCENT**

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**AREA OPEN WITH BUILDINGS**
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HISTOGRAM FREQUENCY

| MEAN | 12.324 |
| MODE | 6.140 |
| SKW  | 1.995 |
| SKEWNESS | 1.389 |

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A3  AREA CEN W/OUT BLOWS

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### Analysis

- The data distribution is slightly skewed to the right, as indicated by the positive skewness value.
- The median is lower than the mean, suggesting a possible right-skewed distribution.
- The interquartile range (IQR) is calculated as the difference between the 75th and 25th percentiles, which is 12.50 - 5.00 = 7.50.

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**Total:** 70

- The distribution shows a moderate number of occurrences in the lower range values (1-3) and a gradual decrease as the values increase.
- The data appears to be relatively evenly distributed across the range, with no significant clustering in any particular range.
## HISTOGRAM FREQUENCY

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| VALID CASES | 220     | MISSING CASES | 0    |

46
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TOTAL: 220

### HISTOGRAM FREQUENCY

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HISTOGRAM FREQUENCY
### Descriptive Statistics

- **Mean**: 29.209
- **Std Err**: 1.276
- **Median**: 25.000
- **Std Dev**: 19.928
- **Variance**: 398.285
- **Skewness**: 2.740
- **Kurtosis**: 10.251
- **Minimum**: 9.000
- **Maximum**: 140.000
- **Sum**: 6426.000

### Percentiles

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### Frequency Distribution

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### Histogram

![Histogram Image]

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**TOTAL** 220 **100.0** **100.0**

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CART MIDPOINT THE SYMBOL EQUALS APPROXIMATELY 15 OCCURRENCES

| 17 | 75 | ************** |
| 11 | 63 | *************** |
| 19 | 119 | *************** |
| 17 | 147 | *************** |
| 5 | 175 | *** |
| 11 | 203 | **** |
| 8 | 251 | **** |
| 5 | 259 | *** |
| 5 | 257 | *** |
| 0 | 315 | |
| 0 | 371 | |
| 3 | 379 | ** |
| 1 | 427 | * |
| 2 | 456 | |
| 0 | 473 | |
| 0 | 511 | |
| 0 | 539 | |
| 1 | 567 | |
| 2 | 595 | |

I + I + I + I + I + I

HISTOGRAM FREQUENCY

| MEAN | 120 232 | STD ERR | 6 687 | MEDIAN | 80 500 |
| MODE | 3 000 | STD DEV | 99 257 | VARIANCE | 9550 051 |
| KURTOSIS | 6 968 | S KURT | 1 991 | SKEWNESS | 2 408 |
| SKEW | 164 | RANGE | 570 000 | MINIMUM | 30 000 |
| MAXIMUM | 600 000 | SUM | 26451 000 |

PERCENTILE VALUE PERCENTILE VALUE PERCENTILE VALUE

| 10 00 | 45 000 | 25 000 | 60 000 | 33 30 | 70 000 |
| 50 00 | 87 500 | 66 70 | 110 000 | 75 00 | 150 000 |
| 90 00 | 230 000 | |

VALID CASES | 220 | MISSING CASES | 0 |

VALUE FREQUENCY VALUE FREQUENCY SUM VALUE FREQUENCY SUM

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| 1.7 | 1 | 0 | 1 | 50 | 1 | 4 | 50 | 140 | 1 | 0 | 85 |
| 1.8 | 1 | 0 | 2 | 55 | 5 | 2 | 52 | 150 | 6 | 3 | 87 |
| 2.0 | 3 | 4 | 5 | 60 | 9 | 4 | 56 | 160 | 4 | 2 | 59 |
| 2.2 | 1 | 0 | 6 | 65 | 4 | 2 | 58 | 200 | 2 | 1 | 90 |
| 2.4 | 2 | 1 | 7 | 70 | 4 | 2 | 60 | 210 | 2 | 1 | 91 |
| 2.6 | 1 | 0 | 7 | 75 | 3 | 1 | 61 | 220 | 4 | 2 | 93 |
| 2.8 | 8 | 15 | 80 | 5 | 2 | 64 | 240 | 3 | 1 | 94 |
| 3.0 | 1 | 0 | 16 | 90 | 11 | 5 | 69 | 250 | 4 | 2 | 96 |
| 3.2 | 2 | 4 | 17 | 95 | 1 | 0 | 95 | 275 | 1 | 0 | 96 |
| 3.4 | 10 | 5 | 31 | 100 | 13 | 3 | 74 | 300 | 2 | 1 | 97 |
| 3.6 | 14 | 6 | 33 | 105 | 3 | 1 | 75 | 330 | 1 | 0 | 98 |
| 3.8 | 4 | 38 | 110 | 7 | 3 | 78 | 350 | 1 | 0 | 98 |
| 4.0 | 1 | 0 | 39 | 115 | 1 | 3 | 79 | 400 | 2 | 1 | 99 |
| 4.2 | 3 | 4 | 43 | 120 | 3 | 4 | 83 | 420 | 1 | 0 | 100 |
| 4.4 | 1 | 0 | 43 | 125 | 1 | 2 | 93 | 450 | 1 | 0 | 100 |

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Spatial areas of building materials
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**Summary Statistics**

- **Mean**: 2765.735
- **Std. Err.**: 428.614
- **Median**: 67.141
- **Mode**: 0.0
- **Std. Dev.**: 4357.366
- **Variance**: 0.0416106
- **Skewness**: 3.368
- **Kurtosis**: 9.991
- **Range**: 37320-256
- **Minimum**: 0.0
- **Maximum**: 37320-256
- **Sum**: 50461.756
- **Valid Cases**: 220
- **Missing Cases**: 0

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**Sum**: 100.0

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| MINIMUM | 21900 000 | SUM | 40375 656 |

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### Summary Statistics

- **Mean**: 139.833
- **Median**: 135.973
- **Standard Error**: 0.000
- **Standard Deviation**: 135.973
- **Variance**: 1839784.06
- **Kurtosis**: 123.733
- **Skewness**: 16.250
- **Minimum**: 0.000
- **Range**: 16250.000
- **Maximum**: 24852.915

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**Valid Cases**: 220
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COUNT  MIDPOINT  ONE SYMBOL EQUALS APPROXIMATELY 400 OCCURRENCES

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**Means and Standard Deviations:**

- **Mean:** 1.059
- **Std Dev:** 0.0972
- **Median:** 1.000
- **Variance:** 1.133
- **Skewness:** 2.25
- **Kurtosis:** -1.259
- **Minimum:** 4,000
- **Maximum:** 233,000

**Percent of Populations:**

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**Missing Cases:** 0
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**Missing Cases**: 0
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VALID CASES: 220
MISSING CASES: 0
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**TOTAL** 220 | 100.0 | 100.0 |

### MEAN, MEDIAN, SD, SE, RANGE, VARIANCE, SK, SEK, KURT

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**TOTAL** 220 | 100.0 | 100.0 |
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**Valid Cases:** 220  **Missing Cases:** 0
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## Descriptive Statistics

- **Mean:** 0.055
- **Std Dev:** 0.022
- **Skewness:** 5.845
- **Kurtosis:** 32.455
- **Variance:** 0.107

## Percentiles

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## Material

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**TOTAL:** 220
NO MATERIAL
PAINTED
BARE GALVANIZE
BARE ALUMINUM
OTHER

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VALID CASES 220  MISSING CASES 0

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MISSING CASES 0

TOTAL 220 100.0 100.0

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Valid Cases: 220, Missing Cases: 0
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**HISTOGRAM FREQUENCY**

- **Mean**: 93.082
- **Median**: 99.963
- **Mode**: 0
- **Variance**: 21861.162
- **Standard Deviation**: 147.855
- **Range**: 999
- **Sum**: 11679
- **Minimum**: 0
- **Maximum**: 999

**Count** vs. **Midpoint**: One symbol equals approximately 40 occurrences.
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**VALID CASES**: 220  **MISSING CASES**: 0

### APPFL INDICATOR: FLASHING

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**TOTAL**: 220  **100.0% 100.0%**

### MEASURES OF CENTRAL TENDENCY AND VARIABILITY

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### PERCENTILE VALUE

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**VALID CASES**: 220  **MISSING CASES**: 0

---

**FREQUENCY**

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**TOTAL CASES**: 220  **MISSING CASES**: 0

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74
## Rain gutters, downspouts and fences

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- **Std Dev**: 1.398
- **Variance**: 1.955
- **Skewness**: 0.595
- **Range**: 3.000
- **Minimum**: 0.0
- **Maximum**: 3.000
- **Sum**: 240.000

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VARIANCE  2140.330

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90.00  30.000

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SARE GALVAN WIRE  2  3  1.4  1.4  1.4
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| VALID CASES | 220 | MISSING CASES | 0 |

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### Chart Summary

**Symbol Occurrences Approximately 40**

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- 100
- 110
- 140
- 150
- 200
- 250
- 300
- 320
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| VALID CASES | 220 | MISSING CASES | 0 |
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11-86

DTIC