

COMPARISON OF THE 1977 CENSUS OF CONSTRUCTION INDUSTRIES
AND THE VALUE OF NEW CONSTRUCTION PUT IN PLACE SERIES

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1. INTRODUCTION

Construction is a significant and strategic component of the Nation's total economy, whether measured in terms of investment, employment, income, wealth or tax revenue. In 1979, new construction alone accounted for more than \$225 billion or almost 10 percent of the GNP.

For many years the Census Bureau has been providing data users with a wealth of current statistics on construction activity. However, very little information has been available on the construction industries and the establishments that make up these industries.

The purpose of this comparison is to pinpoint and evaluate major differences between two series of data published by the Bureau - the Value of New Construction Put in Place (VIP) series and the 1977 Census of Construction Industries.

The major differences between these two series are that one measures the value of all new construction that is being currently installed or erected, and the other measures and provides information on the financial characteristics of the establishments that are performing the construction work. The methodologies and universes covered differ significantly for these two statistical programs and the results of this comparison will (1) show the volume of all new construction activity accounted for by the construction industry itself, and (2) pinpoint areas that merit more detailed examination with the aim of making the two series comparable and therefore more useful to the data user.

In section II of this paper descriptions of both series and a definition of construction are presented. Section III describes the adjustments made to each series prior to comparing specific types of construction. Sections IV and V deal with a comparison of the two series for 1977 and Section VI provides a summary and recommendations for further research.

II. DESCRIPTION OF SERIES AND DEFINITIONS

A. Value of New Construction Put in Place (VIP) series

The VIP series measures the dollar value of all new construction put in place within the United States during the survey month. This requires a series of 13 surveys designed to measure for each classification of construction the amount of work put in place each month. The statistics are derived by either direct measurement surveys or by indirect estimation.

The statistics that come from direct measurement are based on respondent reports of the actual value of construction progress or expenditures obtained from a sample of construction projects.

For the year 1977, estimates measured directly accounted for about 67 percent of all new construction. These series include private multifamily residential buildings, private nonresidential buildings, nonhousekeeping residential buildings, public utilities, residential additions and alterations, farm nonresidential construction, and virtually all public construction.

For an individual project, the following types of expenditures are included:

1. Cost of materials installed,
2. Cost of labor by contractors and owner's employees,
3. A proportionate share of the cost of construction equipment rental,
4. Contractor's profit,
5. Project owner's overhead costs,
6. Cost of architectural and engineering work and
7. Miscellaneous costs chargeable to the project on the owner's books.

The total value of construction put in place, or work done, for a given month is the sum of the value put in place on all projects underway during the month, regardless of when the work was started or when payment was made to the contractors.

The remaining estimates (33 percent of all new construction) are measured indirectly using related construction statistics. For example, value in place for new single-family housing units is derived by: (1) multiplying the number of new single-family housing units started each month by an estimated average construction cost; (2) distributing the resulting value of those units started into a monthly value in place figure; and (3) applying a monthly rate of construction progress to that total, based on past experience.

Although indirect estimation procedures, such as the one described above, may be less desirable because they do not respond to actual events, particularly over the short run, they do reflect sustained trends reasonably well. A detailed description of the procedures used to develop this series appears in Construction Reports C30-74S. Value of New Construction Put in Place: 1947 to 1974, issued December 1975.

B. 1977 Census of Construction Industries

The Census of Construction Industries, conducted every five years, covers all establishments primarily engaged in construction and operating as general contractors, operative builders, special trade contractors, or land subdividers and developers, as defined in the 1972 SIC Manual.^{1/} Excluded from the Census are investment builders-establishments building on own account for lease or rental. The Census of Construction Industries is conducted on an establishment basis. A "construction establishment" is defined as a relatively permanent office or other place of business where the usual business activities related to construction are conducted. A relatively permanent office is one which has been established for the management of more than a single project or job and which has been or is expected to be maintained on a continuing basis. Such "establishment" activities include, but are not limited to, estimating, bidding, scheduling, purchasing, supervising, and operating the actual construction work being conducted at one or more construction sites.

Concerns with more than one construction establishment were required to submit a separate report

for each such establishment operated during all or any part of 1977. Separate construction reports were not required for each project or construction site. Aggregated information was included in the report of the construction establishment responsible for the work of the construction projects and sites.

The Census covered both employers (establishments with payroll) and nonemployers (establishments without payroll). For employer establishments the Census obtained data on construction receipts for individual establishments that included the following:

1. receipts from general contracting, special trades contracting, subcontracting, land development and land improvement work;
2. both new construction and maintenance and repair work;
3. the value of any construction work done by a construction establishment for itself; and
4. fees received as sponsors of joint ventures and fees received as agents for owners of construction work.

Respondents were allowed to use any system of accounting by which they maintained their books. Therefore, reports could be based on cash, accrual, or completion of contract methods of accounting. Also, it was intended that each report cover the calendar year 1977.

A universe of approximately 550,000 construction employer establishments was developed using the Census Bureau's Standard Statistical Establishment List (SSEL). This list is a comprehensive computerized name and address file of all known employer business enterprises and their establishments in the United States. This list has been developed using Census Bureau records for information on multiestablishment firms and using the records of other government agencies (Internal Revenue Service, Social Security Administration, etc.) as the basic input sources on single-unit companies. For more information concerning this program, see Technical Paper No. 44, "The Standard Statistical Establishment List Program," - U.S. Department of Commerce, Bureau of the Census.

From this universe, a sample of 180,600 employer establishments were selected - stratified by standard industrial classification (SIC) code in State sequence - and mailed a Census of Construction Industries questionnaire. The sample included all construction establishments in multiestablishment companies, all single-establishment companies with a payroll equivalent of 15 or more employees, and a subsample of single-establishment companies with less than 15 employees.

C. Definition of New Construction

The following types of activities were defined as new construction for both the Value in Place series and the Construction Census:

1. Erection of new structures;
2. Mechanical installation such as plumbing, heating, electrical work, elevators, escalators, central air conditioning, and other similar building services to new or existing structures;
3. Additions and alterations such as additions of a wing or one or more floors to an existing building or the conversion of space requiring structural changes;

4. Outside construction of fixed structures or facilities such as highways and streets, parking lots, railroad tracks, piers, sewers, power distribution and transmission lines, petroleum and gas pipelines and distribution lines, and similar facilities which are built into or fixed to the land;
5. Installation of such items as overhead traveling cranes, blast furnaces, refrigeration systems, boilers, and open hearth furnaces;
6. Erection of all fixed, mainly site fabricated equipment which is not housed in a building, such as petro-chemical plant and similar plant structures;
7. Land development including clearing and grading of undeveloped land; and
8. Structural changes to a building which are necessary for the installation of equipment items that are not considered construction.

The following types of activities were excluded from new construction in both series:

1. Maintenance and repair to existing structures or service facilities such as repainting, reroofing, and street and highway patching;
2. The value of machinery and equipment items not specifically covered above, such heavy industrial machinery, printing presses, stamping machines, bottling machines, and special purpose equipment designed to prepare the structure for a specific use, such as steamtables in restaurants, pews in churches, and lockers in school buildings; and
3. Drilling of gas and oil wells, including erection of off-shore drilling platforms; digging and shoring of mines (construction of buildings at mine sites is included); work which is an integral part of farming operations such as plowing and terracing.

III. ADJUSTMENTS TO FACILITATE COMPARISONS OF CONSTRUCTION AND VIP PUBLISHED STATISTICS

The Construction Census data represent actual receipts obtained in 1977 by all kinds of construction establishments cross-classified by specific type of structure or category (houses, office buildings, highways & streets, etc.). The VIP series represents the value of costs of new construction work done on various types of structures as reported by the owner or general contractor of the overall project, or estimated as described in Section II. Since the two series are not directly comparable, several preliminary adjustments were necessary before making the actual comparison.

A. Adjustment of Construction Census Statistics for Employer Establishments.

In the Construction Census respondents were asked to indicate what percent of their construction receipts were for "new" work done on specific structures or categories. These percentages were then applied to the value reported as construction receipts, by each establishment, and aggregated to produce the results shown in the Census publication and in Table B, column 1.

These statistics, however, reflect the activity of both the general contractors and the sub-contractors. It was necessary, therefore, to make additional adjustments to unduplicate these receipts data before making any further comparisons. Each construction establishment reported

"payments made for work subcontracted to other contractors," at a total level, not by specific category. This figure was subtracted from the establishment's total construction receipts to derive a "net" construction receipts figure. For this study the percentages reported for new work were then applied to that "net" construction receipts figure. Finally, net new construction receipts for establishments that did not report by specific category were distributed proportionally across all categories of construction. All establishments were then summed to industry and U.S. totals, and the results are shown in Table B, column 2.

B. Adjustment of Value in Place (VIP) Statistics

Architectural and engineering fees, the cost of owner supplied labor and materials, owner's overhead and office costs (taxes, fees, etc.), and other miscellaneous costs which are considered as part of the owner's overall cost or value of work done for a particular project, are included in the published VIP statistics shown in column 1 of Table C.

These items are excluded from the Construction Census data because architectural fees are collected from separate establishments classified in the Census of Service Industries; labor and materials supplied by the owner are not considered as costs to the contractor; and office and other miscellaneous costs were not collected in the Construction Census. Therefore, it was necessary to deduct these items from the VIP data before making any further comparisons with the Census data. Percentage and dollar estimates of these items for each construction category were obtained from special studies conducted by the Bureau of the Census and other Federal agencies. For example, based upon a study of private nonresidential building projects, it was determined that architectural and engineering fees, the cost of owner supplied labor and materials, and other miscellaneous costs account for 12.9 percent of the VIP. Therefore, the published VIP statistics for that category were reduced by that amount. In another study it was estimated that the value of owner supplied labor and materials for single family houses in 1977 was \$4.9 billion. This amount was deducted from the total value of single family houses and the resulting adjusted VIP statistics appear in column 2 of Table C.

C. Final Adjustments

A final step prior to the actual comparison involved an analysis of the detailed categories of construction for each of the series. Whenever it was felt that consolidations of categories or splitouts of categories in either series could make comparisons more meaningful, such adjustments were made. For example, the value of warehouses included in the VIP commercial category was transferred to the industrial category.

IV. GENERAL COMPARISONS OF THE 1977 CONSTRUCTION CENSUS AND THE VALUE IN PLACE SERIES

If we assume that the respondents in each of the Census and VIP series in 1977 reported correctly, that correct classifications were assigned to the responses, and also assume that the analytical adjustments were carried out correctly in this study, we would then expect to find that the Census figures would be somewhat

lower than the VIP statistics.

A look at the comparison of the two sets of adjusted data, presented in Table A, shows that at the total level, the Construction Census is only \$11.5 billion lower, or 92 percent of VIP. This would indicate that after the necessary adjustments are made to bring the two series to a more comparable level, the establishments in the Census of Construction Industries account for more than 90 percent of the construction activity performed in the United States. This could be useful to data users for estimating or assuming the extent of activity of construction establishments, between Census years, based on the annual data published in the VIP series. However, a detailed examination of the comparison indicates major differences between the two series for certain construction categories.

Before examining each construction category there are some basic concepts or principles that differ for more than one type of construction and to the \$11.5 billion differences between the two series. The major difference between the two series is that the Census measures the industry only, and VIP measures all new construction activity. Construction activities performed by "Nonconstruction" establishments are not included in the Census. For example, investment builders (owner-builders that derive a majority of their receipts from rentals) are excluded from the Census of Construction Industries.

Also, many retail stores do construction work for their customers, including additions and alterations, painting, installation of air conditioning, etc., with their own labor force. In the 1972 Census of Retail Trade a question was included on the report forms for Paint, Glass, and Hardware Stores (SIC's 5211, 5231 and 5251) concerning the installation of such materials. The installation receipts for those establishments, estimated at that time to be \$252 million, plus the value of the materials installed would represent construction work not included in the Census figures, but most of which would be included in VIP. This question did not appear on the report forms for 1977 and comparable data for that year, therefore, are not available.

The manufacture of prefabricated wood and metal structures is not covered in the Construction Census. The value of these structures as measured by the Census of Manufactures in 1977 was \$3.5 billion. These types of buildings are generally purchased by the owner and installed by the manufacturer or the owner. If any construction work related to these structures was performed by a construction establishment, then that value would have been included in the Construction Census figures. Unfortunately, there is no way of estimating how much of that \$3.5 billion was performed by construction establishments and included in the Construction Census.

As previously mentioned, there are significant differences in the two series when comparing specific construction categories. Category misclassification by respondents and definitional differences between the two series are the main reasons. In the Census, the respondents select the category of construction from a pre-printed list on the questionnaire and interpretation of these categories could vary among respondents. In the VIP series, most

classifications are assigned by analysts based on the project description. Also, VIP data for buildings often include auxiliary facilities such as parking lots, streets, water and sewer connections, sidewalks, and fences built in conjunction with buildings. Census classifications are based on the function of the structure whereas VIP classifications are sometimes based on the ownership of the project. For example, in the VIP series schools and chapels built at military installations are in the military facilities category. These would be in the educational or religious categories in the Census statistics. You must keep in mind that the general objectives or purposes of the two series when initiated were basically different. The VIP series was developed to produce estimates of the construction activity in the United States, and the Construction Census, developed at a much later time, was designed to produce statistics comparable to establishment data published in the other Economic Censuses (Manufacturing, Retail, Wholesale, etc.). In Section V. we attempt to explain specific differences and in Section VI discuss some of the research projects that will be accomplished to alter the two series and make classifications comparable wherever possible.

Statistics by construction category for approximately 720,000 nonemployer establishments are not available in the Census. These establishments accounted for \$20.2 billion, or only 8 percent of all business receipts for all construction establishments. Data were obtained from administrative records and there is no basis for estimating the net new construction receipts by category for these establishments.

There is another basic difference in the two sets of figures. VIP measured the value of work done regardless of when payment was made, whereas Census measured receipts during the year, comparable to the "shipments" and "sales" data collected in the other economic areas, regardless of when the work was done. The difference between receipts and value of work done could be sizable when there is a large increase or decrease in construction activity in the months preceding or following the Census year.

V. COMPARISON OF SPECIFIC CONSTRUCTION CATEGORIES

Building Construction

1. Single Family Houses - Census is 64 percent of VIP - \$20.2 billion lower.

Some of the difference results from the fact that VIP implicitly includes privately built streets and utilities in the value of houses, whereas the Census includes this type of work in the nonbuilding category. Between December 1976 and December 1977 there was a 19 percent increase in the number of speculatively built houses under construction but not yet sold, which would indicate that Census receipts would be at a lower level than VIP.

2. Multifamily Buildings - Census is 58 percent of VIP - \$4.7 billion lower.

The primary reason for this difference may be that substantial construction activity is done by Real Estate Operators of Apartment Buildings (SIC 6513), who are not included in the Construction Census.

In past years some studies were conducted to see where apartment house builders were classified for Census purposes. In one study a small

sample of projects were selected from the multi-family residential survey conducted as part of the VIP series. Employer identification numbers and SIC codes for these builders were matched to Census records. About one-half of the sample were classified as construction. The others were classified in Management Consulting and Public Relations Service (SIC 7392), Real Estate Operators (SIC 651) and Hotels, Motels and Tourist Courts (SIC 7011). In another study a special listing of Real Estate Operators of Apartment Buildings (SIC 6513) was obtained and a small sample of these were matched to the "Bluebook of Major Homebuilders." Many were listed as owner-builders. These "owner-builders," however, do not sell the buildings but collect rental payments and are therefore correctly classified in SIC 6513. Even from these small studies, it is clear that many apartment house builders are not classified as construction establishments.

3. Nonhousekeeping Residential Buildings - Census is 181 percent of VIP - \$0.8 billion higher.

The major difference between VIP and Census is due to building classifications. For example, VIP does not include military barracks in this category as does Census. The VIP estimate for troop housing is included in military construction. Dormitories on campuses would be included here for the Census but classified as educational buildings in VIP.

4. Office and Commercial Buildings - Census is 97 percent of VIP - \$0.4 billion lower.

The scope of the Census and classification differences account for the discrepancy between VIP and Census. Investment builders are out of scope of the Census but are included in VIP. Also, VIP covers the building project and auxiliary construction such as sidewalks and parking lots.

5. Religious Buildings - Census is 138 percent of VIP - \$0.4 billion higher.

This can be explained in part by classification differences. Religious buildings built by the military and by State and local governments, such as base chapels and State university chapels, are not included in this category for VIP.

6. Educational Buildings - Census is 102 percent of VIP - \$0.1 billion higher.

VIP does not include educational buildings built by the military such as base schools, facilities at service academies, and miscellaneous training facilities in this category, but in military facilities.

7. Hospital and Institutional Buildings - Census is 129 percent of VIP - \$1.3 billion higher.

Some of the differences may be that Census respondents might erroneously classify medical office buildings and prisons in this category, whereas VIP would classify them as office buildings and other public buildings respectively. Another factor contributing to the Census being greater than VIP may be "turnkey construction." This is when a contractor has the responsibility for not only the building itself but for the erection and installation of equipment within the building, and may include in the Census the value of the installed equipment.

8. Farm Nonresidential Structures - Census is 27 percent of VIP - \$2.9 billion lower.

Even after adjustment, VIP probably includes a great deal more force account construction and owner supplied materials that would not be included in Census. This is due to the fact that the VIP adjustment was based on private nonresidential buildings since there was no direct estimate for this category. VIP also includes non-building farm construction which is estimated to be 45 percent of the total farm number, or \$2.1 billion.

9. Industrial Buildings and Warehouses - Census is 175 percent of VIP - \$7.3 billion higher.

This category needs extensive study and proposals will be presented in section VI. Some assumptions concerning the \$7.3 billion differences are that (1) the Census unintentionally includes a great deal of installed equipment; (2) VIP has some industrial buildings in Military facilities and Power and Conservation; and (3) the VIP factor used to adjust for under-coverage of all private nonresidential buildings may be insufficient for this category.

Nonbuilding Construction

10. Power and Conservation - Census is 105 percent of VIP - \$0.9 billion higher.

This may be accounted for by classification differences and inadequate adjustment procedures. VIP includes buildings for power and communication companies which are classified in one of the "building" categories in the Census. However, the Census data may include the value of installed equipment, excluded in VIP.

11. Pipelines - Census is 112 percent of VIP - \$0.3 billion higher.

Although VIP includes outside structures other than pipelines built by private gas and oil companies, Census may include the value of the installed equipment.

12. Highways and Miscellaneous Nonbuilding Construction - Census is 129 percent of VIP - \$3.3 billion higher.

Most of the difference in this category is accounted for by swimming pools, parking lots and fencing that are included here for the Census, but are included for the most part as auxiliary structures in building construction in VIP.

13. Water and Sewer - Census is 144 percent of VIP - \$2.9 billion higher.

Some water and sewer work is included in other VIP categories, such as highways and streets and many of the building categories.

14. Mass Transit - Census is 57 percent of VIP - \$0.5 billion lower.

VIP includes a large amount of building construction in this category. For example, buildings built by privately owned railroad companies would have been included here, since classification was based on ownership rather than functions of each structure.

VI. RESEARCH STUDIES AND RECOMMENDATIONS

The study shows that in 1977, after adjustments were made to the VIP and Census data, employer establishments in the construction industry accounted for about 92 percent of all new construction activity. There are differences in the two programs in both content and classification by construction category which could not be completely reconciled by the analytical adjustments. Of particular concern are the construction categories of multifamily buildings and industrial

buildings and warehouses which showed substantial differences between VIP and Census. Further research in these areas as well as research applicable to all construction categories is needed.

To establish further comparability between these two series, the following research activities are underway or are being considered:

1. The VIP estimate for industrial buildings and warehouses is substantially below the Census estimate. A coverage evaluation study of the VIP sampling frame for nonresidential building construction is being conducted. A sample of industrial building projects has been drawn from the VIP universe and is being matched to a listing of building permits, to evaluate our coverage in that area. Results of this study will be available later this year.

In addition, the Census figures for industrial buildings and warehouses are also being reviewed. The theory that the Census data contain a substantial amount of the value of the equipment being installed in these buildings is being tested. A pilot study was conducted to determine if establishments primarily engaged as general contractors on industrial buildings and warehouses (SIC 1541) had included the value of the machinery and production equipment being installed in these buildings. In conjunction with our standard review process for the 1977 Census, fourteen companies in this SIC were contacted by telephone. Eleven companies said "yes," the value is included in the Business Receipts figure, and 3 companies said "no." However, the 11 companies that stated "yes" could not provide us with a good estimate of that value.

2. The Census estimate for hospital and institutional buildings is almost 30 percent higher than the VIP estimate. A study similar to the one described above was made of the general contractors in SIC 1541 that are primarily engaged in constructing hospitals. In this case, of the 17 companies that were contacted, 9 said that they had not included the value of the machinery and equipment and 8 said they had - and that the value of the equipment was between 1 and 3 percent of the total.

Based on the results of these limited studies, we will adjust the questionnaire for 1982 to more clearly indicate what values should and should not be included in the construction receipts figures.

3. The preprinted list of construction categories on the Census questionnaire did not include detailed definitions or examples and this could possibly have resulted in some misclassifications. For the 1982 Census, more detailed descriptions of the construction categories will be included on the survey form.

4. One of the major problems in relating the two series is that the VIP series classifies certain structures according to the ownership of an entire project, whereas the Census classifies the structure according to its functional use. A more detailed study of the types of structures that are included in both the VIP and Census categories is now being conducted.

We plan to (a) list and define the various structures that are in each series, (b) suggest possible changes, and (c) solicit comments and suggestions from data users concerning these changes.

Changes to the VIP and Census questionnaires as a result of this review could produce construction categories that would lend themselves to a more direct comparison and analytical review.

5. The comparison also indicated large differences in multifamily building construction. Since "Investment Builders" obtain a majority of their receipts from rentals, they are classified in Major SIC Group 65, "Real Estate" rather than in construction industries. A study is being conducted to determine where builders of multifamily units are classified in the SIC system. A sample of projects was selected from the VIP multifamily residential survey. The general contractors of these sampled projects have been identified and are being matched to Census files to show the SIC classification. Results of this study will be available later this year.

We also assume that many of these establishments obtain receipts from the construction and sale of new buildings in addition to their rentals. Since their rental receipts are their primary business, they are not included in the Construction Census and whatever sales receipts they have is similarly excluded. An effort will be made during the 1982 Census to survey these establishments and determine how much of their total receipts for 1982 would be derived from activities that would normally be included in the Census.

6. Nonemployer establishments are included in the Census but receipts data by type of construction are not available for them. Total receipts for these establishments are obtained from administrative records. As mentioned previously, these establishments accounted for approximately 8 percent of the total receipts of all establishments in the 1977 Census. It would be difficult to go to these establishments now and obtain information for 1977. Instead, we plan to conduct a sample survey of these establishments in conjunction with the 1982 Census of Construction Industries to obtain similar information by type of structure as collected for the employer establishments.

7. Costs of owner supplied labor and materials are included in VIP but not in the Census. These values are eliminated from the VIP data in the adjustment process described in Section III. Adjustments were based on analytical studies and information gathered a number of years ago. A two-part study is anticipated to achieve (1) a better system to evaluate the amount to be subtracted and (2) a system for obtaining actual information for the 1982 Comparison Study rather than relying on assumption.

8. Some nonresidential additions and alterations are not included in the VIP data, but are included in the figures for Census respondents. We have not as yet been able to determine just how much is not covered by VIP. General discussions indicate that a study of this magnitude, allowing us to make accurate estimates for this category, would require a considerable amount of time and resources to even develop appropriate methodologies and cannot be done at this time.

9. During 1980 we plan to evaluate the data collection and processing procedures of both series. For the VIP series, selections of a sample for reinterview will be considered along with designs for a new questionnaire and development of new estimation procedures.

A general evaluation of the 1977 Census questionnaire is also being conducted - the result of which is the subject of a paper presented at the A.S.A. annual meeting in 1980.

Prototypes of the Census questionnaire for 1982 are now being developed, integrating some of the ideas generated from this comparison study.

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1/ Standard Industrial Classification Manual: 1972, for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Stock No. 4101-0066. 1977 Supplement. Stock No. 003-005-00176-0.

If the reader is interested in receiving the statistical tables that accompany this paper, please communicate with the author.