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Chapter Title: Method of Estimating Nonfarm Residential Construction

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owner-occupied houses standing, including vacant, in 1934. This number, in turn, was multiplied by the average value of mortgaged owner-occupied houses for each population group by geographic divisions, found as previously described, to obtain an estimated total value of all owner-occupied mortgaged properties in 1934. Finally, this aggregate value of owner-occupied mortgaged properties was multiplied by the debt-value ratio of mortgaged properties derived as described in the first part of this section, to estimate total mortgage debt on owner-occupied residential properties as of January 1, 1934.

In this preliminary estimate of debt, the different types of residential structures are not treated separately. The validity of using composite figures on debt frequency and debt-value ratios for all types combined, as is done here, rests upon the representativeness of the data. The representativeness of apartment dwellings is probably most doubtful. Such properties are usually encumbered more frequently than others

and it is more difficult to obtain credit data on them. Consequently the sample data probably do not adequately represent that type and mortgages are probably underestimated, at least on rented properties.

#### 4 Mortgage Loans, Two New York City Areas

The data for the Lower East Side and Harlem in New York City, Table D 48, were collected in 1934 by a CWA project on residential property conditions of these areas, sponsored by the New York Building Congress under the direction of Arthur Holden. The value and finance data on the schedules were analyzed as part of this study by the National Bureau with the cooperation and assistance of the Mayor's Planning Committee.

The primary data on assessed value, mortgage debt, priority of liens, source and terms of loans, were obtained from public records. The mortgage data were checked with the holder of the loan.

## CHAPTER V

### *Method of Estimating Nonfarm Residential Construction*

The estimates of residential construction summarized in Part Three, Tables E 1-5, were published in National Bureau *Bulletin 65*, together with a condensed statement of method. The estimates were made in five stages: (1) organization and adjustment of data; (2) estimate, in detail, by geographic division, population group, and type of dwelling, of aggregate nonfarm dwelling units built during 1920-29, corrected for bias in the basic building permit series; (3) estimate, based on the relationships found in (2), of aggregate nonfarm dwelling units built each year since 1920, and separate estimates for 1935 and 1936; (4) estimate, by applying average costs per dwelling unit to estimated units built, of the dollar value of new residential building each year since 1920; (5) estimate of aggregate nonfarm dwelling units built by decades, 1890-1929.

#### 1 Description of Data: Organization and Adjustment of Primary Data Used

The estimates are based primarily on reported building permits for principal cities of the United States as published by the Bureau of Labor Statistics for the years since 1920,<sup>1</sup> and on changes in the number of families as derived from Census data. The permit data were adjusted for undervaluation and for under-

over-representation of actual construction, as described below. The data on number of families were adjusted to allow for changes in the boundaries of cities and for the varying area coverage of building permit reports.<sup>2</sup>

Among the items in the permit data are type of structure (i.e., 1- or 2-family dwellings, apartments, hotels, clubs, and lodging houses); number of family dwelling units; and estimated cost of the proposed structure, all as declared by the applicant for the permit. The permit data are available on an annual basis from 1920 to 1930, and monthly since September 1929. For 1920-32 reports are available only for cities having populations of 25,000 or more, the number of cities varying from 189 in 1920 to 360 in 1932.<sup>3</sup> In 1933 the number of cities covered by the permit reports of the Bureau of Labor Statistics was increased to 811 by the addition of population groups 10,000-25,000. During 1936 the number was again increased to nearly 2,000 by the addition of population groups

<sup>1</sup> *Building Permits in the Principal Cities of the United States. Bulletins 295, 318, 347, 368, 397, 424, 449, 469, 500, 524, and 545; Monthly Labor Review, March and April 1932, March and April 1933, and April 1934; Building Construction, Serial No. R-219, R-351, and R-538.*

<sup>2</sup> *Estimates based on contracts awarded are discussed in Note A.*

<sup>3</sup> *The total number of cities in the United States with populations over 25,000 was 287 in 1920 and 376 in 1930.*

2,500–10,000. Data for 1,689 of the 2,000 cities were available for the entire year 1936.

As the number of reporting cities has varied considerably during the period, principal reliance was placed on data for 257 cities with populations over 25,000 and reporting continuously since 1921. Data for 1920 were estimated on the basis of the 189 cities reporting. For estimating construction in 1935 and 1936 the enlarged samples of 811 and 1,689 cities then available were used in combination with the data for the 257 cities. The data for recent years give some representation in all 48 states, but the coverage is not uniform for states or regions.<sup>4</sup> Neither suburban developments nor farms outside city limits are represented by permits, and throughout most of the period for which estimates were made small cities and towns of less than 25,000 population were not covered.

The 257 reporting cities accounted for about one-half of total nonfarm population, or approximately two-thirds of the population in centers with 2,500 or more, usually designated as urban. Thus, to estimate total nonfarm building, the amount in areas having in the aggregate approximately half the total nonfarm population had to be determined.

In order to establish rates of change in population and building for different classes of cities, the 257 cities were classified into three groups, based on their location within or outside metropolitan districts: (1) 113 central cities included in the 96 metropolitan districts as defined by the Bureau of the Census and containing 120 central cities, ranging in population from 25,000 to over 6,000,000; (2) 64 satellite cities of from 25,000 to 116,000 population in the environs of 14 of the 96 metropolitan districts, with 33 of the 64 cities in the environs of New York City and Boston, and none in the environs of central cities in the South, West Central, or Mountain regions; (3) 80 nonmetropolitan cities with populations of from 25,000 to 100,000.

These three groups of cities, which provide the sample data used in the estimates, constitute differing proportions of the total urban population in the three classes of cities. The 113 central cities cover all but 1.5 per cent of the population in the 120 central cities; however, the population in the 7 central cities not included among the 257 cities grew more than twice as fast as that in the 113 cities (Table EM 1). The population in the urban environs represented by the 64 reporting satellite cities was only about one-fourth of that in all environs, and the rate of growth in the reporting cities was only half that in the unreported areas. Population of the 80 reporting cities comprised

<sup>4</sup> There is no reporting city among the 257 cities in Vermont, North Dakota, Mississippi, Idaho, Wyoming, New Mexico, or Nevada, but the aggregate nonfarm population of these states is only 2 per cent of the United States total.

one-fifth of that in the urban areas outside metropolitan districts here classified as "nonmetropolitan urban." While the two groups of 64 and 80 cities constitute relatively small parts of the population of their re-

TABLE EM 1

Population of 257 Cities reporting Building Permits, and Unreported Urban and Nonfarm Areas, by Class of City, 1920 and 1930<sup>1</sup>

	POPULATION			
	1920 Jan. 1 <sup>2</sup>	1930 April 1	In-crease 1920-30	Distri- bution 1930
	(thousands)		(percentage)	
<i>Metropolitan districts</i>	42,680	54,753	28.3	59.3
113 reporting central cities <sup>3</sup>	30,913	37,253	20.5	40.3
7 unreported central cities <sup>4</sup>	394	562	42.6	0.6
<b>Total, 120 central cities</b>	<b>31,307</b>	<b>37,815</b>	<b>20.8</b>	<b>40.9</b>
64 reporting satellite cities <sup>5</sup>	3,024	3,810	26.0	4.1
Unreported urban environs	4,667	7,517	61.1	8.1
<b>Total urban environs (pop. 2,500 and over)<sup>6</sup></b>	<b>7,691</b>	<b>11,327</b>	<b>47.3</b>	<b>12.2</b>
Rural environs (pop. under 2,500)	3,682	5,612	52.4	6.1
<b>Total, environs</b>	<b>11,373<sup>7</sup></b>	<b>16,939</b>	<b>48.9</b>	<b>18.3</b>
177 reporting metropolitan district cities	33,937	41,063	21.0	44.5
Unreported Metropolitan district areas	8,743	13,690	56.6	14.8
<i>Nonmetropolitan cities</i>	16,142	19,813	22.7	21.5
80 reporting	3,351	3,846	14.8	4.2
Unreported	12,791	15,967	24.8	17.3
<i>All urban areas<sup>8</sup></i>	58,822	74,567	26.8	80.8
257 reporting cities	37,288	44,909	20.6	48.6
Unreported urban areas	21,534	29,658	37.7	32.2
<i>Rural nonfarm<sup>9</sup></i>	15,274	17,763	16.6	19.2
<b>Total nonfarm</b>	<b>74,096</b>	<b>92,330</b>	<b>24.6</b>	<b>100.0</b>

<sup>1</sup> "Reporting cities" are those in the U. S. Bureau of Labor Statistics series of 257 cities; "unreported areas" are cities or unincorporated areas not among the 257 cities.

<sup>2</sup> Population of reporting cities includes estimated 1920 population of areas annexed during 1920-30 to obtain comparable areas on the 1930 basis.

<sup>3</sup> In 91 of 96 metropolitan districts.

<sup>4</sup> In 5 metropolitan districts: Evansville, Ind.; Johnstown and Reading, Pa.; Miami, Tampa, and St. Petersburg, Fla.; and Ashland, Ky.

<sup>5</sup> In 14 of 96 metropolitan districts.

<sup>6</sup> Obtained by combination of special tabulations of the population of satellite cities with 2,500-25,000 (furnished by Division of Construction and Public Employment, Bureau of Labor Statistics); and satellite cities with 25,000 and over (by National Bureau of Economic Research).

<sup>7</sup> Partly estimated. Census data available for environs of only 85 metropolitan districts in 1920.

<sup>8</sup> National Bureau classification: includes places under 2,500 in environs usually classified as "rural" but considered as urban for estimating building. Census total, 1930: 68,954,823; 1920 total for identical areas on 1930 classification: 55,140,358, special tabulation by Bureau of the Census, unpublished.

<sup>9</sup> National Bureau classification: excludes places under 2,500 in environs of metropolitan districts.

spective groups of cities, their representation is greatly strengthened when they are used in conjunction with the enlarged samples of 811 cities with populations over 10,000 and available since 1933, and the 1,689 cities with populations over 2,500 reporting in 1936.

Rural nonfarm areas were not represented in the permit data. As defined by the Census their aggregate population increased 23 per cent between 1920 and 1930 (Table EM 1), but that portion included in metropolitan districts and designated in this study as "rural environs" increased 52.4 per cent while the other, more typically rural areas, increased only 16.3 per cent.

#### b Statistical Advantages in Using Data on Number of Families rather than Population

In the early stages of this study total dwelling units built during 1920-29 in metropolitan, nonmetropolitan, and rural nonfarm areas were estimated by computing per capita building rates in reporting cities and applying similar rates to the population of unreported areas. The building rate to be applied to the population of an unreported area was selected from the regression line derived in a computation for the corresponding group of reporting cities, determining the correlation of (1) families provided for per 10,000 population during 1920-29 and (2) the percentage increase in population between Census dates 1920 and 1930.<sup>5</sup> The correlation of building rates and population increase was high and almost entirely independent of size of population group or geographic location. However, the method proved too unwieldy to apply on a regional basis and was not carried further.<sup>6</sup>

The method finally adopted to estimate aggregate building during 1920-29 was based directly on Census data on families, utilizing ratios of dwelling units built to the increase in the number of families in cities reporting building permits, and applying these ratios or modifications of them to the increase in the number of families in areas not covered by building permits.<sup>7</sup>

The elements included in these ratios may be illustrated by the final estimate. Approximately 7,035,000 nonfarm dwelling units were built between 1920 and 1929, while the Census indicates a 5,541,000 net increase in the number of nonfarm families. The indicated ratio of units built to the increase in the number of families is 1.27, i.e., for an increase of 100 families, approximately 127 units were built. The additional 27 units per 100 families, or 1,494,000 dwellings in all, are accounted for as follows. By definition, the Census enumeration of families is also a count of the occupied dwelling units; when vacant units in 1920 and 1930 are added to the Census count of families (occupied dwellings) in 1920 and 1930, the net increase for the decade in all units standing is approximately 6,580,-

000. Vacant units in 1920 were estimated at 177,000 and in 1930 at 1,216,000, indicating an increase of 1,039,000, which may be apportioned roughly into three parts: (1) building to make up the housing shortage that had accumulated at the beginning of the decade; (2) building to provide a nominal vacancy accompanying the 5,541,000 increase in occupied units; (3) excess building which resulted in greater than "normal" vacancy by 1930.

In addition to providing for the estimated increase of nearly 6,580,000 units in the total of all units standing, some building was necessary to replace dwellings demolished either to make way for other buildings or by fire, flood, and other causes. This was estimated to be nearly 580,000 units which, added to the 6,580,000 net increase in units standing, would indicate a gross volume of building of 7,160,000 units. However, when allowance is made for the net increase of 125,000 units, resulting from remodeling and conversion of many existing buildings, the net new construction is indicated as only 7,035,000 dwelling units. The excess in

<sup>5</sup> This is the same general principle used recently by F. J. Hallauer for estimating construction during 1920-29 (*Population and Building Construction*, Journal of Land and Public Utility Economics, February 1934; and *Population and Building Construction, a Revision*, Journal of Land and Public Utility Economics, February 1936) and anticipated by King and Leven in 1924 (*Population Growth and Building*, Journal of American Statistical Association, Vol. XIX, 1924) and the Federal Trade Commission in its report, *The National Wealth and Income (1926)*, p. 368.

<sup>6</sup> Other factors that led to the abandonment of the use of per capita rates (except for 1935 and 1936 when there is practically no alternative) were: (1) any per capita building rate computed on the basis of total population in a city or other area at a given time is essentially an average of new building related to "old" population. It assumes, and imposes on the figures, a relationship that does not exist except indirectly, since over a period of years dwelling units equal to 85 to 90 per cent of all residential building have been required to house the increase in population, with only 10 to 15 per cent to replace losses of dwellings occupied by the "old" population and maintained a supply of vacant units. Consequently per capita building rates applied to the population in unreported areas produce erroneous results unless adjusted for differences in the rates of growth of the reporting cities and unreported areas. (2) The use of per capita rates usually involves averaging rates for a group of cities having an extremely wide dispersion about the mean, overweighting the rates for the most rapidly growing cities since they account for most of the construction within the group. (3) Population growth is only an indirect and not always accurate measure of the increase in the number of families, which is the more direct measure of housing requirements over a period of years. A given increase in population may mean an 8 to 10 per cent greater increase in the number of families in large cities than in rural areas, owing to the difference in the rate of decline in the average size of family. In certain regions, as the Pacific Coast, the number of families increased 14 per cent more than population while in some southern states it increased only 2 to 5 per cent more than population, 1920-30.

<sup>7</sup> This is application in more detail of the method developed by George Terborgh, to whom acknowledgment is due for many helpful suggestions during the progress of this study.

construction of 1,494,000 dwelling units over the increase in the number of families is accounted for, therefore, by the 1,039,000 increase in vacancy, plus 580,000 dwellings constructed to replace those demolished or destroyed, less 125,000 units added by conversions.<sup>8</sup>

Certain important differences among population groups are to be considered in measuring their rates of new construction. The ratio of units built to the increase in the number of families, which was 1.27 for the entire nonfarm area, is higher for large cities than for small towns for several reasons: (a) The additional building required to maintain a "normal" vacancy tends to be relatively greater in large cities, mainly because of the many apartments, in which vacancies ordinarily average much higher than in 1-family dwellings which predominate in small communities. During 1920-30 the percentage increase in vacancy was greater in apartments than in other types. (b) Building to replace dwellings demolished because of the encroachment of business on residential sections, physical deterioration, or other causes is proportionately greater in large cities. In a new residential area outside city limits building to replace demolitions would be virtually nil, and new construction would usually be in the proportion of one unit to each family moving into the area, since in most instances the family's moving would depend upon the completion of a dwelling unit to accommodate it. (c) The majority of the largest cities, except Los Angeles, Detroit, and Queens and Bronx Boroughs in New York City, have been growing more slowly than smaller cities; consequently building on account of demolitions and vacancy change in large cities would be greater relative to the absolute increase in the number of families.<sup>9</sup>

The differences in the ratios of units built to the increase in the number of families as found in the 1920-29 data for the various classes of the 257 cities are: 113 central cities in metropolitan districts, 1.415; 64 satellite cities in metropolitan districts, 1.279; 80 non-metropolitan cities, 1.182.

#### c Special Problems in Adjusting the Primary Data

As an aid in describing in detail the method of using these ratios (Table EM 2) to estimate building in unreported areas, the steps involved in assembling the basic data on families in all areas and on building in the reporting cities are presented below.<sup>10</sup>

<sup>8</sup> See Tables EM 12 and 13 for the details mentioned above.

<sup>9</sup> This would be true of any city, regardless of size, having a low rate of growth. At some future date, if the number of families reaches a maximum and the net increase becomes zero, the present method will no longer be applicable. Building will then be primarily to replace losses and to accommodate intraregional migration.

#### 1) Basic population and family data

Estimates by population groups were of particular significance in considering the construction work of the period covered, since, as stated in Part One, the latest building boom was predominantly in metropolitan districts. However, this detailed treatment of population groups and geographic divisions introduces several difficulties. Since Census data on families in metropolitan districts are provided for neither 1920 or 1930, the distribution of urban families between metropolitan districts and the areas outside was estimated from Census data on population. The overlapping of some metropolitan districts across regional boundaries made it necessary to adjust the number of families in each geographic division to correspond to the population. Also, the metropolitan districts as defined by the Census include many towns and villages under 2,500 and unincorporated areas usually classified by the Census as rural. From the standpoint of building, these small places in environs of metropolitan districts are essentially urban in character, since their activities are strongly influenced by the larger centers of which they are a part. To obtain the population of these "rural" environs the population in both 1920 and 1930 of all satellite cities over 2,500 in each region<sup>11</sup> was subtracted from the total population in environs. Since the population in "rural" environs was considered urban in this study, total urban population is correspondingly increased and the other rural nonfarm population is less than that shown by the Census (see Table EM 1). The number of families was distributed, as between urban and rural environs, on the basis of population in each region.

Part of the increase in urban population and in the number of urban families, 1920-30, was due to the classification of some towns as urban in 1930 that in 1920 had a population less than 2,500 and were then classified as rural nonfarm. Furthermore, the 1930 Census modified the definition of urban areas as applied to some towns in the New England and Middle Atlantic states and in California.<sup>12</sup> In all these instances comparability was established by the use of the 139 city special tabulation which gave the estimated urban population in identical areas in 1920, by states

<sup>10</sup> Throughout this discussion reference is made to the "number of families" and "ratios of building to the increase in the number of families." This is largely a matter of convenience, since the family data are actually used as measures of the number of occupied dwelling units rather than the number of married couples or families as social units.

<sup>11</sup> This was made possible by a special tabulation of population in 1920 and 1930 of the 2,798 cities with populations from 2,500 to 25,000, segregated by satellite and nonsatellite cities, and by regions, prepared by the Division of Construction and Public Employment, Bureau of Labor Statistics. Corresponding data for cities 25,000 and over were tabulated by the National Bureau of Economic Research.

<sup>12</sup> Census of Population, 1930, I, 7.

and regions, based on the 1930 classification. It was assumed that any shift in the total nonfarm population from farm to nonfarm classification, or vice versa, would be negligible.

The 1930 Census data on families were first adjusted to include quasi-families living in hotels, clubs, and institutions to make them comparable with population figures, as well as with the 1920 family data; then the 1920-30 increase was corrected to a "private family" basis, since the estimates of building are for number of housekeeping units alone.

Corresponding data on the increase in the number of families in the 257 Bureau of Labor Statistics cities were assembled in a table which is summarized in Table EM 2, column 1, for reporting cities. In 121 of these cities a part of the increase was due to the annexation of territory between 1920 and 1930, which increased the area and population reported by the Census as within the city limits, and consequently changed the coverage of the Bureau of Labor Statistics permit data. The total population involved in annexations during the decade amounted to 3 per cent of the 1930 population of the 257 cities, though in some cities annexations caused as much as a 20 or 30 per cent increase.

Since the area and population involved in annexations to cities between 1930 and 1936 were negligible except in a few cities, 1930 was taken as a base; the adjustment for annexations was made by estimating the 1920 population in territory annexed during 1920-30 from data on population in counties outside the cities in question, and adding this estimated annexed population to the population enumerated in 1920 for the 1920 areas. As published by the Bureau of the Census, annexation data cover only a few of the annexations occurring between Census dates and are in terms of population rather than families. Special tabulations, prepared by the Bureau of the Census from unpublished data on population in annexed areas,<sup>13</sup> made possible their conversion to a family basis on the assumption that the same proportionate changes occurred in the number of families.

Building in reporting cities was estimated from a tabulation<sup>14</sup> of Bureau of Labor Statistics data on the number of families provided for in each of the 257 cities annually during 1920-36. "Families provided for" include total family dwelling units in 1- and 2-family dwellings and apartments, also dwellings and apartments with stores, for which building permits are granted. Since in 1920 family dwelling unit data were incomplete in 22 cities and were not available in 66 of the smaller cities, part of the number of units built had to be estimated. The units thus estimated amounted to

12.8 per cent of the combined total of reported and estimated units for 1920, but only 0.4 per cent of the total for 1920-29, hence any error introduced by these estimates would be negligible relatively to the ten-year total, except possibly in a few cities. Ten-year subtotals of the "families provided for" were obtained for the cities grouped within each geographic division as: (a) central, (b) satellite, (c) nonmetropolitan.

Seven of the 120 central cities were not included by the Bureau of Labor Statistics in the 257 city series because reports for them were lacking in one year or more. For these cities estimates were made for the few missing years, thus giving complete data for all 120 central cities for the entire period.

Estimates of "families provided for" in the 7 cities were made as follows: Johnstown, Pennsylvania (1925), Reading, Pennsylvania (1921), Evansville, Indiana (1920), based on data for adjacent years; Miami and Tampa, Florida (1920-21), based on Bradstreet's total building permit data; St. Petersburg, Florida (1920-25), based on the trend for Tampa, the other central city in the same metropolitan district; and Ashland, Kentucky (1920-31), based on data for Huntington, West Virginia. The units thus estimated amounted to 17.6 per cent of the 17-year total for the 7 cities but only 0.3 per cent of the total for all 120 cities. The chief advantage of adding data for these 7 cities to the basic 257 city series is the representation given the cities prominent in the Florida boom. Jacksonville, the only Florida city among the 257 cities, was not representative.

In the cities in which annexations increased the coverage of the building permit series as discussed above, the number of families provided for reported by building permits was increased in each year affected in proportion to the population, which had been raised to include the current population of areas annexed after 1920.<sup>15</sup> The greatest percentage correction was in 1920 when absolute volume was low, the correction gradually declining to zero by 1930. The net effect for the 264 cities, including the additional 7 central cities, was an increase of 2.7 per cent in the number of families provided for in 1920 and 1.4 per cent in 1920-29. Though a correction for this amount would have been of minor importance in the estimate for the country as a whole, it was a significant factor in individual regions, particularly in the South. The figures for the three northeastern regions and the Pacific coast required virtually no correction.

#### 2) Correction for lapsed permits and underreporting

The other principal adjustment to the building data in reporting cities was for lapsed permits. An inquiry ad-

<sup>13</sup> Portions of these data had been made available previously through the courtesy of F. J. Hallauer.

<sup>14</sup> Too voluminous to be included.

<sup>15</sup> This correction is probably conservative since higher building rates could be expected in the annexed territory because of their more rapid rate of growth generally.

dressed to building officials in 30 large cities brought replies from 22<sup>16</sup> which disclosed that, both before and after 1929, except in two cities, very few residential permits were allowed to lapse, averaging less than 2 or 3 per cent in most cities.<sup>17</sup> Philadelphia and New York City were the exceptions, and for these cities the records are such that correction can be made. In certain years proposed changes in building codes and tax laws affecting apartment buildings in both cities caused a large number of permits to be taken out that were not acted upon, notably in 1929 in Philadelphia, and in 1923 and 1929 in New York City. The figures on number and cost of buildings for New York City in the building permit series are for "plans filed" which indicate a larger volume of building than in permits granted or buildings actually completed, not only in 1923 and 1929 but also in nearly all years. On the basis of data on apartments completed, obtainable over a period of years from the annual reports of the New York City Tenement House Department,<sup>18</sup> the New York City figures were corrected to eliminate the apartment units for which plans were filed but that were not actually built. In order to keep the figures comparable, a 6-month time lag was allowed between the series for plans filed and buildings completed, based on the above-mentioned Bureau of Labor Statistics study and on a comparison of the timing of the curves for plans filed and apartments completed in New York City, 1918-36. The correction to the New York City data for 1920-29 amounted to over 97,000 apartment units, or nearly 18 per cent of all apartments and 10 per cent of all dwelling units built in New York City, as reported by the Bureau of Labor Statistics. The correction for the 257 cities amounted to 6 per cent of total apartments built and nearly 3 per cent of all dwelling units built. In some years the correction was sufficient to modify the trend for the 257 cities; for example, published data on dwelling units built in the 257 cities show a decline from 1923 to 1924, while the corrected figures show a continued uptrend.<sup>19</sup>

Lapsed permits in Philadelphia were not similarly corrected because the data were not received until after the basic tabulations on dwelling units had been made, and a correction was not warranted, most lapses oc-

<sup>16</sup> Having an aggregate population of 22 million in 1930 and accounting for one-half of the total building reported in the 257 cities.

<sup>17</sup> This is in accord with the study of lapsed permits in 10 large cities in 1929 and 1931 made by the Bureau of Labor Statistics (Monthly Labor Review, Jan. 1933).

<sup>18</sup> Acknowledgment is due James Taylor of the Federal Housing Administration for suggestions concerning use of these data.

<sup>19</sup> Data on the completion of other types of dwellings, including 1- and 2-family dwellings, hotels, and lodging houses, are also obtainable for the five boroughs of New York City separately in the Bureau of Building records of each borough, but they are not uniform in items covered in the different boroughs, and as the completeness of coverage is in doubt they were not used.

curing in 1929. The units involved constituted less than 2 per cent of the total for all reporting cities in the Middle Atlantic division, and less than 0.7 per cent of the total for the 120 central cities in 1929, the totals that would be affected in the present estimates.

Offsetting the tendency of building permits in some cities to overstate actual building, because of the inclusion of some permits that are allowed to lapse, there appears to be a tendency in some cities to underreport actual construction. For example, a study of construction during the 15-year period 1919-33 in 46 of the 64 Real Property Inventory cities showed that the units reported by the Bureau of Labor Statistics permit data<sup>20</sup> were 10 per cent fewer than those estimated by this project from Real Property Inventory data.

The apparent underreporting may arise in some instances from local building regulations which require permits only in fire zones rather than in the entire area within city limits, or because permit regulations are not fully enforced. The 46 cities provide only a small sample on which to draw conclusions concerning possible underreporting in all cities. On the other hand, the data on lapsed permits are not a satisfactory basis for correcting for lapsed permits annually over a period of years. Consequently, Bureau of Labor Statistics figures on dwelling units, other than those for apartments in New York City, were not corrected. There is, accordingly, still some uncertainty in the figures, with respect to both lapsed permits and underreporting. Any corrections for these two items for the country as a whole would tend to offset one another.

## 2 Dwelling Units Built, 10-Year Aggregate, 1920-1929

The basic data on families and construction assembled, ratios were computed showing the relation of aggregate dwelling units built during 1920-29 to the increase in the number of families (occupied units) in reporting cities. These ratios, with certain modifications, were then applied to the increase in the number of families in unreported areas. The complete table of these computations in detail for all nine geographic divisions is not presented, because of its size, but the United States totals are summarized by classes of cities in Table EM 2. Table EM 3 gives the ratios as derived for the reporting cities, by geographic division, and as applied in estimating building in the unreported areas. These two summary tables illustrate the method and range of estimate.

### a Use of Ratios of Dwelling Units Built to Increase in Number of Families

The highest ratio in Table EM 3 is 1.955, for the group of 13 reporting central cities in New England, which

<sup>20</sup> Units in 1919 estimated on the basis of U. S. Geological Survey building permit data.

TABLE EM 2

Dwelling Units Built, Estimated Aggregate, 1920-1929, Summary by Class of City

	INCREASE IN NUMBER OF FAMILIES (THOUSANDS)			RATIO OF UNITS BUILT TO INCREASE IN NUMBER OF FAMILIES			DWELLING UNITS BUILT (THOUSANDS)		
	Reporting cities	Unreported areas	Total	Reporting cities	Unreported areas	Total	Reporting cities	Unreported areas	Total
	(1)	(2)	(3)	(4) = (7) ÷ (1)	(5)	(6) = (9) ÷ (3)	(7)	(8) = (2) × (5)	(9) = (7) + (8)
96 Metropolitan districts	2,440	1,356	3,744	1.401	1.185	1.326	3,419	1,546	4,965
120 Central cities	2,192	..	2,192	1.415	..	1.415	3,102	..	3,102
Urban environs	248	768	1,016	1.279	1.211	1.227	317	930	1,247
Rural environs	..	536	536	..	1.148	1.148	..	616	616
Total environs	248	1,304	1,552	1.279	1.185	1.200	317	1,546	1,863
Nonmetropolitan cities	160	927	1,087	1.182	1.163	1.166	190	1,077	1,267
Total urban	2,600	2,231	4,831	1.388	1.176	1.290	3,609	2,623	6,232
Rural nonfarm	..	710	710	..	1.132	1.132	..	803	803
Total nonfarm	2,600	2,941	5,541	1.388	1.165	1.270	3,609	3,426	7,035

had the lowest percentage increase in the number of families between 1920 and 1930, and which had building on account of vacancy changes and to replace losses nearly equal to that needed to house the increment in the number of families. The lowest ratio was 1.007, the average for the 9 reporting central cities in the West South Central area. Building to replace losses would be a relatively small portion of total construction in these new, rapidly growing cities, since the aggregate number of families in the 9 cities increased 57 per cent between 1920 and 1930, and the change in vacancy was probably small, possibly decreasing in some cities affected by the oil boom in the late 1920's.

TABLE EM 3

Ratio of Dwelling Units Built to Increase in Number of Families, by Geographic Division, 1920-1929

	REPORTING CITIES			UNREPORTED AREAS			
	113 central (1)	80 satel- lite (2)	64 Non-met. dist. (3)	Urban envi- rons (4)	Rural envi- rons (5)	Non-met. urban (6)	Rural non-farm (7)
Total	1.415	1.279	1.182	1.211	1.148	1.163	1.132
New England	1.955	1.252	1.304	1.252	1.149	1.222	1.144
Mid. Atlantic	1.687	1.544	1.023	1.283	1.168	1.017	1.138
E. N. Central	1.266	1.059	1.093	1.059	1.035	1.068	1.042
W. N. Central	1.468	..	1.073	1.279	1.165	1.053	1.078
S. Atlantic	1.559	..	1.395	1.477	1.283	1.289	1.196
E. S. Central	1.173	..	1.350	1.173	1.103	1.256	1.146
W. S. Central	1.007	..	1.257	1.007	1.004	1.188	1.106
Mountain	1.379	..	1.231	1.305	1.181	1.169	1.116
Pacific	1.260	1.257	1.778	1.257	1.152	1.133	1.125

Because of the completeness of reporting in the larger cities it was not necessary to use the high ratios in Table EM 3, columns 1, 2, and 3. The highest ratio actually applied was 1.477 in the environs of South Atlantic central cities, but the building to be estimated there was relatively small. The major portion of building in unreported areas was estimated on the basis of ratios under 1.200 and approaching 1.000, the equivalent of one dwelling unit for each additional family.

In determining the increase in the number of fami-

lies in the unreported areas, the ratios for the most appropriate population groups were used as follows:

1) *Urban environs*

For the New England, East North Central, and Pacific divisions the same ratios were used as for reporting satellite cities; for the Middle Atlantic, average ratios for reporting satellite and nonmetropolitan urban cities; for the West North Central, South Atlantic, and Mountain, average ratios of reporting central and nonmetropolitan urban cities, there being no reporting satellite cities in these areas; for the East and West South Central, the same ratios as for central cities, since little building had to be estimated.

2) *Rural environs and rural nonfarm areas*

An estimate of the distribution, by population group, for the country as a whole indicates average ratios of dwelling units built to the increase in the number of families as follows: rural environs, 1.125; all nonmetropolitan cities, 1.166; rural nonfarm, 1.110. Owing to the limitations of the data on vacancies, demolitions, and conversions, it was not feasible to estimate the ratios directly by geographic divisions, but using each of the above United States figures as a base, the ratios for unreported areas were assigned in the several divisions in the same proportions as previously found for areas most nearly corresponding to the unreported areas. For example, ratios for the rural environs were assumed to have the same divisional patterns in relation to the United States average of 1.125 indicated above as had been derived for the unreported urban environs. When the ratios were applied to the increase in the number of families in the rural environs in each division the resulting ratio for all rural environs was 1.148 rather than 1.125, because the divisional distribution of families in the rural environs was different from that in the urban environs, from which the ratios had originally been derived. Similarly, ratios for rural nonfarm areas were assigned

the divisional pattern that had been derived for unreported urban areas, and the resulting weighted average in Table EM 2 was 1.132 instead of 1.110.

### 3) *Nonmetropolitan urban*

For nonmetropolitan urban areas the same divisional pattern of ratios was used as for reporting nonmetropolitan cities, except in the Pacific region, where the sample consisted of only one city, Stockton, California, which was not considered representative. The unweighted United States average for unreported nonmetropolitan cities was therefore applied to the Pacific division. The weighted average, derived after application of these ratios in all divisions, was 1.163, which, combined with 1.182 for reporting cities, results in the estimated ratio of 1.166 for all nonmetropolitan cities.

### 3 Dwelling Units Built Annually, 1920-1936

After the dwelling units built during 1920-29 had been established (Table EM 2) those built each year were estimated (Table EM 10). Preliminary annual totals were first projected from the data for reporting cities,<sup>21</sup> by applying relationships shown in Table EM 2 to 1930-36 as well as to 1920-29 (discussed under a below). Then the entire series for 1920-36 was corrected for the downward bias in the 257 city series (discussed under b below).

#### a Preliminary Totals, Uncorrected for Bias

Units built in the 120 central cities, comprising those reported for 113 central cities and those (partly estimated) for the 7 central cities are given in Table EM 10, lines 1 and 2. Total building in the environs was derived by averaging two estimates made as follows: The first was an expansion to full coverage based on the trend of the 64 satellite cities (line 5, Table EM 10) by multiplying the dwelling units reported to have been built in the 64 cities each year by 5.875.<sup>22</sup> The second estimate followed the trend of building in all 184 of the reporting cities, which was applied to both central and satellite cities in metropolitan districts and established the multiplier, 0.545.<sup>23</sup> This procedure was evolved as the most satisfactory compromise of several methods tested, including attempts to estimate for separate metropolitan districts and groups of metropolitan districts within geographic divisions. If the trend of building in the environs were assumed to follow the trend in the 64 reporting cities, a trend that is dominated by reporting cities in the environs of Boston and

<sup>21</sup> Corrected for change in coverage due to annexations, for lapsed permits on apartments in New York City, and including data (partly estimated) for 7 central cities not among the 257 cities.

<sup>22</sup> Relation of units built in all environs to units built in 64 reporting cities, 1920-29, as shown in Table EM 2 ( $1,862,941 \div 317,117 = 5.875$ ).

<sup>23</sup> Relation of units built in all environs to units built in 184 reporting cities ( $1,862,941 \div 3,418,921 = 0.545$ ).

New York would be imposed on environs in some of the southern and western metropolitan districts. Furthermore, building in the 64 cities constituted less than one-sixth of building in all the environs; therefore, the year-to-year changes cannot be assumed to be satisfactorily representative. In the South and West the central cities constitute the only representation in the metropolitan districts.

Building in urban and rural environs was estimated as 0.669 and 0.331 respectively of the total for all environs (Table EM 2).

Building in nonmetropolitan urban areas was estimated on the basis of the 80 reporting cities (Table EM 10, lines 11-12). Estimated total urban building is shown in line 16. The trend of building in rural nonfarm areas was derived by averaging two estimates based on: (a) the 80 nonmetropolitan cities; (b) total urban building. The sum of the urban and rural nonfarm estimates obtained above gives tentative nonfarm totals in line 20.

The use of the above method involves the assumption that building outside reporting cities follows the trend of building within the cities, year by year. The assumption is not valid if the trend of all the reporting cities combined is applied directly to the entire unreported nonfarm area as a unit, because of the downward bias of the 257 city series, as will be shown later. Likewise the year-to-year trend of building outside some individual cities may differ considerably from that within. However, for groups of cities within reasonably large areas such as metropolitan districts, building in the environs follows that in the central city quite closely. For example, the year-to-year building trends in the 14 reporting satellite cities in the Boston metropolitan district taken individually had apparently little relation to one another or to the trend in Boston from 1920 to 1936, but the combined annual totals of the 14 cities, representing a sizeable sample of the environs, followed the trend for Boston. Similarly, in the environs of Providence, New York City, and Philadelphia, the trend for each group of reporting satellite cities conformed in general to that of its central city. Because the sample of reporting cities was small, comparisons in other metropolitan districts are less conclusive.

Similar relationships are evident in new residential construction in 31 metropolitan districts as shown in the 1934 Real Property Inventory of 64 cities; also, cities that have much the same general economic conditions and rates of growth have similar building trends even though they are in different states. Thus the tentative assumption that building in unreported areas followed the trend of reporting cities seems to be applicable to areas that are homogeneous with respect to the factors influencing building. For these reasons, the estimates of year-to-year trends, made by metro-

politan and nonmetropolitan areas, probably give more accurate results than if made by regions.

#### b Correction for Bias

The preliminary totals of dwelling units built (Table EM 10, lines 1-20) were corrected in lines 22-34 for the downward bias in the 257 city series. Evidence of this bias is given by estimates of total nonfarm building based on the larger sample of cities in 1935 and 1936 (Tables EM 14 and 15), which show that all nonfarm building increased to about 2.5 times that for the 257 cities during the depression, in contrast to an average of about twice during 1920-29. This bias continued throughout the 17 years, though it was much less prior to 1928-29, as indicated by data for 31 metropolitan districts included in the Real Property Inventory of 64 cities. The percentage corrections are smallest in the years of greatest activity in the middle 1920's, and most pronounced during the depression when absolute volume was low.

The preliminary totals of nonfarm units built (Table EM 10, line 20) were multiplied by the factors in line 22, derived from the sources mentioned in the preceding paragraph, to obtain the corrected nonfarm totals in line 23, except in 1935 and 1936 when the estimates based on 811 and 1,689 cities were used (Tables EM 14 and 15). Since the central cities were covered almost completely by the permit reports, their estimated building would not be affected, but the estimates for building in the areas outside them required adjustment so that the total would equal line 23. These steps are indicated in lines 27-34. In the absence of conclusive evidence to the contrary, it was assumed that the adjustment for each year applied equally to all the areas outside the central cities for 1920-30, but additional adjustments were made for 1931-36. Comparison of the estimate for 1936 (Table EM 15) with that based on 257 cities indicated that the process used in the latter produced virtually the same number of units in the total environs as the former, but tended to overestimate for the urban environs by 8½ per cent, and consequently to underestimate for the rural environs; therefore a correction was applied to the estimates for urban environs based on the 257 cities, graduated from zero in 1930 to 7 per cent in 1935. Similarly, the estimates based on 257 cities would have overestimated building in the nonmetropolitan cities 15½ per cent in 1936; hence a graduated correction was applied, ranging from zero in 1930 to 12½ per cent in 1935. Thus lines 26-34, Table EM 10, present estimates of building annually in five segments of the nonfarm areas that reflect the separate trends of subgroups of the 257 cities, yet correct for the tendency of building to shift outward from the large cities.<sup>24</sup>

<sup>24</sup> See Note B for comparisons with other estimates.

#### c Comparison of Estimated Trend with Shipments of Materials

To check the trend of nonfarm residential units built, as estimated above, comparisons were made with other available indexes of the physical volume of residential building, including shipments of bathtubs, lavatories, and kitchen sinks (Table EM 4). Although comparison of relative volumes is not clear-cut because of the considerable number of bathtubs, sinks, and lavatories going into replacements and the modernization of old buildings in cities, as well as into farm dwellings, shipments seem to confirm the trend of nonfarm units built.

TABLE EM 4

Dwelling Units Built, and Factory Shipments of Baths, Lavatories, Kitchen Sinks, and Radiators, 1920-1936

DWELLING UNITS BUILT <sup>1</sup> (thousands)	FACTORY SHIPMENTS <sup>2</sup>			RADIATORS (millions of sq. ft. of heating surface)	
	BATHS	LAVA- TORIES	KITCHEN SINKS		
1920	247	617	617	723	..
1921	449	498	698	797	..
1922	716	898	1,098	1,144	..
1923	871	1,085	1,326	1,370	143
1924	893	1,148	1,323	1,445	148
1925	937	1,326	1,528	1,551	165
1926	849	1,195	1,365	1,364	172
1927	810	1,133	1,253	1,315	162
1928	753	1,117	1,266	1,318	161
1929	509	938	1,118	1,159	127
1930	286	592	743	760	86
1931	212	461	550	565	79
1932	74	(series discontinued)			45
1933	54				39
1934	55				50
1935	144				58
1936	282				78

<sup>1</sup> From Table EM 10, line 34.

<sup>2</sup> Survey of Current Business.

Shipments of radiators (Table EM 4) differ in trend from all nonfarm units built because of the relatively larger number of radiators used in apartments and hotels as well as in office buildings, schools, and other non-residential structures, than in small dwellings. Radiator shipments reached a peak in 1926 and remained at high levels in 1927 and 1928, showing a trend not unlike that in apartment building, which reached a maximum later than 1- and 2-family dwellings.

Shipments of other materials used largely, but not exclusively, in residential building, such as lumber, common brick, lime, plaster, lath, and shingles, confirm the general pattern of estimated dwelling units built. Though less conclusive for year-to-year comparisons, the general trend is the same in biennial figures on production of window glass, putty, fillers, and sewer pipe.

#### d Method of Estimating Dwelling Units Built, by Geographic Division

Estimates for different geographic divisions were obtained by different methods. In the New England, North Central, and South Central divisions preliminary totals of nonfarm units built each year were estimated in one process by raising the number of units built in the reporting cities of the 257 city series in each geographic division in the same proportions as indicated for 1920-29 in the detailed tables from which the United States summary (Table EM 2) was derived. In the Middle Atlantic division separate estimates were made for environs, nonmetropolitan cities, and rural nonfarm areas, based on the corresponding groups of reporting cities, but excluding New York City. In the South Atlantic and Mountain regions separate estimates were also made by population group in order to give the sample of nonmetropolitan cities proper weighting. In the Pacific division estimates for unreported areas were based on the 14 reporting cities, excluding Los Angeles; inclusion of Los Angeles would have given a disproportionate weighting. The entire series of estimates was then corrected for the downward bias of the 257 cities,<sup>25</sup> so that the resulting United States totals matched those previously derived in Table EM 10. This procedure assumes that the correction for bias is approximately the same for all regions, since data on which to base corrections for each region, with any degree of certainty, are insufficient.

#### e Dwelling Units Built, by Type of Dwelling

The units of each type of dwelling (apartments, 1- and 2-family dwellings) built each year were calculated in the same general manner as the total of all units as described above. First, aggregate units of each type built during 1920-29 in each population group were estimated on the basis of the 257 reporting cities and Census data on dwellings in 1930. The 2-family dwelling and apartment units built each year were then distributed according to the trends of these types in the 257 reporting cities, which included a large portion of the total building of these types. The difference between the total of 2-family and apartment units thus obtained and the nonfarm total of all units built each year as previously estimated in Table EM 10 gave 1-family dwellings. The 1-family dwelling classification includes not only detached 1-family houses but also dwelling units in row houses, the two types not being reported separately in the basic building permit data.

Estimates of dwelling units of various types built since 1920, by years, are summarized in Table E 1, section A. They are confined to nonfarm totals for each type: 1-, 2-, and 3-or-more-family (apartment) dwellings. Separate estimates on an annual basis for geo-

<sup>25</sup> Table showing these computations omitted; see Part Three, Table E 1, sec. C.

graphic divisions or for metropolitan and nonmetropolitan areas within divisions were not attempted, owing to the extensive tabulations necessary.

Aggregate units of each type built during 1921-30<sup>26</sup> were obtained as follows: The 10-year totals of 2-family and apartment units built in (a) 113 central cities, (b) 64 satellite cities, (c) 80 nonmetropolitan cities were estimated by means of the basic tabulations for all units built and a special study of 1-family dwellings built in the 257 cities. Subtracting 1-family units from total units built gave a combined total for 2- and 3-family dwellings. The proportion of units in each type was estimated in accordance with the totals for the two types as reported in the 257 cities.<sup>27</sup> Then the 2- and 3-or-more family units built were estimated for each unreported area: (a) 7 central cities, (b) environs, (c) nonmetropolitan urban, (d) rural nonfarm, by means of the percentage distribution of units by type, derived from the 1930 Census data on dwellings in different population groups and described in Chapter I. The percentage distribution thus obtained of all nonfarm units built, by type, 1921-30, was applied to the 1920-29 aggregate of 7,035,473 units built as derived in Table EM 10, resulting in the accompanying estimates.

	DISTRIBUTION (Per Cent)	DWELLING UNITS (Number)
All types	100.0	7,035,473
1-family dwellings	60.7	4,270,532
2-family dwellings	15.5	1,090,498
Apartments	23.8	1,674,443

The 257 cities reported 38, 55, and 77 per cent respectively of the estimated nonfarm totals of 1-, 2-, and 3-or-more family dwelling units for 1920-29. Because of the dominance of the 257 cities it was assumed that the annual trend of the nonfarm totals of the 2-family and apartment units would follow the respective trends for the 257 cities, and that this would apply during 1930-36 as well as 1920-29. Consequently an index of the 2-family units built in the 257 cities was computed with the 1920-29 average as 100 and applied to the ten-year average of all nonfarm 2-family dwelling units. A similar procedure was followed for apartments. An additional adjustment was made in the indexes for 2-family dwellings and for apartments, 1931-36, based on: (a) Bureau of Labor Statistics estimates of dwelling units provided in urban areas during 1936 by type of dwelling and de-

<sup>26</sup> The period 1921-30 was used instead of 1920-29 because detailed data by type of dwelling for 1920 are few; aggregate units and proportions by type are virtually the same for both periods.

<sup>27</sup> Since the 113 central cities accounted for 89 per cent of all 2-family and apartment units built in the 257 cities, the proportions would be virtually the same for both groups of cities.

rived from building permit reports from 1,689 places over 2,500 in population (press release, February 19, 1938); (b) the relation of total 2-family and apartment dwelling units standing in 1930 in nonfarm and urban areas, developed in connection with the estimates on aggregate values and rents in 1930 (Ch. II); (c) the shifts between 1930 and 1936 in the proportions that 2-family and apartment dwelling units were of the total units provided in the 257 cities. Estimates of the nonfarm totals of 2-family and apartment dwelling units provided in 1936 were then revised on the basis of these adjusted indexes. They resulted in estimates somewhat higher for 2-family dwellings and lower for apartments than the estimates based on the 257 city series alone. The indexes for these two types of dwellings were then adjusted to the revised 1936 level, with corrections each year graduated from the full correction in 1936 to zero in 1930. Subtracting the sum of the 2-family and apartment units built each year from total nonfarm units of all three types built, previously estimated in Table EM 10, gave the number of 1-family units built. The results of these estimates are summarized in Table E 1, section A.

#### 4 New Dwelling Units Built, Estimated Value

The value of new nonfarm dwelling units built annually since 1920 was estimated (Table EM 11) by applying average costs per dwelling unit to the corresponding number of dwelling units built (Table EM 10). The derivation of the average costs per unit is described below.

##### a Unit Costs

A special study on unit costs of 1-family dwellings built in the 257 cities showed marked differences in satellite and nonmetropolitan cities (Part Three Table E 7). The regional differences were even wider, costs in the northeastern states averaging nearly double those in the South. Because the sample was small, however, it was not feasible to estimate cost of residential building by regions without considerable further study of the distribution of the number of units by type of dwelling in each region.

##### b Basic Data on Unit Costs, Building Permits

Table EM 11, lines 35-39 show basic data on unit costs as derived from the Bureau of Labor Statistics data for 257 cities, while lines 40-42, 45, and 47 show these data after correction for undervaluation of permits and as used in estimating cost of dwellings in urban areas.<sup>28</sup>

The unit costs for the reporting 113 central and 64 satellite cities (lines 36 and 37) are composite averages for all housekeeping units, including 1-, 2-, and

3-or-more family dwellings, derived by subtracting the value of nonhousekeeping dwellings from the value of all new residential building as published by the Bureau of Labor Statistics and dividing by the number of families provided for. In the central cities this average is usually lower than the average for 1-family dwellings in Table E 7, because of the large number of apartments and 2-family dwellings which average lower in cost per unit than 1-family dwellings. Line 39 shows the unit costs for 1-family dwellings alone in the 80 nonmetropolitan cities as derived in the special study of average costs of 1-family dwellings. Since most of the nonmetropolitan cities for which building must be estimated are in the 2,500-25,000 population group, in which 1-family dwellings predominate, the 1-family average unit cost is more representative than a composite average including apartments.

##### c Adjustment for Undervaluation

Each series (Table EM 11, lines 35, 37, and 39) was increased 18 per cent as a tentative correction for undervaluation of permits. This adjustment is based on several sets of data, all of which indicate that average values of permits were understated. Such comparisons as can be made with the F. W. Dodge Corporation data on contracts awarded support the reasonableness of the 18 per cent correction.

Among the evidence used to correct permit valuations is that given in a release entitled "Construction Statistics Analyzed: Permit Records and Contract Records Compared," dated July 20, 1936, in which the F. W. Dodge Corporation discuss undervaluation in building permits, stating in part:

"Permit valuations are generally recorded considerably below actual cost, for the following reasons:

1. Applicants expect tax assessments to be based upon permit valuations given.
2. In many cases, permit fees are charged in proportion to valuation given in the application.
3. In some places, costs of heating, plumbing, and wiring are not included.

In one of the largest cities of the country, projects are very generally undervalued one-third for purposes of the permit record. The degree of undervaluation varies from place to place. Here are some actual instances, reported by Dodge field men who interviewed building department heads:

3 cities	30 per cent undervalued
1 city	30 per cent to 40 per cent undervalued
2 cities	30 per cent undervalued
2 cities	25 per cent undervalued
2 cities	15 per cent to 20 per cent undervalued."

In many large cities permit valuations are rather carefully checked against architects' estimates of current

<sup>28</sup> Table EM 11, and the line numbering, is a continuation of Table EM 10.

costs for finished structures of similar type on a square or cubic foot basis. Significant undervaluations in such cities would be the exception rather than the rule.

A comparison of permit valuations and loan appraisal values of 255 residential structures built in Minneapolis, 1922-32, indicated an undervaluation in permits of approximately one-third.<sup>29</sup> However, the appraised loan values, reflecting the selling price of the dwelling to the purchaser, may include items other than the actual cost of construction, which would reduce the permit undervaluation.

In contrast to these indications of undervaluation of permits, it is possible that in boom times some speculative builders overstate valuation in permit applications in order to cite these "official" records as sales arguments.

If these instances are typical for the country as a whole, unit costs reported in permit data evidently cannot be taken as accurate measures of value, since they tend toward understatement. However, despite their limitations, the building permit cost data proved to be a more homogeneous and usable series than contracts awarded, as discussed in more detail in Note A.

Any correction for undervaluation of permits should possibly be less in recent years because of the increasing strictness of permit regulations and checking of permit values. In the absence of specific data on which to base such graduated correction, the 18 per cent was applied throughout the period.

Another difficulty in using average unit costs derived from building permits is that they are at times distorted by the inclusion of a few very expensive dwellings, as became apparent in the course of the special study on 1-family dwelling unit costs.<sup>30</sup> However, in the absence of data on the actual dispersion of unit costs about the average in the unreported areas, it is difficult to state what correction, if any, is necessary. To the extent that the derived average costs are too high to apply to dwellings built in the unreported areas, they tend to offset any undervaluation in permits. This was one factor in limiting the correction for undervaluation to 18 per cent rather than using the 25-40 per cent indicated as necessary by other data cited above.

An additional correction must be made for the 64 satellite and 80 nonmetropolitan cities, because the unit costs derived for these groups of cities—all of which have populations of more than 25,000—are not representative of the corresponding unreported areas,

<sup>29</sup> The Construction Industry in Minnesota (*University of Minnesota, Employment Stabilization Research Institute, II, No. 9, June 1934*), p. 20.

<sup>30</sup> Confirmed by data recently published by the Bureau of Labor Statistics showing cost arrays for different types of dwellings and materials of construction for 815 cities with populations over 10,000 in which detailed studies were made of building permits for 1929-35.

which include many smaller places. The average for the 64 cities was increased 5 per cent to approximate the average for all urban environs, while the 80 city average was decreased 18 per cent because of the large number of low priced units built in the nonmetropolitan areas with populations between 2,500 and 25,000. The need for such adjustment was demonstrated by comparison of averages for the 64 satellite and 80 nonmetropolitan areas with data for the 1,689 cities reporting permits in 1936, from which the average cost per dwelling unit, all types, by population group, was derived.<sup>31</sup>

	NO. OF REPORTING CITIES	AVG. COST PER DWELLING UNIT
All reporting cities	1,689	\$4,048
Central	120	3,992
Satellite	613	5,467
Nonmetropolitan	956	2,965

The average for all 1,689 cities obscures the very marked differences between average costs in the environs of metropolitan centers and in nonmetropolitan areas. Furthermore, the average of \$5,467 per unit for the 613 satellite cities reporting in 1936 is 5 per cent higher than the corresponding 1936 average for the 64 satellite cities among the 257 cities. This was to be expected because of the greater number of relatively expensive 1-family dwellings in the small cities in the environs of metropolitan centers. The composite correction for both undervaluation and nonrepresentativeness of the sample becomes  $1.18 \times 1.05 = 1.24$ , applied to line 37, Table EM 11, to obtain line 41.

The average of \$2,965 (for all types) in the 956 nonmetropolitan cities reporting in 1936 is lower than the average of \$3,410 for 1-family dwellings in the 80 nonmetropolitan cities, the series upon which estimates are based for the earlier years. This relationship is consistent with the findings of a study of Census data for 1930: the average value of houses in small towns outside metropolitan districts was found to be much lower than in larger cities or cities of the same size within metropolitan districts. When estimates based on the averages for reporting cities in each size group are extended to all nonmetropolitan cities, the average becomes \$2,818 (compared with \$2,965 in the 956 reporting cities), only 82 per cent of the 1-family average, \$3,410, for the 80 cities. The composite correction is then  $1.18 \times 0.82 = 0.97$ , which, applied to line 39, gives line 45 (Table EM 11).

#### d Unit Costs in Rural Areas

Virtually no information is available on the year-to-year cost of construction of dwellings in either the

<sup>31</sup> Based on Bureau of Labor Statistics data on "number of families provided for" and "estimated valuation of new residential buildings," the latter corrected to exclude nonhousekeeping dwellings (*Building Construction, February 1937, p. 62*).

rural environs of metropolitan districts or the strictly rural areas. The Bureau of Labor Statistics receives no reports from these areas and the F. W. Dodge data on contracts awarded do not lend themselves to a segregation of urban and rural nonfarm construction. Consequently, the trend of the average cost of dwelling units built in rural environs, predominantly 1-family dwellings, is estimated on the basis of the trend for 1-family dwellings in the reporting satellite cities, but at a level 24 per cent lower. This relatively lower level was determined by a detailed study of the estimated average value of all dwellings in places over and under 2,500, in environs of metropolitan districts, based on the 1930 Census data on values and rents. Since the Census data are for 1930 alone, and include value of land and both new and old dwellings, they may not represent the relative costs of new dwellings built either during 1930 or over a period of years. However, analysis of the unit costs for new dwellings during 1936 in the 1,689 reporting cities, by size groups, shows much the same relations in average costs between cities of different size as were found in the 1930 value data (after allowances for differences in land values), when the cities are segregated by metropolitan and nonmetropolitan areas, indicating that the Census data give a reasonable basis for estimating relative average costs.

Similarly, unit costs of new dwellings in rural nonfarm areas were estimated as 66 per cent of those in nonmetropolitan urban centers (line 45), on the basis of the relation of estimated values of structures in rural nonfarm areas and of values in nonmetropolitan urban cities as shown in the 1930 Census.

Partial confirmation of the correctness of these estimated average costs is contained in Part VII of the Report of the President's Conference on Housing (1931), *Farm and Village Housing*. The results of a mailed inquiry on the cost of houses built in rural areas in 18 states during 1926-30 are summarized. The sample was rather small, comprising 1,546 returns, 970 of which were for houses on farms, 312 in villages, and 264 in other rural areas; location within or outside metropolitan districts was not designated. New York and Georgia had the highest and lowest averages. The average values of \$3,912 for new village houses

	FARM	VILLAGE	OTHER RURAL	TOTAL RURAL
18 states, average	\$2,789	\$3,912	\$3,556	\$3,146
New York (highest)	3,235	6,113	5,545	4,894
Georgia (lowest)	1,607	2,088	1,739	1,706

and \$3,556 for other rural houses for the 18 states are lower than the average of \$4,788 per unit for "rural" environs (Table EM 11, line 42), but higher than the average of \$2,508 for rural nonfarm dwellings (line 47) for the corresponding period, 1926-30. However, if rural environs and rural nonfarm areas are combined, a composite average of \$3,525 per unit is de-

rived, only slightly lower than the averages of \$3,912 and \$3,556 for "village" and "other rural" dwellings in the sample study above. Extension, by the Bureau of Labor Statistics, of the reporting of building permits to places with populations under 2,500 will in time provide a basis for revising, if necessary, the average unit costs tentatively assumed in Table EM 11.

The unit costs as derived above (Table EM 11, lines 40, 41, 42, 45, and 47), when multiplied by the number of units built each year for the respective population group (Table EM 10, lines 26, 27, 28, 31, and 33), result in the estimated value of new housekeeping dwellings (Table EM 11, lines 49-57).

In order to have estimates of the cost of all residential construction, including nonhousekeeping units (hotels, clubs, and lodging houses), comparable to other estimates previously available, the cost of nonhousekeeping units was estimated tentatively (Table EM 11, line 58). These estimates are subject to revision when the basic data for the 257 cities in earlier years are corrected by the Bureau of Labor Statistics. To allocate the estimates for nonhousekeeping units by geographic division or population group was not attempted.

The estimates described above are for new construction alone; they do not include expenditures for repairs and alterations of residential buildings.

#### 5 Aggregate Nonfarm Dwelling Units Built by Decades, 1890-1929

Estimates of aggregate new nonfarm dwelling units built by decades since 1890 are summarized in Tables E 6 and EM 5. Estimates for the three decades prior to 1920 were derived by the method described for 1920-29. That is, it was assumed that net new dwelling units built each decade were equal to the total increase in dwelling units standing, obtained by adding the increase in the number of families (number of occupied units) and in vacant units, plus building to replace losses, less units added by conversions. The estimates for earlier years are subject to a wider range of uncertainty than those for the period since 1920. They are tentative, subject to revision if more reliable data become available. Even if the estimates for the earlier decades are slightly inaccurate, they, together with the 1920-36 estimates, provide basic data for gauging current developments against a background of nearly half a century. They provide also a means of checking estimates of total units built annually prior to 1920. The methods used in deriving the component parts of the estimates are summarized below in the order in which they appear in Table EM 5.

#### a Increase in Number of Families, 1890-1930

##### 1) Necessary adjustments of Census data

Basic data on total nonfarm families as published by

the Bureau of the Census for the five Census dates between 1890 and 1930 (Table EM 6) require several adjustments before they can safely be used in estimating construction in the manner described above.

TABLE EM 5

## Dwelling Units Built by Decades, 1890-1929 (thousands)

	1890-99	1900-09	1910-19	1920-29
Increase in no. of				
1 Occupied units	2,262	3,445	4,109	5,541
2 Vacant units	9	291	-530	1,039
3 Demolitions, fire, flood, and other losses	208	297	414	580
4 Total units built (1+2+3)	2,479	4,033	3,993	7,160
5 Conversions	62	81	103	125
6 Net new units built (4-5)	2,417	3,952	3,890	7,035

The reasons for the adjustments are:

- a) The Census data for 1900 and 1930 are for private families only, while the 1890, 1910, and 1920 figures include quasi-family groups, e.g., groups living in hotels, lodging houses, schools, institutions, labor camps, or army posts.
- b) The number of persons included in the quasi-family classification in 1900 was not comparable with that in 1930 for several reasons: relatively more persons were counted as living in lodging houses in 1900 than would have been counted on the basis of the 1930 classification; the average number per lodging house in 1900 was under 10; in 1930 the minimum was 11 and the average over 20. Because of greater care in reporting transient residents in hotels in 1930 according to their permanent residence, probably fewer persons were counted as quasi-families in hotels in 1930 than in 1900. Also, the Census of 1900, taken June 1, apparently included relatively more farm labor groups than the later censuses taken in January or April.
- c) The intercensal periods vary in length because the Census enumerations were made on June 1 in 1890 and 1900, April 15, 1910, January 1, 1920, and April 1, 1930.
- d) The distribution of total families between farm and nonfarm as published for 1900 and 1910 appears to be inconsistent with that for other years because of some possible change in classification or other cause as yet undetermined by the Bureau of the Census. Farm families exceeded farms by 4.4, 4.7, and 6.0 per cent in 1890, 1920, and 1930, respectively;<sup>32</sup> in 1900 and 1910 farm families were reported as 0.8 and 3.7 per cent less than the number of farms (see Table EM 6). These variations are small in terms of the totals, but, as will be shown later, they affect considerably

<sup>32</sup> If the number of occupied farm dwellings in 1935 is considered as a minimum count of farm families, there were at least 8 per cent more farm families than farms in 1935 (see *Farm Dwellings, Census of Agriculture, 1935, release, June 12, 1936*).

the increases in the number of both farm and nonfarm families between Census dates.

2) *Methods used in making adjustments*

The adjustments made to the Census data on families are summarized below.

- a) The family data for all five Census dates were reduced to a "private-family" basis by applying the ratio of private families to all families in the 1930 Census. Since the Census Bureau did not tabulate separately private and quasi-family groups for farm and nonfarm families in 1930, the same ratio was applied to both farm and nonfarm totals. The correction to the totals is of course small (one-fourth of 1 per cent),

TABLE EM 6

## Families and Farms, United States, Census Data, 1890-1930 (thousands)

No. of families <sup>1</sup>	1890	1900	1910	1920	1930
	June 1	June 1	April 15	Jan. 1	April 1
1) Total	12,690	15,964	20,256	24,351	29,905
2) Farm	4,767	5,690	6,124	6,751	6,669
3) Nonfarm	7,923	10,274	14,132	17,600	23,236
4) No. of farms <sup>2</sup>	4,565	5,738	6,362	6,448	6,289
5) Ratio of farm families to farms	1.044	0.992	0.963	1.047	1.060
Increase in no. of families	1890-00	1900-10	1910-20	1920-30	
6) Total	3,274	4,292	4,096	5,553	
7) Farm	923	434	628	-83	
8) Nonfarm	2,351	3,858	3,468	5,636	

<sup>1</sup> Census, 1930, VI, Table 16, p. 11. The headnote to this table reads in part: "Figures for 1930 and 1900 represent private family homes alone; those for 1920, 1910 and 1890 include the premises occupied by the small number of institutions and other quasi-family groups which were counted as families in the respective censuses. . . ."

<sup>2</sup> Census, 1930, VI, 50.

but its effect is more pronounced on the increases between Census dates, and was made for the sake of consistency in the figures rather than for the fine degree of accuracy implied (see Table EM 7).

- b) Farm families in 1900 and 1910 were estimated to be respectively 1.045 and 1.046 times the number of farms. These ratios were interpolations between the 1890 and 1920 ratios, 1.044 and 1.047, of farm families to farms (Table EM 6). This adjustment was made after consultation with Bureau of the Census officials and study of state-by-state comparisons of the number of farm families and of farms at each of the five Census dates, made possible by a special Bureau of the Census tabulation. Nonfarm families were obtained by subtracting farm families from the United States totals.

- c) The increases in the number of families between Census dates were adjusted to a uniform ten-year interval, equivalent to a January 1 basis throughout (Table EM 7, lines 6-8). The 1900-10, 1910-20, and the 1920-30 increases based on Table EM 7, lines 2,

4, and 5, were divided by 0.9875, 0.9708, and 1.025 respectively, to correct for the uneven intercensal periods of 9.875, 9.708, and 10.25 years instead of 10 years. Comparison with the corresponding data published by the Census (Table EM 6) shows an increase in the number of farm families from 1890 to 1900, and 1900 to 1910, a third to a half greater, and an increase from 1910 to 1920, only one-sixth as much. Furthermore, the adjusted increases in farm families show a steady decline from 1890 to 1930, whereas the published Census data indicate a greater increase from 1910 to 1920 than in the preceding decade. Likewise, the adjusted data (Table EM 7) show successively larger increases in nonfarm families each decade from 1890 to 1930 instead of the interruption to the rate of increase indicated in 1910-20 (Table EM 6, line 8).

TABLE EM 7

Number of Families, 1890-1930, and Adjusted Increase in Number of Private Families by 10-Year Intervals (thousands)

	Number of families, Census dates				
	1890 June 1	1900 June 1	1910 April 15	1920 Jan. 1	1930 <sup>4</sup> April 1
1 Total, all families <sup>1</sup>	12,690	16,188	20,256	24,351	29,980
2 Total, private families only <sup>2</sup>	12,658 <sup>3</sup>	16,147	20,204	24,290	29,905
3 Farm, all families <sup>1</sup>	4,767	5,997 <sup>4</sup>	6,654 <sup>5</sup>	6,751	..
4 Farm, private families only <sup>2</sup>	4,755	5,982	6,637	6,734	6,669
5 Nonfarm, private families only (2)-(4)	7,903	10,165	13,567	17,556	23,236
Increase in no. of private families, adj. to 10-year intervals, January 1-January 1					
	1890-00	1900-10	1910-20	1920-30	
6 Total	3,488	4,109	4,209	5,477	
7 Farm	1,226	664	100	-64	
8 Nonfarm	2,262	3,445	4,109	5,541	

<sup>1</sup> Source: Census, 1930, VI, Table 14, p. 10.

<sup>2</sup> Estimated as same proportion of "all families" as in 1930 = 0.9975.

<sup>3</sup> Census count of private families in 1900 was not used, as it is not strictly comparable with private families as enumerated in 1930.

<sup>4</sup> Estimated at 1.045 times the number of farms (see Table EM 6).

<sup>5</sup> Estimated at 1.046 times the number of farms (see Table EM 6).

<sup>6</sup> Not tabulated separately by the Census Bureau.

#### b Change in Percentage of Vacant Units

Total units standing January 1 of each Census year were estimated and the ten-year increases obtained by the method described in Note C for 1920-29. The difference between the increase in the dwelling units standing and in occupied dwelling units (increase in number of families) in each decade is the net change in vacant units (Table EM 5). Vacant units, as percentages of the total standing at the beginning of each decade, were estimated to be: 1890, 5; 1900, 4; 1910,

5; 1920, 1; 1930, 5. The basis of selection of the 1920 and 1930 vacancy percentages is described in Note C. For earlier years data are exceedingly scanty, but from the available evidence on vacancies and building activity it was concluded that vacancies were probably fairly numerous at the beginning of 1890 and 1910 following active periods of building.<sup>33</sup> The situation was probably similar to that which followed the active building of the middle 1920's. On the other hand, less building during the 1890's, together with continued increase in the number of families and immigration, probably resulted in somewhat fewer vacancies in 1900.

#### 1) Supporting evidence on variations in the percentage of vacancies

This general pattern of vacancies is confirmed by the following information:

a) Vacancies in St. Louis were reported by Wenzlick to be approximately 6.7 per cent in 1900; 8.9 in 1910; 3.6 in 1920, and 9.5 per cent in 1930. They average higher than for the country as a whole, as might be expected because of the larger than average proportion of 2- and 3-or-more family dwellings there,<sup>34</sup> in which types vacancies on the average are higher than in 1-family dwellings.

b) Vacancy surveys in apartment buildings made by the New York Tenement House Department<sup>35</sup> reported apartment vacancies at 8.08 per cent in early 1909 and 5.60 per cent in early 1916. At the beginning of 1920, however, apartment vacancies in New York City were probably less than 1 per cent, since they were 2.18 per cent in March 1919 and 0.36 per cent in March 1920.

c) Vacancies in dwellings (only those fit for occupancy) in Philadelphia averaged 5 per cent in 1912, the date of the first vacancy survey made by the Philadelphia Housing Association. At the next surveys in 1917 and 1921 they were 1.65 and 0.67 per cent respectively, indicating a vacancy of not more than about 1 per cent at the beginning of 1920.

The above data furnish a very inadequate basis on which to estimate total vacancies in nonfarm areas. Furthermore, a change of only 1 per cent in total vacancy at the beginning or end of a decade can affect appreciably the estimate of change during it. However, variations in the assumed percentages of vacancy would have a relatively small effect on the estimate of total building, and would not materially change the

<sup>33</sup> See J. R. Riggleman, *Building Cycles in the United States, 1875-1932*, Journal of the American Statistical Association, June 1933. The data are for total building but presumably residential building fluctuated in essentially the same manner.

<sup>34</sup> Of all occupied dwelling units in St. Louis, 58 per cent were in 2- and 3-or-more family dwellings combined compared with 30 per cent in all nonfarm areas, 1930 (Census, 1930, VI).

<sup>35</sup> Tenth Annual Report, Table 28, pp. 162-3.

longer term proportions of construction done during the several decades.

### c Demolitions and Other Losses

The basis of estimating the reduction in dwelling units during 1920-29 due to demolitions, fire, flood, and other losses is described in Note C. For the earlier decades there are virtually no empirical data. Aggregate property loss by fire in the United States as reported by the National Board of Fire Underwriters in the four decades following 1890 totaled \$1,373, \$2,168, \$2,457, and \$5,053 million respectively, only a portion of which was in residential property (see Note C). Even if the proportion of the total that was residential property were known, it would be difficult even to approximate the number of dwelling units destroyed by fire, owing to the lack of a satisfactory measure of urban property values over a long period. The larger loss that might be expected in later years because of the larger number of dwellings in existence, might be partly or wholly offset by improved fire protection methods and equipment.

During the 1920's demolitions of dwellings (many in good condition) to make way for other buildings constituted a large proportion of all losses. This accompanied the rapid urbanization, most pronounced in large metropolitan areas, and was probably a much less important factor in earlier years. Consequently, it was estimated that average annual losses, including those from demolitions, fire, flood, and other causes were 5, 5½, and 6 units per 10,000 population respectively in the three decades 1890-99, 1900-09, and 1910-19, comparable with 6.97 units during 1920-29 derived from empirical data and separate estimates for demolitions and other losses as described in Note C.

### d Conversions

In the absence of empirical data for earlier years, annual conversions were estimated on the same basis as for 1920-29, namely, at 1½ units per 10,000 population. Since, as thus estimated, they averaged less than 3 per cent of total building, a considerable margin of error in the conversions estimate would not materially affect estimated total new building.

### 6 Limitations of the Estimates

The chief limitations of the estimates are due to the nature and scope of the data available. The estimates

for 1920-36 are based on a sample of building permits for cities, which, in terms of both population and dwelling units built over a period, has varied from about 40 to 60 per cent of total nonfarm dwellings. While this is a fairly large sample for the country as a whole, the representation varies widely by regions and size of population groups.

Any estimate of the value of construction based on either building permits or contracts awarded presents difficulties in interpretation with respect to the time at which construction actually occurs. Both permits and contracts report a lump sum as of a given date, but the actual expenditure for materials and labor is usually spread over several months. The estimates presented herewith are annual totals; monthly trends are not attempted. Owing to the marked concentration of residential building in the summer, particularly in 1-family dwellings which comprise the bulk of residential building, there is no serious distortion to the annual figures due to carry-overs from one year to the next, and any error that may arise from this cause is much smaller than for certain types of nonresidential and heavy engineering construction. Furthermore, the extreme range of fluctuation in the national totals over a period of years and the marked differences in regional trends tend to reduce the significance of short term fluctuations in the national totals.

The tables in this chapter should not be taken as implying as fine a degree of accuracy as might be inferred from computations to the last digit or to thousands of dollars. The figures were carried out for the purpose of checking with reported data and other computations. Furthermore, important parts of the basic material refer to items that cannot be defined exactly. For example, a family dwelling unit may be any one of several types—an apartment, a flat over a store, a row house, in a 2-family dwelling, or a 1-family detached dwelling. Dwelling units may vary in size from 1 to 10 or more rooms. A single family dwelling may be anything from a 1-room shack with a minimum of improvements to a 10- or 20-room mansion on an estate. While these represent extremes they are included in the figures currently reported by the Bureau of Labor Statistics without segregation by number of rooms or material of structure. Despite these variations, the series of dwelling units and average values for the last 17 years are quite consistent.

### *Notes: Supplementary Information concerning Construction*

#### **A Value of Residential Construction, Present Estimates Compared with F. W. Dodge Corporation and Other Estimates**

Unlike previous estimates of the total value of new residential construction, the present estimates are based primarily on building permits in relation to

changes in the number of families, rather than on contracts awarded. This method was chosen only after detailed analysis of both series. The advantages and disadvantages of the permits series are discussed in Chapter V. Contracts awarded, as published by the F. W. Dodge Corporation, are gathered for a commer-