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AUDIT OF THE BASELINE SURVEY OF RESIDENTIAL BUILDINGS IN SITE II

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PREFACE

This working note was prepared for the Office of Policy Development and Research, U.S. Department of Housing and Urban Development. It presents the findings of an audit of the baseline survey of residential buildings that was conducted in St. Joseph County, Indiana, between April and December 1975.

The survey is one of several being conducted in St. Joseph County as part of the Housing Assistance Supply Experiment. The surveys are addressed to a stratified probability sample of residential properties, their owners, and their occupants, and are designed jointly to monitor the effects of an experimental housing allowance program on the local housing market. The baseline surveys were conducted shortly before that program began.

The baseline survey of residential buildings gathered information on the physical characteristics of residential buildings, the properties on which they were located, and their immediate neighborhoods. The survey audit reported here was designed to assess the completeness and reliability of those data for the benefit of users of the data, and to provide guidance for future modifications of instruments, field procedures, and data preparation procedures.

The authors conducted the audit. Larry Day assumed primary responsibility for performing and reporting on the various audit tasks, with several major exceptions. Charles Noland formulated checks for implausible and inconsistent survey responses, compared validation data with original survey data, and developed the algorithm used to construct composite quality and condition ratings. He drafted the related portions of Sec. V as well as Appendixes A, D, and E. Robert Young and Susan Augusta prepared the survey file and coordinated analytical data processing. Doris Allison and Elizabeth Davidson consulted on matters relating to data cleaning. Susan Welt Luxenberg responded to queries related to survey fieldwork. Timothy Corcoran consulted on sampling issues. Daniel Relles calculated weights for survey observations.

Stanley Abraham, Lawrence Helbers, and Ira S. Lowry reviewed this note and contributed suggestions that substantially improved its organization and clarity.

Rachel Kuntz prepared the draft typescript. Christine D'Arc edited the text. Charlotte Cox supervised production of the final copy.

This note was prepared pursuant to HUD Contract H-1789, Task 2.6.3.3, in fulfillment of Rand's requirement to ensure the quality of experimental survey data.

SUMMARY

The baseline survey of residential buildings (SRB) for Site II of the Housing Assistance Supply Experiment was conducted in St. Joseph County, Indiana, between April and December 1975. It was designed to provide data on the physical characteristics of 5,120 residential buildings, the 4,443 properties on which they were located, and the immediate neighborhood of each property. The data were gathered by fieldworkers (evaluators) hired locally and trained by Rand's fieldwork subcontractor. The evaluators visited each property and completed a detailed questionnaire; the data thus reflect direct observation, not interview responses.

At the end of fieldwork, different evaluators revisited 27 percent of the observed properties to validate the original observations; then all records were shipped to Santa Monica. Rand staff edited the data and converted them to machine-readable form. The resulting file of "cleaned" survey records was subjected to the audit reported here.

AUDIT PURPOSES AND PROCEDURES

The audit assessed the completeness and reliability of the survey data for the benefit of future users by

- Accounting for the outcomes of attempts to evaluate all buildings and properties in the survey sample.
- Determining the extent of record-level nonresponse bias and correcting bias where possible by appropriately weighting usable records.
- Checking for evidence of item nonresponse bias.
- Examining the quality of the data.

The audit findings are summarized below.

ACCOUNTING FOR SAMPLE ELEMENTS

Forty-one percent of all scheduled observations were not completed. Virtually all of those (94 percent) were deliberately not attempted

(not "triggered") because the property's survey record was already known to be incomplete for lack of an interview with its owner or occupants. Only a few observations were not carried out because of administrative or field error.

RECORD-LEVEL NONRESPONSE BIAS

As noted above, the triggering requirement considerably reduced the sample completion rate. Review of variables whose values were known for both surveyed and unsurveyed buildings in the original stratified random sample revealed significant nonresponse bias within most of the 18 sampling strata. Compensatory weighting reduced much of that intrastratum bias, but some remains. Two small strata of specialized housing are clearly misrepresented by the sample of usable records.

In two of the nine strata of urban rental properties, weighted survey observations overrepresent properties with larger numbers of buildings and units, in one case understating average assessed values for improvements and in the other case overstating them. The sample of rooming house properties is so small (three properties) that we are unable to draw clear inferences about differences between the surveyed properties and the population they are intended to represent. Among mobile home properties, weighted survey observations overrepresent newer, larger properties, with higher total assessed values of land and improvements but lower average assessed values per unit. There also, caution must be used in drawing inferences about the significance of differences between the 13 analysis-complete properties and the total of 20 properties in the sampling stratum.

With the cautions noted above, the file of analysis-complete SRB records serves well the main use to which those records will be put--complementing the data obtained in the landlord and household surveys. Nevertheless, we now question the wisdom of the triggering requirement. Had observations not been limited to properties whose owners or occupants had been interviewed, a stronger base would have been provided for subsequent analysis.

Why did we wait so long to question this?

ITEM NONRESPONSE BIAS

Less than one percent of the applicable responses were unusable, and nonresponse did not generally occur in ways that would bias estimates of population characteristics from the data. However, one form of item nonresponse did occur often enough to warrant close scrutiny of the data. The interior public areas (such as lobbies and hallways) of 38 multiunit buildings were inaccessible to the evaluators, who simply skipped all survey questions about the quality and condition of those areas. In searching for evidence of bias, we found definite differences between the buildings whose interior public areas were observed and those whose areas were not observed. However, the differences were so subtle, and the proportion of buildings with inacessible areas was small enough, that estimates of interior public areas in the wider population will not be significantly biased except possibly in strata 6 and 9, both urban rental properties of 5+ units.

DATA QUALITY

Data cleaning and auditing purged the SRB file of clearly erroneous responses, replacing them where possible with accurate, usable data and inserting audit codes when correct data were not found. Implausible or inconsistent responses were noted in a separate file of suspect data for reference by users. With few exceptions, erroneous and suspect data appeared evenly distributed across record segments and response fields, affirming the high quality of the data.

Only in the reproducibility of individual survey responses--examined by comparing original and validation data and reviewing validation procedures--did we find evidence of unreliable data. Original responses to descriptive questions were reliably reproduced by the validator; original responses to evaluative questions were not. For two infrequently validated questions, 52 percent of the validators' ratings differed from the originals. However, different fieldworkers nearly always chose adjacent ratings on a four-point scale and the discrepancies were unbiased.

Because the rating discrepancies on evaluative questions appear to reflect random response error, they only slightly reduce the reliability of parameter estimates based on samples of 100 or more buildings. Comparing two such samples, a difference as small as .07 between mean ratings of exterior building characteristics is statistically significant at the 95 percent level of confidence. However, in comparing individual buildings or the same building over time, a rating difference of two or more intervals would usually be needed to infer a true difference in the evaluated characteristic at that level of confidence.

And what are the implications for the Supply Experiment analysis?

CONTENTS

TABLES

GLOSSARY

Alternate tax parcel (ATP) number--a unique property identifier keyed to its real tax parcel number, designed to keep the latter confidential (p. 9).*

Analysis-complete--a designation given to a record that has adequate responses to all items deemed necessary for analysis purposes (pp. 15-17).

Audit code--an alphabetic entry in a *response field* explaining the absence of a legitimate response. Alphabetic audit codes were transformed to negative integers for processing convenience (pp. 31-33).

Baseline sample--the properties scheduled for surveying at the beginning of fieldwork (pp. 2-5).

Building record folder--a form on which fieldworkers and editors record observation attempts, outcomes, and *final status codes* for scheduled fieldwork. It also serves as a repository of all survey field materials for a sampled building (p. 6).

Comparability panel--a sample of properties selected according to Urban Institute specifications, for their comparison with other households participating in another part of HUD's experimental allowance program, the Demand Experiment (p. 5).

Comparability panel property--a property that is part of the comparability panel but not in the *baseline sample* (p. 5).

Complete property record--a collection of records for a property consisting of interviews with the owner and (for rental properties) some or all of the tenants; and field reports on the residential buildings on the property (p. 3).

Edited field report (EFR) file--a computer file containing the "cleaned" records of completed interviews or observations and their auxiliary field reports (p. 10).

Effective sampling rate--the ratio of the number of sampled items successfully surveyed to the total number of items in the population (p. 67).

Field-complete--a designation given to a record for a property or building that has been successfully surveyed (p. 10).

Final status code--the final outcome of a particular interview or observation at the end of fieldwork (p. 13).

HAMISH--(HASE Management of Information for the Survey of Housing) a computer-based survey record management system gradually installed from late 1974 through 1976, with parts in use by late 1975 (p. 12). See also *record management system*.

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*Page numbers refer to the text of this report.

Item nonresponse--the lack of usable answers in applicable response fields of an otherwise complete building observation (p. 31).

Logic check--a computerized data cleaning check that detects inconsistencies among logical relationships and within skip patterns in a survey questionnaire (pp. 40-41).

Marginals--question-by-question response distributions for all *field-complete* records in the *preliminary master file*; they appear in the *survey codebook* (p. 2).

Nonresponse bias--bias that impairs the ability to estimate population parameters, measured by an increase in the standard deviation of the population distribution around the respondent (rather than the population) mean (pp. 20-30).

Nonresponse rate--the proportion of sample elements for which complete survey data are lacking (p. 21).

Permanent panel--the properties with *complete property records* at baseline that are included in the list to be resurveyed annually throughout the experiment (p. 3).

Preliminary master file (PMF)--a computer file containing the complete records of all *field-complete* observations and associated auxiliary reports, later enlarged to contain one record for every property on the final *baseline sample* list, regardless of the outcome of fieldwork. Interpretations of all coded responses and *marginals* for each item in the questionnaire for all records in the PMF appear in the *survey codebook* (p. 11).

Question grid--a questionnaire format that specifies a choice of responses for multiple items, all constituting a single question (pp. 7-8).

Range check--a computerized data cleaning check designed to ensure that responses in a given field fall within a specified range or list of values (p. 40).

Record management system--a computer-based system for managing survey fieldwork and records, designed to monitor the progress and field status of all surveys, track changes in sample elements, and generate reports required for fieldwork and sample maintenance (such as addresses of all buildings to be surveyed, records in the *permanent panel*) (p. 12). See also *HAMISH*.

Refusal report--a report filed if a field observation cannot be completed because a tenant or owner refuses permission altogether or breaks off the attempt once begun (p. 6).

Response field--a space reserved in the survey instrument for the observer to note the answer to a particular question or item; many response fields in the instrument were precoded, requiring the observer simply to circle one or more appropriate numbers (p. 31).

Sample completion rate--the number of completed interviews divided by the number of properties on the *baseline sample* list (pp. 18, 58).

Sampling history--the *sampling rate* and stratum of each element at each stage in the sampling procedure (pp. 23-24).

Sampling history weight--the inverse of a property's probability of selection, compounded through sequential stages of sample selection (pp. 23-24).

Sampling rate--the ratio of items to be surveyed to the total number of items in the population (p. 21).

Smoothed sampling history weight--the sum of exact sampling history weights for a set of properties divided by the number of sampled properties (pp. 24, 69).

Standard file format (SFF)--a well-defined structure for records in computer files that allows different files to be processed by a common set of programs (p. 10).

Stratified random sample--a statistical sample obtained by breaking the universe down into smaller parts (*strata*) made up of relatively homogeneous units and taking a random sample from each part (p. 20).

Stratified random cluster sample--a *stratified random sample* each element of which consists of a cluster of smaller units of observation (p. 20).

Stratum--a statistical subpopulation (pp. 3-4).

Survey codebook--a document listing each survey question, defining all allowable response codes, explaining interview instructions that affect the interpretation of answers, and providing an unweighted frequency distribution of responses to each question (called *marginals*) for all records in the *preliminary master file* (pp. 1-2).

Suspect data file--a special file of identifiers for items whose responses, though unchanged in the *edited field report file,* were nevertheless suspected by the data editor to be inaccurate (p. 41).

Triggering requirement--the proviso that SRB observations were only to be conducted for properties that already had completed interviews with the landlord and at least one tenant (for rental properties) or with the owner (for ownership properties) (p. 9).

Unedited field report (UFR) file--the first machine-readable version of the questionnaire responses compiled just after transcription onto magnetic tape (p. 10).

Validation report--the results of readministering parts of the original survey questionnaire to test whether responses were consistent and reliable (p. 6).

I. INTRODUCTION

The Housing Assistance Supply Experiment (HASE) monitors the effects of experimental housing allowance programs operating in two midwestern housing markets by regularly surveying a marketwide sample of residential properties. The owners and occupants of those properties are interviewed annually; the observable physical characteristics of residential buildings and their environs are recorded at less frequent intervals.

The survey agenda is large and complex, with separate but linked surveys of landlords, tenants, homeowners, residential buildings, and neighborhoods. Field reports from each survey are edited or "cleaned" and transcribed into machine-readable form for storage and analysis. Additionally, each survey is audited to assess the completeness and reliability of the data that were collected. The audit serves future users of the data and may suggest ways to improve the survey instrument, field procedures, or data-cleaning methods.

This note reports on the audit of the baseline survey of residential buildings (SRB) conducted in St. Joseph County, Indiana, between April and December 1975. Section II reports the outcome of fieldwork on each building selected for observation, reconciling field reports received with the baseline sample list and other records of field activity. Section III assesses the extent to which the file of complete building records represents the population of buildings in St. Joseph County and explains how the complete records were weighted so as to improve that representation. Section IV reports the incidence and implications of item nonresponse within otherwise complete records. Section V reports on data quality, checking for incorrect, inconsistent, or implausible responses and reviewing the field and editing procedures that might introduce errors into the data. Section VI summarizes the findings.

Readers of this note will find it helpful to refer to the codebook for this survey.* The codebook reproduces each question exactly as it

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*HASE Survey Group, *Codebook for the Survey of Residential Buildings, Site II, Baseline,* The Rand Corporation, WN-9895-HUD, September 1977.

appears in the survey instrument, including all precoded response alternatives and any codes added after the survey was fielded. It also summarizes instructions to fieldworkers and editors that affect the interpretation of responses. Finally, it presents unweighted frequency distributions of responses, called *marginals*. The names for the variables cited in the text and tables of this note are identical to those used in the codebook.

PURPOSES OF THE SURVEY OF RESIDENTIAL BUILDINGS

In each experimental site, the SRB covers the buildings on a stratified random sample of residential properties.* Information is gathered on the physical characteristics and condition of residential buildings, of the properties on which they stand, and of their immediate neighborhoods. The baseline survey data reflect those characteristics before the allowance program began. Later surveys will focus on changes in characteristics that may result from the program. Descriptions of the interiors of the residential units by landlords, tenants, and homeowners in other surveys will be combined with data obtained from the SRB to produce a fairly complete description of each building and its condition. The data will enable us to monitor changes over time in the characteristics and condition of the housing inventory in each site, to be used in assessing program effects on the local housing market.

SAMPLE DESIGN AND SELECTION

The sample of residential properties for which we sought baseline data was chosen in stages.** We first screened a large but crudely

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*See Ira S. Lowry, *Monitoring the Experiment: An Update of Sec. IV of the General Design Report*, The Rand Corporation, WN-9051-HUD, April 1975, for a description of the market-monitoring plan, including the design of a stratified random sample of residential properties and the annual surveys of residential buildings and their owners and occupants.

**For a detailed description of the sample design in both HASE sites, see Timothy M. Corcoran, *Survey Sample Design for Site I*, The Rand Corporation, WN-8640-HUD, March 1974. For the procedures employed in selecting the sample, see Sandra H. Berry, Daniel A. Relles, stratified sample of residential properties.* Then we used screening survey data on tenure and--for rental properties--gross monthly rent per unit to further stratify that sample. From the new strata we randomly selected a smaller sample of properties for the baseline surveys.

The baseline sample list consisted of 4,307 residential properties divided among 16 strata on the basis of type of property (rental or ownership), location (urban or rural), number of dwelling units (1, 2-4, 5+), and rent or value (dividing countywide distributions into terciles or quartiles). Two additional strata were created for rooming houses and mobile home parks, for a total of 18 sampling strata.

For each property on the list, we sought to compile a *complete property record*, consisting of interviews with the owner and (for rental properties) some or all of the tenants; and field reports on some or all of the residential buildings on the property. Those with complete baseline records would be eligible for inclusion in a *permanent panel* of approximately 2,000 residential properties to be resurveyed annually.

The SRB is thus only one of several surveys addressed to the properties on the baseline list. On properties with up to six separate residential buildings, all were to be surveyed; on larger properties, a random sample of six buildings was to be surveyed. Following that rule, 4,967 residential buildings were listed for SRB fieldwork. Table 1.1 shows the number of properties and number of buildings in each baseline sampling *stratum*, together with estimates of the corresponding populations.**

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and Eugene Seals, *Sample Selection Procedure for St. Joseph County, Indiana,* The Rand Corporation, WN-8588-HUD, January 1974; Daniel A. Relles, *Selecting the Baseline Sample of Residential Properties: Site II,* The Rand Corporation, WN-9027-HUD, October 1975; and Timothy M. Corcoran, *Selecting the Permanent Panel for Residential Properties: Site II,* The Rand Corporation, WN-9577-HUD, April 1977.

*The screening survey was the first HASE survey conducted in St. Joseph County; fieldwork was done between July and September 1974. The purpose was to gather information on a large sample of residential properties so that they could be stratified by type of property, and to gather enough data on housing characteristics and costs and on household composition and income to set standards for the experimental housing allowance program.

**In this note, most tables classified by sampling stratum use the panel strata updated after the baseline survey rather than the original

Table 1.1

BASELINE POPULATION ESTIMATES AND SAMPLE SIZES FOR PROPERTIES AND BUILDINGS BY PANEL STRATUM

Panel Stratum		Number of Properties		Number of Buildings	
Number	Property Description[a]	Estimated Total Population[b]	Baseline Sample	Estimated Total Population[b]	Baseline Sample[c]
	Urban Rental				
	Single-family:				
1	Lower tercile	1,142	256	1,142	256
4	Middle tercile	1,917	576	1,917	577
7	Upper tercile	2,732	644	2,732	644
	2-4 units:				
2	Lower tercile	1,494	354	1,597	395
5	Middle tercile	1,067	455	1,179	516
8	Upper tercile	427	126	613	152
	5+ units:				
3	Lower tercile	112	99	337	178
6	Middle tercile	68	58	289	136
9	Upper tercile	38	37	247	148
	Rural Rental				
10	Lower and middle terciles	488	277	582	362
11	Upper tercile	283	123	288	129
	Urban Owner				
12	Lower quartile	10,691	332	10,879	354
13	Second quartile	13,541	340	13,592	360
14	Third and upper quartiles	25,661	147	25,665	150
	Rural Owner				
15	Lower and second quartiles	2,064	188	2,083	196
16	Third and upper quartiles	4,051	152	4,052	154
	Specialized Housing				
17	Rooming houses	5	3	5	3
18	Mobile homes	21	20	1,856	130
Total		65,802	4,187[d]	68,920	4,840[e]

SOURCE: Baseline sample sizes tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline. Total populations estimated using HAMISH, version S2-291.

[a]Rental residential properties--properties containing at least one rental unit--are stratified according to location, number of residential units, and mean gross monthly rent per unit. Rental properties lacking data to compute mean gross monthly rent are assigned to their respective lower tercile stratum. Owner-occupied properties are stratified according to location and equalized assessed value. Most owner-occupied properties contain only one single-family housing unit.

[b]Components may not add up to totals because of rounding.

[c]Includes only buildings for which SRB observations were scheduled. When properties contained more than 6 buildings, only 6 were selected randomly for surveying.

[d]Excludes 120 properties no longer in residential use and 13 properties mistakenly added to the sample but subsequently retired. Also excludes 136 comparability-panel properties, discussed in the accompanying text.

[e]Excludes 127 buildings on nonresidential properties, 13 buildings on properties mistakenly added to the sample but subsequently retired, and 140 buildings on comparability-panel properties.

Besides the baseline sample of residential properties, we selected a sample of low-income urban renter households according to the specifications of the Urban Institute, which intends to compare a sample of households in the Supply Experiment with similar households participating in the Demand Experiment.* Each year, members of the *comparability panel* are to be reinterviewed (and the buildings in which they reside reevaluated) so long as they continue to live in St. Joseph County, even though they may move from their baseline addresses. In contrast, annual interviews will be sought with the current owners and occupants of the properties, buildings, and housing units in the HASE permanent panel. Approximately half of the comparability panel households occupied housing units on baseline sample properties. The remaining households lived on *comparability panel properties*, which are not part of the baseline sample.** We scheduled SRB observations for 140 buildings on 136 comparability panel properties.

THE SURVEY INSTRUMENT

The survey instrument used for the baseline SRB in St. Joseph County was designed by the HASE Survey Group. The final version consisted of two modules. Module A, completed only once for each property, sought information on the characteristics of the property and the immediate neighborhood.*** Module B, completed for all buildings that

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strata based on screening survey and tax data. The exceptions are the tables in Sec. II, in which the original baseline strata are appropriate.

*The Demand Experiment is another part of HUD's experimental housing allowance program. In it, subsamples of enrollees in Phoenix and Pittsburgh receive allowances on different terms, with a control group of nonrecipients. The housing and budgetary decisions of both groups are being monitored for three years.

**Data on comparability panel properties and the buildings thereon are excluded from all tables in this note except Table 2.1, which shows the final status of all scheduled baseline SRB observations.

***"Immediate neighborhood" was defined as follows:

- In urban or suburban areas arranged in blocks: properties on both sides of the street between the two nearest cross streets.
- In urban or suburban areas not arranged in blocks: all

were scheduled for observation, sought information on the building's use, its physical characteristics, the presence of related tenant facilities, and the condition of the exterior and of the interior public areas.* Three additional forms were designed to supplement modules A and B: the *building record folder*, the *validation report*, and the *refusal report*.

The building record folder provided space for fieldworkers and editors to record observation attempts and outcomes and, ultimately, the final status of scheduled observations. It also served as a repository: When fieldwork was completed for a sampled building, all survey materials relating to it were enclosed in the building record folder and shipped to Santa Monica.

A sample of completed building observations was validated by another observer. The validation report repeated parts of modules A and B to validate responses to two types of questions: those that sought data critical to SRB analyses and those that were good indicators of data reliability.

The refusal report was filed if the field observation could not be completed. It notes whether the attempt was forestalled or broken off, the characteristics of the tenant or owner who refused permission to conduct the observation, any reasons given for the refusal, and the vehemence of the refusal.** It also asks about basic characteristics of the property and its buildings that could be observed from off the

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properties within a 100-yard radius but not beyond any cross streets.

- For properties located on rural public roads and for isolated rural houses or farms: all properties within a quarter-mile radius.
- For apartment complexes and mobile home parks: all properties within 100 yards in all directions of the boundaries of the complex or park.

*Interior public areas are defined as areas such as hallways, stairs, elevators, and entryways that are inside the front doors of multifamily dwellings but outside the front doors of individual units.

**If it appeared that another observer, prepared to assure a skeptical resident of the legitimacy of the survey, might successfully complete an observation, another attempt might have been scheduled.

property. The contents of the supplementary forms are reproduced in the codebook along with those of the basic survey instrument.

Two features distinguish the SRB from the HASE surveys of landlords, tenants, and homeowners. First, the SRB relies on direct observations by fieldworkers rather than on responses from people associated with the property. Consequently, the SRB's problems with fieldwork and data quality differ markedly from those encountered in the interview surveys. Second, the SRB instrument relies heavily on evaluative *question grids* rather than the simple evaluative or descriptive questions found in other HASE surveys, including the Brown County baseline SRB.* The grids illustrated in the figure below replace simple evaluative questions that required observers to average ratings for an item showing more than one condition (e.g., part of an exterior wall surface could have major defects even if most of it was in very good condition; part of a wall surface might be stucco but the rest brick veneer). The grid format allowed observers to indicate, within broad ranges, what portion of an evaluated item fell into each category. After the data were converted to machine-readable form, cleaned, and released for auditing, we developed an algorithm, described in Appendix A, that reduced the data from evaluative grids to a single composite rating for use in analysis.

FIELD PROCEDURES

Fieldwork was done by Westat, Inc., from an office in South Bend. Begun in late April 1975, the observations were 85 percent complete by mid-July and finished by the end of the year. The portion completed after July was commissioned to obtain building observations on certain sampled properties that were deliberately not triggered (see below) for SRB fieldwork during the initial field period.

Westat hired a local staff of 24 observers and prepared a training manual that set general evaluation and recordkeeping procedures and attempted to anticipate problems. The HASE Survey Group reviewed the

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*Auditing the Brown County data persuaded us to revise the instrument. See Larry A. Day, *Audit Report for the Baseline Survey of Residential Buildings in Site I,* The Rand Corporation, WN-8973-HUD, January 1976.

B
BUILDING SECTION

16. Indicate for each type of material listed below the approximate proportion of the exterior walls of the building composed mainly of that material. EXCLUDE PORCH(ES), WINDOW AND DOOR FRAMES AND TRIM.

CARD 04

	ALL	MOST	SOME	NONE	
A. WOOD	4	3	2	1	13/
B. COMPOSITION SIDING (ASBESTOS, ASPHALT)	4	3	2	1	14/
C. ALUMINUM OR VINYL SIDING	4	3	2	1	15/
D. BRICK	4	3	2	1	16/
E. STUCCO	4	3	2	1	17/
F. BRICK OR STONE VENEER	4	3	2	1	18/
G. FIBERBOARD	4	3	2	1	19/
H. SHEET METAL SIDING	4	3	2	1	20/
I. STONE	4	3	2	1	21/
J. CONCRETE OR CINDER BLOCK	4	3	2	1	22/
K. OTHER	4	3	2	1	23/

SPECIFY: ______________________ (OFFICE USE) [|] 24-25/

17. Rate the condition of the exterior walls of the (building/mobile home). For each condition, circle the code which indicates the appropriate proportion of walls in that condition. Explain a rating of "minor defects" or "major defects."

	ALL	MOST	SOME	NONE	
A. VERY GOOD...Paint in very good condition; no cracks or chips out of brick, concrete, stucco, stone; siding panels or shingles tight fitting; no signs of rotting in wood	4	3	2	1	26/
B. REASONABLE WEAR AND TEAR...Small holes, chips, or cracks; small amounts of peeled or bubbled paint; crooked panels of siding; slight separation of some shingles, panels, or siding strips	4	3	2	1	27/
C. MINOR DEFECTS...Large cracks or chips, slight denting or buckling of metal strips or panels; large areas of peeled or bubbled paint	4	3	2	1	28/
EXPLAIN ______________________					
D. MAJOR DEFECTS...Large pieces of plaster or mortar missing; missing shingles, bricks; siding strips rotted; severely buckled or rusted metal siding	4	3	2	1	29/
EXPLAIN ______________________					
E. CANNOT EVALUATE CONDITION	4	3	2	1	30/
F. CONSTRUCTION, RENOVATION, REPAIR WORK UNDERWAY	4	3	2	1	31/

Figure--Examples of SRB question grids

manual and attended the evaluator training sessions to monitor training methods and to answer questions about the research design that might pertain to the observation procedures.

Fieldwork for the SRB began as the landlord and household surveys neared completion. Because all buildings and units on sampled properties had been enumerated during the screening survey, we were able to provide Westat with addresses and building identifications for each building to be surveyed.*

Observations were not to be made unless interviews had first been completed--with the landlord and at least one tenant for rental properties and with the owner for ownership properties. As a result of that "triggering" requirement, 38 percent of all scheduled building observations were retired before fieldwork began.

Module A sought data on property and neighborhood characteristics, so it was to be completed only once per property. Westat developed recordkeeping and field procedures for multibuilding properties to implement that policy. Finally, a minimum 20 percent random sample of all field-complete SRB observations was validated by independent fieldwork. Validation editors compared the original responses with their validation counterparts. If discrepancies exceeded certain predetermined limits of magnitude or incidence, the editors were instructed to declare the original observations invalid and to commission another observation.**

DATA REDUCTION AND FILE DEVELOPMENT

When fieldwork was terminated on a particular building, Westat assembled its field report forms in the building record folder, verified that the folder's contents were complete, and shipped it to HASE's Survey Data Preparation Group (SDPG) in Santa Monica.

Upon receiving a building's survey materials, the SDPG staff checked to see that each component was labeled with the building's unique identifying number and the alternate tax parcel (ATP) number of the property

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*On five properties, SRB observers discovered buildings that had been missed during the screening survey.

**That procedure was not always followed. See Sec. V for details.

on which the building stood. They then separated the materials before beginning the data cleaning process. All building record folders were processed together, as were SRB questionnaires, validation reports, and refusal reports.

After the forms received a cursory editing for obvious problems, they were transcribed onto magnetic tape and compiled into separate *unedited field report* (UFR) files for each type of form. For each question in the survey instrument and supplementary forms, SDPG listed a set or range of legitimate response codes and devised logical tests for interquestion response consistency. Records in the UFR files were machine-processed against those specifications to detect illegitimate and inconsistent responses. SDPG editors determined the appropriate corrective action and updated the machine-readable record accordingly. SDPG then compiled cleaned survey records into their *edited field report* (EFR) files for each type of form. Module A information (property and neighborhood characteristics) for multiple-building properties was copied by machine onto the records of each building on the property.

Then the data, hitherto grouped by type of form, were grouped according to individual building, with enough space in each record to accommodate all possible combinations of survey data gathered for that building. Each of the 5,087 records contained at least the data from its corresponding building record folder. Some 3,066 records also contained *field-complete* responses to modules A and B, and 828 also contained validation reports. Thirty-two contained refusal reports.

SDPG then transformed the integrated EFR file into HASE *standard file format* (SFF). All numeric data except record identifiers were converted from character (EBCDIC) format to binary floating-point representation; alphabetic audit codes were changed to negative numeric values; and all blanks were marked -11.* At that point, the SFF version of the EFR file was released to the Design and Analysis Group (DAG) for auditing.

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*Audit codes are inserted in response fields of the questionnaire to indicate reasons for the absence of data. See Table 4.1.

During the audit, we added 33 records to the EFR file* and corrected a number of individual responses (see Sec. V). The resulting file, containing 5,120 records, was labeled the SRB *preliminary master file* (PMF). Unless otherwise specified, tabulations in this note are produced from that file.

WEIGHTING THE RECORDS

To estimate population parameters from sample data, each observation must be weighted to reflect the number of population elements it represents. In a stratified random sample, the weight for each record should in principle be the inverse of its probability of selection. However, field-complete SRB records pertain to a nonrandom subset of the baseline sample, omitting buildings on properties for which owner or occupant data were lacking and a few for which SRB observations could not be completed.

To compensate for possible nonresponse bias, field-complete SRB records were weighted equally within each of 108 strata, crossing the 18 panel sampling strata with jurisdiction (South Bend, Mishawaka, and the rest of the county) and subsidy status (subsidized, unsubsidized). Because module A dealt with property characteristics and module B with characteristics of individual buildings, both property and building weights were created for each record.

Section III and Appendix B describe the computation of both types of weights and compare authoritative control totals with tabulations of property and building characteristics generated from the weighted SRB records.

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*Final status codes for the 33 affected buildings indicate that observations were not attempted either because they were not triggered or because the buildings were no longer in residential use. The building record folders for these cases, which would have contained only building identifiers and final status codes, were never forwarded to Santa Monica, so we created the records and added them to the EFR file.

II. ACCOUNTING FOR SAMPLE ELEMENTS

Including the comparability panel, a total of 5,120 buildings on 4,443 properties were scheduled for field observation. The EFR file delivered to DAG for auditing contained records for 5,087 buildings, of which 3,086 were apparently field-complete observations. This section describes how we reconciled the sample list and the field reports, accounting for incomplete or missing records and for administrative or fieldwork errors that led to records for buildings not on the sample list. Briefly, we found only a few procedural errors, some of which could be corrected using sources available to us. Ninety-four percent of all incomplete records were for properties on which prior attempts to interview the owners or occupants had failed, so that SRB fieldwork was intentionally not triggered.

ACCOUNTING METHODS

Besides submitting the field reports that constitute an SRB record in the EFR file, Westat reported the final field status of each building, using a separate form. That information was entered into Rand's record management system (HAMISH), where it was integrated with sample selection data and final status records for other surveys pertaining to that property.*

Accounting for the sample began by comparing the contents of the SRB file with the St. Joseph County HAMISH file. Three types of discrepancies were found: (a) the SRB file lacked records for 118 buildings in HAMISH, (b) the SRB file contained records for 5 buildings not

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*The HAMISH (HASE Management of Information for the Survey of Housing) data base contains the final status codes for all applicable HASE surveys and other information that is used to stratify and select properties at each stage of sample selection. In the file, property-, building-, and unit-level record segments are arrayed hierarchically. For any given property, there is one property-level segment, as many building-level segments as there are buildings on the property, and as many unit-level segments as there are units in the building. For more information on the variables in HAMISH, see Corcoran, *Selecting the Permanent Panel for Residential Properties: Site II*, pp. 12-15, 25, and 37-48.

in HAMISH, and (c) the final status of 59 SRB records disagreed with the corresponding *final status codes* in HAMISH.

Review of the HAMISH final status codes of the buildings for which SRB records were lacking revealed that all had been retired. Some observations were not triggered as a result of nonresponse to the landlord or household surveys; some buildings were no longer in residential use. Westat had neglected to send building record folders containing property and building identifiers and final status codes for those buildings. We corrected the problem by adding the missing records to the SRB file, from HAMISH data.

As for the 5 buildings in the SRB file but not in HAMISH, we determined that all were on multibuilding properties where previous fieldworkers had understated the number of residential buildings. When SRB fieldworkers visited the properties, they discovered the additional buildings and completed survey forms for them. Those records turned up in the SRB file before HAMISH building records had been updated to reflect the fieldworkers' discoveries.

Discrepancies in final status code between the SRB and HAMISH files were resolved by consulting survey data other than final status codes, reviewing hardcopy questionnaires, and querying the Survey Group. On occasion, the Survey Group conferred with Westat to determine the correct status.

Comparison of retirement codes in the SRB file and HAMISH disclosed other discrepancies. For example, one file might show that a building had been retired because it was no longer residential, while the other indicated that the observation had not been triggered. Such problems were resolved in the manner described above.

A number of properties with field-complete survey records in the SRB file were represented by retirement codes in HAMISH. Except for properties designated unsampled, we replaced the retirement code with its field-complete counterpart. For buildings on properties designated unsampled, the first number of the final status code was changed to 6 (e.g., 010 became 610), thereby preserving the final status from fieldwork while signaling that the record was not a part of the analysis sample.

In a few cases in which SRB and HAMISH final status codes disagreed, neither was found to be correct. That usually occurred when responses to HAMISH clarification requests had not yet been translated into updated final status codes.*

FINAL STATUS OF BUILDINGS SCHEDULED FOR OBSERVATION

Table 2.1 presents an audited account of SRB final status codes for all buildings either on the baseline sample list or on comparability panel properties. Of the 5,120 buildings ever scheduled for observation, nearly 38 percent were deleted from the field schedule (not triggered) because of prior failure to secure interviews with their owners or occupants. Of the remaining 3,183, 37 were retired because the building no longer existed, because the property was discovered to be inappropriate for inclusion in the baseline sample, or because the record was created erroneously.

Thus, observations were truly sought on 3,146 buildings and were completed on 3,066 of them. Of the 80 incomplete records, 32 were cases in which the owner or occupant refused permission to inspect the property, and 28 were cases in which Westat's site manager judged it advisable not to attempt access because of special circumstances. In only a few cases did administrative or field error result in failure to complete a desired observation.

Table 2.2 acounts for the 4,967 buildings on the baseline sample list. In addition to the defects recorded by final status codes, it reports the number of records that proved on closer examination to lack adequate entries in module B (analysis incomplete), usually because the building had been demolished or was uninhabitable. The results are displayed by baseline sampling stratum, property assignments that were made *before* the baseline survey. They include six special strata (21 through 26) created for 810 single-unit properties whose tenure could not be determined before baseline fieldwork.**

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*HAMISH clarification requests were formal queries to the Survey Group regarding the status of sampled properties, buildings, or units and the associated field reports.

**Those properties were conditionally fielded. As soon as fieldwork produced evidence of property tenure (ownership or rental), those

Table 2.1

FINAL STATUS OF ALL BUILDINGS EVER SCHEDULED FOR OBSERVATION

Code	Description	Number of Records	Percent of Total
010	Complete on-property observation	3,024	59.1
012	Complete off-property observation	42	.8
014	Invalid, wrong building on right property	2	(*a*)
017	Invalid, building on wrong property	11	.2
022	Breakoff	6	.1
030	Refusal	26	.5
050	Retired after four unsuccessful attempts	7	.1
055	Never fielded, inappropriate for survey	24	.5
067	Retired at site manager's discretion	28	.5
098	Not triggered	1,937	37.8
610	Complete, building on unsampled property	7	.1
655	Not fielded, building on unsampled property	1	(*a*)
698	Not triggered, building on unsampled property	5	.1
	Total	5,120	100.0

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

NOTE: The total includes 4,967 buildings on the baseline sample list, 140 on comparability panel properties, and 13 erroneously created records for properties with multiple addresses.

[a]Less than 0.05 percent.

Table 2.2 shows that 1,902 buildings were never triggered for SRB observations. Of the remaining 3,065 buildings, *analysis-complete* records were obtained for 2,926, or 95 percent. The incomplete records are widely dispersed among sampling strata and by reason for failure to complete.

Table 2.3 lists the final status of SRB observations for sampled properties by baseline stratum. A property was considered analysis-complete if there was an analysis-complete observation for at least one of its buildings. Some properties are analysis-incomplete because they had been converted to nonresidential use; they are further classified according to their use at the time SRB fieldwork ended.

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not needed for the baseline sample were retired. For details, see Relles, *Selecting the Baseline Sample of Residential Properties: Site II.*

Table 2.2

FINAL STATUS OF ALL BUILDINGS IN BASELINE SAMPLE BY BASELINE STRATUM

Baseline Stratum		Number of Building Records							
			Fieldwork Triggered						
			Fieldwork Completed[b]		Fieldwork Not Completed				
Number	Property Description	Fieldwork Not Triggered[a]	Analysis Complete	Analysis Incomplete[c]	Refusal or Breakoff[d]	Invalid Observation[e]	Retired for Other Reasons[f]	Total Triggered	Total Sample
	Urban Rental								
	Single-family:								
1	Lower tercile	160	213	5	2	0	4	224	384
4	Middle tercile	144	328	6	3	0	4	341	485
7	Upper tercile	181	216	3	1	0	1	221	402
	2-4 units:								
2	Lower tercile	122	258	4	6	3	3	274	396
5	Middle tercile	186	363	2	2	0	5	372	558
8	Upper tercile	41	61	1	1	0	3	66	107
	5+ units:								
3	Lower tercile	30	179	1	1	2	3	186	216
6	Middle tercile	22	157	1	0	2	1	161	183
9	Upper tercile	13	97	0	0	0	17	114	127
	Rural Rental								
10	Lower and middle terciles	156	206	1	2	2	6	217	373
11	Upper tercile	35	48	0	1	2	1	52	87
	Urban Owner								
12	Lower quartile	51	104	1	0	0	1	106	157
13	Second quartile	77	155	0	2	0	0	157	234
14	Third and upper quartiles	41	68	0	2	0	0	70	111
	Rural Owner								
15	Lower and second quartiles	40	75	0	2	0	0	77	117
16	Third and upper quartiles	31	47	2	3	0	1	53	84
	Specialized Housing								
17	Rooming houses	1	2	0	0	0	0	2	3
18	Mobile homes	42	76	6	3	2	1	88	130
	Tenure Uncertain[e]								
	Unconditional baseline:								
21	Urban single-family rental	311	156	3	0	0	4	163	474
22	Rural single-family rental	135	39	0	1	0	0	40	175
23	Urban owner	35	39	2	0	0	0	41	76
24	Rural owner	16	14	0	0	0	0	14	30
	Conditional baseline:								
25	Urban single-family rental	25	19	0	0	0	0	19	44
26	Rural single-family rental	7	6	1	0	0	0	7	14
	Total	1,902	2,926	39	32	13	55	3,065	4,967

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

NOTE: Excludes 140 records for buildings on comparability panel properties and 13 records for buildings mistakenly added to the sample but subsequently retired (final status codes 610, 655, and 698).

[a] Fieldwork not attempted because of prior failure to complete interviews with owners or occupants of the property (final status code 098).

[b] Final status codes 010 and 012.

[c] Lacks usable data in module B because building was demolished, uninhabitable, or differed substantially from an earlier description of it.

[d] Final status codes 022 and 030.

[e] Final status codes 014 and 017.

[f] Final status codes 050, 055, and 067.

Table 2.3

FINAL SURVEY STATUS OF SAMPLED PROPERTIES BY BASELINE STRATUM

Baseline Stratum		Number of Baseline Sample Properties				
			Analysis-Incomplete			
Number	Property Description	Analysis Complete	Residential Properties	Nonresidential Properties	Total	Total Sample
	Urban Rental					
	Single-family:					
1	Lower tercile	213	150	20	170	383
4	Middle tercile	327	149	7	156	483
7	Upper tercile	215	182	4	186	401
	2-4 units:					
2	Lower tercile	237	110	2	112	349
5	Middle tercile	323	166	5	171	494
8	Upper tercile	52	37	1	38	90
	5+ units:					
3	Lower tercile	94	21	4	25	119
6	Middle tercile	50	12	0	12	62
9	Upper tercile	27	6	0	6	33
	Rural Rental					
10	Lower and middle terciles	148	120	11	131	279
11	Upper tercile	44	30	4	34	78
	Urban Owner					
12	Lower quartile	104	53	0	53	157
13	Second quartile	155	79	0	79	234
14	Third and upper quartiles	68	42	1	43	111
	Rural Owner					
15	Lower and second quartiles	75	42	0	42	117
16	Third and upper quartiles	47	37	0	37	84
	Specialized Housing					
17	Rooming houses	2	1	0	1	3
18	Mobile homes	13	7	0	7	20
	Tenure Uncertain					
	Unconditional baseline:					
21	Urban single-family rental	156	281	34	315	471
22	Rural single-family rental	39	115	21	136	175
23	Urban owner	39	36	1	37	76
24	Rural owner	14	16	0	16	30
	Conditional baseline:					
25	Urban single-family rental	19	21	4	25	44
26	Rural single-family rental	6	7	1	8	14
Total		2,467	1,720	120	1,840	4,307

SOURCE: Tabulated by HASE staff from the survey of residential buildings, Site II, baseline.

NOTE: An analysis-complete property is one for which there is at least one analysis-complete building record.

To see whether property-level SRB nonresponse exacerbated nonresponse to the surveys of landlords and households--thereby diminishing the number of properties eligible for the permanent panel*--we compared the final status codes for interviews of property owners and tenants with SRB final status codes for properties. Very few properties were found to lack SRB observations that had been triggered by the completion of the appropriate interviews. Only 0.3 percent of the 3,025 sampled rental properties and 3.1 percent of the 1,162 sampled ownership properties were so affected.

Tables 2.2 and 2.3 are included here primarily to document fieldwork outcomes and to explain Table 2.4, which reports *sample completion rates* by baseline stratum, both for properties and for individual buildings. The rates are low (53 to 86 percent in the regular strata), not because of SRB fieldwork failures but because of prior failures in the interview surveys of the owners and occupants of those properties. The properties that lacked the appropriate interviews were ineligible for the permanent panel of residential properties; consequently, SRB observations on them were cancelled. Of the buildings triggered for SRB fieldwork, 95 percent yielded analysis-complete records.

The SRB data will be used in two ways. For some analyses, information about properties or buildings will be taken from SRB records and added to interview records for landlords, tenants, or homeowners. In such cases, the untriggered SRB records will obviously not be sought. For other analyses, the SRB file itself will be used to estimate the characteristics of residential properties in St. Joseph County. In that case, the analysis-complete records must be weighted to properly represent the population from which they came. Section III addresses the problem of choosing weights to serve that purpose.

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*See Corcoran, *Selecting the Permanent Panel for Residential Properties: Site II*, pp. 29-33, for a definition of panel-eligible properties.

Table 2.4

SAMPLE COMPLETION RATES FOR PROPERTIES AND BUILDINGS BY BASELINE STRATUM

Baseline Stratum		Sample Completion Rate	
Number	Property Description	Properties	Buildings
	Urban Rental		
	Single-family:		
1	Lower tercile	0.56	0.55
4	Middle tercile	0.68	0.68
7	Upper tercile	0.54	0.54
	2-4 units:		
2	Lower tercile	0.68	0.65
5	Middle tercile	0.65	0.65
8	Upper tercile	0.58	0.57
	5+ units:		
3	Lower tercile	0.79	0.83
6	Middle tercile	0.79	0.86
9	Upper tercile	0.82	0.76
	Rural Rental		
10	Lower and middle terciles	0.53	0.55
11	Upper tercile	0.56	0.55
	Urban Owner		
12	Lower quartile	0.66	0.66
13	Second quartile	0.66	0.66
14	Third and upper quartiles	0.61	0.61
	Rural Owner		
15	Lower and second quartiles	0.64	0.64
16	Third and upper quartile	0.56	0.56
	Specialized Housing		
17	Rooming houses	0.67	0.67
18	Mobile homes	0.65	0.58
	Tenure Uncertain[a]		
	Unconditional baseline:		
21	Urban single-family rental	0.33	0.33
22	Rural single-family rental	0.22	0.22
23	Urban owner	0.51	0.51
24	Rural owner	0.47	0.47
	Conditional baseline:		
25	Urban single-family rental	0.43	0.43
26	Rural single-family rental	0.46	0.43
	Total	0.57	0.59

SOURCE: Tabulated by HASE staff from the survey of residential buildings, Site II, baseline.

NOTE: The sample completion rate is the number of analysis-complete properties or buildings divided by the total of all sampled properties or buildings.

[a]Sample completion rates are lower in these strata because we sought to apply baseline surveys only to selected properties in them, and because the information used as the basis for this stratification was less reliable than the information used for the earlier stratification.

III. WEIGHTING THE ANALYSIS-COMPLETE SAMPLE

With minor qualifications, the baseline sample of residential properties is a *stratified random sample*, and the baseline sample of residential buildings is a *stratified random cluster sample*. Such samples can readily be used to estimate the size and composition of the populations from which they are drawn, if the probability of selection is known for each sample element. However, the analysis-complete samples of properties and buildings constitute only about 60 percent of the properties and buildings in the baseline sample. All sampling strata suffer from a high level of nonresponse* because of the triggering rule described in Sec. I. That rule economized on fieldwork leading to selection of the permanent panel, but it may have biased the SRB sample of analysis-complete observations.

In this section, we show that nonresponse bias does indeed exist in most sampling strata. Properties with analysis-complete SRB records differ significantly from those with incomplete records on a variety of characteristics for which comparisons are possible, and they must be presumed to differ on other characteristics for which comparisons cannot be made.

To remedy those biases, we partitioned each sampling stratum into what we hoped would be more homogeneous substrata, and then weighted the analysis-complete properties and buildings separately within each new substratum. The assignment of weights was controlled by substratum population estimates calculated from the full (unbiased) baseline sample. Thus, the weighted file of analysis-complete property and building records was made unbiased with respect to the stratifying variables. The biases observed in other property characteristics were substantially reduced but not eliminated. For certain variables in certain strata, the analysis-weighted file is still a poor representation of the stratum population. Those instances are reported for the benefit of future users of the data.

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*Although the SRB was completed by observers and not from respondent information, the term "nonresponse" is used here. As in a respondent-centered survey, it connotes incomplete records.

TESTING FOR NONRESPONSE BIAS

Two factors determine the extent of nonresponse bias in the analysis-complete sample: the *nonresponse rate*, or proportion of sample elements for which we lack complete survey data; and the magnitude of differences between buildings or properties for which we have data and those for which we lack data. Other things being equal, the probability of serious nonresponse bias increases as nonresponse rates increase. But substantial nonresponse may be tolerable if differences in the characteristics of surveyed and unsurveyed buildings and properties (hence, between surveyed buildings and properties and all buildings and properties in the sample) are slight.

Below, we compare the characteristics of sample elements for which we have complete data with those of all elements in the baseline sample. The comparisons illustrate succinctly the combined effects of nonresponse rate and differences between surveyed and unsurveyed sample elements. Because baseline *sampling rates* differ by stratum, the examination of nonresponse bias among unweighted survey observations is confined to the items within each stratum.*

To test for nonresponse bias, we needed property or building descriptors that were available independently of the SRB for all properties and buildings in the baseline sample. Such descriptors were taken from tax records, other local public sources, and earlier field-listings of the buildings and units on sampled properties. They include location, property tenure, number of dwelling units, equalized assessed value, lot size, building size (first-floor area), and building age.

Table 3.1 compares, for each panel stratum, the mean values of selected property characteristics for the analysis-complete sample of properties with corresponding means for the entire baseline sample.

*Because record weights take into account the variable sampling rates among strata, the extent of bias in estimates produced using weighted observations need not be analyzed only intrastratum. Here we focus on intrastratum bias among weighted observations so as to determine the extent to which weighting exacerbates or moderates nonresponse bias within each stratum.

Table 3.1

NONRESPONSE BIAS OF ANALYSIS-COMPLETE SRB FILE BY PANEL STRATUM AND CHARACTERISTIC

Panel Stratum: Number	Panel Stratum: Property Description	Ratio of Analysis-Complete Sample Mean to Baseline Sample Mean: Number of Buildings on Property	Number of Units on Property	Average Assessed Value per Unit	Assessed Value of Land	Assessed Value of Improvements	Age of Main Building	Number of Units in Building
	Urban Rental							
	Single-family:							
1	Lower tercile	1.00	1.00	*.91*	.96	*.90*	1.03	1.00
4	Middle tercile	1.00	1.00	1.03	.97	1.04	1.01	1.00
7	Upper tercile	1.00	1.00	.97	*.88*	.96	.98	1.00
	2-4 units:							
2	Lower tercile	1.00	.99	.97	.99	*.94*	1.03	1.02
5	Middle tercile	1.00	1.02	.98	1.00	1.00	1.01	1.03
8	Upper tercile	1.01	1.01	.98	.96	.99	1.02	1.02
	5+ units:							
3	Lower tercile	*1.12*	*1.13*	*1.05*	*1.14*	*1.17*	.98	*1.08*
6	Middle tercile	*1.24*	*1.24*	*.60*	*1.09*	1.04	1.00	*1.05*
9	Upper tercile	1.00	1.01	*1.06*	*1.07*	*1.09*	.98	*1.11*
	Rural Rental							
10	Lower and middle terciles	*1.10*	*1.11*	*.94*	.97	1.03	1.00	1.03
11	Upper tercile	1.01	1.01	*.94*	*.89*	*.93*	*1.07*	1.01
	Urban Owner							
12	Lower quartile	*1.41*	*1.67*	1.03	*1.69*	*1.67*	1.03	*1.18*
13	Second quartile	*1.10*	*1.43*	1.01	*1.20*	*1.46*	.99	*1.21*
14	Third and upper quartiles	1.00	.98	.97	.96	*.89*	.96	.99
	Rural Owner							
15	Lower and second quartiles	.97	.97	1.03	*1.10*	1.00	1.03	1.01
16	Third and upper quartiles	.99	.99	1.03	*1.26*	1.03	.99	1.01
	Specialized Housing							
17	Rooming houses	1.00	*.85*	*.32*	*.24*	*.26*	*1.17*	*.85*
18	Mobile homes	*1.07*	*1.07*	*.82*	*1.27*	*1.22*	*.53*	1.00
	Total	*1.13*	*1.32*	*.95*	*1.12*	*1.32*	1.02	*1.22*

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline. Variables tabulated here are from fieldlistings and tax records for properties in the baseline sample, not from SRB fieldwork. The ratios were derived as shown in appendix Tables B.1-B.7.

NOTE: Analysis-complete sample means are based on records for 2,467 properties, each with an analysis-complete record for at least one of its buildings. Baseline sample means are based on records for 4,187 properties remaining in the baseline sample after fieldwork had been completed and earlier sample stratifications had been corrected. Italicized numbers indicate a bias greater than 5 percent of the full-sample mean. Similarly, the mean number of units per building was computed using an analysis-complete sample of 2,926 building records and a total sample of 4,967 such records.

The difference between such means roughly measures the error that would result if the unweighted analysis-complete sample were used to estimate the population mean of the variable. For ease of inspection, the table shows only the ratios of means and highlights those that indicate a bias greater than 5 percent of the full-sample mean.

Such biases are rare among small urban rental properties and rural ownership properties. Larger biases are common among large urban rental properties, urban ownership properties, and specialized housing. In general, the amount of bias increases with the diversity of the stratum population. Urban rental properties with 5 or more units range in size up to 800 units. Urban ownership properties include both single-family houses and multiunit cooperatives and condominiums. In the case of specialized housing, diversity is exacerbated by small populations and samples; the baseline sample contains only 3 rooming houses and 20 mobile home properties, of which 2 and 13, respectively, are analysis-complete.

Aside from the specialized housing, the biases in our analysis-complete sample appear mainly to reflect greater success in interviewing the owners and occupants of large properties than of small ones. That pattern, consistent through strata 3, 6, 12, and 13, can be explained by the fact that only one occupant of a multiunit property had to be interviewed in order to trigger an SRB observation for that property. On large properties, including cooperatives and condominiums, more dwellings were sampled, so the likelihood of obtaining an interview was greater.

COMPENSATING FOR NONRESPONSE BIAS

If all scheduled SRB observations had been completed, our weighting procedures would have been dictated solely by the sample design and the histories of sampled properties.* Applying strict *sampling*

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*The *sampling histories* of some properties were quite complex, requiring sophisticated computations to produce exact sampling history weights. For example, a property originally thought to be a single-family rental may have been selected as part of an 80 percent sample of such properties. When the screening survey revealed that the property was owner-occupied, we moved it to the appropriate stratum, *history weights* to all baseline sample elements produces an unbiased representation of the number and characteristics of all residential properties and buildings in St. Joseph County. But, largely because of the triggering requirement, a minimum of one SRB observation was completed for only 60 percent of all sampled properties, and observations were completed for only 63 percent of the estimated 4,840 buildings on those properties. The lack of data for such large portions of sampled buildings and properties necessitated taking nonresponse into account when constructing record weights.

A remedy was sought in the further stratification of properties. If we could group them so that within each group the properties with complete records closely resembled those with incomplete records, nonresponse bias would no longer be troublesome. Preliminary diagnostics led to choosing jurisdiction (South Bend, Mishawaka, rest of county) and subsidy status (subsidized, unsubsidized) as additional dimensions of stratification. That choice reflected the analytical importance of those distinctions and the diagnostic indications that the resulting substrata would be more homogeneous with respect to other property characteristics.

Computing Property Weights

Crossing panel stratum (18 categories) with jurisdiction (3 categories) and subsidy status (2 categories) yields 108 nominal substrata, although some are empty cells. After assigning each property in the baseline sample to its appropriate cell, we summed the sampling history weights by substratum. Those sums--unbiased estimates of substratum populations--thereafter served as control totals.

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originally sampled at, say, a 10 percent rate. If the property was selected for the baseline sample, its sampling history weight was computed by taking into account its probability of being selected at each stage of sample selection, rather than by dividing the estimated number of properties in the stratum by the number selected for the baseline sample. Later, however, we summed exact sampling history weights for all properties in a stratum (or a significant subset) and then divided by the number of sampled properties, to produce a uniform ("smoothed") sampling history weight for all properties in the stratum or substratum.

Next, we rescaled sampling history weights for the analysis-complete properties within each substratum so that the adjusted weights summed to the applicable control total. Thus, if half of all sampled properties in a substratum were analysis-complete, the sampling history weight for each property was doubled to arrive at the analysis weight.*

While computing property weights, we monitored the consistency of certain analysis-weighted building and unit counts with control totals. Within the 54 categories produced by combining panel stratum and jurisdiction, we reviewed weighted counts of the total number of buildings and units, the number of buildings and units on subsidized properties, and the number of buildings and units on farm properties.**

Large differences between analysis-weighted building and unit counts and their corresponding control totals were evident only in strata of urban ownership properties, where large multibuilding and multiunit ownership properties were substantially overrepresented. Because all such properties were included in the urban ownership strata of the baseline sample, and most had been surveyed, we overrode our general weighting procedures and set their property weights at unity.

Computing Building Weights

We computed two alternative building weights. The first, BWGT1, was calculated by weighting all analysis-complete observations for buildings on a property to represent all buildings on that property, and then multiplying that weight by the property analysis weight. BWGT2 was calculated by estimating the number of buildings in each of the 108 substrata and dividing that estimate by the number of analysis-complete observations in the substratum. For both sets of weights, we compared--within the 54 categories--weighted counts of the total number of buildings and units, the number of buildings and units on subsidized properties, and the number of buildings and units on farm properties.

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*See Appendix B for details of the weighting algorithm.

**Though we constrained weighted property counts to agree with sampling history weight estimates, we did not constrain the weights to make building and unit counts generated using analysis weights agree completely with such counts generated using sampling history weights.

For each of the 108 substrata, we chose the building weight that appeared to minimize the differences between analysis-weighted totals and control totals.* BWGT2 was chosen for most analysis-complete observations: those for buildings on unsubsidized properties with fewer than five units that were not multiunit ownership properties. BWGT1 was chosen for observations of buildings on large rental properties, on subsidized properties, and on single-unit ownership properties. The sole exception was the subsidized South Bend properties in stratum 3 (lower rent tercile, 5+ units), for which BWGT2 appeared to be the best analysis weight.

Table 3.2 recombines the substrata into the 18 panel strata originally defined for property sampling. It compares the population estimates--for both properties and buildings--obtained by summing baseline sampling history weights with those obtained by summing the analysis weights just described.

Estimates of the stratum populations of properties from the two sources are virtually identical except for stratum 12, where the systematic algorithm was overridden, as explained above. The small differences in some other strata reflect rounding errors in computing the analysis-complete weights. Estimates of the stratum populations of buildings diverge more often because building-level weights were not constrained to agree with control totals. The largest discrepancies are in strata 6, 12, 15, and 18. Despite these discrepancies, we judge the results to be about as close as could be hoped without constraining building weights to match control totals. We avoided such a constraint in the belief that it would create more bias than it would eliminate.

RESIDUAL BIAS IN THE ANALYSIS-COMPLETE FILE

The effects of the compensatory weighting scheme on nonresponse bias are reflected in Table 3.3. Like Table 3.1, it compares the sum of selected property characteristics, but here both samples are

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*We did not compute a statistic that summarized residual bias under each weighting scheme but reviewed plots of such bias in each of the 54 stratum-jurisdiction categories when selecting building weights. When the plots lacked sufficient resolution, we compared the sum of weights in a classification with the corresponding control totals.

Table 3.2

ESTIMATED POPULATIONS OF PROPERTIES AND BUILDINGS BY PANEL STRATUM: FULL BASELINE SAMPLE VS. ANALYSIS-COMPLETE SAMPLE

Panel Stratum		Sum of Property Weights		Sum of Building Weights	
Number	Property Description	Baseline Sample	Analysis-Complete Sample	Baseline Sample	Analysis-Complete Sample
	Urban Rental				
	Single-family:				
1	Lower tercile	1,142	1,142	1,142	1,142
4	Middle tercile	1,917	1,917	1,917	1,917
7	Upper tercile	2,732	2,732	2,732	2,732
	2-4 units:				
2	Lower tercile	1,494	1,494	1,597	1,598
5	Middle tercile	1,067	1,057	1,179	1,169
8	Upper tercile	427	435	613	621
	5+ units:				
3	Lower tercile	112	112	337	338
6	Middle tercile	68	68	289	328
9	Upper tercile	38	38	247	236
	Rural Rental				
10	Lower and middle terciles	488	488	582	589
11	Upper tercile	283	283	288	288
	Urban Owner[a]				
12	Lower quartile	10,691	10,640	10,879	10,829
13	Second quartile	13,541	13,537	13,592	13,588
14	Third and upper quartiles	25,661	25,660	25,665	25,664
	Rural Owner				
15	Lower and second quartiles	2,064	2,052	2,083	2,056
16	Third and upper quartiles	4,051	4,050	4,052	4,050
	Specialized Housing				
17	Rooming houses	5	5	5	5
18	Mobile homes	21	21	1,856	2,041
Total		65,802	65,733	68,920	69,190

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Includes some multiunit and multibuilding cooperatives or condominiums.

Table 3.3

RESIDUAL BIAS (AFTER WEIGHTING) OF ANALYSIS-COMPLETE SRB FILE
BY PANEL STRATUM AND CHARACTERISTIC

Panel Stratum: Number	Panel Stratum: Property Description	Ratio of Analysis-Weighted Sample Sum to Estimated Total Population: Number of Buildings on Property	Number of Units on Property	Average Assessed Value per Unit	Assessed Value of Land	Assessed Value of Improvements	Age of Main Building	Number of Units in Building
	Urban Rental							
	Single-family:							
1	Lower tercile	1.00	1.00	*.87*	1.01	*.82*	*1.05*	1.00
4	Middle tercile	1.00	1.00	1.02	.96	1.03	1.02	.97
7	Upper tercile	1.00	1.00	.96	*.81*	*.94*	1.01	1.00
	2-4 units:							
2	Lower tercile	1.01	1.00	1.00	.99	.99	1.00	1.00
5	Middle tercile	.99	1.01	.96	.98	.98	1.00	.99
8	Upper tercile	1.02	1.02	*1.10*	*1.10*	*1.11*	1.01	1.02
	5+ units:							
3	Lower tercile	1.00	1.03	1.01	*1.05*	1.01	.98	*.63*
6	Middle tercile	*1.14*	*1.10*	*.63*	1.00	*.87*	1.02	*1.08*
9	Upper tercile	.96	.96	1.02	1.03	1.03	1.04	*.95*
	Rural Rental							
10	Lower and middle terciles	*1.06*	*1.08*	*.93*	*.93*	1.01	.99	*.90*
11	Upper tercile	1.01	1.00	*.93*	*.87*	*.91*	.99	1.00
	Urban Owner							
12	Lower quartile	1.00	.99	1.02	1.02	1.01	*1.07*	.99
13	Second quartile	1.00	1.00	1.00	.97	1.00	1.00	1.00
14	Third and upper quartiles	1.00	1.00	.96	.98	.96	.99	1.00
	Rural Owner							
15	Lower and second quartiles	.99	.99	1.02	*1.05*	1.00	.99	.99
16	Third and upper quartiles	1.00	1.00	1.01	*1.16*	1.01	*1.05*	1.00
	Specialized Housing							
17	Rooming houses	1.00	*.85*	*.27*	*.21*	*.21*	*.71*	*.85*
18	Mobile homes	*1.07*	*1.07*	*.89*	*1.26*	*1.21*	*.50*	*1.10*
	Total	1.00	1.00	.98	1.01	.97	1.00	.98

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline. Variables are from fieldlistings and tax records for properties in the baseline sample, not from SRB fieldwork. The ratios were derived as shown in appendix Tables B.1-B.7.

NOTE: Estimates from the analysis-complete sample are based on records for 2,467 properties, each with an analysis-complete record for at least one of its buildings. Estimates from the full baseline sample are based on records for 4,187 properties remaining in the baseline sample after fieldwork had been completed and earlier sample stratifications had been corrected. Estimates of population means from each source are based on weighted values for individual records. Italicized numbers indicate bias greater than 5 percent.

weighted. Thus, the table compares estimates of population sums rather than sample means.

Comparing Tables 3.1 and 3.3 reveals both gains and losses due to compensatory weighting. Before weighting, 51 of 126 tests (7 variables times 18 strata) indicated a bias of 5 percent or more, and 36 indicated a bias of 10 percent or more. After weighting, the figures are 41 and 25. However, weighting created biases in 10 cases where none had been evident before. The greatest improvement came in the urban ownership strata (12, 13, and 14), where special treatment was given to the few cooperative and condominium properties that were intermixed with single-family houses. Bias was also substantially reduced among large urban rental properties (strata 3, 6, and 9). On the other hand, new biases appeared among smaller rental properties, especially in stratum 8. Biases in the two strata of specialized housing (17 and 18) were only slightly reduced.

CONCLUSIONS

Because the SRB inherited the combined nonresponse problems of the landlord and household surveys, the file of analysis-complete SRB records has important limitations as a database for estimating population parameters. As weighted for analysis, the file may be used with considerable confidence to estimate the numbers of properties or buildings in each of the 18 strata that divide those populations by urban or rural location, property tenure, and rent or value interval; and in each of the substrata that further divide the populations by jurisdiction (South Bend, Mishawaka, rest of county) and subsidy status. However, simple counts in those categories can be estimated even more reliably from the full baseline sample because the variables do not come from SRB fieldwork.

The evidence indicates that the weighted analysis-complete sample yields biased estimates of some property characteristics in some strata. The two strata of specialized housing--both small populations--are poorly represented by analysis-complete records. There is enough evidence of bias in strata 1, 3, 6, 8, 10, and 11 to warrant considerable caution by analysts attempting to estimate property or building characteristics of the stratum populations.

The main use of SRB records, however, will be to amplify the records of landlord and household interviews with data on the properties and buildings they own or occupy. Since less than 5 percent of the incomplete SRB records pertain to properties that have complete interview data, the file of analysis-complete SRB records serves that purpose well.* Nevertheless, in retrospect we question the wisdom of HASE's decision not to survey residential buildings unless the owners and occupants had been fully interviewed. A more complete baseline file would have provided a stronger base for subsequent analysis, even though the additional properties would not have been eligible for the permanent panel.

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*To be sure, analysis of the interview surveys must deal with the interview nonresponse bias that governed SRB fieldwork. Audits of the baseline landlord and household surveys indicate that the problems there are less severe and are greatly ameliorated by compensatory weighting. See Richard E. Stanton and Therman P. Britt, *Audit of the Baseline Landlord Survey in Site II*, The Rand Corporation, WN-9739-HUD (forthcoming), and John Mulford, *Audit of the Baseline Survey of Tenants and Homeowners in Site II*, The Rand Corporation, WN-9229-HUD (forthcoming).

IV. ITEM NONRESPONSE

This section describes the process and reports the results of examining the field-complete records for evidence of item nonresponse bias.* Briefly, we found that less than one percent of the applicable responses were unusable, and that nonresponse did not generally occur in ways that would bias population estimates from the data.

One form of item nonresponse did occur often enough to warrant close scrutiny of the data. The interior public areas of 38 multi-unit buildings were inaccessible to the evaluators, who simply skipped all survey questions about the quality and condition of those areas without recording audit codes. We examined the data to determine whether item nonresponse bias resulted. Definite differences were found between buildings whose interior public areas were observed and those whose areas were not observed. However, the differences were so subtle, and the proportion of buildings with inaccessible areas was small enough, that estimates of population characteristics from those data will not be significantly biased.

CONVENTIONAL ITEM NONRESPONSE

To determine the incidence of item nonresponse in the data,** we tabulated by *response field* and record the number of applicable responses, the number of usable responses, the ratio of usable to applicable responses, and the number of audit codes inserted in response fields (Table 4.1 lists the audit codes).***

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*Item nonresponse is defined as the lack of usable answers in applicable response fields of an otherwise complete building observation.

**The data we examined included the building record folder, modules A and B of the survey instrument, and the validation and refusal reports. The analysis here focuses on item nonresponse in modules A and B and in the validation report.

***Responses of an administrative nature, such as property and building identifiers, are excluded from this analysis.

Table 4.1

SRB AUDIT CODES

Code[a]		Definition	Explanation
Alphabetic	Numeric		
SRB Data Elements			
C	-2	Not observable (validation data element only)	Indicates that an item was not observable during validation, but that circumstances of the observation were different from those of original questionnaire. Code is allowed only for off-property validations of original questionnaires completed on-property.
D	-3	Don't know	
E	-4	Data transferred to original questionnaire (validation data elements only)	Indicates that validation data were used to resolve a field-editing problem by transferring them from validation form to original questionnaire. The validation data were then replaced by code E.
I	-5	Response unintelligible	Used when response is illegible or otherwise indecipherable, and efforts to obtain a plausible or correct response have failed.
M	-6	Unintentional skip	Used for questions that should have been answered but for which no response was recorded.
S	-9	Breakoff	Used for questions that were not completed because resident refused to allow observation to continue.
U	-13	Unresolvable problem	Used when data are confusing and no solution is obvious after Design and Analysis Group review.
Blank	-11	Valid skip of question	Used to avoid confusion between blanks and zeros when computer reads data.

Table 4.1--Continued

Code[a]		Definition	Explanation
Alphabetic	Numeric		
	Data Elements Derived from Other Files		
(*b*)	-21	Valid absence of data	Used to distinguish valid absence of data from absence of desired data (analogous to -11 above).
(*b*)	-22	Absence of desired data	Desired data missing or unusable in source file.
(*b*)	0	Valid absence of data--applicable only to TU, BS, and SS	Used like -21 for data elements spanning fewer than 3 bytes.
Blank	Blank	Absence of desired data--applicable to BLDGSTAT and BLDGTYPE	Used like -22 for alphabetic data elements.

SOURCE: HASE Survey Group, *Codebook for the Survey of Residential Buildings, Site II, Baseline*, pp. 203-204.

NOTE: TU = taxing unit; BS = baseline stratum; SS = screening stratum; BLDGSTAT indicates whether building is to be surveyed; BLDGTYPE indicates type of building (residential, commercial, etc.).

[a]Alphabetic codes were used in hardcopy and early machine-readable records. They were transformed to numeric codes when the EFR file was converted to standard file format.

[b]Inapplicable.

Table 4.2 summarizes those counts and ratios for all SRB records and shows that less than one percent of the 748,000 applicable response fields in modules A and B and the validation report contained unusable entries. In module A, unusable responses were quite rare, perhaps because the module is relatively short and has straightforward skip patterns. Module B showed the highest average number of unusable responses per record of all three record segments. The apparent reason is that it contained more complex and extensive skip patterns and therefore presented greater opportunity for overlooked questions, errors of skip logic, and inconsistent responses. Module B was also the only

Table 4.2

SUMMARY OF ITEM NONRESPONSE IN SRB SURVEY RECORDS

Item	Record Segment			Full Record
	Module A	Module B	Validation Report	
Number of Records or Responses				
Applicable records	2,565	3,092	828	3,092
Response fields per record	94	307	103	504
Total response fields	241,110[a]	949,244	85,284[a]	1,275,638[a]
Less legitimate skips	86,464	414,999	25,727	527,190
Total desired responses	154,646	534,245	59,557	748,448
Less unusable responses	166	4,825	1,490	6,481
Total usable responses	154,480	529,420	58,067	741,967
Records with any unusable responses	42	297	380	(*b*)
Unusable Responses				
Maximum per record	13	298	46	(*b*)
Average per record	.06	1.56	1.80	2.10
Average per record with any unusable responses	3.95	16.25	3.92	(*b*)
As percent of desired responses	.11	.90	2.50	.87

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Counts module A response fields only once per property. Counts validation report response fields only for validated observations.

[b]Not calculated.

part of the questionnaire that required the observer to be on the property, so an observation was more likely to be broken off by an owner's or tenant's refusal to continue.

Despite the greater *number* of unusable responses in module B, they constituted a small *proportion* of the number of responses desired. Unusable responses were proportionately highest in the validation reports; they consisted mainly of codes signifying unobservable property or building characteristics or replacement of problematic data in the original SRB questionnaire by data from the validation report. Those codes reflect neither substandard performance by validation observers nor unreliable validation data.

Many unusable responses could be traced to questionnaire skip patterns that were incorrectly followed by observers, who simply overlooked or misunderstood the skip logic, or else gave inconsistent responses to related questions. Where possible, we replaced the erroneous data with correct responses, which often made other questions applicable that originally had appeared inapplicable. Code -6 was inserted in those response fields, as well as in the response fields of overlooked questions in a series. Where an inconsistency could not be resolved, we replaced one or more of the conflicting responses with code -13. Unintelligible responses--usually a result of circling multiple answers to a question permitting only one answer--were assigned code -5 if they could not be resolved.

Review of frequency distributions for the various types of unusable responses, shown in Table 4.3, revealed nothing unusual.

Table 4.3

UNUSABLE RESPONSES BY RECORD SEGMENT AND TYPE OF RESPONSE

Type of Unusable Response		Number of Unusable Responses by Record Segment				
Code	Description	Building Record Folder	Module A	Module B	Validation Report	Total
-2	Not observable[a]	--	--	--	603	603
-4	Data transferred to original questionnaire[a]	--	--	--	586	586
-5	Response not intelligible	21	2	10	17	50
-6	Unintentional skip	503	160	3,325	281	4,269
-9	Breakoff	--	--	1,482	--	1,482
-13	Unresolvable problem	--	4	8	3	15
Total		524	166	4,825	1,490	7,005

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

NOTE: Refusal reports contained no unusable data.

[a]Code applies only to validation reports.

NONRESPONSE TO THE OBSERVATION OF INTERIOR PUBLIC AREAS

Observers failed to gain access to the interior public areas of 38 buildings, or 17 percent of the 223 observed buildings containing such areas.* Because substantial differences between buildings with

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*Excludes 11 buildings on comparability panel properties and one single-family dwelling erroneously thought to contain an interior public area.

accessible interior public areas and those with inaccessible areas might produce biased estimates from survey data, we compared the characteristics of the two groups by panel stratum. If the building types differed only on the dimensions used to stratify residential properties, estimates of population characteristics should emerge unbiased. But if they differed on other dimensions, bias might result.

Only buildings in multiunit urban rental strata had inaccessible interior public areas. Inaccessibility was highest among the 2-to-4-unit properties with low and medium rent (42 and 35 percent, respectively) and lowest among properties of 5+ units with low rent (4 percent). Overall, the nonresponse rate for 2-to-4-unit properties is higher than for properties of 5+ units (36 vs. 12 percent).

Appendix C reports the distributional parameters for a number of variables where values are known for both responding and nonresponding multiunit properties. The comparison shows that the buildings permitting access to interior public areas contain fewer units and stand on properties containing fewer buildings and units. Those buildings also have a higher average assessed value per unit. Fewer of the "accessible" buildings are completely residential and, in strata 3 and 6, fewer are subsidized. Except in stratum 2, the buildings are located on properties with yards that are not as extensively landscaped, well-maintained, or clean, and in neighborhoods where yards in general are less well maintained.*

Thus, although buildings with accessible and inaccessible interior public areas and the properties on which they stand differ in size and quality, the intrastratum differences appear subtle enough, and the number of buildings denying access is small enough, that estimates based on our data will not be biased. Nonresponse to the observation of interior public areas, though slight, may compound record-level nonresponse in strata of urban rental properties with 5+ units, where the number of

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*The reasons for the exception are unclear, but perhaps the presence of resident landlords on 40 percent of the properties accounts for the cleaner, better-maintained, more extensively landscaped yards in stratum 2 buildings.

analysis-complete records is small. Table 4.4 shows that sample completion rates computed after excluding records for buildings with inaccessible interior public areas were 1 to 7 percentage points lower than the rates for all analysis-complete records. The only differences greater than 2 percentage points occur in strata 6 and 9, where sample completion rates are 5 and 7 percentage points less, respectively. Given the fairly high original sample completion rates, the magnitude of those declines is substantial and may produce estimates that, though not necessarily biased, are not quite as reliable as the rest of the survey data.*

CONCLUSIONS

The incidence of item nonresponse per record, record segment, and response field is generally low except for 21 records in which substantial portions of module B were inappropriately skipped. In those instances observers either misunderstood or failed to follow the questionnaire branching logic, or hostile owners or occupants denied permission to complete the observation. Despite the lack of module B data for those 21 cases, item nonresponse rates are not high enough to significantly affect the reliability of any estimates made from the survey data. The differences between buildings with accessible interior public areas and those with inaccessible areas are slight enough, and the interior area nonresponse rate is low enough, to preclude serious biases in estimates based on those data, except possibly in strata 6 and 9.

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*Note that only estimates made from observations of interior public areas are subject to decreased reliability due to combined nonresponse.

Table 4.4

COMBINED EFFECTS OF RECORD-LEVEL NONRESPONSE AND INACCESSIBILITY OF INTERIOR PUBLIC AREAS ON SAMPLE SIZE: MULTIUNIT URBAN RENTAL STRATA

Multiunit Urban Rental Strata		Number of Buildings						Sample Completion Rate	
				Buildings with Interior Areas					
Number	Property Description	Total Sample (a)	Analysis-Complete (b)	Surveyed (c)	Unsurveyed (d)	Total (c+d)	Analysis-Complete Less Unsurveyed Buildings (b-d)	Including Unsurveyed Buildings (b/a)	Excluding Unsurveyed Buildings ((b-d)/a)
	2-4 units:								
2	Lower tercile	396	258	14	10	24	248	.65	.63
5	Middle tercile	558	363	13	7	20	356	.65	.64
8	Upper tercile	107	61	5	1	6	60	.57	.56
	5+ units:								
3	Lower tercile	216	179	47	2	49	177	.83	.82
6	Middle tercile	183	157	50	9	59	148	.86	.81
9	Upper tercile	127	97	56	9	65	88	.76	.69
Total		1,587	1,115	185	38	223	1,077	.70	.68

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

V. INDICATORS OF DATA QUALITY

Missing or otherwise unusable data are readily identified in survey records, so they can be taken into account in the analysis. Errors or imprecision in apparently usable data are harder to detect and can thus mislead analysts. We checked SRB records in several ways for evidence of incorrect, inconsistent, implausible, or imprecise responses.

First, we reviewed changes made to field reports during data cleaning, both to confirm the reliability of the editing and to detect systematic problems with instrument design or observers' instructions. Second, we devised and applied tests for implausible or inconsistent responses, in addition to the range and logic checks made during data cleaning. Third, we compared original observations with field validation reports for a sample of buildings. Finally, we checked for evidence of substandard performance by individual fieldworkers.

Although we discovered various minor ambiguities and errors, only one issue merits a general caution to users of the data: Responses to evaluative questions (appraisals of the condition or quality of various features of a property) are imprecise. Different observers often rated the same feature differently, though nearly always choosing adjacent ratings on a four-point scale. The problem was first noted in the baseline SRB for Site I, and the Site II instrument was redesigned--apparently without greatly improving response precision.

This section describes the tests we performed and their specific results.

RESPONSES CHANGED DURING DATA CLEANING

We examined the number and type of data changes made during cleaning to determine whether SDPG data editors had found systematically erroneous or unreliable responses. Comparison of the UFR file, containing records as they existed before data cleaning, with the EFR file that was released for auditing after the data were cleaned, revealed little of note.

In many respects, the patterns of data cleaning changes corresponded to those of item nonresponse, discussed in Sec. IV. When observers inadvertently skipped questions or encountered problems at branch points in the questionnaire, the cleaning programs caught the errors. Where possible, SDPG editors replaced missing data with the correct responses, gleaned from notes handwritten on the questionnaire or from other responses. Where the correct response could not be found, they inserted audit codes.

Observers sometimes mistook branch points for questions to be answered and completed sections of the questionnaire that were inappropriate for the type of building they were evaluating. Data editors changed the incorrect response to either an audit code or a correct value, as indicated by other data on the questionnaire, and converted extraneous responses to blanks.

When data editors were able to decipher responses that had originally been unintelligible (and hence given an I audit code), they replaced the alphabetic code with the correct data. During auditing, we converted the I codes of responses remaining undecipherable to the SFF code of -5. We also changed some numeric responses to different numeric values when we discovered erroneous or inconsistent responses and were able to correct them. Leading zeros that were missing in multiple-column fields were added by data editors.

Review of the frequency distributions of the various types of data cleaning changes disclosed no serious problems. The overall incidence of changes was modest, and the patterns of the changes, both in type and distribution among record segments and response fields, conformed to the patterns discussed above. Thus, the instrument appears to have been manageable by fieldworkers, and they followed instructions well. SDPG editors adhered to editing instructions and improved the data received from the field.

SUSPECT DATA

During data cleaning, the responses on each record were subjected to extensive range and logic checks. Range checks determined whether responses fell within a range of allowable or plausible values, and logic checks tested the consistency of two or more responses on the same survey record. When the data cleaning software detected an apparent error, it issued a hardcopy error report, listing the check violated and the names and values of the affected response fields. Data editors compared the hardcopy questionnaire with the error report to determine which responses were really in error and to search for the correct data. They were able to replace all but three clearly erroneous responses with accurate data from other parts of the questionnaire.

When editors discovered that a reportedly erroneous response was in fact correct, they overrode that cleaning specification and thus prevented the generation of the same error report during later iterations of the data cleaning process.

Editors followed a similar procedure when they encountered a clearly erroneous response that could not be corrected or inconsistent responses that could not be resolved. They overrode the cleaning specification and entered the record and response field identifiers in a *suspect data file*, along with codes indicating why and by whom the response was designated suspect.[*]

Unlikely dates or times reported for observation attempts constituted most suspect data. All but 2 of the 89 suspect building record folder responses fell in that category. Unlikely times for beginning or ending an observation were the reasons for 133 of 972 suspect responses in modules A and B[**] and for 131 of 167 suspect responses in the validation reports. (No suspect responses were found in the refusal reports.) The rest of the suspect data were fairly evenly distributed across all response fields, with five exceptions.[***]

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[*] Some responses were designated suspect by SDPG editors; others were so designated by the DAG. The date of the action and the identification number of the editor who made the entry were also included.

[**] Frequencies for module A and B suspect responses exclude 42 responses flagged as suspect by SDPG data editors but later corrected or cleared of suspicion when we examined records that failed audit checks of consistency and plausibility.

[***] The five exceptional response fields each accounted for 2 to 4 percent of the suspect data. Three (A14, B4, and B9) were responses to questions asking observers to classify the building or buildings

Aside from these exceptions, the incidence of suspect data in substantive matters is too low to significantly affect data reliability. And even in the exceptional response fields the suspect responses constituted less than 2 percent of all desired responses.

IMPLAUSIBLE AND INCONSISTENT RESPONSES DETECTED DURING THE AUDIT

The logic and range checks described above were not designed to check the plausibility or relative consistency of individual responses, nor to compare responses across modules. Therefore, we designed and ran additional checks to detect such errors. The checks were of two types: (a) for disagreements between assertions of fact, and (b) for implausible combinations of subjective ratings that, though not clearly contradictory, ran counter to intuition and experience. Asserting that commercial units are present in an entirely residential building is an example of the former condition, and rating the condition of a roof surface as excellent when major defects are said to exist in the roof structure is an example of the latter.

Appendix D describes the checks that were performed. Table D.1 lists the 43 checks for disagreement between assertions of fact. A computer program examined 49 variables in each of the 3,066 field-complete records, or a total of 150,234 response fields. The results showed 238 records (7.8 percent) with at least one inconsistency of that type. Most checks found errors in 10 or fewer records, only two checks (36 and 39) affected over 10 each--22 and 95 records respectively. Apart from those exceptions, the percentage of affected records, shown in the last column of Table D.1, was quite low.

All 238 records containing inconsistencies were examined individually. We were able to correct 180 response errors, thus resolving

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sampled (e.g., single-family home, duplex, multiple-unit apartment building)--an inherently difficult task. The remaining two (B16:D, VLB10:F) were responses to evaluative questions about the composition of exterior wall surface and the portion (all, most, or some) covered by each material when more than one material was used. Sometimes the observers were unable to precisely determine the components of the wall surface, but more often they had difficulty specifying the portion of the wall surface covered by each component. We resolved the discrepancies attributable to the latter problem during data cleaning but flagged the corrected responses as suspect because they were generally based on circumstantial evidence.

inconsistencies for 72 records (see Table 5.1). As a result, 42 items were deleted from the suspect data file. Unresolvable inconsistencies added 396 items to the suspect data file, beyond the 48 items already added during cleaning. Thus, a total of 444 responses (0.3 percent of those examined by these checks) had unresolvable inconsistencies.

Resolution of inconsistencies left only one check that was violated on more than 10 records. On 95 records, observers either failed to include nonresidential land when completing the land use question (A18), or they coded beneficial or detrimental features associated with nonresidential land uses outside the evaluated area (A19-A21). These errors, detected by check 39, amounted to 274 (62 percent) of the 444 responses added to the suspect data file during the audit.

Checks of the second type were for implausible but not necessarily incorrect response combinations (see Table D.2), so the discrepancies were not added to the suspect data file. A computer program applied 35 checks to 37 variables in the field-complete records, or a total of 113,442 response fields. The results showed 595 records (19.4 percent) with at least one discrepancy of that type. The discrepancies involved 28, or three-fourths of the variables examined, but only 1,213 (1.1 percent) of the response fields.

To summarize, 78 checks were applied to 78 variables* in each of 3,066 records, resulting in the examination of 239,148 response fields. Errors in 180 responses were corrected, but 1,657 response fields (0.7 percent of those examined)** remained inconsistent. Of the latter group, 444 fields were entered in the suspect data file. Overall, the incidence of inconsistent responses is so small that it is not a problem.

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*Some variables underwent both types of checks.

**That is an upper bound on the number of inconsistent fields. Because we did not separately examine every error detected by the second type of check, we were unable to subtract fields that were flagged by more than one check and thus double-counted.

Table 5.1

INCONSISTENT RECORDS CORRECTED DURING AUDIT

Check Number[a]	Inconsistency	Number of Inconsistent Records		
		Detected	Corrected	Remaining
3	Mobile home without metal roof (roof observable)	1	1	0
12	Disagreement concerning presence of other residential buildings in area[b]	2	2	0
13	Disagreement concerning presence of other residential buildings in area[b]	5	5	0
15	Disagreement whether building is a single-family residence	6	5	1
18	Disagreement whether building is a multiple-unit apartment house	7	7	0
19	Disagreement whether building is a mobile home	2	2	0
21	Disagreement whether building is residential or commercial	1	1	0
30	Disagreement whether building is in apartment complex or mobile home park	8	3	5
31	Disagreement whether building is single-family home with no commercial units or mobile home	8	8	0
32		9	7	2
33	Disagreement whether building is on urban or suburban block	7	4	3
35	Disagreement whether building is in rural area	9	5	4
36	Disagreement whether building is in apartment complex or mobile home park	22	22	0
Total		87	72	15

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Used in the suspect data file to denote the type of inconsistency.

[b]This check was performed twice, each time with a different variable.

Only with regard to land use data and the presence of beneficial or detrimental features associated with nonresidential land use is the inconsistency rate much higher than for the other variables. Those inconsistencies account for 62 percent of the items added to the suspect data file at this stage. The land use data are probably more reliable than are the data on features associated with nonresidential land use.

VALIDATION COMPARISONS

Westat was required to validate a 20 percent random sample of all field-complete SRBs. The validations were intended to ensure that observers evaluated the correct buildings and to allow Rand to assess the reproducibility (hence reliability) of the data.

Because Westat personnel did not know beforehand what the field-completion rate would be, they overvalidated to be sure of obtaining a 20 percent sample. Still more buildings were validated for administrative purposes, resulting in validations for 828 (27.0 percent) of the 3,066 field-complete records.

Eight observers revisited validation-sample buildings and readministered selected questions. At that time those observers were no longer conducting regular SRBs, and they did not have access to the original responses. The 56 validated questions were of three types: administrative, descriptive, and evaluative.

Administrative questions, designed to describe the conditions under which the observation was conducted, covered such matters as building observability, accessibility of interior public areas, and whether the observer talked to any residents. Because their responses did not describe the residential property or structure, and hence had little analytic content, we did not investigate their reproducibility.

Descriptive questions were intended to record the presence or absence of certain characteristics and to define, describe, or count items. Such factual questions required little judgment on the observer's part. The reproducibility of descriptive question data is affected by observer training, item observability, legitimate differences due to elapsed time, coding errors, and ambiguous definitions.

Evaluative questions required observers to rate the conditions of building, property, and surrounding area characteristics, by ranking each characteristic on a four-point scale. The reproducibility of evaluative question data is affected by the factors mentioned above and by observers' subjectivity.

Comparison of the original responses and validation responses to descriptive and evaluative questions revealed the discrepancies shown in Tables 5.2 and 5.3, respectively. Legitimate skip patterns, incorrectly skipped questions, and noncomparable responses account for the variation in the number of applicable responses. Discrepancy rates for the 27 validated descriptive questions range from 0 to 43.1 percent, but 24 (88.9 percent) have a discrepancy rate of less than 10 percent and 18 (66.7 percent) have a discrepancy rate of less than 5 percent. The least reproducible questions have to do with the largest street type in the immediate area of the building (A22), predominant type of residential buildings in the area (A14), and exterior wall material (B16).

The high discrepancy rate for largest street type (43.1 percent) probably owes to a definitional problem. Observers had to choose among "major road or boulevard," "arterial street--feeding onto major road or boulevard with moderate to heavy traffic," and "residential street with thru traffic." The arterial category is confusing because it overlaps with the others. Assuming observers could have distinguished a major boulevard from a residential street (minus the arterial category), the discrepancy rate would drop to 11 percent. Since there is no way of knowing whether a street coded as arterial should be a major boulevard or a residential street, we recommend that analysts aggregate the three categories. For future survey waves we recommend deleting the arterial category and sharpening the distinction between the other two categories.

The 11 percent discrepancy rate for predominant type of residential building in the area owes largely to observers' inability to distinguish between single-family homes and buildings with two or more residential units (both building types with no commercial units).

Table 5.2

DISCREPANCIES BETWEEN ORIGINAL AND VALIDATION RESPONSES
TO DESCRIPTIVE QUESTIONS

Question	Description	Number of Applicable Responses[a]	Discrepancies	
			Number	Percent of Applicable Responses
A1	Additional buildings under construction on property	706	0	.0
A2	Buildings listed on property torn down, condemned, or destroyed	709	2	.3
A3	Unlisted, neighboring buildings may be on property	708	3	.4
A5	Existence of nonresidential, noncommercial, permanent buildings	670	15	2.2
A13	Definition of area where building is located	701	5	.7
A14	Type of residential buildings in area	701	78	11.1
A22	Largest street type in area	699	301	43.1
A25:A	Existence of street lighting in area	703	1	.1
A25:B	Existence of boarded-up or abandoned buildings in area	701	2	.3
A25:C	Existence of abandoned vehicles in area	701	7	1.0
B1	Building address and description correct on information sheet	819	19	2.3
B2	Building type correct on information sheet	813	7	.9
B3	Number of residential units agrees with information sheet	803	9	1.1
B6	Building condemned or heavily damaged	814	8	1.0
B7	Occupancy status of building	766	19	2.5
B8	Building vacant and under construction, condemned, or heavily damaged	31	3	9.7
B9	Building type	793	22	2.8
B15	Number of stories	786	49	6.2
B16	Material covering most of exterior wall surface	776	111	14.3
B18	Presence of major faults in exterior wall structure	752	59	7.8
B28	Type of roof construction	788	14	1.8
B41	Presence of garage for residents' use on property	783	49	6.3
B69	Building type	786	16	2.0
B70	Existence of interior public areas	274	16	5.8
B83	Definition of area where building is located	786	37	4.7
B84	Existence of other residential buildings in area	788	16	2.0
B85	Size of building relative to others in area	767	51	6.6

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Excludes unusable responses (indicated by audit codes) and usable responses that disagree about the applicability of a question or the observability or construction status of a characteristic.

The 14.3 percent discrepancy rate for exterior wall material owes partly to a confusion between wood, aluminum, vinyl, composition, and fiberboard siding. Discrepancies between those materials account for 44 percent of the 111 discrepancies. Lack of opportunity to inspect the wall material closely appears not to have been a significant factor (see the discussion of controlled observability below). The main

Table 5.3

DISCREPANCIES BETWEEN ORIGINAL AND VALIDATION RESPONSES TO EVALUATIVE QUESTIONS

			Discrepancies by Magnitude					
			1 Interval		2 or 3 Intervals		Total	
Question	Description	Number of Applicable Responses[a]	Number	Percent of Applicable Responses	Number	Percent of Applicable Responses	Number	Percent of Applicable Responses
A23	Condition of area streets	704	247	35.1	7	1.0	254	36.1
B17	Condition of exterior wall surface	773	289	37.4	13	1.7	302	39.1
B58	Overall state of repair of building's exterior	749	245	32.7	12	1.6	257	34.3
B72:1	Wall surface condition in interior public areas	44	21	47.7	2	4.5	23	52.3
B72:2	Floor condition in interior public areas	44	18	40.9	1	2.3	19	43.2
B74	Overall state of repair of interior public areas	44	23	52.3	0	.0	23	52.3
B87	Condition of building relative to others in area	767	171	22.3	12	1.6	183	23.9

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Excludes unusable responses (indicated by audit codes) and usable responses that disagree about the applicability of a question or the observability or construction status of a characteristic.

reasons appear to be the poor training of observers in answering the question and the difficulty of distinguishing the wall materials.

The 6.2 percent discrepancy rate for number of stories stems mainly from confusion about when to count attics and how to count split levels. All 49 discrepancies are of only one interval (one story), and 48 involve differences between either one and two or two and three stories.

The seven evaluative questions listed in Table 5.3 have rank-ordered responses for which the degree of discrepancy can be measured in intervals: A discrepancy of two or more intervals is more severe than one.* The last column of Table 5.3 shows discrepancy rates of 24 to 52 percent. Most differences are of only one interval; discrepancies of two or more intervals occur in less than 5 percent of the applicable responses. Evaluations of interior public areas are least reproducible (discrepancy rates of 43 to 52 percent, although based on only 44 cases). Exterior building and area evaluations have overall discrepancy rates of 24 to 39 percent, and two-or-more-interval discrepancy rates of 1.0 to 1.7 percent.

It is remotely possible that the validation procedure itself increased discrepancy rates and understated the true reproducibility of SRB data. Building, property, or neighborhood features could have legitimately changed between the original and the validation observation, but such changes were recorded as discrepancies. Differences in observability might also have caused spurious discrepancies.

We investigated the probability that discrepancies might reflect legitimate differences by considering the elapsed time between original and validation observations. Almost two-thirds of the validations were done within two weeks, and three-fourths within three weeks, of the original observation. All but 17 (2 percent) were done within six weeks. It is unlikely that many legitimate differences could have occurred during such short periods.

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*All but one of the questions have four-point scales, for which a three-interval discrepancy is the maximum. Because the maximum occurs so infrequently, we have grouped two- and three-interval discrepancies into one category.

Observability differences could have arisen if the validators and original evaluators had stood at different distances from the building or had had a different number of building sides visible to them. To determine whether such differences influenced discrepancy rates, we compared the responses in records showing the same observability conditions at the original and validation observations. Observability was defined as the same if (a) both original and validation observations were conducted on the property, and (b) the same sides of the building (including the roof) were coded "completely observable."

Table 5.4 presents the results for the descriptive questions. The last column shows the change in the discrepancy rate when observability was controlled. Since the questions in module A referred to the surrounding area, building observability as defined above should have had little effect on module A discrepancy rates. The data confirm that expectation. But only one module B question had a discrepancy rate improvement of over three percentage points, and rates worsened for nearly as many questions as they improved. Those differences are probably due to random errors; it does not appear that observability differences contributed to the discrepancy rates for descriptive questions.

Table 5.5 presents the results for the building-specific evaluative questions. Controlling for observability substantially lowered the discrepancy rates for interior public area ratings (differences of 17.5, 4.1, and 13.2 percentage points, respectively, for B72:1, B72:2, and B74), bringing them more into line with exterior rating discrepancy rates. But for the remaining questions only one rate changed by more than four percentage points.

We conclude that the discrepancy rates reported in Tables 5.2 and 5.3 accurately reflect data reproducibility, except for interior public area evaluations, whose reproducibility may be understated in Table 5.3 because of observability differences between original and validation observations.

The high discrepancy rates for the evaluative questions prompted us to investigate the possibility of improving reproducibility by

Table 5.4

DESCRIPTIVE QUESTION DISCREPANCY RATES WITH BUILDING OBSERVABILITY CONTROLLED

Question	Description	Number of Applicable Responses[a]		Percent of Discrepancies		Difference in Discrepancy Rates (%)
		All Validated Records	Selected Records[b]	All Validated Records	Selected Records[b]	
A1	Additional buildings under construction on property	706	230	.0	.0	.0
A2	Buildings listed on property torn down, condemned, or destroyed	709	230	.3	.0	.3
A3	Unlisted, neighboring buildings may be on property	708	229	.4	.4	.0
A5	Existence of nonresidential, noncommercial, permanent buildings	670	226	2.2	2.2	.0
A13	Definition of area where building is located	701	226	.7	.9	-.2
A14	Type of residential buildings in area	701	226	11.1	8.8	2.3
A22	Largest street type in area	699	228	43.1	42.5	.6
A25:A	Existence of street lighting in area	703	230	.1	.4	-.3
A25:B	Existence of boarded-up or abandoned buildings in area	701	229	.3	.9	-.6
A25:C	Existence of abandoned vehicles in area	701	229	1.0	.9	.1
B1	Building address and description correct on information sheet	819	259	2.3	4.2	-1.9
B2	Building type correct on information sheet	813	260	.9	1.2	-.3
B3	Number of residential units agrees with information sheet	803	258	1.1	1.9	-.8
B6	Building condemned or heavily damaged	814	259	1.0	.8	.2
B7	Occupancy status of building	766	239	2.5	3.4	-.9
B8	Building vacant and under construction, condemned, or heavily damaged	31	8	9.7	.0	9.7
B9	Building type	793	258	2.8	1.9	.9
B15	Number of stories	786	257	6.2	6.4	-.2
B16	Material covering most of exterior wall surface	776	256	14.3	11.3	3.0
B18	Presence of major faults in exterior wall structure	752	256	7.8	7.0	.8
B28	Type of roof construction	788	257	1.8	8.2	-6.4
B41	Presence of garage for residents' use on property	783	258	6.3	6.2	.1
B69	Building type	786	259	2.0	.4	1.6
B70	Existence of interior public areas	274	98	5.8	3.1	2.7
B83	Definition of area where building is located	786	258	4.7	7.0	-2.3
B84	Existence of other residential buildings in area	788	259	2.0	1.9	.1
B85	Size of building relative to others in area	767	253	6.6	7.9	-1.3

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Excludes unusable responses (indicated by audit codes) and usable responses that disagree about the applicability of a question or the observability or construction status of a characteristic.

[b]Records showing the same observability conditions for original and validation observations: both conducted on the property and both recording the same sides of the building "completely observable."

Table 5.5

EVALUATIVE QUESTION DISCREPANCY RATES WITH BUILDING OBSERVABILITY CONTROLLED

Question	Description	Number of Applicable Responses[a]		Percent of Discrepancies: All Validated Records			Percent of Discrepancies: Selected Records[b]			Difference in Discrepancy Rates (%)		
		All Validated Records	Selected Records[b]	1 Interval	2 or 3 Intervals	Total	1 Interval	2 or 3 Intervals	Total	1 Interval	2 or 3 Intervals	Total
B17	Condition of exterior wall surface	773	257	37.4	1.7	39.1	39.3	1.9	41.2	-1.9	-.2	-2.1
B58	Overall state of repair of building's exterior	749	242	32.7	1.6	34.3	34.3	1.2	35.5	-1.6	.4	-1.2
B72:1	Wall surface condition in interior public areas	44	23	47.7	4.5	52.3	30.4	4.3	34.8	17.3	.2	17.5
B72:2	Floor condition in interior public areas	44	23	40.9	2.3	43.2	39.1	.0	39.1	1.8	2.3	4.1
B7[illegible]	Overall state of repair of interior public areas	44	23	52.3	.0	52.3	39.1	.0	39.1	13.2	.0	13.2
B87	Condition of building relative to others in area	767	253	22.3	1.6	23.9	17.4	5.5	22.9	4.9	-3.9	1.0

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Excludes unusable responses (indicated by audit codes) and usable responses that disagree about the applicability of a question or the observability or construction status of a characteristic.

[b]Records showing the same observability conditions for original and validation observations: both conducted on the property and both recording the same sides of the building "completely observable."

aggregating rating categories. Table 5.6 reports the results. The nonaggregated discrepancy rates duplicate those in Table 5.3.* Aggregating the categories to a three-point scale reduces discrepancy rates by 5 to 16 percentage points, but they still remain high. Aggregating to a two-point scale reduces the discrepancy rates considerably, but they still remain higher than those for descriptive questions. The price of steadily reducing the discrepancy rate by aggregating categories is a weakening of the discriminating power of the data.

Appendix E presents statistical models that allow inferences to be drawn about the reliability of SRB rating comparisons. Analysts comparing means for groups of more than 100 buildings (e.g., for the panel strata) will be able to detect differences as small as .07 for exterior building characteristics. Differences in ratings of interior public areas will have to range from .2 to 1.0 to be statistically significant. Exact significance levels for actual comparisons can be computed by means of the standard t-test.

In comparisons of individual ratings, two-interval differences are highly significant. One-interval differences are not significantly different from 0, using the standard t-test at the 95 percent confidence level. For four of the five evaluative questions examined, one-interval differences become significant between the 80 and 90 percent confidence levels. A test recommended by many statisticians, however, results in their being significant for all five questions. Analysts should consult the test statistics reported in Appendix E, consider what degree of confidence they require, and then decide whether to accept one-interval differences when comparing individual ratings.

EFFECTS OF FIELD PROCEDURES ON DATA QUALITY

Because the SRB required numerous subjective evaluations of condition and quality, we thoroughly reviewed field procedures and observer performance for evidence of anomalies that might have lowered data

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*B87 is omitted because it is already reduced to a three-point scale and it does not represent a significant group of nonvalidated questions.

Table 5.6

EVALUATIVE QUESTION DISCREPANCY RATES WITH RATING CATEGORIES AGGREGATED

Question	Description	Number of Applicable Responses[a]	Discrepancy Rate (Percent of Applicable Responses): Not Aggregated			Aggregated: 3-point Scale[b]			Aggregated: 2-point Scale[c]
			1 Interval	2 or 3 Intervals	Total	1 Interval	2 or 3 Intervals	Total	
A23	Area street maintenance	704	35.4	1.0	36.1	31.2	.0	31.2	5.8
B17	Condition of exterior wall surface	773	37.4	1.7	39.1	29.4	.1	29.5	11.3
B58	Overall state of repair of building's exterior	749	32.7	1.6	34.3	20.8	.0	20.8	15.1
B72:1	Wall surface condition in interior public areas	44	47.7	4.5	52.3	40.9	2.3	43.2	13.6
B72:2	Floor condition in interior public areas	44	40.9	2.3	43.2	36.4	.0	36.4	9.1
B74	Overall state of repair of interior public areas	44	52.3	.0	52.3	36.4	.0	36.4	15.9

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.

[a] Excludes unusable responses (indicated by audit codes) and usable responses that disagree about the applicability of a question or the observability or construction status of a characteristic.

[b] Responses were recoded from a 4- to a 3-point scale as follows: Codes 1 ("very good") and 4 ("major defects") remained the same, and codes 2 ("reasonable wear and tear") and 3 ("minor defects") were combined.

[c] Responses were recoded from a 4- to a 2-point scale as follows: Codes 1 and 2 were combined, and codes 3 and 4 were combined.

quality. We found one such anomaly in reviewing validation procedures but are unsure of its implications for data quality.

Besides validating the 20 percent random sample of SRB observations, Westat was required to validate any questionnaire having editing problems or missing data for certain "callback" questions.* Validation data were to be copied onto the original questionnaire only (a) to supply missing data for callback questions, and (b) to replace problematic responses to questions repeated on the validation questionnaire. When validation data were so copied, they were replaced by an "E" (-4) audit code in the validation report.

After the transfer of validation data to the original questionnaire, the remaining validation and original data were compared to assess the overall reliability of the original data. If field editors found few discrepancies, and none in the callback questions, the validation report was designated complete. If they found a moderate number of discrepancies, but none in callback questions, they were to designate the validation report a problem validation and cite the reasons. Finally, if they found discrepancies in any callback questions or in a large portion of the other questions, they were to declare both the original and validation questionnaires invalid and readminister the observation for that building.

As a result of a misunderstanding, those procedures were not followed and invalid observations were generally not readministered. Instead, an especially knowledgeable third person was brought in to resolve discrepancies between original and validation data--for both invalid and problem designations.** Thus, Westat probably degraded

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*Questions critical to analyzing the sampled buildings and for which Westat was required to provide answers by going back and resurveying if necessary.

**During auditing, before we compared the original and validation data, we examined original and validation questionnaires, determined whether data had been changed to agree during the resolution of discrepancies, and if necessary changed the data back to the original responses. We thus avoided reporting artificially high reproducibility rates.

data quality by neglecting to readminister observations originally declared invalid.* Furthermore, because the third observer also converted problem validations to nonproblem validations, there is no documentation of the reason for the problem designation. The discussion of validation comparisons above examines the reproducibility of responses as thoroughly as is possible given the data available, but we can only speculate about the quality of nonvalidated responses on questionnaires originally declared invalid.

CONCLUSIONS

Data cleaning and auditing purged the SRB file of clearly erroneous responses, replacing them where possible with accurate, usable data and inserting audit codes when correct data were not found. Implausible or inconsistent responses** were identified in a separate suspect data file for reference by researchers who might wish to exclude such responses from their analyses.

With the few exceptions noted above, data changes and suspect responses appeared evenly distributed across record segments and response fields, affirming the high quality of the data. Only in the reproducibility of individual survey responses--examined by comparing original and validation data and reviewing validation procedures--did we find evidence of data unreliability. Responses to descriptive questions were highly reproducible; responses to evaluative questions were much less so. In the latter group, discrepancies of one or more rating intervals occurred in a maximum 52 percent of the validated cases.

Statistical analysis of the evaluative question discrepancies revealed that differences between sample means, computed with at least 100 observations, would be statistically significant at the 95 percent confidence level. We believe that distributional parameters computed

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*If discrepancies in the *validated questions* were substantial enough to cause the validation to be designated problematic or invalid, we can assume that discrepancies in the questions *not repeated in the validation report* were equally serious.

**If two or more responses to questions clearly contradicted each other, we did not change them but flagged them all as suspect.

from unrecoded responses to the evaluative questions are of sufficient statistical significance to be used in most analyses of SRB data. But in comparisons of the ratings of two buildings or of the same building over time, only differences of more than one rating interval should be considered significant using the standard t-test at the 95 percent confidence level.

VI. CONCLUSIONS

We undertook the SRB audit to assess the quality and completeness of the survey data and to determine how they might affect the reliability of future analytical findings. In the process, we accounted for sample elements and examined the incidence of nonresponse. We assessed the potential for nonresponse bias, and the extent to which such bias was diminished or exacerbated by analysis weights. Searching for evidence of unreliable data, we reviewed data cleaning results and performed additional plausibility and consistency checks. We scrutinized field procedures and variations in observer proficiency for anomalies that might have produced response errors too subtle for detection by data cleaning and audit checks.

Triggering requirements reduced sample completion rates to 0.57 for properties and 0.59 for buildings, and buildings whose observations were not triggered differed from those surveyed by fieldworkers. As a result, we found substantial intrastratum nonresponse bias among the unweighted survey observations. Compensatory record weighting reduced much of the known intrastratum bias, but some remains in several sampling strata. Two small strata of specialized housing are clearly misrepresented by the sample of usable records.

In strata 6 (urban medium-rent properties with 5+ units) and 8 (urban high-rent properties with 2-4 units), weighted survey observations overrepresent properties with larger numbers of buildings and units. But in stratum 6, such properties have lower total assessed values for improvements and lower assessed values per unit, whereas in stratum 8 the overrepresented properties have higher assessed values. In stratum 17, rooming house properties, the sample is so small (three properties; two analysis-complete, one incomplete) that we are unable to draw clear inferences about differences between the two surveyed properties and the population they are intended to represent. In stratum 18, weighted survey observations overrepresent newer, larger mobile home properties, with higher total assessed values of land and improvements but lower average assessed values per unit. There also we must be cautious about drawing inferences about the significance of differences between the 13 analysis-complete properties and the total of 20 properties in the sampling stratum.

In examining nonresponse to the evaluation of interior public areas, we found a slight intrastratum bias in multiunit urban rental strata (the only strata in which such nonresponse occurred). The information provided in Sec. IV and Appendix C enables analysts to avoid drawing unfounded conclusions from those data. However, record-level nonresponse, when combined with nonresponse to the observation of interior public areas (particularly among urban rental properties of 5+ units, having small analysis-complete samples), may decrease the reliability of, and perhaps bias, estimates of interior public area characteristics.

A review of the indicators of data quality disclosed that responses to descriptive questions were highly reliable but that responses to evaluative questions were imprecise and hence substantially less reliable. The distributional parameters for evaluative questions are highly reliable when computed on the basis of more than 100 observations, but only differences of more than one interval between pairs of ratings are significant at the 95 percent confidence level (computed using the t-statistic). Many applied statisticians contend that differences between pairs of ratings that equal or exceed one standard deviation (computed using all observations for which the rating is applicable) are of practical significance. Applying that rule of thumb, differences of one interval or less between pairs of ratings would be of practical significance for most of our rating variables.

Though less reliable than the responses to the descriptive questions, the evaluative question data are usable in the housing market analyses for which they were sought. Guided by the information and cautions presented in this note, researchers should be able to draw accurate inferences about the characteristics of St. Joseph County's residential buildings, the properties on which they stand, and their neighborhoods.

Appendix A

CONSTRUCTION OF COMPOSITE QUALITY AND CONDITION RATINGS

As described in Sec. I and depicted in the figure, the baseline SRB for St. Joseph County used a number of evaluative question grids for rating various property and building characteristics. (Table A.1 lists the characteristics.) This appendix describes the procedure we followed to collapse the four to eight possible responses to an evaluative question grid into a single composite rating for use in analysis.

The simplified example below shows the response portion of a typical evaluative question grid:

Question X	All	Most	Some	None
A. Very good	4	3	2	1
B. Reasonable wear and tear	4	3	2	1
C. Minor defects	4	3	2	1
D. Major defects	4	3	2	1
E. Definitely not present	4	3	2	1
F. Not sure whether present	4	3	2	1
G. Present, cannot evaluate condition	4	3	2	1
H. Construction, renovation, repair work under way	4	3	2	1

We call parts A through D *rating categories*. *Nonrating categories* are any additional parts that appear in the question (here, E through H).* *Response* is defined as the code circled by an observer next to any category. Each category has possible responses of 1, 2, 3, 4, or an audit code--a negative number indicating missing or problem data.** The grid *response pattern* is the number of times each response occurs in rating categories.

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*Certain nonrating categories were converted to rating categories, as described below.

**A response of 7 is also possible for all categories in some grids. It indicates that the characteristic was not observable because of snow. We treat such responses as negative responses--they provide no useful data for composite rating construction.

Table A.1

TOPICS OF EVALUATIVE QUESTION GRIDS

Topic	Question
Property or Surrounding Area Characteristics	
Condition of outbuildings on property	A8
Landscaping of area buildings	A16
Yard maintenance of area buildings	A17
Area street maintenance	A23
Building Characteristics	
Condition of exterior walls	B17
Condition of permanent windows	B22
Condition of storm windows	B23
Condition of screen windows	B24
Condition of permanent doors	B25
Condition of storm doors	B26
Condition of screen doors	B27
Condition of roof surface	B30
Condition of gutters and downspouts	B32
Condition of chimneys, flues, and vents	B33
Cleanliness of uncovered and unenclosed porches	B36
Condition of unenclosed porches	B37
Condition of balconies	B39
Condition of sidewalks and paved walkways	B56
Condition of exterior stairways or steps	B57
Building's Interior Public Area Characteristics	
Condition of walls	B72:1
Condition of floors	B72:2
Condition of doors	B72:3
Condition of windows and skylights	B72:4
Condition of ceilings	B72:5
Condition of lighting fixtures	B72:6
Condition of stairways	B72:7
Condition of banisters	B72:8
Condition of elevator	B72:9
Condition of mailboxes	B72:0
Validated Questions	
Area street maintenance	VLA8
Condition of exterior walls	VLB11
Condition of walls in interior public areas	VLB19:1
Condition of floors in interior public areas	VLB19:2

SOURCE: Compiled from the survey of residential buildings, Site II, baseline.

The responses correspond to the following percentages or percentage ranges of the characteristic being rated:

Response	Code	Percentage
All	4	100
Most	3	51-99
Some	2	1-50
None	1	0

Because the responses to all categories for a question must account for 100 percent, only certain response patterns are legitimate. If the response to one category is "all," the responses to all other categories must be "none." Only one category can have a response of "most," and if so at least one other category must have a response of "some." If no category has an "all" or "most" response, at least two must have "some" responses.

In principle, the construction of a composite rating is simple. Each rating category is assigned a numeric equivalent. Those numbers replace the rating categories and become the ratings for each category. In each question grid, the rating categories are assigned weights based on the proportion of the characteristic that is rated in each category. A category's weight is determined by both its response and the question's response pattern. Each rating category's numeric equivalent is then multiplied by its weight. Summing those products over all rating categories yields the question's composite rating.

After long experimentation with alternative rating assignment and weighting schemes, we arrived at the procedure described below. The first problem was to assign values to the four rating categories: (a) very good, (b) reasonable wear and tear, (c) minor defects, and (d) major defects. Although the categories are rank-ordered, we have no prior information about the distance between any two adjacent categories. Rank-ordered, ordinal data can usually be treated as if they were cardinal by assigning numbers to the categories. Sanford Labovitz has written:

> Treating ordinal data (which *may or may not* be approximately interval) as interval data by arbitrarily assigning numbers to the ordinal categories can be both

> legitimate and useful. If there is a rationale for indicating that the data approximate an interval scale, then the proof . . . is even stronger, because some selection can be made on the assignment of numbers. However, . . . arbitrary assignment, *which is consistent with the rank order,* rarely alters the results of statistical analysis to an appreciable degree.*

Unless the data are dichotomous, a linear interval system best approximates the true (unknown) system. Additional work by Labovitz bears out that conclusion,** so we chose a linear system and assigned values of 1 (for the best condition) to 4 (for the worst). That scheme is also the one used in the survey instrument for Brown County.

Choosing the weighting scheme for the rating categories was more difficult. Two weights are decided automatically by response definitions: Any category with a response of "all" is given a weight of 1, and any with a response of "none" is given a weight of 0.

Responses of "most" correspond to 51 through 99 percent of the characteristic. No single weight can represent the whole range. Lacking any prior information about the density function, we chose to use the midpoint of the range (75 percent). Responses of "some" correspond to 1 through 50 percent; any number of categories could have such responses. In the case of multiple responses, we have no way of knowing how the total proportion represented by the "some" responses is divided among them. We assume it is distributed evenly, so the proportion for each individual response equals the total proportion divided by the number of "some" responses.

If no rating category in a question has a "most" response, the "some" responses account for 100 percent of the characteristic. In that case, the weight for any category with a "some" response equals 1.00, divided by the number of rating categories with such responses. If one rating category has a "most" response, the "some" responses account for only 25 percent of the characteristic. In that case, the

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*"Some Observations on Measurement and Statistics," *Social Forces,* Vol. 46, No. 2, December 1967, pp. 151-160.

**"The Assignment of Numbers to Rank Order Categories," *American Sociological Review*, Vol. 35, 1970, pp. 515-524.

weight for any category with a "some" response equals .25, divided by the number of rating categories with such responses.

Note that the weighting rules defined above ignore nonrating categories; responses to them do not contribute to the composite ratings. In order to construct ratings for as many records as possible, we used the information available to convert some nonrating categories to rating categories.

In all but one case we assumed that items under construction would be, when completed, in the best rating category. Thus we equated "under construction" with the rating category "very good" and assigned it a value of 1. The exception was landscaping of surrounding buildings (A16); we reasoned that construction would lead to average landscaping and assigned a value of 2 to the "landscaping work underway" category.

We judged the absence of certain items to be a major defect. Hence for questions B23, B24, B26, B27, B32, B72:6, and B72:9, the category "not present" was equated with "major defects" and assigned a value of 4.*

A dummy variable was constructed to indicate whether the composite rating included evaluation data for all of the characteristic. It is signified by the addition of the prefix PCT to the variable number, e.g., the dummy variable corresponding to the first rating variable is PCTA8. The dummy variable was assigned the value 1 if 100 percent of the characteristic fell into rating categories that could be given numeric values, and 0 otherwise. Thus, if the PCT variable corresponding to a composite rating was 1, that rating was constructed with rating data for the entire characteristic (e.g., all of the wall surface, all windows).

The procedure described above resulted in composite ratings that are continuous in the range of 1 through 4. The composite rating

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*There were qualifications. Absence of the following was considered a major defect only under the conditions specified: storm windows and doors (B23 and B26), only if the evaluation was done before May 16 or after October 14; screen windows and doors (B24 and B27), only if the evaluation was done between May 16 and October 14; elevators (B72:9), only if the building had more than three floors.

variables are signified by a prefix RTG before the variable number, e.g., the first one is RTGA8.* To produce composite ratings comparable to those for Site I baseline, we converted the continuous ratings to four rating categories as follows:

Let $RTGX$ = the continuous composite rating variable.

Then if $1.0 \leq RTGX \leq 1.5$, $X = 1$,

if $1.5 < RTGX \leq 2.5$, $X = 2$,

if $2.5 < RTGX \leq 3.5$, $X = 3$,

and if $3.5 < RTGX \leq 4.0$, $X = 4$.

The converted composite rating variable was the one used throughout the audit report. It is signified by the grid variable to which it corresponds. For example, the first one is A8.

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*The exceptions are the variables corresponding to VLB19:1 and VLB19:2, which are called RTVB19:1 and RTVB19:2.

Appendix B

COMPUTATION OF RECORD WEIGHTS AND COMPARISON OF WEIGHTED TABULATIONS WITH CONTROL TOTALS

Because the SRB did not cover all residential properties and buildings in St. Joseph County, we developed record weights to enable us to extrapolate the survey findings to the total populations of properties and buildings in the county.

The type of weight assigned to survey observations depends on the sample selection procedure. If a truly random sample of items is selected, all observations should be assigned equal weights that are equal to the inverse of the *effective sampling rate*.* For example, given a 10 percent random sample, all observations should be assigned weights of 10. If we separate the population into two or more groups that are randomly sampled at different rates, we must weight the observations according to the sampling rates in their respective groups, or *strata*. If, for example, the population of residential properties is divided into urban and rural groups, and 10 percent of the former and 50 percent of the latter are sampled, the weights for survey observations will equal 10 for urban properties and 2 for rural properties.

The weighting of observations may be more complex when the samples are not selected entirely randomly, like the buildings and units on our sample of residential properties.** Even then, however, weights are usually computed as though the selection were completely random.

Continuing with our example of urban and rural properties, let us assume total populations of 200 urban properties and 40 rural properties (yielding samples of 20 urban and 20 rural properties). Further assume that each urban property has a garage that accommodates two cars, whereas all rural properties have single-car garages. To compute the

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*The ratio of the number of sampled items successfully surveyed to the total number of items in the population.

**Although properties were randomly selected within sampling strata, many contained clusters of buildings and units.

average car capacity of garages for the county, we would perform the following computation:

$$((2 \times 20 \times 10) + (1 \times 20 \times 2))/((20 \times 10) + (20 \times 2))$$
$$= ((2 \times 200) + (1 \times 40))/(200 + 40)$$
$$= (400 + 40)/240$$
$$= 440/240$$
$$= 1.833.$$

Observations would be similarly weighted in a cross-tabulation. Although simplified, this example illustrates the principle behind our weighting of observations.

COMPUTATION OF SRB WEIGHTS

We used the following formula to compute PARWGT, the SRB property weight:

> If no analysis-complete record exists for the property, PARWGT = 0.
>
> If one or more analysis-complete records exist for the property, PARWGT = SAMPWGT2 × (number of properties in PS (panel stratum), CITY (South Bend, Mishawaka, rest of county), SUBSIDY (subsidized or not) classification/number of properties in classification with at least one analysis-complete record).*

We overrode this formula and set PARWGT = 1 for multiunit (coop or condominium) ownership properties.

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*Exact sampling history weights, as the name implies, reflect the probability of a property's being selected for the survey sample; the lower that probability, the larger the weight. At each sample selection stage we restratified properties whose tenure or subsidy status had changed, so the exact sampling history weights of properties within the same panel stratum may vary dramatically. See Relles, *Selecting the Baseline Sample of Residential Properties: Site II*, p. 82, and Corcoran, *Selecting the Permanent Panel for Residential Properties: Site II*, p. 30, for summaries of restratification at critical sample selection stages.

But the use of exact sampling history weights frequently distorts analytical results, so a technique called *smoothing* is often applied

We computed two alternative preliminary building weights. The first, BWGT1, was computed by weighting the analysis-complete observations of buildings on a property to represent all the buildings on that property, and then multiplying that weight by PARWGT:

BWGT1 = PARWGT × (number of buildings on property/number of analysis-complete records for property).

BWGT2 was computed by estimating the number of buildings in a panel stratum-city-subsidy combination and dividing the estimate by the number of analysis-complete records in the combination.

BWGT2 = (estimated number of buildings in the combination/ number of analysis-complete records in the combination).

For each of the 108 substrata, we chose the weighting scheme that minimized nonresponse bias. Thus, we set BLDGWGT to 0 if the record was analysis-incomplete; equal to BWGT2 if the parcel was unsubsidized, had fewer than five units, and was not a multiunit ownership property; and equal to BWGT1 otherwise. The exception is the combination containing subsidized South Bend properties in stratum 3, where we set BLDGWGT = BWGT2.

COMPARISON OF ANALYSIS-WEIGHTED TABULATIONS WITH CONTROL TOTALS

Tables B.1 to B.7 compare the distributional parameters for selected variables computed with SRB property and building weights with their authoritative counterparts computed with sampling history weights. These tabulations supplement those presented in Sec. III.

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to the weights of properties to produce more reliable results. Smoothing consists of summing the sampling history weights of all the properties within a sampling stratum or substratum. That sum is then divided by the number of properties in the stratum or substratum, and each property is assigned an equal *smoothed sampling history weight*, here designated SAMPWGT2.

Table B.1

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: NUMBER OF BUILDINGS ON PROPERTY

Panel Stratum		Number of Buildings on Property					
		Unweighted Sample			Weighted Sample		
Number	Property Description	Analysis-Complete Sample Mean	Baseline Sample Mean	Ratio	Analysis-Complete Sample Sum	Estimated Total Population	Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	1.00	1.00	1.00	1,142	1,142	1.00
4	Middle tercile	1.00	1.00	1.00	1,917	1,917	1.00
	Upper tercile	1.00	1.00	1.00	2,732	2,732	1.00
	2-4 units:						
2	Lower tercile	1.09	1.09	1.00	1,597	1,608	1.01
5	Middle tercile	1.14	1.13	1.00	1,179	1,164	.99
8	Upper tercile	1.21	1.21	1.01	613	623	1.02
	5+ units:						
3	Lower tercile	3.63	3.25	1.12	337	336	1.00
6	Middle tercile	5.91	4.78	1.24	289	328	1.14
9	Upper tercile	6.66	6.65	1.00	247	236	.96
	Rural Rental						
10	Lower and middle terciles	1.42	1.29	1.10	582	618	1.06
11	Upper tercile	1.04	1.03	1.01	288	289	1.01
	Urban Owner						
12	Lower quartile	2.20	1.55	1.41	10,879	10,829	1.00
13	Second quartile	1.27	1.15	1.10	13,592	13,588	1.00
14	Third and upper quartiles	1.01	1.01	1.00	25,665	25,664	1.00
	Rural Owner						
15	Lower and second quartiles	1.01	1.04	.97	2,083	2,056	.99
16	Third and upper quartiles	1.00	1.01	.99	4,052	4,050	1.00
	Specialized Housing						
17	Rooming houses	1.00	1.00	1.00	5	5	1.00
18	Mobile homes	99.31	92.80	1.07	1,856	1,980	1.07
Total		1.92	1.70	1.13	69,056	69,165	1.00

Table B.2

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: NUMBER OF UNITS ON PROPERTY

Panel Stratum: Number	Panel Stratum: Property Description	Unweighted Sample: Analysis-Complete Sample Mean	Unweighted Sample: Baseline Sample Mean	Unweighted Sample: Ratio	Weighted Sample: Analysis-Complete Sample Sum	Weighted Sample: Estimated Total Population	Weighted Sample: Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	1.00	1.00	1.00	1,142	1,142	1.00
4	Middle tercile	1.00	1.00	1.00	1,917	1,917	1.00
7	Upper tercile	1.00	1.00	1.00	2,732	2,732	1.00
	2-4 units:						
2	Lower tercile	2.53	2.54	.99	3,667	3,673	1.00
5	Middle tercile	2.34	2.30	1.02	2,402	2,429	1.01
8	Upper tercile	2.20	2.18	1.01	895	910	1.02
	5+ units:						
3	Lower tercile	23.23	20.54	1.13	2,092	2,146	1.03
6	Middle tercile	44.07	35.43	1.24	2,097	2,298	1.10
9	Upper tercile	76.53	75.89	1.01	2,813	2,708	.96
	Rural Rental						
10	Lower and middle terciles	1.82	1.63	1.11	697	751	1.08
11	Upper tercile	1.09	1.08	1.01	295	296	1.00
	Urban Owner						
12	Lower quartile	4.11	2.47	1.67	11,266	11,132	.99
13	Second quartile	3.16	2.20	1.43	13,961	13,954	1.00
14	Third and upper quartiles	1.01	1.03	.98	25,669	25,664	1.00
	Rural Owner						
15	Lower and second quartiles	1.01	1.04	.97	2,083	2,056	.99
16	Third and upper quartiles	1.00	1.01	.99	4,052	4,050	1.00
	Specialized Housing						
17	Rooming houses	6.50	7.67	.85	34	29	.85
18	Mobile homes	99.31	92.80	1.07	1,856	1,980	1.07
Total		4.78	3.61	1.32	79,670	79,866	1.00

Table B.3

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: AVERAGE ASSESSED VALUE PER UNIT

Panel Stratum		Average Assessed Value per Unit ($)					
		Unweighted Sample			Weighted Sample		
Number	Property Description	Analysis-Complete Sample Mean	Baseline Sample Mean	Ratio	Analysis-Complete Sample Sum	Estimated Total Population	Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	1,786.57	1,952.97	.91	2,612,411	2,262,321	.87
4	Middle tercile	2,201.88	2,141.36	1.03	4,405,363	4,513,234	1.02
7	Upper tercile	2,270.48	2,339.07	.97	7,091,863	6,834,168	.96
	2-4 units:						
2	Lower tercile	1,206.11	1,245.65	.97	1,786,826	1,786,124	1.00
5	Middle tercile	1,431.69	1,455.48	.98	1,487,184	1,432,861	.96
8	Upper tercile	2,003.03	2,044.75	.98	1,224,704	1,349,854	1.10
	5+ units:						
3	Lower tercile	1,151.49	1,096.51	1.05	111,592	113,008	1.01
6	Middle tercile	1,358.21	2,274.33	.60	134,561	85,290	.63
9	Upper tercile	2,523.26	2,383.31	1.06	86,263	88,000	1.02
	Rural Rental						
10	Lower and middle terciles	2,447.40	2,610.43	.94	1,290,802	1,204,896	.93
11	Upper tercile	4,058.60	4,308.92	.94	1,221,523	1,134,596	.93
	Urban Owner						
12	Lower quartile	1,729.01	1,682.96	1.03	18,143,582	18,460,945	1.02
13	Second quartile	2,654.77	2,640.23	1.01	36,298,738	36,137,676	1.00
14	Third and upper quartiles	5,284.52	5,460.88	.97	139,043,187	133,618,625	.96
	Rural Owner						
15	Lower and second quartiles	2,306.06	2,247.69	1.03	4,706,711	4,788,648	1.02
16	Third and upper quartiles	5,230.16	5,066.00	1.03	21,220,957	21,466,676	1.01
	Specialized Housing						
17	Rooming houses	197.00	616.33	.32	2,203	598	.27
18	Mobile homes	502.08	613.30	.82	13,966	12,371	.89
Total		2,187.02	2,306.05	.95	240,882,752	235,290,288	.98

Table B.4

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: ASSESSED VALUE OF LAND

Panel Stratum: Number	Panel Stratum: Property Description	Assessed Value of Land ($): Unweighted Sample: Analysis-Complete Sample Mean	Unweighted Sample: Baseline Sample Mean	Unweighted Sample: Ratio	Weighted Sample: Analysis-Complete Sample Sum	Weighted Sample: Estimated Total Population	Weighted Sample: Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	452.85	474.02	.96	585,293	591,850	1.01
4	Middle tercile	419.37	431.93	.97	797,894	769,743	.96
7	Upper tercile	431.22	490.68	.88	1,638,542	1,328,365	.81
	2-4 units:						
2	Lower tercile	568.90	575.96	.99	850,099	842,982	.99
5	Middle tercile	519.79	521.28	1.00	545,155	534,108	.98
8	Upper tercile	799.10	831.11	.96	501,551	552,393	1.10
	5+ units:						
3	Lower tercile	3,663.29	3,205.96	1.14	323,030	339,207	1.05
6	Middle tercile	6,637.95	6,062.07	1.09	354,884	355,685	1.00
9	Upper tercile	10,762.19	10,035.40	1.07	371,254	381,870	1.03
	Rural Rental						
10	Lower and middle terciles	2,344.52	2,428.82	.97	1,154,200	1,068,191	.93
11	Upper tercile	3,699.71	4,140.89	.89	1,184,714	1,035,997	.87
	Urban Owner						
12	Lower quartile	1,198.31	708.28	1.69	3,223,525	3,275,184	1.02
13	Second quartile	708.04	587.68	1.20	5,753,609	5,567,238	.97
14	Third and upper quartiles	804.34	839.52	.96	20,552,137	20,076,562	.98
	Rural Owner						
15	Lower and second quartiles	642.44	585.89	1.10	1,309,215	1,380,281	1.05
16	Third and upper quartiles	2,602.33	2,068.95	1.26	8,067,852	9,372,980	1.16
	Specialized Housing						
17	Rooming houses	210.00	870.00	.24	3,123	646	.21
18	Mobile homes	14,986.92	11,760.50	1.27	241,358	303,247	1.26
Total		1,248.53	1,116.59	1.12	47,457,424	47,776,496	1.01

Table B.5

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: ASSESSED VALUE OF IMPROVEMENTS

Panel Stratum		Assessed Value of Improvements ($)					
		Unweighted Sample			Weighted Sample		
Number	Property Description	Analysis-Complete Sample Mean	Baseline Sample Mean	Ratio	Analysis-Complete Sample Sum	Estimated Total Population	Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	1,407.66	1,566.33	.90	2,143,099	1,767,852	.82
4	Middle tercile	1,809.81	1,739.67	1.04	3,655,509	3,775,285	1.03
7	Upper tercile	1,860.37	1,939.43	.96	5,977,781	5,620,543	.94
	2-4 units:						
2	Lower tercile	2,428.71	2,589.66	.94	3,570,628	3,522,542	.99
5	Middle tercile	2,762.38	2,761.98	1.00	2,892,616	2,828,862	.98
8	Upper tercile	3,684.24	3,740.14	.99	2,208,393	2,445,346	1.11
	5+ units:						
3	Lower tercile	37,992.56	32,439.09	1.17	3,211,874	3,235,771	1.01
6	Middle tercile	60,726.82	58,498.62	1.04	3,432,218	2,989,248	.87
9	Upper tercile	17,242.56	162,366.56	1.09	6,007,719	6,215,844	1.03
	Rural Rental						
10	Lower and middle terciles	2,664.06	2,575.07	1.03	1,185,469	1,196,374	1.01
11	Upper tercile	3,091.16	3,340.24	.93	927,091	843,581	.91
	Urban Owner						
12	Lower quartile	5,575.06	3,340.90	1.67	15,781,258	15,982,355	1.01
13	Second quartile	7,469.10	5,129.82	1.46	31,691,383	31,698,395	1.00
14	Third and upper quartiles	4,582.89	5,164.15	.89	120,242,250	114,955,250	.96
	Rural Owner						
15	Lower and second quartiles	1,799.22	1,793.60	1.00	3,671,928	3,689,521	1.00
16	Third and upper quartiles	4,225.16	4,112.90	1.03	17,296,234	17,498,156	1.01
	Specialized Housing						
17	Rooming houses	1,315.00	5,060.00	.26	17,939	3,761	.21
18	Mobile homes	9,044.61	7,401.00	1.22	152,031	183,298	1.21
Total		7,500.50	5,677.25	1.32	224,065,840	218,452,144	.97

Table B.6

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: AGE OF MAIN BUILDING

Panel Stratum: Number	Panel Stratum: Property Description	Age of Main Building (yr): Unweighted Sample: Analysis-Complete Sample Mean	Unweighted Sample: Baseline Sample Mean	Unweighted Sample: Ratio	Weighted Sample: Analysis-Complete Sample Sum	Weighted Sample: Estimated Total Population	Weighted Sample: Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	55.24	53.52	1.03	53,293	56,215	1.05
4	Middle tercile	53.89	53.46	1.01	98,565	100,469	1.02
7	Upper tercile	52.05	52.96	.98	135,292	136,940	1.01
	2-4 units:						
2	Lower tercile	72.31	70.13	1.03	99,979	100,203	1.00
5	Middle tercile	66.66	65.89	1.01	68,184	68,371	1.00
8	Upper tercile	58.43	57.25	1.02	19,390	19,586	1.01
	5+ units:						
3	Lower tercile	62.51	63.85	.98	6,594	6,451	.98
6	Middle tercile	49.59	49.84	1.00	2,844	2,912	1.02
9	Upper tercile	22.88	23.37	.98	741	772	1.04
	Rural Rental						
10	Lower and middle terciles	48.80	48.59	1.00	22,493	22,362	.99
11	Upper tercile	55.26	51.48	1.07	14,028	14,993	.99
	Urban Owner						
12	Lower quartile	59.36	57.71	1.03	640,716	640,506	1.07
13	Second quartile	41.61	42.16	.99	560,238	556,081	1.00
14	Third and upper quartiles	24.41	25.41	.96	586,415	578,289	.99
	Rural Owner						
15	Lower and second quartiles	48.68	47.49	1.03	97,262	96,487	.99
16	Third and upper quartiles	31.67	32.07	.99	119,458	125,650	1.05
	Specialized Housing						
17	Rooming houses	67.00	57.50	1.17	124	88	.71
18	Mobile homes	15.75	29.57	.53	209	104	.50
	Total	54.50	53.23	1.02	2,525,822	2,526,474	1.00

Table B.7

SAMPLE MEANS AND SUMS FOR CALCULATING NONRESPONSE BIAS IN THE ANALYSIS-COMPLETE FILE: NUMBER OF UNITS IN BUILDING

Panel Stratum: Number	Panel Stratum: Property Description	Number of Units in Building — Unweighted Sample: Analysis-Complete Sample Mean	Unweighted Sample: Baseline Sample Mean	Unweighted Sample: Ratio	Weighted Sample: Analysis-Complete Sample Sum	Weighted Sample: Estimated Total Population	Weighted Sample: Ratio
	Urban Rental						
	Single-family:						
1	Lower tercile	1.00	1.00	1.00	1,142	1,142	1.00
4	Middle tercile	1.00	1.00	1.00	1,917	1,859	.97
7	Upper tercile	1.00	1.00	1.00	2,732	2,732	1.00
	2-4 units:						
2	Lower tercile	2.14	2.28	1.02	3,670	3,665	1.00
5	Middle tercile	1.94	2.02	1.03	2,417	2,402	.99
8	Upper tercile	1.75	1.81	1.02	895	912	1.02
	5+ units:						
3	Lower tercile	4.93	8.57	1.08	4,187	2,649	.63
6	Middle tercile	6.16	8.84	1.05	2,323	2,520	1.08
9	Upper tercile	8.15	13.11	1.11	2,964	2,806	.95
	Rural Rental						
10	Lower and middle terciles	1.21	1.26	1.03	710	641	.90
11	Upper tercile	1.02	1.03	1.01	295	295	1.00
	Urban Owner						
12	Lower quartile	1.04	1.26	1.18	11,277	11,180	.99
13	Second quartile	.99	1.38	1.21	13,987	13,952	1.00
14	Third and upper quartiles	1.03	1.01	.99	25,660	25,664	1.00
	Rural Owner						
15	Lower and second quartiles	.99	1.00	1.00	2,083	2,056	.99
16	Third and upper quartiles	.99	.99	1.01	4,052	4,050	1.00
	Specialized Housing						
17	Rooming houses	10.00	7.67	.85	34	29	.85
18	Mobile homes	1.00	1.00	1.00	1,856	2,041	1.10
	Total	1.44	2.18	1.22	82,202	80,593	.98

Appendix C

POTENTIAL NONRESPONSE BIAS IN EVALUATIONS OF THE INTERIOR PUBLIC AREAS OF APARTMENT BUILDINGS

This appendix presents tabulations of the differences between apartment buildings whose interior public areas were accessible to SRB observers and those whose interior areas were inaccessible. As discussed in Sec. IV, those differences appear to indicate a possible nonresponse bias in the responses to questions evaluating interior public areas. Interior public areas were inaccessible only in multi-unit urban rental strata, so the tables include only those strata.

Table C.1

FREQUENCY DISTRIBUTION OF BUILDING AND PROPERTY CHARACTERISTICS BY PANEL STRATUM AND COMPLETENESS OF INTERIOR PUBLIC AREA OBSERVATION

Urban Rental Multiunit Property Strata		Type of Building			Surrounding Area			
Stratum Number	Property Description and Observation Status	Completely Residential	Mixed Residential-Commercial	Percent Subsidized	Urban Blocked	Urban Unblocked	Apartment Complex	Percent with Resident Landlords
	2-4 Units							
2	Lower tercile:							
	Complete	71.4	28.6	.0	92.9	7.1	.0	7.1
	Incomplete	60.0	40.0	.0	100.0	.0	.0	40.0
5	Middle tercile:							
	Complete	92.3	7.7	.0	100.0	.0	.0	15.4
	Incomplete	71.4	28.6	.0	100.0	.0	.0	14.3
8	Upper tercile:							
	Complete	60.0	40.0	.0	100.0	.0	.0	.0
	Incomplete	.0	100.0	.0	100.0	.0	.0	.0
	5+ Units							
3	Lower tercile:							
	Complete	80.9	19.1	17.0	74.5	.0	25.5	10.6
	Incomplete	50.0	50.0	.0	100.0	.0	.0	.0
6	Middle tercile:							
	Complete	96.0	4.0	60.0	30.0	4.0	66.0	6.0
	Incomplete	100.0	.0	33.3	66.7	.0	33.3	11.1
9	Upper tercile:							
	Complete	98.2	1.8	.0	16.1	5.4	78.6	1.8
	Incomplete	100.0	.0	.0	22.2	.0	77.8	.0
	All complete	89.7	10.3	20.5	48.6	3.2	48.1	6.5
	All incomplete	78.9	21.1	7.9	73.7	.0	26.3	15.8

SOURCE: Tabulated by HASE staff from records of the survey of residential buildings, Site II, baseline.
NOTE: Includes only the records of strata having buildings with reportedly inaccessible interior public areas.

Table C.2

DISTRIBUTIONAL PARAMETERS FOR SELECTED CHARACTERISTICS BY PANEL STRATUM AND COMPLETENESS OF INTERIOR PUBLIC AREA OBSERVATION

Urban Rental Multiunit Property Strata		Number of Buildings on Property			Number of Units on Property			Number of Units in Building		
Stratum Number	Property Description and Observation Status	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases
	2-4 Units									
2	Lower tercile:									
	Complete	1.071	.267	14	3.500	.650	14	3.429	.756	14
	Incomplete	1.000	.000	10	2.900	.738	10	2.900	.738	10
5	Middle tercile:									
	Complete	1.000	.000	13	2.923	.954	13	2.923	.954	13
	Incomplete	1.143	.378	7	2.571	.787	7	2.429	.787	7
8	Upper tercile:									
	Complete	1.200	.447	5	2.600	.894	5	2.400	1.140	5
	Incomplete	1.000	.000	1	2.000	.000	1	2.000	.000	1
	5+ Units									
3	Lower tercile:									
	Complete	3.277	4.042	47	49.553	61.688	47	20.638	30.540	47
	Incomplete	1.000	.000	2	8.000	2.828	2	8.000	2.828	2
6	Middle tercile:									
	Complete	21.680	22.662	50	221.440	211.225	50	14.180	11.458	50
	Incomplete	8.111	10.422	9	55.333	71.067	9	7.556	3.046	9
9	Upper tercile:									
	Complete	17.196	11.239	56	379.786	348.762	56	20.482	17.871	56
	Incomplete	6.778	4.944	9	71.444	53.294	9	15.222	9.563	9
	All complete	12.081	15.891	185	187.941	267.450	185	15.805	20.133	185
	All incomplete	4.079	6.283	38	31.737	51.629	38	7.079	6.926	38

SOURCE: Tabulated by HASE staff from the records of the survey of residential buildings, Site II, baseline.
NOTE: Includes only the records of strata having buildings with reportedly inaccessible interior public areas.

Table C.2--Continued

Urban Rental Multiunit Property Strata		Average Assessed Value per Unit ($)			Age of Main Building (yr)			Condition of Streets in Area		
Stratum Number	Property Description and Observation Status	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases
	2-4 Units									
2	Lower tercile:									
	Complete	1,452	1,281	14	74.6	14.6	14	1.804	.539	14
	Incomplete	1,821	1,834	10	73.8	12.9	8	1.625	.412	10
5	Middle tercile:									
	Complete	1,486	1,031	13	66.7	19.3	13	1.596	.564	13
	Incomplete	1,541	593	6	68.3	23.9	6	1.964	.548	7
8	Upper tercile:									
	Complete	1,998	1,221	5	62.6	13.5	5	2.000	.306	5
	Incomplete	4,650	0	1	70.0	.0	1	1.000	.000	1
	5+ Units									
3	Lower tercile:									
	Complete	1,497	1,144	46	57.8	29.1	37	1.939	.534	47
	Incomplete	1,474	252	2	52.0	.0	1	1.250	.000	2
6	Middle tercile:									
	Complete	1,539	870	50	22.1	28.6	36	1.555	.526	50
	Incomplete	1,686	657	8	34.6	32.8	8	1.833	.685	9
9	Upper tercile:									
	Complete	1,941	1,445	51	11.9	19.1	30	1.862	.344	56
	Incomplete	2,770	1,364	9	6.0	4.4	6	1.750	.484	9
	All complete	1,645.1	1,180.2	179	40.9	33.8	135	1.8	.5	185
	All incomplete	2,041.0	1,365.2	36	47.8	33.2	30	1.7	.5	38

SOURCE: Tabulated by HASE staff from the records of the survey of residential buildings, Site II, baseline.
NOTE: Includes only the records of strata having buildings with reportedly inaccessible interior public areas.

Table C.2--Continued

Urban Rental Multiunit Property Strata		Extent of Landscaping on Property			Maintenance of Yard			Cleanliness of Yard		
Stratum Number	Property Description and Observation Status	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases
	2-4 Units									
2	Lower tercile:									
	Complete	3.000	1.240	14	2.333	.651	12	2.583	.900	12
	Incomplete	2.300	.949	10	1.778	.667	9	1.667	.500	9
5	Middle tercile:									
	Complete	2.154	.376	13	2.000	.707	13	1.692	.630	13
	Incomplete	2.143	.378	7	2.571	.787	7	2.143	.900	7
8	Upper tercile:									
	Complete	2.600	.894	5	2.500	.577	4	2.6	.548	5
	Incomplete	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)
	5+ Units									
3	Lower tercile:									
	Complete	2.511	1.040	47	1.975	.577	40	1.732	.895	41
	Incomplete	3.500	2.121	2	3.000	.000	1	2.000	.000	1
6	Middle tercile:									
	Complete	2.160	.650	50	1.426	.542	47	1.333	.519	48
	Incomplete	2.000	.000	9	2.000	.500	9	1.444	.726	9
9	Upper tercile:									
	Complete	1.946	.227	56	1.268	.447	56	1.196	.444	56
	Incomplete	2.000	.000	9	1.444	.527	9	1.444	.527	9
	All complete	2.259	.792	185	1.634	.658	172	1.531	.756	175
	All incomplete	2.263	.828	38	1.943	.725	35	1.657	.684	35

SOURCE: Tabulated by HASE staff from the records of the survey of residential buildings, Site II, baseline.
NOTE: Includes only the records of strata having buildings with reportedly inaccessible interior public areas.
[a]Data missing.

Table C.2--Continued

Urban Rental Multiunit Property Strata		Extent of Landscaping--Yards in Area			Condition of Yards in Area		
Stratum Number	Property Description and Observation Status	Mean	Standard Deviation	Number of Cases	Mean	Standard Deviation	Number of Cases
	2-4 Units						
2	Lower tercile:						
	Complete	2.344	.374	12	2.188	.401	12
	Incomplete	2.056	.110	9	1.861	.377	9
5	Middle tercile:						
	Complete	2.048	.120	13	2.077	.237	13
	Incomplete	2.286	.366	7	2.214	.443	7
8	Upper tercile:						
	Complete	2.000	.000	5	2.425	.447	5
	Incomplete	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)	(*a*)
	5+ Units						
3	Lower tercile:						
	Complete	2.091	.216	44	2.045	.271	44
	Incomplete	2.000	.000	2	2.375	.530	2
6	Middle tercile:						
	Complete	2.005	.036	48	1.391	.464	48
	Incomplete	2.083	.217	9	1.806	.464	9
9	Upper tercile:						
	Complete	1.946	.220	51	1.456	.373	51
	Incomplete	1.889	.132	9	1.639	.377	9
	All complete	2.0	.2	173	1.7	.5	173
	All incomplete	2.1	.2	36	1.9	.5	36

SOURCE: Tabulated by HASE staff from the records of the survey of residential buildings, Site II, baseline.

NOTE: Includes only the records of strata having buildings with reportedly inaccessible interior public areas.

[a]Data missing.

Appendix D

AUDIT CHECKS FOR IMPLAUSIBLE AND INCONSISTENT RESPONSES

This appendix describes 78 checks performed during the audit for implausible and inconsistent responses. Table D.1 lists 43 checks for disagreements between assertions of fact, and Table D.2 lists 35 checks for implausible but not necessarily incorrect responses. For each check the table reports the number of SRB records found to contain such implausible or inconsistent response patterns.

Table D.1

CHECKS FOR INCONSISTENT RESPONSES

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
1	Mobile home without aluminum or metal exterior walls	B4 = 5 and B16:C = 1 and B16:H = 1	0	.0
2	Elevator present in interior public area of one-story building	(B72:1 > 0 or B72:9G > 1) and B15 = 1	0	.0
3	Mobile home without metal roof (roof observable)	(B4 = 5 or B4 = 5) and B29:F = 1 and B29:I = 1	1	.0
4	Presence of fire escapes on one-story building	B20 = 1 and B15 = 1	0	.0
5	Building has no commercial units when garage is shared with commercial units in building	B43 = 2 and B9 > 0 and B9 ≠ 3	3	.1
6	Building has no commercial units when carport is shared with commercial units in building	B46 = 2 and B9 > 0 and B9 ≠ 3	0	.0
7	Building has no commercial units when open parking is shared with commercial units in building	B49 = 2 and B9 > 0 and B9 ≠ 3	2	.1
8	No bodies of water present in area when attractive body of water in area is a beneficial feature	A18:1 = 0 and A20:C = 3	9	.3
9	Disagreement whether most area buildings are single-family homes	A14 = 1 and A15 > 0 and A15 ≠ 1	4	.1
10	Disagreement whether most area buildings are multiple-unit buildings	A14 = 2 and (A15 = 1 or A15 = 5)	5	.2
11	Disagreement whether most area buildings are mixed residential/commercial	A14 = 3 and (A15 = 1 or A15 = 2 or A15 = 3)	2	.1
12	Disagreement concerning presence of other residential buildings in area	A14 = 5 and B84 = 1	2	.1
13	Disagreement concerning presence of other residential buildings in area	(A14 = 1 or A14 = 2 or A14 = 3 or A14 = 4 or A14 = 6) and B84 = 2	5	.2
14	No other residential properties in area but there is residential land use in area	A14 = 5 and ((A18:A + A18:B) > 0)	4	.1
15	Disagreement whether building is a single-family residence	B4 = 1 and B9 ≠ 1 and B9 > 0	6	.2

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Table D.1--Continued

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
16	Disagreement whether building is a side-by-side duplex	B4 = 2 and B9 ≠ 2 and B9 > 0	0	.0
17	Disagreement whether building is a row house	B4 = 3 and B9 ≠ 2 and B9 > 0	0	.0
18	Disagreement whether building is a multiple-unit apartment house	B4 = 4 and (B9 = 1 or B9 = 5 or B9 = 6)	7	.2
19	Disagreement whether building is a mobile home	B4 = 5 and B9 ≠ 5 and B9 > 0	2	.1
20	Disagreement whether building is single-family with commercial units	B4 = 6 and B9 ≠ 3 and B9 > 0	0	.0
21	Disagreement whether building is residential or commercial	B4 = 7 and B9 ≠ 6 and B9 > 0	1	.0
22	Disagreement concerning presence of commercial units in building	B4 = 8 and B9 ≠ 3 and B9 > 0	0	.0
23	Building is mixed residential-commercial when number of commercial units is 0 or type of first commercial unit is blank, or building has no commercial portion when number of commercial units is greater than 0 or type of first commercial unit is nonblank	(B9 = 2 and (B10 < 1 or B11:1 < 0)) or (B9 > 0 and B9 ≠ 3 and (B10 > 0 or B11:1 > 0))	5	.2
24	Single-family house with more than four stories	B9 = 1 and B15 > 4	0	.0
25	Mobile home with more than one story	B9 = 5 and B15 > 1	0	.0
26	Failure to follow skip pattern for commercial buildings	B9 = 6 and B10 > 0	0	.0
27	Uncovered porch present but cleanliness not rated	(0 < B35:A < 88) and B36 = -21	0	.0
28	Covered, unenclosed porch present but cleanliness not rated	(0 < B35:B < 88) and B36 = -21	0	.0
29	Covered, unenclosed porch present but condition not rated	(0 < B35:B < 88) and B37 = -21	0	.0

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Table D.1--Continued

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
30	Disagreement whether building is in apartment complex or mobile home park	(A11 = 1 and ((A13 ≠ 5 and A13 > 0) or B59 = 2)) or (A11 = 2 and (A13 = 5 or B59 = 1))	8	.3
31	Disagreement whether building is single-family home with no commercial units or mobile home	B69 = 1 and (B4 = 2 or B4 = 3 or B4 = 6 or B4 = 7 or B4 = 8)	8	.3
32		B69 = 2 and (B4 = 1 or B4 = 5)	9	.3
33	Disagreement whether building is on urban or suburban block	A13 = 1 and B83 ≠ 1 and B83 > 0	7	.2
34	Disagreement whether building is in urban/suburban unblocked area	A13 = 2 and B83 ≠ 2 and B83 > 0	4	.1
35	Disagreement whether building is in rural area	(A13 = 3 or A13 = 4) and B83 ≠ 2 and B83 > 0	9	.3
36	Disagreement whether building is in apartment complex or mobile home park	A13 = 5 and B83 ≠ 4 and B83 > 0	22	.7
37	Indication that no detrimental features are associated with nonresidential area land use when specific detrimental features are noted	A19:F = 6 and (A19:A = 1 or A19:B = 2 or A19:C = 3 or A19:D = 4 or A19:E = 5 or A19:G = 8)	4	.1
38	Indication that no beneficial features are associated with nonresidential area land use when specific beneficial features are noted	A20:D = 4 and (A20:A = 1 or A20:B = 2 or A20:C = 3 or A20:E = 8)	2	.1
39	Area land use is 100 percent residential when some beneficial or detrimental feature is associated with nonresidential land use in area	A18:A = 100 and (A19:A = 1 or A19:B = 2 or A19:C = 3 or A19:E = 5 or A19:G = 8 or A20:A = 1 or A20:B = 2 or A20:C = 3 or A20:E = 8 or A21 > 0)	95	3.1
40	Condition of unenclosed porches rated when no unenclosed porches are indicated present	B37 > 0 and (B35:A ≤ 0 or B35:A = 88) and (B35:B ≤ 0 or B35:B = 88)	0	.0
41	Commercial building with residential units	B9 = 6 and BUNITS > 0	1	.0
42	Residential building with no residential units	(B9 = 1 or B9 = 2 or B9 = 3 or B9 = 4 or B9 = 5) and BUNITS = 0	10	.3
43	Survey conducted on property and all sides of building were observable but exterior walls were not observable	B18 = 3 and (B14:A + B14:B + B14:C + B14:D = 12) and B88 = 1	1	.0

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Table D.2

IMPLAUSIBLE RESPONSE CHECKS

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
44	Cleanliness of interior public areas disagrees with overall state of repair of interior public areas by more than two intervals	(B73 = 1 and B74 = 4) or (B73 = 4 and B74 = 1)	0	.0
45	Overall state of repair of interior public areas disagrees with overall state of exterior repair by more than two intervals	(B58 = 1 and B74 = 4) or (B58 = 4 and B74 = 1)	0	.0
46	Overall yard cleanliness disagrees with interior public area cleanliness by more than two intervals	(B55 = 1 and B73 = 4) or (B55 = 4 and B73 = 1)	2	.1
47	Cleanliness of uncovered, unenclosed porches disagrees with cleanliness of interior public areas by more than two intervals	(B36 = 1 and B73 = 4) or (B36 = 4 and B73 = 1)	0	.0
48	Not all entrances are locked but observer could not enter interior public areas	B71 = 3 and B78 > 1	7	.2
49	Roof surface in very good condition when subroofing is sagging or buckling	B30 = 1 and B31 = 1	109	3.6
50	Condition of roof surface disagrees with overall state of exterior repair by more than two categories	(B30 = 1 and B58 = 4) or (B30 = 4 and B58 = 1)	2	.1
51	Condition of gutters and downspouts disagrees with overall state of exterior repair by more than two categories	(B32 = 1 and B58 = 4) or (B32 = 4 and B58 = 1)	86	2.8
52	Condition of chimneys, flues, and vents disagrees with overall state of exterior repair by more than two categories	(B33 = 1 and B58 = 4) or (B33 = 4 and B58 = 1)	16	.5
53	Condition of exterior walls disagrees with overall state of exterior repair by more than two categories	(B17 = 1 and B58 = 4) or (B17 = 4 and B58 = 1)	2	.1
54	Condition of permanent windows disagrees with overall state of exterior repair by more than two categories	(B22 = 1 and B58 = 4) or (B22 = 4 and B58 = 1)	1	.0
55	Condition of permanent doors disagrees with overall state of exterior repair by more than two categories	(B25 = 1 and B58 = 4) or (B25 = 4 and B58 = 1)	1	.0

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Table D.2--Continued

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
56	Condition of storm doors disagrees with overall state of exterior repair by more than two categories	(B26 = 1 and B58 = 4) or (B26 = 4 and B58 = 1)	62	2.0
57	Condition of storm windows disagrees with overall state of exterior repair by more than two categories	(B23 = 1 and B58 = 4) or (B23 = 4 and B58 = 1)	28	.9
58	Condition of screen doors disagrees with overall state of exterior repair by more than two categories	(B27 = 1 and B58 = 4) or (B27 = 4 and B58 = 1)	103	3.4
59	Condition of screen windows disagrees with overall state of exterior repair by more than two categories	(B24 = 1 and B58 = 4) or (B24 = 4 and B58 = 1)	32	1.0
60	Condition of unenclosed porches disagrees with overall state of exterior repair by more than two categories	(B37 = 1 and B58 = 4) or (B37 = 4 and B58 = 1)	0	.0
61	Condition of balconies disagrees with overall state of exterior repair by more than two categories	(B39 = 1 and B58 = 4) or (B39 = 4 and B58 = 1)	1	.0
62	Condition of fire escapes disagrees with overall state of exterior repair by more than two categories	(B21 = 1 and B58 = 4) or (B21 = 4 and B58 = 1)	0	.0
63	Condition of exterior stairways or steps disagrees with overall state of exterior repair by more than two categories	(B57 = 1 and B58 = 4) or (B57 = 4 and B58 = 1)	4	.1
64	Condition of detached garage disagrees with over-all state of exterior repair by more than two categories	(B42 = 1 and B58 = 4) or (B42 = 4 and B58 = 1)	10	.3
65	Exterior wall structure has major faults when overall state of exterior repair is very good	B16 = 1 and B58 = 1	2	.1
66	Foundation has major faults when overall state of exterior repair is very good	B19 = 1 and B58 = 1	13	.4
67	Subroofing is sagging or buckling when overall state of exterior repair is very good	B31 = 1 and B58 = 1	36	1.2

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Table D.2--Continued

Check Number	Inconsistency	Logical Statement	Number of Records Affected	Percent of Total[a]
68	Most other buildings in area are smaller when building is one-story, single-family house	B85 = 2 and (B4 = 1 or B9 = 1) and B15 = 1	10	.3
69	Property could be or is farmed when located in urban or suburban area, apartment complex, or mobile home park	(A4 = 1 or A4 = 2) and (A13 = 1 or A13 = 2 or A13 = 5)	5	.2
70	Single-family home with more than one residential unit	B9 = 1 and BUNITS > 1	33	1.1
71	Multiple-unit residential structure with only one residential unit	(B9 = 2 or B9 = 4) and BUNITS = 1	13	.4
72	Mobile home with more than one residential unit	B9 = 5 and BUNITS > 1	0	.0
73	Row house (three or more residential units) with fewer than three residential units	B4 = 3 and (BUNITS = 1 or BUNITS = 2)	0	.0
74	Most other residential buildings in area larger than this building with three or more floors and over 29 units	B85 = 1 and (BUNITS ≥ 30 or B15 ≥ 3)	3	.1
75	Exterior walls in very good condition when exterior wall structure has major faults	B17 = 1 and B18 = 1	14	.5
76	Overall exterior condition not defective, yard is very clean, landscaping is extensive, yard maintenance is good, and most other buildings in area are older, when evaluated building is in worse condition than most other buildings in area	(B58 = 1 or B58 = 2) and B55 = 1 and B53 = 1 and B54 = 1 and B86 = 1 and B87 = 2	0	.0
77	Overall exterior condition defective, yard is littered, there is no landscaping or yard maintenance, and most other buildings in area are newer, when evaluated building is in better condition than most other buildings in area	(B58 = 3 or B58 = 4) and B55 = 4 and B53 = 4 and B54 = 4 and B86 = 2 and B87 = 1	0	.0
78	Property has swimming pool when building landscaping is minimal or nonexistent, yard maintenance is minimal or nonexistent, yard is considerably littered, overall exterior condition is defective, and (for buildings with interior public areas) overall state of repair exhibits defects	A10 = 1 and (B53 = 3 or B53 = 4) and (B54 = 3 or B54 = 4) and (B55 = 3 or B55 = 4) and (B58 = 3 or B58 = 4) and (B74 = 3 or B74 = 4)	0	.0

SOURCE: Tabulated by the HASE staff from records of the survey of residential buildings, Site II, baseline.

[a]Percentage of the 3,066 field-complete records.

Appendix E

STATISTICAL SIGNIFICANCE IN THE ANALYSIS OF EVALUATIVE COMPOSITE RATINGS

This appendix investigates what magnitude of rating difference is necessary to reject the null hypothesis that the true difference is 0 (i.e., that the ratings are the same). The two most frequent SRB rating comparisons are considered--those between sample means for a group of buildings and those between individual buildings.

Even small differences in sample means of SRB evaluative ratings will be significantly different (in the statistical sense) from 0. Most regular panel strata contain 100 to 300 sampled buildings, and sample variances range from .2 to .6. Within that range, differences of .07 to .22 between sample means allow rejection of the null hypothesis (that the true means are the same) at the 95 percent confidence level. Property and area ratings involve slightly smaller sample sizes, so differences of about .2 to .3 are necessary to say the ratings differ. For interior public area ratings, with much smaller sample sizes and larger sample variances, only differences of .2 to 1.0 are significantly different from 0.

Analysts comparing individual ratings (e.g., for two buildings at the same time or for the same building over time) must be more cautious. Consider the following model for any evaluated characteristic:

$$r_{ij} = c_i + e_1 ,$$

where r_{ij} = observer j's rating for building i,
c_i = the true condition of building i,
e_1 = the error term ($\sim N(0,\sigma^2)$).

Assuming that the original and validation observations are independent measures of the same, true building condition,

$$(r_{ij} - r_{ik}) = e_2 ,$$

where r_{ij} and r_{ik} are the original and validation ratings for building i, and $e_2 \sim N(0, 2\sigma^2)$.

An unbiased estimator of $2\sigma^2$ is

$$2s^2 = (1/(n - 1)) \sum_{j=1}^{n} (r_{ij} - r_{ik})^2 ,$$

where n is the number of paired (original and validation) observations. Estimates for five of the validated evaluative questions in Table 4.3 are as follows:

A23	.388
B17	.448
B58	.385
B72:1	.791
B72:2	.512

The model above can be applied to ratings for the same building over time. Assuming that the distribution of the error term does not change,

$$r_t = c_t + e_1 ,$$

where r_t = the rating for the building at time t,
c_t = the true condition of the building at time t,
e_1 = the error term ($\sim N(0,\sigma^2)$).

Then

$$r_t - r_s = c_t - c_s + e_2 ,$$

where $e_2 \sim N(0, 2\sigma^2)$.

We can test the null hypothesis that the true condition does not change over time (H_0: $c_t = c_s$). Using the t-test with a 95 percent confidence level, we can reject the null hypothesis when

$$\left[(r_t - r_s)/\sqrt{2s^2}\right] \geq 1.96 \ .$$

The table below gives the test statistics for our five questions, assuming that the ratings differ by one and by two intervals:

	One Interval	Two Intervals
A23	1.61	3.21
B17	1.49	2.99
B58	1.61	3.22
B72:1	1.12	2.25
B72:2	1.40	2.80

In every case, one-interval differences are not significantly different from 0 at the 95 percent confidence level (the test statistic is less than 1.96), but all two-interval differences are significant, even at the 99 percent level. The one-interval differences are significant at the 80 to 90 percent confidence level.

Many statisticians recommend comparing the test statistic with 1 instead of 1.96. That is the test applied to the coefficient of a regression variable to decide whether or not to retain it. If we used that test here, the one-interval differences would be significantly different from 0 for all five questions.