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HIST 1.0

Decision Support Software for Rating Buildings by Historic Significance

Barbara C. Lippiatt
Stephen F. Weber

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Office of Applied Economics
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899

U.S. Department of Commerce
Ronald H. Brown, *Secretary*
Technology Administration
Mary L. Good, *Under Secretary for Technology*
National Institute of Standards and Technology
Arati Prabhakar, *Director*

Prepared for:
U.S. General Services Administration
Roger W. Johnson, *Administrator*
Public Buildings Service
Kenneth R. Kimbrough, *Commissioner*
Office of Portfolio Management

Preface

The historic building rating system this report describes was developed in close cooperation with Public Buildings Service (PBS) staff. The report and accompanying software is intended for readers familiar with the Building Preservation Plan (BPP) system for collecting detailed data on the design, material, and historic characteristics of the PBS buildings. The software runs only on systems containing the BPP data files.

Abstract

Sixty percent of the buildings owned by the Public Buildings Service (PBS) are classified as historic structures based solely on their age. Some of these buildings are truly historic, while others have little historic significance. In order to manage them effectively, a rating system for evaluating the relative historic importance of the PBS buildings was developed and implemented in the software *HIST* (*H*istoric *I*mportance *S*oftware *T*ool). *HIST* is compatible with software currently used by PBS managers to collect detailed data on the historic characteristics of the PBS buildings. It integrates these data into a comprehensive, consistent, and reliable rating system to measure the combined historic significance at several levels of building detail. *HIST* is used for ranking and analyzing the PBS building inventory, and as the basis for budget planning and allocation. The report documents the rating system and the *HIST* software.

Key words: Analytic hierarchy process; budget allocation; decision support software; economic analysis; historic buildings; historic preservation; multi-attribute decisions; qualitative data.

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Getting Started

System Requirements

HIST runs on an MS-DOS™ personal computer with a 386 or higher microprocessor, at least one high density floppy diskette drive (3.5" or 5.25"), and MS-DOS™ Version 5.0 or higher. Your CONFIG.SYS file must specify a minimum of 30 files in the FILES command. (Refer to your MS-DOS™ documentation for the correct syntax for the FILES command). A printer is preferred but not required.

***HIST* runs only on systems with the following six Building Preservation Plan (BPP) data files:**

ID.DBF, ID.DBT	**- BPP building data files**
ZONES.DBF, ZONES.DBT	**- BPP zone data files**
ELEMENTS.DBF, ELEMENTS.DBT	**- BPP element data files**

Installing *HIST*

HIST must first be installed on your hard drive and then run from there. From your hard drive (e.g., drive C), make the directory to which *HIST* will be installed by typing **MD\HIST** and pressing ↵ . Then go to the new directory by typing **CD\HIST** and pressing ↵ . Next, insert the distribution disk into any floppy drive (e.g., drive A), type **COPY A:*.*** and press ↵ . All the *HIST* program and data files will be copied to the new \HIST directory on your C drive.

The *HIST* distribution diskette contains these files:

HIST.BAT	- Batch file for starting *HIST*
HISTRUN.EXE	- Executable program
GROUPWT.DBF	- Data file with rating system weights
RATINGWT.DBF	- Data file with numeric scores corresponding to verbal ratings
MMCODEWT.DBF	- Data file with verbal ratings corresponding to every possible BPP building element
TRNSLATE.DBF	- Data file with BPP rating reassignments

The structure and contents of all *HIST* data files (files with the "DBF" extension) are documented in appendix B.

Running *HIST*

To start *HIST*, go to the directory in which it is installed by typing **CD\HIST** and pressing ↵ . Then type **HIST** and press ↵ . If you would like to be able to run *HIST* from another directory, move the file HIST.BAT to any directory in your PATH. Then you can start *HIST* by simply typing **HIST** from any directory.

Note: The BPP data files referenced in **System Requirements** need not reside in the \HIST directory. The *HIST* batch file HIST.BAT specifies the location of these six BPP data files. If not found in this

default directory, you will be prompted for their location when starting *HIST*. For a more permanent solution, you may choose to change the default directory by using a text editor to correct the directory referenced in the **HISTRUN //F:30 <BPP directory>** line of HIST.BAT. Similarly, if you have installed the *HIST* files in a directory other than your current drive's \HIST, simply change the directory reference in the **CD\<*HIST* directory>** line of HIST.BAT.

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1. Background and Introduction

Sixty percent of the buildings owned by the Public Buildings Service (PBS) are classified as historic structures based solely on their age. Some of these buildings are truly historic, while others have little historic significance. In order to manage them effectively, PBS needs a tool for evaluating their relative historic importance. Such a tool can be used as the basis for budget planning and allocation and for analysis of the PBS building portfolio.

PBS has developed and is currently implementing the Building Preservation Plan (BPP), a system for collecting detailed data on the design, material, and historic characteristics of its buildings.[1] The purpose of the BPP system is to manage the preservation, maintenance, and repair of PBS buildings. The system identifies and classifies buildings and their features and specifies appropriate maintenance and repair instructions. The BPP system operates on three separate levels (called stages) of a building, including its individual architectural elements (such as door glazing and wall trim), its zones, and the building as a whole. A numeric rating system reflecting historic significance was incorporated in the BPP system at each of these stages. The BPP system assigns every element, every zone, and the building itself a historic significance rating. As a result, the BPP system offers a rich set of detailed data on the historic properties of each PBS building. The next logical step is to refine and integrate the three rating systems into a comprehensive, consistent, and reliable rating system to measure the combined design, material, and historic significance at all levels of building detail. Such a system was developed and implemented in the software *HIST* (*H*istoric *I*mportance *S*oftware *T*ool).

This report documents both the technical details of the *HIST* Rating System (Section 2) and the *HIST* software that implements the system (Section 3). Two appendices provide the algorithms used to compute the historic ratings (Appendix A) and a data dictionary explaining the contents and structure of the *HIST* data files (Appendix B).

[1]U.S. General Services Administration, Public Buildings Service, *HBPP: Historic Building Preservation Plan*, Washington, D.C., 1991.

2. The *HIST* Rating System

In developing the *HIST* methodology, three separate rating systems were developed corresponding to the three stages at which the BPP system evaluates historic significance. The element and zone rating systems each combine the individual BPP ratings for their stage into a composite rating for the entire building. These rating systems are known as the Composite Element Rating and Composite Zone Rating systems. The building rating system assigns a single rating representing the historic significance of the building as a whole. These three ratings (Composite Element Rating, Composite Zone Rating, and Building Rating) are then integrated into an overall Historic Quality Index (HQI), which measures a building's combined historic significance at all levels of detail. The HQI is used for ranking of the PBS building inventory.

An additional rating system was developed to reflect another factor important to a building's ability to attract preservation funds, but not explicitly included in the three ratings comprising the HQI. The rating is known as the Building Support Factor (BSF), and it represents the degree of public support for a building at the national, state, and community levels. When the BSF is combined with the HQI, it yields the Historic Support Index (HSI). The HSI is used for analysis of an individual building and not as an overall ranking factor.

This section describes each of these rating systems in turn. Appendix A presents the mathematical algorithms that underlie the rating systems.

2.1 Composite Element Rating System

The composite element rating system is based on five principles developed in close cooperation with PBS:

Principle 1.1. The combined importance of a zone's elements does not vary from zone to zone.

Principle 1.2. There are qualitative differences among elements. Some elements are intrinsically more historically significant than others. For example, wall ornaments are intrinsically of more historic significance than floor insulation. The more intrinsically significant its elements, the higher should be a building's Composite Element Rating.

Principle 1.3. The BPP element ratings range from one to six, with one being the highest possible rating. The higher a building's elements are rated on the BPP scale, the higher should be its Composite Element Rating. An exception occurs for elements with BPP ratings of four, five, and six. PBS has assigned a historic value of zero to these three BPP ratings.

Principle 1.4. Similar elements should be categorized into element groups on a zone-by-zone basis. For example, a zone's utilities elements should be grouped together, as should its foundation elements. Element groups vary in their historic significance. Elements in groups with more historic significance are more important than elements in groups with less historic significance.

Principle 1.5. The importance of an element should not depend on how many elements are in its element group.

In deriving a Composite Element Rating for an entire building, the system first combines the individual BPP element ratings for a *zone* into a single rating that takes into account the historic significance of all the elements of a single zone. This is known as the Zone-specific Element Rating. The average of the Zone-specific Element Ratings is then taken to derive a building's Composite Element Rating (Principle 1.1).

The Zone-specific Element Ratings are based on the intrinsic importance of a zone's elements (Principle 1.2), its BPP ratings (Principle 1.3), and the relative importance of the groups to which the elements belong (Principles 1.4 and 1.5).

To implement Principle 1.2, PBS specified intrinsic qualitative differences among elements by assigning to each either a "Special" or a "Normal" intrinsic historic significance. The intrinsic ratings for all elements remain fixed from building to building. For example, wall ornaments are always designated "Special" and floor insulation "Normal."

The BPP element ratings are ordinal ratings. They express the order or rank of the elements, with the *lowest* numerical value, 1, representing the *highest* rank. For example, consider two wall ornament elements, the first with a BPP rating of 1, and the second with a BPP rating of 2. Since the BPP ratings are ordinal or ranking numbers, we know the first ornament has more historic value than the second. The major shortcoming of such ordinal systems is that they do not indicate *how much* more historic value one element has compared with another. To know how much more historic value, we need to convert the ordinal BPP ratings into cardinal, or scalar scores, with a higher score representing more historic significance. A system for rating buildings by historic significance that is based on scalar scores offers a much more useful planning and budgeting tool.

To convert the ordinal ratings into scalar scores that reflect degrees of historic preference, the pairwise comparison method of the Analytical Hierarchy Process (AHP) was used. The AHP is a multi-criteria decision tool that has recently gained in popularity and been applied to a wide variety of complex problems. The AHP technique was developed in the 1970's by Thomas L. Saaty at the Wharton School of the University of Pennsylvania.[2] It is a mathematical technique for converting normally incommensurable criteria or scores into scalar values using pairwise comparisons. The pairwise comparisons are based on judgments about relative differences between the criteria or scores when they are directly compared in a pairwise fashion. PBS used the pairwise comparison method to derive scalar scores of historic significance based on the six ordinal ratings combining an element's BPP rating with its intrinsic significance: 1-Special, 1-Normal, 2-Special, 2-Normal, 3-Special, and 3-Normal. (Since elements with BPP ratings of 4 to 6 have no historic significance regardless of their intrinsic importance, they are automatically assigned a scalar score of zero.)

If there are n ordinal ratings to be converted into scalar values, then there are only $n(n-1)/2$ pairwise

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[2]Thomas L. Saaty, *Multicriteria Decision Making: The Analytic Hierarchy Process*, University of Pittsburgh, Pittsburgh, PA, 1988.

comparisons to be made. Thus, the 6 ratings required 15 (= (6*5)/2) comparisons. This is based on two assumptions: (1) each rating is of equal historic value to itself; and (2) if rating A represents twice as much historic value as B, then B represents half the historic value of A.

The NIST software *AutoMan* implements the AHP pairwise comparison method and was used by PBS to compute the scalar scores.[3] For each pair of ordinal ratings, PBS was asked to compare their importance, or historic significance. Exhibit 1 displays hypothetical pairwise comparison judgments. For example, in exhibit 1 the ordinal rating 1-Special is judged to have one and one-half times as much historic value as 1-Normal.

Exhibit 1. Scalar Element Scores and Inconsistency Ratio

Recording Pairwise Comparisons:
"1-Special" is how many times as IMPORTANT as "1-Normal"? [Use 0.100 to 9.900]

Ordinal Ratings

	1-Special	1-Normal	2-Special	2-Normal	3-Special	3-Normal
1-Special		**1.500**	2.000	2.500	3.500	4.000
1-Normal			1.100	2.000	2.200	3.000
2-Special				1.500	2.000	2.500
2-Normal					1.100	2.000
3-Special						1.500
3-Normal						

	1-Special	1-Normal	2-Special	2-Normal	3-Special	3-Normal
Scores	**0.319**	**0.214**	**0.180**	**0.120**	**0.098**	**0.069**

Inconsistency Ratio 0.003

Once the pairwise judgments are entered, *AutoMan* computes the resulting scalar scores. The scalar scores sum to one. These are also displayed in exhibit 1. The scalar scores computed by *AutoMan* are proportional to historic significance. That is, a score of 0.500 is twice as good as a score of 0.250. In addition to the scalar scores, *AutoMan* reports an Inconsistency Ratio. The pairwise comparison method reveals inconsistencies in judgment. Perfect consistency results when rating A is always judged to be four times as good as C if A is twice as good as B and B is twice as good as C. The Inconsistency Ratio measures how far all the pairwise judgments deviate from perfect consistency among all comparisons. If the Inconsistency Ratio exceeds 0.10, it is advisable to redo the pairwise comparisons. Otherwise, the scalar scores may be distorted. As seen in exhibit 1, the inconsistency ratio of the hypothetical pairwise comparisons, 0.003, is near perfect consistency.

The scalar scores were converted to a 0-100 scale so that the best possible rating, 1-Special, would have a more meaningful score of 100, while still preserving proportionality. Table 1 shows the exhibit 1 scores after conversion to a 0-100 scale. Each element in a zone is assigned a scalar score such as these depending on the combination of its intrinsic rating and its BPP element rating. (Note that the *HIST* system is distributed with the actual scalar scores as assigned by PBS headquarters.)

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[3]Stephen F. Weber, Barbara C. Lippiatt, and Katherine S. Johnson, *AutoMan 2.0: Decision Support Software for Automated Manufacturing Investments -- Software and User Manual*, NISTIR 4543, National Institute of Standards and Technology, Washington, DC, 1991.

Table 1. BPP Ordinal Element Ratings and Hypothetical Scalar Scores

BPP ORDINAL ELEMENT RATING	HYPOTHETICAL SCALAR SCORE
1-Special	100
1-Normal	67
2-Special	56
2-Normal	38
3-Special	31
3-Normal	22
4-Special, 4-Normal 5-Special, 5-Normal 6-Special, 6-Normal	0

Once each element in a zone is assigned a score, the scores for all elements are combined into a single rating that takes into account the historic significance of all the elements of a single zone. This is the Zone-specific Element Rating. It is useful for comparing the historic significance of one zone's elements against that of other zones. Moreover, the Zone-specific Element Ratings form the basis of a building's Composite Element Rating.

Element weights are needed in order to combine element scores for a zone. If all n elements in a zone are equally important, their weights are all $1/n$. Some elements, however, have more historic importance than others, so their weights are unequal. According to Principle 1.4, elements should be organized into element groups that vary in historic importance. The seven BPP element groups used are: site, exterior, interior, foundation, furnishings, utilities, and fire/life/health/safety. Elements in groups with more historic significance are more important (and are weighted higher) than elements in groups with less historic significance. PBS used the pairwise comparison method to establish a "standard" set of weights reflecting the relative historic value of the element groups. (Just as the pairwise comparison method can be used to derive scalar scores from ordinal ratings, it can also be used to derive weights, or shares of importance, for a set of mutually exclusive criteria such as element groups.) The standard weights vary across element groups, but remain fixed from zone to zone. Hypothetical weights are shown in Table 2.

To implement Principle 1.5, the standard element group weights illustrated in table 2 are adjusted to reflect each zone's unique distribution of elements across element groups. This is necessary to preclude giving more importance to individual elements in small groups and less to elements in large groups. The "adjusted" element weights vary across element groups *and* vary from zone to zone. The relationships between groups reflected in the standard weights are translated to relationships between individual elements to derive the adjusted weights. For example, consider two element groups, say interior elements and furnishings elements, each with the same standard element group weight. Assume a zone with 10 interior elements and 5 furnishings elements. If the standard element group

Table 2. Hypothetical Standard Element Group Weights

ELEMENT GROUP	HYPOTHETICAL WEIGHT (%)
Site	12
Exterior	17
Interior	17
Foundation	17
Furnishings	17
Utilities	10
Fire/Life/ Health/Safety	10

weights were used, the scores for the interior elements would each be assigned *half* the weight as the scores for the furnishings elements. Using the adjusted element weights, the scores for each interior element and each furnishings element will be assigned *equal* weight. The latter is more appropriate because the elements belong to element groups of equal historic importance.

A hypothetical example in Tables 3 and 4 illustrates the derivation of the Zone-specific Element Rating. Consider two zones, both with only three elements, all of which belong to the interior element group. Suppose these elements are assigned the BPP ratings listed in Table 3. Since the elements all belong to the same element group, their weights are equal, and the Zone-specific Element Rating is the simple average of the corresponding scores: 41 for Zone 1, and 23 for Zone 2.

Suppose that after further review, the BPP rating for Ceiling Trim in Zone 1 is changed from a 1 to a 6 due to a data entry error. Table 4 illustrates how this change reverses the relative standing of the two zones: now Zone 2 has a higher Zone-specific Element Rating.

As noted above, the Composite Element Rating is the simple average of the Zone-specific Element Ratings across all zones of a building. The Composite Element Rating is a single rating that takes into account the significance of all the elements of an entire building.

2.2 Composite Zone Rating System

The composite zone rating system combines the BPP zone ratings across zones to arrive at a single rating that takes into account the historic significance of all the zones of a single building. Four principles define the system:

Principle 2.1. The higher a building's zones are rated on the BPP zone rating scale (ranging from

Table 3. Base Case: Zone 1 Has Higher Zone-Specific Element Rating

ELEMENT	INTRINSIC RATING	BPP ORDINAL RATING (SCALAR SCORE) Zone 1	Zone 2
Ceiling Trim	Special	1 (100)	3 (31)
Door Frame	Normal	3 (22)	2 (38)
Floor Surface	Normal	4 (0)	5 (0)
ZONE-SPECIFIC ELEMENT RATING		41	23

Table 4. Corrected BPP Rating: Now Zone 2 Has Higher Zone-Specific Element Rating

ELEMENT	INTRINSIC RATING	BPP ORDINAL RATING (SCALAR SCORE) Zone 1	Zone 2
Ceiling Trim	Special	**6 (0)**	3 (31)
Door Frame	Normal	3 (22)	2 (38)
Floor Surface	Normal	4 (0)	5 (0)
ZONE-SPECIFIC ELEMENT RATING		**7**	23

one to six, with one being the highest possible rating), the higher its Composite Zone Rating should be. An exception occurs for BPP zone ratings of five and six, which are irrelevant to historic significance. PBS has reassigned these to ratings one through four.

Principle 2.2. Every building has two groups of zones: the interior zone group and the exterior zone group. The importance of BPP ratings for the interior zone group relative to the exterior zone group is fixed from building to building.

Principle 2.3. The relative importance of BPP ratings for zones within the exterior zone group depends upon type of exterior zone (e.g., primary facade, secondary facade, tertiary facade, site, or roof). The relative importance of exterior zone types *is fixed* from building to building.

Principle 2.4. The relative importance of BPP ratings for zones within the interior zone group depends upon relative zone size. The relative importance of interior zones *varies* from building to building.

The Composite Zone Rating system uses many of the same techniques as the Composite Element Rating system. First the ordinal BPP zone ratings one to four are converted to scalar scores using the pairwise comparison method. The scalar scores are then converted to a 0-100 scale. Then weights are applied to combine these scalar scores across zones to arrive at a building's Composite Zone Rating.

The weights for the interior zone scores are based on the relative size of the corresponding interior zones (Principle 2.4), scaled down to reflect the importance of the interior zone group as a whole (Principle 2.2). The weights for the exterior zone scores are based on the relative importance of the corresponding exterior zone types (Principle 2.3). The relative importance of exterior zone types is estimated once for all buildings using the pairwise comparison method. The exterior zone type weights are then scaled down to reflect the importance of the exterior zone group as a whole (Principle 2.2). Each building is assigned a Composite Zone Rating representing a weighted average of the scores for its zones.

An example based on a hypothetical three-zone building illustrates the Composite Zone Rating method. Say PBS sets the zone group weights at 75 percent for the interior zone group, and 25 percent for the exterior zone group. This implies that the scores for interior zones as a group are always three times as important, and will receive three times the weight, as the scores for the exterior zone group. Further suppose the BPP zone ratings for the hypothetical building, and their corresponding scalar scores, are as listed in Table 5. The last row of table 5 shows the computation of the Composite Zone Rating. First take the average of the two interior zone group scores, weighted by relative zone size. Then scale down the result by the 75 percent importance weight of the interior zone group. Add to this the score for the single exterior zone, scaled down by the 25 percent importance weight for the exterior zone group. The resulting composite zone rating is 77.

2.3 Building Rating System

The building rating system assigns a single rating representing the historic significance of the building as a whole. It is based on two principles:

Principle 3.1. The higher a building is rated on the verbal building rating scale, the higher should be its scalar building score.

Principle 3.2. Building size is irrelevant to historic significance and should not be included in the building rating. For example, a small building has just as much historic significance as a large building, other things being equal.

The building rating system is more straightforward than the composite zone and element rating systems. Like the zone and element systems, it involves converting ordinal ratings to scores (Principle 3.1). Unlike the other two systems, however, it does not involve establishing weights for combining multiple scores or for accounting for size. At the building level, there is only one score, and size is

Table 5. Composite Zone Rating Computation

HYPOTHETICAL DATA				
ZONE	ZONE GROUP	SIZE/TYPE	BPP RATING	SCORE
1	Interior	1,000 m^2	2	75
2	Interior	3,000 m^2	1	100
3	Exterior	Primary Facade	4	25
ZONE GROUP WEIGHTS:		75% Interior/25% Exterior		
COMPUTATION OF COMPOSITE ZONE RATING				
[((75pts * 1,000 m^2/4000 m^2)+(100pts * 3,000 m^2/4000 m^2)) * 75%] + [25pts * 25%] = 77 Composite Zone Rating				

irrelevant (Principle 3.2).

The BPP rating scale for buildings, based solely on its current National Register status, does not always reflect its true historic significance. A better indicator is the building's **potential** for National Register status. To reflect potential rather than actual status, the original BPP building ratings are restructured in two ways. First, the BPP building ratings are reduced to four scopes of historic significance: National Historic Landmark, National Significance, State Significance, and Local Significance. Second, another dimension, called level of historic significance, is added to increase the resolution of the rating system. This new, two-dimensional structure is illustrated in Table 6.

Table 6. *HIST* Building Rating System and Hypothetical Scores

LEVEL	SCOPE OF HISTORIC SIGNIFICANCE			
	National Historic Landmark	National Significance	State Significance	Local Significance
Excellent	100	70	62	38
High	89	65	58	30
Defining	75	60	49	28
Member	69	57	40	20

The pairwise comparison method can be used to convert the 16 verbal building ratings (e.g., National Historic Landmark-Excellent) into scalar values. First, the four scopes of historic significance can be

compared to establish their relative importance weights. Then, within each scope, the four historic significance levels of Excellent, High, Defining, and Member can be compared. For any Scope-Level combination, the scalar building rating is the product of its corresponding scope and level weights. The sixteen scalar building ratings are then set on a 0-100 scale, so that the highest possible verbal rating, NHL-Excellent, will have a more meaningful score of 100. This process was carried out for a hypothetical set of pairwise comparison values. The resulting set of scalar scores for the 16 verbal ratings are shown in Table 6. For this illustration, the Building Rating for an Excellent building at the National Historic Landmark scope would be 100, while for a building that is a Member at the State Significance scope, the Building Rating would be 40.

2.4 Historic Quality Index

The three ratings presented separately above (Composite Element Rating, Composite Zone Rating, and Building Rating) are integrated into the Historic Quality Index (HQI), a comprehensive rating that measures the combined historic significance of a building at all levels of detail. This single scalar score represents all aspects of historic significance possessed by a building. It is used to rank all the buildings in the PBS inventory. To derive the HQI, the pairwise comparison process can first be used to develop relative importance weights for the three ratings. Then the HQI is computed as the weighted average of the Composite Element Rating, Composite Zone Rating, and Building Rating.

2.5 Building Support Factor and Historic Support Index

The Building Support Factor measures the degree of public support for a building at the community, state, and national scopes. It indicates how difficult it would be to generate support outside PBS for a rehabilitation project for the building. While this factor does not add to or detract from a building's historic significance, it is included in the *HIST* Rating System because it does affect a building's ability to attract preservation funds and as such is a factor to be considered in planning decisions.

The Building Support Factor reflects a building's levels of support at all three scopes (community, state, and national). The three scopes and their levels of support are listed and defined in table 7 below.

To convert the *High*, *Medium*, and *None* support levels into scalar scores that reflect degrees of support, the pairwise comparison process can be used. The pairwise comparison process should be conducted separately for the three scopes of building support, leading to a distinct set of scalar scores that sum to one for each scope. Each score is then divided by the highest score for that scope and multiplied by 100 so that the best possible score, *High*, has a more meaningful value of 100, while still preserving proportionality. The pairwise comparison process should then be used to develop relative importance weights among the three scopes.

To arrive at the Building Support Factor, a building is first assigned a level of support (*High*, *Medium*, or *None*) at each of the three scopes. The Building Support Factor is then computed by multiplying the scalar scores for each assigned level of support by the corresponding importance

Table 7. Ordinal Building Support Factor Ratings

ORDINAL RATING	COMMUNITY SUPPORT	STATE SUPPORT	NATIONAL SUPPORT
High	Adds to community stability	Attracts state political and preservation support	Attracts national political and preservation support
Medium	Lends to community stability	Attracts state preservation support only	Attracts national preservation support only
None	Insignificant contributor to community stability	Insignificant state preservation support	Insignificant national preservation support

weights, summing, and then multiplying the result by 25 percent. The Building Support Factor is thus a weighted average rating across the three scopes of building support, on a scale of 0 to 25.

For analysis of an individual building, it may be useful to integrate the Building Support Factor with the Historic Quality Index. The integrated rating is known as the Historic Support Index, or HSI. It is computed as the sum of the Historic Quality Index and the Building Support Factor, with an upper limit of 100 points. Since the HSI includes the Building Support Factor, which does not affect a building's intrinsic historic significance, the HSI is not used as an overall ranking factor. Instead, the Historic Quality Index, combining only the three ratings that *do* reflect historic significance, is used for ranking.

3. *HIST* Tutorial

The *HIST* software automates the computation of historic ratings for PBS buildings that have been thoroughly surveyed and entered into the BPP system. In fact, *HIST* uses as input the actual BPP data files for buildings, zones, and elements. The software offers a user interface for selecting buildings to be rated, viewing results, and printing reports on the historic ratings of buildings.

The *HIST* software includes the data files GROUPWT.DBF and RATINGWT.DBF, which at distribution contain the actual weighting and scoring data to be applied to all buildings. Section 2 described how these data were developed by PBS headquarters. If appropriate, these weights and scores can be changed using a database editor that can edit .DBF files.

Once the *HIST* software is installed and started (see "Getting Started"), a "buildings browser" appears listing the PBS buildings whose elements, zones, and the building as a whole have been surveyed using the BPP system. Exhibit 2 illustrates this screen with hypothetical buildings.

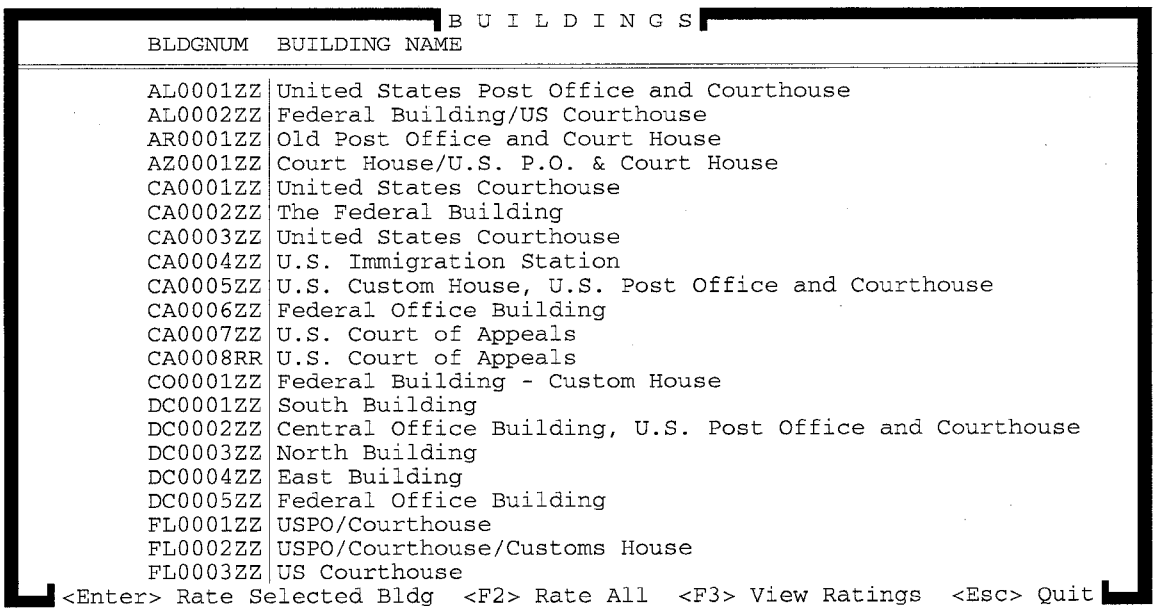

Exhibit 2. *HIST* Buildings Browser

From the *HIST* buildings browser, use ↑, ↓, **PgUp**, and **PgDn** to scroll through the buildings list. From this screen, you may select to rate either one or all the listed buildings. To rate a single building, move the highlight bar to it and press ↵. To rate all buildings, press **F2**. Once you select to rate one or all buildings, the ratings are computed and you are placed in the "historic ratings browser." If you have already rated the buildings and from the buildings browser simply wish to view the historic ratings, press **F3**. To quit *HIST*, press **Esc** from the buildings browser.

The historic ratings browser is depicted in exhibit 3. All buildings that *HIST* has rated are displayed. Again, press ↑, ↓, **PgUp**, and **PgDn** to scroll through the buildings and their ratings. Up to six ratings are displayed for each building: "BLD" denotes the Building Rating, "ZON" the Composite Zone

Rating, "ELT" the Composite Element Rating, "HQI" the Historic Quality Index, "BSF" the Building Support Factor, and "HSI" the Historic Support Index. The BSF and HSI ratings are left blank for those buildings for which BSF data have not yet been entered in the BPP system.

H I S T O R I C R A T I N G S

BLDGNUM	BLD	ZON	ELT	HQI	BSF	HSI	BUILDING	CITY
DC0001ZZ	69	60	50	60.5			South Building	Washington
VA0004ZZ	69	55	38	55.4	14	70	United States Courthouse	Richmond
VA0003ZZ	69	54	38	55.1			United States Custom House	Norfolk
CA0005ZZ	69	59	33	55.0	25	80	U.S. Custom House	San Francisco
SC0003ZZ	69	59	32	54.6			United States Custom House	Charleston
CA0009ZZ	69	49	41	54.5	5	60	Federal Office Building	San Francisco
MD0007ZZ	69	54	36	54.4			Custom House	Baltimore
OR0001ZZ	69	55	29	52.6	10	63	United States Courthouse	Portland
AL0003ZZ	69	43	39	52.1	18	70	Federal Building/US Courthou	Montgomery
AR0002ZZ	69	41	40	51.7	0	52	Old Post Office and Court Ho	Little Rock
GA0009ZZ	69	41	40	51.7			US Courthouse	Augusta
PA0002ZZ	69	45	35	51.3	7	58	Federal Building	Scranton
NM0002AQ	69	51	29	51.2	3	54	Federal Building/US Courthou	Albuquerque
FL0006ZZ	69	38	40	51.0			USPO/Courthouse	Jacksonville
GA0008ZZ	69	41	37	50.9	17	68	Federal Building/US Courthou	Savannah
KY0003ZZ	69	46	33	50.9			Federal Building/US Courthou	London
NJ0005ZZ	69	46	32	50.9			U.S. Post Office and Courtho	Camden
SC0008ZZ	69	44	34	50.8	20	71	US Courthouse	Columbia
TX0004ZZ	69	43	35	50.8	13	64	USPO/Courthouse	San Antonio
CA0006ZZ	69	47	30	50.7			U.S. Court of Appeals	San Francisco

<Enter> Element Ratings <F3> ReSort Display <Esc> BUILDINGS browser
<P> Print Summary Report <D> Detailed Report

Exhibit 3. *HIST* Historic Ratings Browser

Upon first entering the historic ratings browser, the Historic Quality Index column appears in yellow because the buildings are sorted by this rating (in descending order of historic significance). To sort buildings by the building number column (which in effect sorts them by State), or by any of the other five historic ratings columns, press **F3**. A popup box like the one shown in exhibit 4 appears. Move the highlight bar to the column on which you want to sort the historic ratings browser and press ◄┘. The buildings are now sorted by the selected column and it is displayed in yellow.

You may view a building's Zone-specific Element Ratings by highlighting the building and pressing ◄┘ from the historic ratings browser. A popup box similar to the one shown in exhibit 5 appears, identifying the building, its zones, and their Zone-specific Element Ratings. Press **Esc** to return to the historic ratings browser.

Two reports may be printed from the historic ratings browser. The Summary Report is a printed record of the information displayed in the historic ratings browser for all rated buildings. To print it, first ensure your printer is powered on and on line and then press **P**. The Detailed Report gives the historic ratings as well as much of the underlying data on which the ratings are based. To print the Detailed Report, move the highlight bar to the first building of interest and press **D**. You are then asked for how many buildings you want a Detailed Report. Accept the default value **1** for a Detailed Report for the highlighted building only. Enter **10** for a Detailed Report for each of the next ten buildings, beginning with the highlighted building. To print a Detailed Report for all buildings, move the highlight bar to the first building, press **D**, and enter an arbitrarily large number that is greater than the number of rated buildings. An illustrative Detailed Report is given in exhibit 6.

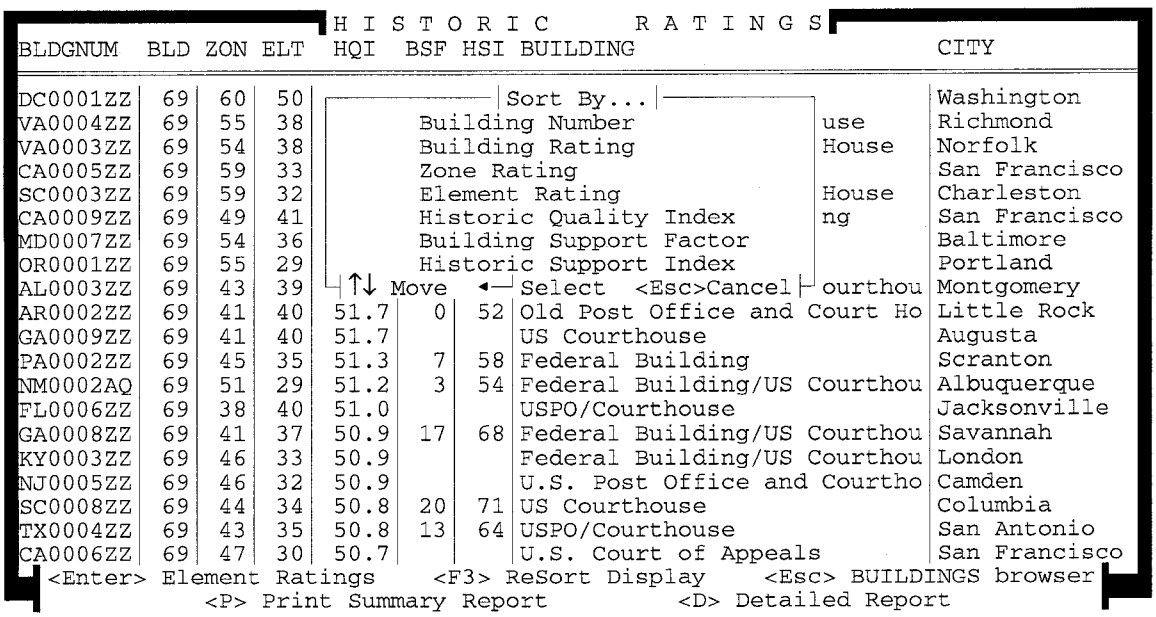

Exhibit 4. Selecting Column on Which to Sort Historic Ratings Browser

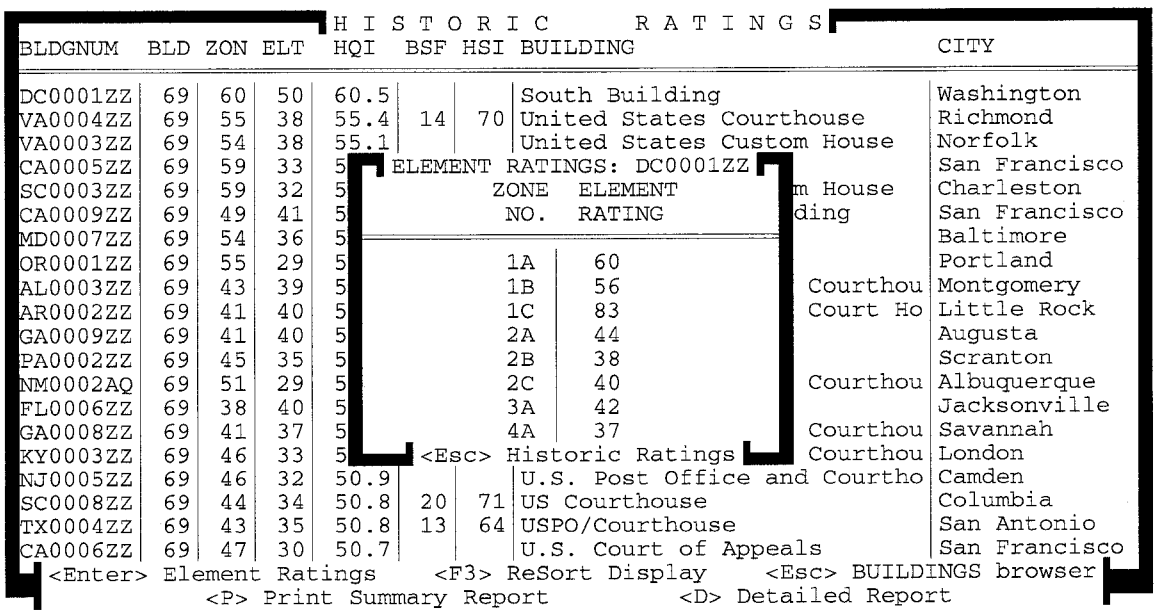

Exhibit 5. *HIST* Zone-Specific Element Ratings Browser

You can examine the derivation of the historic ratings from the data given in the Detailed Report. For example, the Historic Quality Index is computed as the weighted average of the Building Rating, Composite Zone Rating, and Composite Element Rating. Using the hypothetical data given in exhibit 6, the HQI is computed as (40%*69)+(30%*55)+(30%*38)=55.4. Note that the element rating section of the Detailed Report lists the number of elements with each of the BPP ratings one through six.

This information gives you a rough idea of the data underlying the Zone-specific Element Rating printed at the right. Remember that the Zone-specific Element Rating also incorporates the intrinsic historic importance of the elements and the importance of the element groups to which they belong.

When you have finished your *HIST* session, press **Esc** from the historic ratings browser to return to the buildings browser. Press **Esc** again to exit *HIST* and return to DOS.

UNITED STATES COURTHOUSE (VA0004ZZ)
Richmond, VA

Historic Quality Index: 55.4
Historic Support Index: 70

****

BUILDING RATING
(HQI Weight 40%)

BUILDING RATING FOR National Historic Landmark--Member: 69

****

ZONE RATING
(HQI Weight 30%)

	Weight	Rating
Interior Zones	67%	33
Exterior Zones	33%	100

WEIGHTED AVERAGE ZONE RATING: 55

****

ELEMENT RATING
(HQI Weight 30%)

Zone No	Zone Name	No. Elements Rated 1	2	3	4	5	6	Element Rating
1A	SOUTH AND WEST ELEVATIONS	17	1	15	4	1	7	45
1B	2ND FLOOR COURTROOMS	12	0	2	3	0	2	67
2A	ORIGINAL RESTROOMS	6	3	4	3	0	3	44
2B	NORTH AND EAST ELEVATIONS	4	7	1	5	1	3	40
3A	LOBBIES AND CORRIDORS	0	4	1	0	1	6	22
4A	TENANT SPACES	0	2	4	4	0	5	12

SIMPLE AVERAGE ELEMENT RATING: 38

****

BUILDING SUPPORT FACTOR
(Up to 25 Bonus Points that are Added to the HQI to derive the HSI)

Category	Support Level	Rating	Weight
National	High	100	40%
State	Medium	50	35%
Community	Low	0	25%

WEIGHTED AVERAGE BSF: 14

Exhibit 6. *HIST* Detailed Report

Appendix A. *HIST* Rating System Algorithms

Composite Element Rating

The Composite Element Rating for a building is the simple average of the building's Zone-specific Element Ratings. The Zone-specific Element Ratings are computed as follows:

$$\sum_{i=1}^{7} SCORE_i * eltwt_i$$

where

$SCORE_i$ = sum of individual element scores, $score_k$, for element group i (Note: There are seven distinct element groups.)

$$SCORE_i = \sum_{k=1}^{n_i} score_k$$

n_i = number of elements in element group i,

$eltwt_i$ = zone-specific element weight for element group i, based on standard element group weight for element group i, $grpwt_i$. Since $grpwt_i$ is based on the assumption that there are the same number of elements in each group, $eltwt_i$ is derived for each zone to account for size variation in groups:

$$eltwt_i = \frac{grpwt_i}{\sum_{i=1}^{7} grpwt_i * n_i}$$

Composite Zone Rating

The Composite Zone Rating for a building is computed as follows:

$$(zonegrpwt_{exterior} * zonescore_{exterior}) +$$

$$(zonegrpwt_{interior} * zonescore_{interior})$$

where

$zonegrpwt_{exterior}$, $zonegrpwt_{interior}$ = relative importance weights for the exterior and interior zone groups, respectively,

$$zonegrpwt_{exterior} = (1 - zonegrpwt_{interior})$$

$zonescore_{exterior}$ = weighted average score for the exterior zone group based on weights for exterior zone types, $zonewt_i$, and corresponding scores, $zonescore_i$, as follows:

$$zonescore_{exterior} = \sum_{i \in exterior} \frac{zonewt_i}{\sum_{i \in exterior} zonewt_i} * zonescore_i$$

$zonescore_{interior}$ = weighted average score for the interior zone group based on zone area, $zonearea_i$, and corresponding scores, $zonescore_i$, as follows:

$$zonescore_{interior} = \sum_{i \in interior} \frac{zonearea_i}{\sum_{i \in interior} zonearea_i} * zonescore_i$$

Building Rating

The building rating is simply the scalar score corresponding to the verbal building rating (e.g., National Historic Landmark-Excellent).

Historic Quality Index

The Historic Quality Index (HQI) is the weighted average of the Composite Element Rating, Composite Zone Rating, and Building Rating.

Building Support Factor

The Building Support Factor is computed as the weighted average of the three scalar ratings corresponding to the three scopes of building support (community, state, and national), on a scale of 0 to 25.

Historic Support Index

The Historic Support Index (HSI) is computed as the sum of the Historic Quality Index and the Building Support Factor. If this sum exceeds 100 points, the HSI is set to 100 points.

Appendix B. *HIST* Data Dictionary

GROUPWT.DBF:

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
1	STAGE	C	1		Historic rating to which weights apply. (2=zone rating; 3=element rating; 4,5,6=BSF rating; 7=HQI and HSI ratings)
2	GROUP	C	8		Group to which weight applies. Note: For STAGE 2 records (excluding the "xterall" record), an exterior zone group code is the first character of this field, immediately followed by the exterior zone group name. Constraints: Exterior zone group codes must be single alphabetic characters, beginning with "A" and using each successive alphabetic character until all exterior zone groups are defined.
3	WEIGHT	N	5	3	Weight for corresponding GROUP in the STAGE. Constraint: Weights must sum to 1.000 across all GROUPS in each STAGE, except STAGE 2, whose weights must sum to 1.000 across all GROUPS excluding "xterall." The "xterall" weight represents exterior zones' share of the zone rating.

RATINGWT.DBF:

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
1	STAGE	C	2		Historic rating to which score applies. (1=building rating; 2=zone rating; 3=element rating; 4,5,6=BSF rating)
2	RATING	C	5		Verbal rating. (STAGE 1: "Nl"=National Historic Landmark; "Ns"=National Significance; "Ss"=State Significance "Ls"=Local Significance; "E"=Excellent; "H"=High; "D"=Defining; "M"=Member. STAGE 2: "1Pres"=Level 1 Preservation Zone, "2Pres"=Level 2 Preservation Zone, "3Rehb"=Rehabilitation Zone, "4Free"=Free Zone. STAGE 3: "HIGH"=Special intrinsic historic significance; "LOW"=Normal intrinsic historic significance; "1","2","3"=element BPP rating. STAGEs 4,5,6: "Hi","Md", "No" = high, medium, and insignificant levels of building support, respectively, "Nat","StL", "Com" = scopes of National, State, and Community support, respectively.)
3	SCORE	N	5	3	Numeric score for corresponding RATING. Constraint: Highest possible score for each STAGE must be 1.000.

MMCODEWT.DBF:

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
1	MMCODE	C	4		Element code number from BPP Master Element List.
2	HEADING	C	23		Element group to which element belongs, from BPP Master Element List.
3	WEIGHT	C	4		Intrinsic historic significance of element (HIGH or LOW)

TRNSLATE.DBF:

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
1	STAGE	C	2		Historic rating for which BPP ratings must be reassigned (2=zone rating).
2	HBPPRATING	C	2		BPP rating
3	NEWRATING	N	2		Rating to which BPP rating will be reassigned.

ID.DBF (Part):

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
65	SCOPE	C	1		Scope of the building's historic significance, for use in building rating. (1=National Historic Landmark, 2=National Significance, 3=State Significance, 4=Local Significance)
66	LEVEL	C	1		Level of historic significance within SCOPE, for use in building rating. (1=Excellent, 2=High, 3=Defining, 4=Member)
67	NATLSUPP	C	1		Level of building support at the national scale, for use in BSF rating. ("H"=High, "M"=Medium, and "N"=None)
68	STLOSUPP	C	1		Level of building support at the state scale, for use in BSF rating. ("H"=High, "M"=Medium, and "N"=None)
69	COMMSUPP	C	1		Level of building support at the community scale, for use in BSF rating. ("H"=High, "M"=Medium, and "N"=None)

ZONES.DBF (Part):

FIELD	NAME	TYPE	WIDTH	DEC	DESCRIPTION
15	INAREXTYPE	C	6		If an interior zone, this field contains zone floor area. If an exterior zone, the field contains zone type code. Exterior zone type codes are defined in GROUPWT.DBF, in the GROUP field for STAGE 2 records (excluding the "xterall" record). Constraints: Each exterior zone type may be used only once in a given building.