

THE ANALYSIS OF STONE AND SAND AND GRAVEL
STATISTICS FOR SELECTED COUNTIES IN OREGON

by

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THE ANALYSIS OF STONE AND SAND AND GRAVEL
STATISTICS FOR SELECTED COUNTIES IN OREGON

ABSTRACT. The Minerals Yearbook and the Census of Minerals Industries' statistics lack detail, completeness, and accuracy concerning stone and sand and gravel in Oregon and are therefore deficient in their utility. The lack of detail and completeness causes extreme difficulty in comparing varied field-checked statistics. The inaccuracy of the data concerning the number of stone and sand and gravel operators and producing sites results in an error in the reported volume and value of production. This error effectuates stone and sand and gravel planning inefficient and determination of actual reserves impossible. Key Words: Time lag of publication, Data intent, Data unit, Data comparison.

INTRODUCTION

Oregon's mineral resources have provided the basis for the development and growth of its present economy. They are vital in virtually every activity; mineral products supply fuel for energy and supply the necessities for machinery which produce manufactured products.

With society's continued pace of development and growth, there has been created a growing need for products and energy, and thus a greater strain has been placed on our mineral reserves. Presently, there are many minerals which are scarce; the phrase "mineral shortage" is becoming a contemporary term. In the case of sand and gravel, useable surface deposits are becoming exhausted. Land use planners must realize that when determining land use policies, subsurface value must be recognized. Construction of highways, zoning, and environmental concerns are inducing shortages in sand and gravel by preventing subsurface mining in these areas. Since substitutes for sand and gravel have not been developed to replace sand and gravel in large-scale operations, these necessary minerals for cement and construction would be greatly diminished.

As substitutes are being sought to overcome other shortages, these substitute minerals are being intensely developed and overused. This situation calls for effective and efficient planning of mineral resources by municipal, industrial, and environmental planners. Their decisions must be based on accurate mineral data. Data gathered by the U. S. Bureau of Mines, published in the Minerals Yearbook, and by the U. S. Bureau of the Census, published in the Census of Mineral Industries, are obtained by canvassing (through voluntary compliance of questionnaires), generally,

the large and the long-term mines. These surveys often omit the long-term, short-term, and weekend mines, resulting in inaccurate and inefficient mineral statistics.

This project will investigate data completeness and reliability of the Minerals Yearbook and the Census of Mineral Industries for stone and sand and gravel in Oregon. It will include the number of mineral-producing sites and operators and the amount and value of production. Also within this project, the time lag of publication, data intent and unit will be discussed.

TIME LAG OF PUBLICATION

This discussion is concerned with two major data sources: the U. S. Bureau of Mines and the U. S. Bureau of the Census. Specifically, the focus is on the Minerals Yearbook and the Census of Mineral Industries.

Minerals Yearbook

The Minerals Yearbook is an annual publication of the U. S. Bureau of Mines, the agency charged with providing economic and statistical studies of domestic and foreign mineral production, distribution, and consumption.¹ The Yearbook is comprised of three volumes. Volume I, Metals and Minerals, and Volume II, Mineral Fuels, include chapters dealing with metals and non-metals, along with chapters on technological trends, employment, and personal injury

occurring in the mineral industries. Data categories generally include domestic production by volume and/or value, imports, exports, stocks, consumption, and world production.²

Volume III is titled Reports: Domestic, which contains chapters on every state and United States' possessions in the Pacific Ocean and the Caribbean Sea, Puerto Rico, and the Canal Zone. Each chapter contains quantity and value data for the minerals produced in a given state. Also cited are the values of mineral production with the listing of minerals produced and in order of value, and the listing of principal producers, both of these by county.³

In the course of investigating Oregon's mineral data during the summer of 1974, the Minerals Yearbook was utilized. However, the most current chapter summary yet published was 1971. Preprints and surveys are published in advance of the final Yearbook (1972 in this case), but Oregon's was not available. The most recent statistics of Oregon's mineral data were supplied by the 1971 Yearbook. The 1972 chapter preprints of "The Mineral Industry of Oregon," eventually to be published in the Minerals Yearbook, became available in mid July of 1974. Since data collection and analysis began in late May of this year, data which were available prior to the chapter preprint distribution was used.

The time lag between the date of canvassing and the

date of final publication created problems. In attempting to set up direct yearly comparisons of Minerals Yearbook data and field-checked data supplied by the Mine Land Reclamation Department, neoteric statistics were not available.

Census of Mineral Industries

The Census of Mineral Industries is a publication of the U. S. Bureau of the Census. Present plans indicate a mineral industries' census to be conducted covering years ending in "2" and "7."⁴

The Census' data are published in three series: subject, industry, and area. All three of the series' reports were used, but in varying degrees.

Subject Series

The number of reports vary from census to census but usually include data reporting water used in mining, size of establishment, and type of operation. The statistics listed include divisions by geographic areas and by states.

Industry Series

These reports provide data for industry characteristics such as: the number of establishments; employment payrolls; value added in mining; and the quantity and value of products shipped. State coverage is seldom provided.

Area Series

This series provides statistical information for forty-eight individual states, the District of Columbia, and one report combining Maryland and Delaware. Statistics are provided for the mining industries located in a particular state. These statistics include topics such as: type of operation; number of establishments; value in shipments; and value added in mining.⁵

Difficulties arise in working with statistics from all three of the series' reports because county data are seldom supplied; when they are supplied, complete and detailed information is lacking. Also, after the census is conducted, the processing of data results in a delay of publication by three or more years. In this study, the most current census material, containing a listing of counties, was the 1967 census. This time lag limits the Census of Mineral Industries' utility as a source of current information and makes direct comparison to contemporary data impossible.

DATA INTENT

When employing published mineral data, it is essential to understand what commodities have been measured and in what manner. This insight will provide an appreciation of what the statistics are actually revealing.

Stone

In the examination of stone statistics, one should realize that included in quantity and value data of stone are both dimension stone and crushed and broken stone, sold or used by producers. The figures shown as totals, though including various kinds and forms of stone, are intended to report total volume and total value only; at no time is an "average" value of stone established. Detailed tables showing type of stone (granite, marble, basalt, limestone, etc.) and form (dimension or crushed and broken) are presented in the reported Census and Yearbook data with appropriate value. The value of stone is adjusted to avoid duplication when limestone is used in making cement or lime.⁶

Dimension Stone

Dimension stone is classified in the Standard Industrial Classification (SIC) in the Census as industry 1411. This industry represents the reported Census and Yearbook establishments primarily engaged in mining or quarrying dimension stone. Also included are establishments primarily engaged in producing rough blocks and slabs. Establishments primarily involved in mining or quarrying grindstone, pulpstones, millstones, burrstones, and sharpening stones are classified in the SIC code as industry 1497, Natural Abrasives, except for Sand; and those mining or

quarrying dimension soapstone are categorized in industry 1496, Talc, Soapstone, and Pyrophyllite. Nepheline syenite operations are classified in industry 1459, Clay, Ceramic, and Refractory Minerals, Not Elsewhere Classified.⁷

Producing sites categorized in industry 1411, Dimension Stone, as interpreted in the 1967 Census of Mineral Industries and the 1967 and 1971 Minerals Yearbook, represent quarries with or without dressing plants operated as part of the same establishment if the establishment primarily ships rough dimension stone. The following report also includes related 1967 Census of Manufactures figures for dimension stone quarries operated in conjunction with dressing plants which represents part of manufacturing industry 3281, Cut Stone and Stone Products. Thus, the total figures of dimension stone represent all dimension stone quarries and all dressing plants in conjunction with these quarries.

Crushed Stone

Establishments classified in industry 1422, Crushed and Broken Limestone, industry 1423, Crushed and Broken Granite, and industry 1429, Crushed and Broken Stone, Not Elsewhere Classified, represent all separately operated quarries and crushing plants which primarily produce crushed and broken stone. They do not include limestone, cement rock, and other stone quarries which are parts of establishments primarily manufacturing hydraulic cement, quicklime,

hydrated lime, ready-mix concrete, or bituminous concrete.⁸

Census of Mineral Industries' figures, for the crushed and broken stone industry, exclude data on production by federal, state, and local governments, whereas the Minerals Yearbook includes such data. According to the U. S. Bureau of Mines, "noncommercial operations" of the crushed and broken stone variety produced approximately 8 percent of the total for 1967; therefore, large incongruities will appear when comparing these two mineral data sources.

The determination of value for stone and sand and gravel in the Census and Yearbook is accomplished by subtracting the cost of supplies and purchased machinery from the value of shipments and receipts and the capital expenditures.⁹

This value measurement avoids the duplication in the value-of-shipments figure which results from the use of products of some establishments as supplies, energy sources, or materials, by others. Moreover, it provides a measure, not only of value added in mineral production, but also in the development of mineral properties.

Sand and Gravel

As reported in the summary tables of the Minerals Yearbook, sand and gravel includes processed and unprocessed construction sand, and ground and unground industrial sand.

The data are compiled from producers' reports showing quantity and value of sand and gravel sold or used for various purposes. (See Appendix I.) An average value for the combined products is given; in other tables, detailed information is given pertinent to the various types and uses of sand and gravel.

Construction Sand and Gravel

Construction sand and gravel is classified in the Census in the SIC as industry 1332. This industry represents the Census and Yearbook establishments primarily engaged in operating sand and gravel pits and dredges, and in washing, screening, or otherwise preparing sand and gravel for construction uses.

Industrial Sand

Industrial sand is categorized in the Census in the SIC as industry 1446. This industry represents the reported Census and Yearbook establishments primarily involved in identical operations as the Construction Sand and Gravel industry. The only difference is that in the Industrial Sand industry, the preparation of sand is for uses other than construction, such as: glassmaking; molding; and abrasives.

Establishments producing sand and gravel included in the Census of Mineral Industries and the Minerals Yearbook represent only establishments primarily engaged in producing

sand and gravel. Establishments involved in producing sand and gravel as a secondary activity, in conjunction with the production of concrete brick and block, ready-mix concrete, asphalt and tar paving mixtures or other manufactured products, are not classified as sand and gravel in mineral Census or Yearbook data.¹⁰

Although the Census and the Yearbook measure sand and gravel value and volume of production in similar ways, the two sources present wide inconsistencies in their data. This discrepancy occurs because the Census of Mineral Industries' statistics, as in the case of stone, excludes production by federal, state, and local governments, whereas the Minerals Yearbook includes these producers.

Sand and gravel and stone, and nearly all nonmetallic commodities, are apparently valued at the first marketable product stage. However, valuation of each commodity should be thoroughly reviewed by the responsible commodity specialist to determine whether or not the commodity applies to the first marketable product.

DATA UNIT

A related problem in appreciating what the statistics are actually revealing is reflected in the unit of measurement of mineral commodities. For example, in Oregon and in the United States, the volume of production of sand and gravel and stone is generally reported in short tons (2,000

pounds or 907.03 kilograms). This measurement should not be mistaken or confused with long tons (2,240 pounds or 1015.87 kilograms) which commonly measure iron ore, or with metric tons (2204.62 pounds or 999.83 kilograms) which often measure foreign production.

Along with using the unit "short tons" to measure the volume of sand and gravel production, the unit "cubic yards" is often employed. In reporting production in cubic yards, weight per cubic yard of sand and gravel must be indicated in order to establish an equivalence to short tons.

In the case of stone, the unit "cubic feet" is also utilized to indicate volume of production. The cubic foot measurement along with the type of rock indicated provides an equivalence for comparison to short tons.

If caution is not exercised in reviewing statistics measured in different units, inaccurate inferences are drawn.

DATA COMPARISON

The data which will be the basis for comparisons, progressions, and estimations will be supplied by the U. S. Bureau of Mines (henceforth referred to as the Bureau) obtained through canvassing for the Minerals Yearbook publications and through surveys by the Mine Land Reclamation Department (henceforth referred to as MLRD). Data used in the tables and in the text will compare only Bureau and

MLRD data; it will neglect data obtained through canvassing for the Census of Mineral Industries' publications, because both the Yearbook and the Census use the same questionnaire canvassing list. (A sample Bureau questionnaire for stone and sand and gravel which is mailed to operators is provided in Appendices I and II.)

During this research, it was hypothesized that Bureau statistics do not accurately reflect the total number of stone and/or sand and gravel operators and producing sites per county in Oregon and thus are also inaccurate in their reported volume and value of production. The inaccuracy occurs through the Bureau's failure to canvass the total number of operators per county. In so doing, they arrive at an incorrect number of producing sites.

To evaluate this theory, the nine Oregon counties with the most detailed and readily available statistics obtained from the Bureau and from the MLRD were chosen. These selected counties, along with the number of operators and sites producing stone and/or sand and gravel supplied by data based on MLRD statistics, are presented in Table 1. The data in Table 1 include U. S. Forest Service pits, access road pits, stream bank mining pits, and the regular commercial and non-commercial mining pits.

To compare data in Table 1 to Bureau data (number of operators per county), a linear progression was used to update 1971 Bureau data to July 1, 1974. The data resulting

Table 1.--The Number of Operators and Sites Producing Stone and/or Sand and Gravel in Selected Counties of Oregon, July 1, 1974^a

<u>COUNTY</u>	<u>SITES</u>	<u>OPERATORS</u>
Clackamas	133	70
Lane	155	94
Lincoln	40	24
Multnomah	95	59
Tillamook	55	34
Union	33	19
Wasco	43	24
Washington	73	48
Yamhill	<u>73</u>	<u>42</u>
TOTAL	700	414

a The number of mineral operators and mineral producing sites are estimates based upon field checked locations only of operators and sites which produce 10,000 cubic yards/year (9,144 cubic meters/year) or more. Those operators fall under the Mine Land Reclamation Act.

Source: Jerry J. Gray of the Mine Land Reclamation, Albany, Oregon.

from the linear progression (operators per county as of 1972, 1973, and July 1, 1974) are estimates based upon 1971 Bureau statistics. These estimates are not necessarily the statistics that the Bureau will obtain when canvassing for the years involved, but do provide insight into the Bureau's probable operator-per-county totals. Throughout this report, the operator-per-county estimates as of July 1, 1974 will continue to be termed "Bureau statistics" to prevent confusion with MLRD data.

The procedure used to arrive at the progressed July 1, 1974 Bureau statistics involved determining the difference between the 1971 number of operators per county, reported by the Bureau, and the number of operators per county, estimated by MLRD data supplied for July 1, 1974. That difference (the expansion factor) was then added to the 1971 Bureau data to provide a total number of operators per county for 1972. The same procedure was used to obtain the estimated 1973 Bureau operators per county.

The July 1, 1974 estimates were obtained by a similar procedure. The difference between the number of operators per county in 1973 and 1974 was calculated. That difference was then multiplied by .50 because the estimate was sought for July 1, 1974 and not for the entire year.

The comparison of the estimated July 1, 1974 Bureau figures with the estimated July 1, 1974 MLRD figures (operators per county) reveals a 49 percent Bureau deficit

in the total number of operators. The county differences range from Washington County, a 60 percent difference (MLRD = 48.0 operators and Bureau = 19.1 operators) to Union County, a 33 percent difference (MLRD = 19.0 operators and Bureau = 12.7 operators) (Table 2). Because the number of operators per county shown by the Bureau is 49 percent lower than the number shown by the MLRD, the number of producing sites per county may also be in error. Since the Bureau does not provide sites-per-county figures for sand and gravel for either 1967 or 1971, a ratio of the number of sites per county to the number of operators per county was determined. The assumption was made, in calculating this ratio per county, that the stone ratio of sites per operators between the years 1967 and 1971 is equivalent to the sand and gravel ratio between the years 1971 and July 1, 1974.

The procedure used to determine the stone ratio of the number of sites per operator was confronted with the problem of data concealment by the Bureau for reasons of confidentiality of company data. The data supplied by the Bureau contained a figure denoting the total number of sites concealed within the data of the selected counties. The Bureau data also supplied the number of sites per county which were not concealed by data confidentiality restrictions. Not knowing in which counties the number of sites was

Table 2.--The Linear Progression from 1971 to July 1, 1974 of the Number of Operators Producing Stone and/or Sand and Gravel/County and the Comparison to MLRD

<u>COUNTY</u>	<u>BUREAU OPERATORS IN 1971</u>	<u>BUREAU OPERATORS IN 1972</u>	<u>BUREAU OPERATORS IN 1973</u>	<u>BUREAU OPERATORS JULY 1, 1974</u>	<u>MLRD OPERATORS JULY 1, 1974</u>	<u>PERCENTAGE OF OPERATORS/COUNTY UNKNOWN BY BUREAU, JULY 1, 1974</u>
Clackamas	28	30.5	32.8	33.9	70	52%
Lane	33	35.9	38.5	39.7	94	58%
Lincoln	8	11.0	13.2	14.1	24	41%
Multnomah	21	23.8	26.3	27.4	59	54%
Tillamook	15	17.3	19.3	20.2	34	41%
Union	8	10.4	11.9	12.7	19	33%
Wasco	8	11.0	13.2	14.1	24	41%
Washington	9	14.3	17.7	19.1	48	60%
Yamhill	6	13.0	16.2	<u>17.5</u>	<u>42</u>	<u>58%</u>
TOTAL				198.7	414	average 49%

Source: Based upon the 1971 data supplied by Richard N. Appling, Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington.

MLRD estimates supplied by Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon.

concealed, the total of concealed sites was distributed evenly over all of the counties by dividing the total number of sites into the selected counties. Each county was increased 1.0 site in the 1967 data and by 2.64 sites in the 1971 data. The site-to-operator stone ratio per county was then calculated by dividing the total number of sites per county into the total number of operators per county (Table 3).

With the stone ratio for each county determined, multiplying the number of sand and gravel operators by the ratio of stone sites per operator supplies the estimated number of Bureau sand and gravel sites per county as of July 1, 1974. Comparison can now be made between the number of Bureau sand and gravel sites per county and the number of MLRD sand and gravel sites per county as of July 1, 1974 (Table 4).

As in the comparison of the estimated number of operators per county, the comparison of the estimated number of sites per county also reveals a deficiency of Bureau sites by a factor of approximately two. This deficiency occurs when small and temporary operators and sites are overlooked during canvassing. If one small producer is missed, his absence will be of little significance in determining county and state production. But when fifty-four producers and ninety-five sites are overlooked in Lane County, for

Table 3.--The Ratio Per County of Stone and/or Sand and Gravel Producing Sites to the Number of Operators as Canvassed by the Bureau

<u>COUNTY</u>	<u>TOTAL NUMBER OF STONE PRODUCING SITES IN 1967 AND 1971</u>	<u>TOTAL NUMBER OF STONE OPERATORS IN 1967 and 1971</u>	<u>RATIO OF THE NUMBER OF SITES TO THE NUMBER OF OPERATORS, 1967-1971</u>
Clackamas	26.64	19	1.40
Lane	56.64	41	1.38
Lincoln	13.64	7	1.95
Multnomah	6.64	9	0.74
Tillamook	25.64	15	1.71
Union	14.64	8	1.83
Wasco	7.64	4	1.91
Washington	18.64	13	1.43
Yamhill	8.64	5	1.73

Source: Distribution of concealed sites per county based upon the 1971 data supplied by Richard N. Appling, Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington.

Table 4.--The Number of Sites/County Based Upon the 1971 Bureau Data Compared with the Number of Sites/County Based Upon the 1974 MLRD Data

<u>COUNTY</u>	<u>BUREAU, NUMBER OF SITES/COUNTY JULY 1, 1974 (SAND AND GRAVEL)</u>	<u>MLRD, NUMBER OF SITES/COUNTY JULY 1, 1974 (SAND AND GRAVEL)</u>	<u>PERCENTAGE OF SITES/COUNTY UNKNOWN BY BUREAU, JULY 1, 1974 (SAND AND GRAVEL)</u>
Clackamas	47.36	133	64%
Lane	54.79	155	65%
Lincoln	27.50	40	31%
Multnomah	20.28	95	79%
Tillamook	34.54	55	37%
Union	23.24	33	30%
Wasco	26.93	43	37%
Washington	27.31	73	63%
Yamhill	<u>30.28</u>	<u>73</u>	<u>59%</u>
TOTAL	292.23	700	average 52%

Source: Bureau estimates based upon the 1971 data supplied by Richard N. Appling, Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington. MLRD estimates supplied by Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon.

example, their aggregate production is extremely significant in determining accurate county and state statistics. Because of the deficiency in the number of Bureau operators and sites reported per county, the volume and value of stone and/or sand and gravel production is also in error.

When the difference between the estimated July 1, 1974 Bureau sites per county and the estimated July 1, 1974 MLRD sites per county is determined, that difference will represent the small and temporary sites which are overlooked by the Bureau. Assuming that the overlooked sites average 7,500 cubic yards per year mined (6,858 short tons after conversion)*, the overlooked sites multiplied by 6,858 short tons equal the volume of production which is lost during Bureau canvassing. The percentage of production which is lost is provided per county in Table 5 along with the total Bureau and MLRD production figures of all nine counties.

Table 5 is designed to show how much estimated production is unreported by the Bureau because of its failure to canvass all producing sites. The volume of production per county with the added MLRD producing sites are only

*The factor used to convert cubic yards of stone and/or sand and gravel to short tons was: 2.2 cubic yards (2.01 cubic meters) equals 2.0 short tons (1.81 metric tons).

Table 5.--The Comparison Between the Bureau's Production of Stone and/or Sand and Gravel/ County and the Added Production of the MLRD's Producing Sites

<u>COUNTY</u>	<u>BUREAU PRODUCTION OF STONE AND SAND AND GRAVEL IN 1971 (SHORT TONS)</u>	<u>MLRD SITES MINUS BUREAU SITES</u>	<u>VOLUME OF PRODUCTION WITH ADDED MLRD PRODUCING SITES</u>	<u>PERCENT OF VOLUME INCREASE WITH ADDED MLRD PRODUCING SITES</u>
Clackamas	3,516,000	85.64	4,103,319	14%
Lane	3,779,000	100.21	4,466,240	15%
Lincoln	502,000	12.50	587,725	15%
Multnomah	3,866,000	74.72	4,378,430	12%
Tillamook	259,000	20.46	399,315	35%
Union	752,000	9.76	818,934	8%
Wasco	212,000	16.07	322,208	34%
Washington	1,280,000	45.69	1,593,342	20%
Yamhill	<u>302,000</u>	42.72	<u>594,974</u>	<u>49%</u>
TOTAL	14,468,000		17,264,487	average 22%

Source: Based upon the 1971 data supplied by Richard N. Appling, Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington, and Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon. MLRD data based upon data supplied by Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon.

estimates of production as of July 1, 1974. The statistics are estimates because the volume of production per county of the overlooked sites by the Bureau was added to the 1971 Bureau statistics to provide an estimate of the total volume of production per county as of July 1, 1974. The totals of production per county as of July 1, 1974 will change when the Bureau, through canvassing, determines the 1974 volume of production to which the volume of production of overlooked sites will be added.

Table 6 determines the dollar value per county and the dollar value in cumulative county totals not reported by the Bureau due to the number of sites overlooked during canvassing. The percentage of dollar value-per-county increase, due to the added MLRD producing sites, are also presented in Table 6.

Table 6 is designed to show how much estimated dollar value is unreported by the Bureau because of its failure to canvass all producing sites. The dollar value per county with the added MLRD producing sites are only estimates of dollar value as of July 1, 1974. The statistics are estimates because the dollar value of production per county of the overlooked sites by the Bureau was added to the 1971 Bureau statistics to provide an estimate of the total dollar value of production per county as of July 1, 1974. The totals of dollar value per county as of July 1, 1974 will

Table 6.--The Comparison Between the Bureau's Dollar Value of Stone and/or Sand and Gravel Production/County and the Dollar Value Added Through MLRD's Producing Sites

<u>COUNTY</u>	<u>BUREAU, DOLLAR VALUE OF STONE AND SAND AND GRAVEL PRODUCTION IN 1974</u>	<u>DOLLAR VALUE/SHORT TON OF BUREAU'S STONE AND SAND AND GRAVEL PRODUCTION IN 1971</u>	<u>DOLLAR VALUE OF PRODUCTION WITH ADDED MLRD PRODUCING SITES</u>	<u>PERCENT OF DOLLAR VALUE INCREASE WITH ADDED MLRD PRODUCING SITES</u>
Clackamas	\$ 5,369,000	\$1.53	\$ 6,278,078	14%
Lane	5,286,000	1.40	6,252,736	15%
Lincoln	1,033,000	2.06	1,210,714	15%
Multnomah	6,372,000	1.65	7,224,410	12%
Tillamook	308,000	1.19	475,185	35%
Union	1,676,000	2.23	1,826,223	8%
Wasco	484,000	2.28	734,634	34%
Washington	1,937,000	1.51	2,405,946	20%
Yamhill	<u>450,000</u>	1.49	<u>886,511</u>	<u>49%</u>
TOTAL	\$22,915,000		\$27,294,437	average 22%

Source: Based upon the 1971 data supplied by Richard N. Appling, Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington, and Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon.
MLRD estimates based upon data supplied by Jerry J. Gray of the Mine Land Reclamation Department, Albany, Oregon.

also change when the Bureau, through canvassing, determines the 1974 dollar value of production to which the dollar value of overlooked sites will be added.

CONCLUSION

In the discussion of the time lag of publication and data comparison, some of the weaknesses of the Minerals Yearbook and the Census of Mineral Industries' statistics were presented. Another weakness of the two data sources which is not directly related to the statistics themselves is the withholding of reported data by the two publishing agencies (the U. S. Bureau of Mines and the U. S. Bureau of the Census) in order to maintain companies' confidential data. The problem of data confidentiality presented itself in every attempt to acquire stone and sand and gravel statistics. Fortunately, Mr. Appling manipulated the data to provide greater detail than was available in either the Census or the Yearbook while maintaining company confidentiality of data.

Bureau personnel, in most cases, realize that the withholding of data which could be manipulated to prevent the disclosure of companies' confidential data further reduces the utility of that data. Since the U. S. Bureau of Mines and the U. S. Bureau of the Census are the gathering and controlling agencies of much of the nation's mineral data, their practice of data manipulation and

distribution would be most valuable for scholarly analysis. Greater efficiency of data gathering and documentation could result, and thus greater data accuracy by both Bureaus could be obtained.

At present, the method of data gathering and documentation for stone and sand and gravel is inadequate. The low percentage of stone and sand and gravel questionnaire compliance (approximately 60 percent) indicates that far too many operators and producing sites are being overlooked during questionnaire distribution.

The completeness of some of the stone and sand and gravel statistics in the Minerals Yearbook and the Census of Mineral Industries also has been analyzed, and the deficiencies have been sited. The nine counties selected for analysis represent only a few of the counties for which inaccurate statistics have been published. These nine counties were selected on the basis of their available and detailed statistics. It can only be surmised which other counties share the same data inadequacies. A reasonable question to be raised is, "If stone and sand and gravel statistics are in error, which other mineral statistics are also inaccurate?"

The problem of unreported stone and sand and gravel production is that, as production is unreportedly being increased (as compared to the reported production) by the

uncanvassed producers, the planned future reserves of stone and sand and gravel may be knowingly decreased. The decrease in reserves may occur through zoning, environmental concerns, and highway construction. With inaccurate production data as a possible basis for county and state planning decisions, inaccurate estimates of future reserve needs could be made.

FOOTNOTES

1. Thomas J. Maresh, "Mineral Resource Data for Geographic Research and Instruction," in Borden D. Dent (ed.), 1975 Yearbook of the National Council for Geographic Education (forthcoming).
2. Maresh, op. cit., footnote 1.
3. Maresh, op. cit., footnote 1.
4. Maresh, op. cit., footnote 1.
5. Maresh, op. cit., footnote 1.
6. Harry F. Robertson, "Preliminary Report on Bureau of Mines Mineral Production Statistics," (unpublished working paper of the U. S. Bureau of Mines (Aug. 1, 1962)), pp. 12-23.
7. United States Bureau of the Census, "Stone," Census of Mineral Industries, industry series (1967), pp. 14A-2.
8. United States Bureau of the Census, op. cit., footnote 2, p. 14A-2.
9. United States Bureau of the Census, op. cit., footnote 2, p. A3.

10. United States Bureau of the Census, op. cit.,
footnote 2, p. A5.

APPENDIX I

UNITED STATES
 DEPARTMENT OF THE INTERIOR
 BUREAU OF MINES
 WASHINGTON, D.C. 20240

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 O.M.B. No. 42-10264.
 Approval expires November 1975.
 INDIVIDUAL COMPANY
 DATA-CONFIDENTIAL



G09

SAND AND GRAVEL

The data furnished in this report may be disclosed to Federal defense agencies. In some cases the data may be disclosed to the respondent's State government, depending on specific procedures explained in the enclosure to this form. In other than the situations noted above, the data furnished in this report will be treated in confidence by the Department of the Interior unless authorization is granted in the section above the signature.

Please separate forms at perforations

An extra copy is provided for your files

(Please correct if name or address has changed.)

I. Name and location of operation

Name _____ Nearest city or town _____
 State _____ County _____ Section _____ Township _____ Range _____
 If operating company is a subsidiary, please name controlling company _____

INSTRUCTIONS

Please complete and return one copy of this form as promptly as possible in the enclosed envelope. A separate report should be prepared for each operating unit from which a product was sold or used during the calendar year. Additional blanks will be furnished upon request.

Production should include all unconsolidated sand and gravel, detrital rock, talus, crushed boulders or other unquarried surface stone produced by you during the calendar year. EXCLUDE ALL PURCHASED SAND AND GRAVEL. Report in short tons if possible or in cubic yards. Value of production, sold or used, should be shown at the producing plant or nearest point of shipment and should not include delivery costs, freight rates, or similar charges.

Output of products from deposits of sandstone and quartzite should be reported on Form 6-1220-A1 or 6-1220-A2.

II. Sand and gravel shipped or used during the year, by product and use: (Report all products including those produced for Government use). Give actual figures if possible, otherwise estimates will be acceptable.

Products (Including processed and unprocessed) and uses (1)	Code	Quantity (check one) Short tons <input type="checkbox"/> Cubic yards <input type="checkbox"/> *	Office use only Make no entry		Value f.o.b. plant or shipping point (3)
			Q	V	
Sand, construction					
Building (excluding road structures).....	201				\$
Paving (road base and surface, bridges, etc.).....	202				
Railroad ballast.....	203				
Fill.....	204				
Other uses (Specify)	205				
Sand, industrial (Aboveground)					
Glass (for melting only).....	206				
Molding.....	207				
Grinding and polishing.....	208				
Elect.....	210				
Fire or furnaces.....	211				
Engines.....	212				
Filtration.....	214				
Oil (hydraulic).....	215				
Other uses (Specify)	216				
Sand, industrial (Ground)	221				

Enamel.....	233				
Filler.....	234				32
Foundry uses.....	235				
Glass.....	236				
Pottery, porcelain, and tile.....	237				
Other uses (Specify)					
	238				
Total sand.....	239				
Gravel, construction					
Building (excluding road structures).....	241				
Paving (road base and surface, bridges, etc.).....	242				
Railroad ballast.....	243				
Fill.....	244				
Other uses (Specify)					
	248				
Gravel, miscellaneous.....	253				
Total gravel.....	259				
Grand total, sand and gravel.....	299				

(200) *If production is reported in cubic yards, indicate weight per cubic yard: Sand _____ pounds; gravel _____ pounds.

III. Does the above include pit or bank-run (unprocessed) sand and/or gravel? (1) Yes (2) No
 (300) If yes, give tons _____ value \$ _____

IV. Type and number of sand and gravel plants included in this report*		V. Sand and gravel shipped during the year, by method of transportation		
Type	Number	Method of transportation from plant	Code	Quantity (check one) Short tons <input type="checkbox"/> Cubic yards <input type="checkbox"/>
1. Stationary.....		Truck.....	551	
2. Portable.....		Railroad.....	552	
3. Dredge.....		Waterway.....	553	
		Other (specify).....	554	
		Total shipments.....	559	

VI. Sand and gravel for government use and other purposes				
1. Sand and gravel (reported in sec. II.) produced at this establishment for use at government projects:	Code	Specify whether sand or gravel (1)	Specify use (2)	Quantity Short tons <input type="checkbox"/> Cubic yards <input type="checkbox"/> (check one) (3)
(1) Sand and gravel produced by you for your own use as a prime contractor or subcontractor on Federal, State, or local government projects. Name government agencies sponsoring projects. (Continue on back of form if necessary).	671			
(2) Sand and gravel sold directly to Federal, State, or local governments. Name purchasing agencies.	672			
2. All other sand and gravel sold or used.....	673			
3. Total sand and gravel sold or used (Should equal Grand Total, sand and gravel, line 299, sec. II).....	679			

Publications: Annual statistical information for sand and gravel is published in two forms (1) Commodity reports and (2) State reports covering all mineral commodities in a State. If you desire a copy of one or both of these reports, please check the appropriate box.
 (1) Commodity (2) State (3) Both

Name of person to be contacted regarding this report		Tel. area code	No.	Ext.
Address No.	Street	City	State	Zip

May tabulations be published which could indirectly reveal the data reported above?
 Value data (1) Yes (2) No Other (including quantity) data (1) Yes (2) No

Signature	Title	Date
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APPENDIX II



D63

STONE

The data furnished in this report may be disclosed to Federal defense agencies. In some cases the data may be disclosed to the respondent's State government, depending on specific procedures explained in the enclosure to this form. In other than the situations noted above, the data furnished in this report will be treated in confidence by the Department of the Interior unless authorization is granted in the section above the signature.

Please separate forms at perforations

An extra copy is provided for your files

(Please correct if name or address has changed.)

- Name and location of quarry
Name _____
State _____ County _____ Section _____ Township _____ Range _____
Nearest city or town _____
If operating company is a subsidiary, please name controlling company _____
If a separate report cannot be prepared for each quarry, indicate number covered _____
- Status during year (Check one or more) (1) Active From _____ To _____ (2) Shipping from stockpile only
 (3) Idle (4) Abandoned (5) Purchased (6) Sold If ownership changed during year, give date of change _____
and name and address of party to whom transferred _____
- Mining methods (Check one or more) (1) Open quarrying (2) Underground mining (3) Dredging
- Kind of stone of your own production shipped or used by you during the year. CHECK ONE ONLY. Complete a separate report for each kind of stone.
 (1) Limestone (4) Marble (6) Sandstone (10) Trap rock (include gabbro, basalt, diabase, etc.)
 (2) Dolomite (5) Marl (calcareous) (7) Quartz (8) Quartzite (9) Shell
 (3) Granite (include syenite, gneiss, etc.) (11) Other stone (specify) _____
- Stone of your own production shipped or used during the year by use and product
A. DIMENSION STONE. Do not report as rough stone any stone included under dressed stone or any waste stone shipped or used as crushed and broken stone. Crushed and broken stone produced by you and shipped or used by you should be reported in the Crushed and Broken Stone section of Item 53. Report quantity in short tons OR in cubic feet.

For Bureau use →

Product and use (1)	Code	Quantity		Value (4)
		Short tons (2)	Cubic feet (3)	
Architectural work (building and other high class work) Rough blocks (all rough or scabbled including tull).....	101			\$
Construction work Irregular-shaped stone for facing buildings, or for bridges, or other structures.....	102			
Rubble (irregular-shaped stone for foundations, retaining walls, and similar construction).....	103			
Monumental (monuments, gravestones, mausoleums).....	104			
Flagging (specify average thickness _____).....	105			
Other rough stone products and uses (specify)				
Architectural work (building and other high class work) Cut stone (including ashlar and all finished cut stone, including sawed 6-side material ready for use).....	201			
Sawed stone (slabs sawed on 2 or 4 sides).....	202			
House stone veneer.....	203			
Construction work (walls, foundations, bridges, etc.).....	204			
Monumental (monuments, gravestones, mausoleums).....	205			
(specify average size _____).....	206			
(specify thickness _____).....	207			
and uses (specify)				

Rough stone (Do not report as rough stone any stone included under dressed stone)

2000

	Use and product (1)	Code	Quantity		Value (4)	
			Short tons (2)	Cubic yards (3)		
Agricultural purposes	Agricultural limestone.....	301			\$	
	Agricultural marl and other soil conditioners.....	302				
	Poultry and mineral food.....	303				
Construction and maintenance purposes	Concrete aggregate (coarse).....	304				
	Bituminous aggregate.....	305				
	Macadam aggregate.....	306				
	Dense graded road base stone.....	307				
	Surface treatment aggregate.....	308				
	Unspecified construction aggregate and roadstone.....	309				
	Riprap and jetty stone.....	310				
	Railroad ballast.....	311				
	Filter stone.....	312				
	Manufactured fine aggregate (stone sand).....	313				
Manufacture of	Terrazzo and exposed aggregate.....	314				
	Cement.....	315				
	Lime.....	316				
	Metal-lurgical purposes	Dead burned dolomite.....	317			
		Ferrosilicon.....	318			
		Flux stone.....	319			
		Refractory stone (include ganister).....	320			
	Chemical stone for alkali works.....	321				
	Special uses and products	Abrasives.....	322			
		Mine dusting.....	323			
Asphalt filler.....		324				
Whiting or whiting substitute.....		325				
Other fillers or extenders.....		326				
Other uses (specify)						
Total crushed and broken stone.....		399				

6. Transportation of crushed and broken stone to point of use during year by method

Method of transportation (1)	Code	Quantity (Short tons) (2)	Percent (3)	Method of transportation (1)	Code	Quantity (Short tons) (2)	Percent (3)
				Other (specify)			
Truck.....	401				404		
Railroad.....	402						
Waterway.....	403			Total.....	499		100

7. Type of crushing plant operated at this location (1) Stationary (2) Portable (3) Both (4) None
8. Did you produce stone from other operations for which you did not receive a report form (1) Yes (2) No
If yes, please furnish names of other operations
9. Was stone produced from this quarry by any other company under contract to you (1) Yes (2) No

Remarks

Publications: Annual statistical information for stone is published in two forms (1) Commodity reports and (2) State reports covering all mineral commodities in a State. If you desire a copy of one or both of these reports, please check the appropriate box.
 (1) Commodity (2) State (3) Both

Name of person to be contacted regarding this report			Tel. area code	No.	Ext.
Address No.	Street	City	State	Zip	

May tabulations be published which could indirectly reveal the data reported above?
 Value data (1) Yes (2) No Other (including quantity) data (1) Yes (2) No

GENERAL INSTRUCTIONS

Please complete and return one copy of this form as promptly as possible in the enclosed envelope. A separate report should be completed for each quarry active during any part of the calendar year and for each kind of stone produced. Additional forms are available upon request. If you have nothing to report, please complete Items 1 and 2, sign and return.

The results of this survey are used in statistical publications of the Bureau of Mines. They have a variety of users, including industry, State and Federal Governments. Your cooperation is needed to make the results of this survey comprehensive, meaningful, accurate and timely.

In completing this form, estimates may be used wherever exact figures are not available. Round to the nearest whole number.

Please provide us with any specific information that will help us in the interpretation of the data. Use the space for "Remarks" or if more space is required, use the back of this page or a separate sheet of paper. Also, describe briefly any significant changes in your operation and any important events or outside economic conditions that affected your operation.

SPECIFIC INSTRUCTIONS

1, 2, 3, and 4. Self-explanatory.

5. Stone of your own production shipped or used during the year by use and product

Include stone produced by you and used by you for Federal, State, or local government projects. In Column 4 report the net selling value f.o.b. your establishment for the quantities in Columns 2 or 3. Report the total value received after discounts and allowances and excluding container cost where applicable. If you consume material in your establishment or ship it to another establishment of your company, please estimate the value for this material. Use your net selling price as a basis for this estimate; if you did not sell the same type of material, base your estimate on the direct costs of production plus a reasonable proportion of company overhead and profits.

Please specify other uses clearly and report data for each use separately.

6. Transportation of crushed and broken stone to point of use during year by method

If two or more methods of transportation were used for one shipment, report that quantity under the major method of transportation determined on basis of miles of haulage. Include quantity of stone products shipped to others and quantity of stone products used within your company. Report quantity in short tons OR percent of total tonnage. Total (Code 499) should equal total quantity (actual or equivalent short tons) reported in Item 5B, Code 399.



Please furnish names and addresses of new stone producers in your vicinity.

BIBLIOGRAPHY

- Appling, Richard N. Chief of the Western Field Operations, U. S. Bureau of Mines, Spokane, Washington.
- Beatty, W. B., Lee Langan. "Oregon Geology and Mining," Sources of Information on Geology and Mining in the Western States (1958), pp. 17-18.
- Collins, Ronald P., Jerry J. Gray, and Gary A. Kingston. "The Mineral Industry of Oregon," Minerals Yearbook, Vol. II (1967), pp. 663-674.
- Corrick, John D. "The Mineral Industry of Oregon," Minerals Yearbook, Vol. II (1971), pp. 583-593.
- _____, "The Mineral Industry of Oregon," Minerals Yearbook, preprint (1972), pp. 1-11.
- Gray, Jerry J. "A Statistical Study of the Mined Land Reclamation Act," (unpublished working paper of the Department of Geology and Mineral Industries, Albany, Oregon (Nov. 1972)), pp. 2-6.
- Gray, Jerry J. State Department of Geology and Mineral Industries, Mine Land Reclamation Department, Albany, Oregon.
- Maresh, Thomas J. "Mineral Resource Data for Geographic Research and Instruction," in Borden D. Dent (ed.), 1975 Yearbook of the National Council for Geographic Education (forthcoming).
- Mason, Ralph. "An Acre is More Than Just 43,560 Square Feet," The Ore Bin, Vol. 35, No. 3 (Mar. 1973), pp. 54-55.
- Robertson, Harry F. "Preliminary Report on Bureau of Mines Mineral Production Statistics," (unpublished working paper of the Bureau of Mines (Aug. 1, 1962)), pp. 2-23.
- United States Bureau of the Census. "Oregon Mineral Industries," Census of Mineral Industries, area series (1967), pp. 36-1 - 36-4.
- United States Bureau of the Census. "Sand and Gravel" and "Stone," Census of Mineral Industries, industry series (1967), pp. 14B-1 - 14B-7 and pp. 14A-1 - 14A-21.

United States Bureau of the Census. "Type of Operation,"
Census of Mineral Industries, subject series (1967),
pp. 5-12 - 5-14.

United States Geological Survey. "Sand and Gravel in Oregon"
and "Stone in Oregon," Mineral and Water Resources of
Oregon, Bull. 64 (1969), pp. 233-241 and pp. 246-266.