



**US Army Corps  
of Engineers®**  
Engineer Research and  
Development Center

**ERDC**  
INNOVATIVE SOLUTIONS  
for a safer, better world

*Worldwide Construction Practices*

## **Building Identification Wizard**

Version 1.5.1

Byron M. Garton, Speler T. Montgomery, and M. Jason Roth

April 2018

The cover features a globe on the left with two inset images of buildings. To the right, the text reads 'WCP Worldwide Construction Practices' in large, bold, white letters. Below this, 'Building Identification Wizard version 1.5.1' is written in a similar style. At the bottom left, there is a block of text regarding distribution authorization. At the bottom right, the ERDC logo is displayed, which includes the text 'ERDC' in large red letters and 'Engineer Research and Development Center' in smaller black letters, with a small version of the castle logo to the right.

**WCP**  
Worldwide Construction  
Practices

**Building Identification Wizard**  
version 1.5.1

Distribution authorized to U.S. Government Agencies and their contractors; Software Documentation, PATCACE 506; Dec 2005. Other requests for this document shall be referred to U.S. Army Engineer Research and Development Center, ATTN: CEERD-65-V, 3909 Halls Ferry Rd, Vicksburg, MS 39180-6199.

**ERDC**  
Engineer Research and Development Center

**The U.S. Army Engineer Research and Development Center (ERDC)** solves the nation's toughest engineering and environmental challenges. ERDC develops innovative solutions in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the Army, the Department of Defense, civilian agencies, and our nation's public good. Find out more at [www.erdclibrary.usace.army.mil](http://www.erdclibrary.usace.army.mil).

To search for other technical reports published by ERDC, visit the ERDC online library at <http://acwc.sdp.sirsi.net/client/default>.

# **Building Identification Wizard**

Version 1.5.1

M. Jason Roth

*U.S. Army Engineer Research and Development Center (ERDC)  
Geotechnical and Structures Laboratory (GSL)  
3909 Halls Ferry Road  
Vicksburg,, MS 39180-6199*

Byron M. Garton and Speler T. Montgomery

*U.S. Army Engineer Research and Development Center (ERDC)  
Information Technology Laboratory (ITL)  
3909 Halls Ferry Road  
Vicksburg,, MS 39180-6199*

Final report

Approved for public release; distribution is unlimited.

Prepared for Headquarters, U.S. Army Corps of Engineers  
Washington, DC 20314-1000

Under Work Unit AT40-SB-003, Protection Against Terrorist and Conventional Attacks  
in Contingency Environments (PATCACE)

## Abstract

This document discusses the Worldwide Construction Practices Building Identification Wizard program version 1.5.1, which provides a guided user interface that aids in the identification of building construction types and facilitates access to the Worldwide Construction Practices database. It provides an in-depth look into the program's user interface, the Sequential Statistical Evaluation of Building Parameters (SSEBP) algorithm used to determine building types, the export methods used to link information from the Worldwide Construction Practices database with other Army software, and a technical discussion of the internal components of the program. The intent of this report is to thoroughly explain the Building Identification Wizard and provide an understanding of the program from a technical and user-friendly standpoint.

**DISCLAIMER:** The contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute an official endorsement or approval of the use of such commercial products. All product names and trademarks cited are the property of their respective owners. The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

**DESTROY THIS REPORT WHEN NO LONGER NEEDED. DO NOT RETURN IT TO THE ORIGINATOR.**

# Contents

<b>Abstract .....</b>	<b>ii</b>
<b>Figures .....</b>	<b>iv</b>
<b>Preface .....</b>	<b>vi</b>
<b>Acronyms .....</b>	<b>vii</b>
<b>1 Introduction.....</b>	<b>1</b>
<b>2 Installation .....</b>	<b>4</b>
2.1 System requirements .....	4
2.2 Requesting the software .....	4
2.3 Installation and activation.....	4
<b>3 User Interface .....</b>	<b>7</b>
3.1 Introduction.....	7
3.2 Screenshots .....	7
3.3 Automatic updating .....	17
<b>4 Building Identification Process.....</b>	<b>19</b>
4.1 General building construction type.....	19
4.2 Specific building construction type.....	22
4.3 Identification algorithm .....	29
4.4 Scoring methods.....	31
<b>5 Querying the Database .....</b>	<b>33</b>
5.1 About the database .....	33
5.2 Using the database query function .....	33
<b>6 Exporting Data.....</b>	<b>35</b>
6.1 Exporting to a web or PDF File .....	35
6.2 Exporting to other applications.....	36
<b>7 Worldwide Construction Practices Fact Sheets.....</b>	<b>39</b>
<b>References .....</b>	<b>43</b>

**Report Documentation Page**

# Figures

Figure 1. BIW process flowchart.....	3
Figure 2. Installing the BIW software.....	4
Figure 3. Choosing the installation location. ....	5
Figure 4. Key Required prompt.....	5
Figure 5. Hardware fingerprint screen. ....	6
Figure 6. Application startup screen.....	8
Figure 7. Initial wizard screen. ....	8
Figure 8. Location Information screen. ....	9
Figure 9. Story Height Information screen.....	9
Figure 10. Window Information screen. ....	10
Figure 11. Wall Information screen.....	10
Figure 12. Material Information screen. ....	11
Figure 13. Building Information screen.....	11
Figure 14. Choose Main Type screen. ....	12
Figure 15. Initial Specific Construction Type screen.....	13
Figure 16. Additional Information screen.....	13
Figure 17. Choose Sub Type screen.....	14
Figure 18. Final identification screen.....	14
Figure 19. Building List screen.....	15
Figure 20. Building Properties screen. ....	16
Figure 21. Export tab. ....	16
Figure 22. Query builder screen.....	17
Figure 23. Update application start screen.....	18
Figure 24. Update application finish screen.....	18
Figure 25. Mass construction building characteristics. ....	19
Figure 26. Mass construction: Brick buildings.....	20
Figure 27. Mass construction: Box-wall principle building.....	21
Figure 28. Framed building characteristics. ....	21
Figure 29. Mass and framed construction common materials. ....	22
Figure 30. Example of steel moment frame building.....	23
Figure 31. Example of steel frame building with shear walls.....	23
Figure 32. Example of steel frame building with steel bracing.....	24
Figure 33. Example of concrete moment frame building.....	24
Figure 34. Example of concrete frame building with shear walls.....	25
Figure 35. Example of pre-engineered metal frame building.....	25
Figure 36. Example of wood post and beam building.....	26
Figure 37. Example of light stud frame/wood walls building.....	26
Figure 38. Example of concrete shear walls building.....	27

---

Figure 39. Example of precast/tilt-up concrete walls building.....	27
Figure 40. Example of reinforced masonry walls building.....	28
Figure 41. Example of confined masonry walls building. ....	28
Figure 42. Example of cast-in-place concrete walls building. ....	29
Figure 43. Query builder.....	34
Figure 44. Query results list.....	34
Figure 45. Export tab in building properties screen.....	35
Figure 46. Example of PDF report exported from the application.....	36
Figure 47. Selecting AT planner components. ....	37
Figure 48. Select component values.....	38
Figure 49. Worldwide construction practices website on CD.....	39
Figure 50. Main menu button.....	40
Figure 51. Regional construction practices reports. ....	41
Figure 52. Photo viewer for city buildings. ....	42

## Preface

This report is a deliverable product under the military direct-allotted Department of the Army Project AT40, Work Package AT40-256, Protection Against Terrorist and Conventional Attacks in Contingency Environments (PATCACE), Work Unit AT40-SB-003, Structural Response and Assessment for Military Operations and Urban Terrain (MOUT), and is part of a Science and Technology Objective (STO). This research supports the Worldwide Construction Practices (WCP) program that is being developed under the work unit. This work was funded by Headquarters, U.S. Army Corps of Engineers (USACE).

The work was performed by the Survivability Engineering Branch (CEERD-GSV) of the Geosciences and Structures Division (CEERD-GS), U.S. Army Engineer Research and Development Center, Geotechnical and Structures Laboratory (ERDC-GSL). At the time of publication, Mr. Omar G. Flores was Chief, CEERD-GSV; Mr. James L. Davis was Chief, CEERD-GS; and Ms. Pamela G. Kinnebrew, CEERD-GZT, was the Technical Director for Survivability and Protective Structures research area. The Deputy Director of ERDC-GSL was Dr. William P. Grogan, and the Director was Mr. Bartley P. Durst.

COL Bryan S. Green was the Commander of ERDC, and Dr. David W. Pittman was the Director.

## Acronyms

AT	Anti Terrorist
BIW	Building Identification Wizard
CMU	Concrete Masonry Units
DoD	Department of Defense
ERDC	U.S. Army Engineer Research and Development Center
FACEDAP	Facilities and Component Explosive Damage Assessment Program
HTML	Hypertext Markup Language
PATCACE	Protection against Terrorist and Conventional Attacks in Contingency Environments
PDF	Portable Document Format
PI	Pressure Impulse
SSEBP	Sequential Statistical Evaluation of Building Parameters
SQL	Structured Query Language
WCP	Worldwide Construction Practices
XML	Extensible Markup Language

# 1 Introduction

Historically, there has not been a well-documented, centralized source of information regarding worldwide construction practices and material properties. This has presented a problem, as there is an escalating analytical need for reliable information on the geographic distribution of building types, building components, and material properties. Current facility vulnerability assessment algorithms are based on U.S. construction practices leading to inaccurate assessments. These assessments are essential for providing protective measures against conventional weapons and terrorist attacks within the urban environment. This information is also critical for basic input to programs like the Anti-Terrorist (AT) Planner and other types of assessment programs (i.e., target model generation and the determination of collateral damage effects).

The Worldwide Construction Practices (WCP) program was developed by the U.S. Army Engineer Research and Development Center (ERDC) under the Protection Against Terrorist and Conventional Attacks in Contingency Environments (PATCACE) work package, as part of an Army Science and Technology Objective initiative. The WCP program consists of a relational database and a Building Identification Wizard (BIW). The BIW is a desktop application built with the Java programming language to aid in the identification of building construction types by quantifying a series of questions into a confidence level that can be used to make a decision.

The BIW user steps through the process of identifying a building type by inputting easily obtained or visually obvious information and then provides the user typical construction practices and material properties data for the building and building components based on entries in the WCP Database.

The BIW uses the proprietary Sequential Statistical Evaluation of Building Parameters (SSEBP) algorithm to produce building construction type results based on user responses to questions regarding a building's physical characteristics. The SSEBP algorithm, inspired by Ellefsen et al. (1981), Ellefsen (2005), and Loechl et al. (2010), formulates the initial construction type selection derived from a nomination routine that scores the selection based on building characteristics supplied by the user. Further building type

selection is made based on an elimination routine, also derived from user responses to additional building characteristic questions. Whenever a construction type is not definitively determined, the user is supplied with additional information to assist in facilitating an educated decision. A relational database has been developed containing general building components that are compatible with the Facilities and Component Explosive Damage Assessment Program (FACEDAP), oriented building components, and material properties based on typical construction practices worldwide. Additionally, the BIW will query the database based on country, region, urban terrain zone, mass (load-bearing walls) or frame construction, building type, building function, cladding type, and/or year of construction. The BIW provides these required parameters for pressure-impulse (PI) based structural calculations used in engineering tools and modeling and simulations.

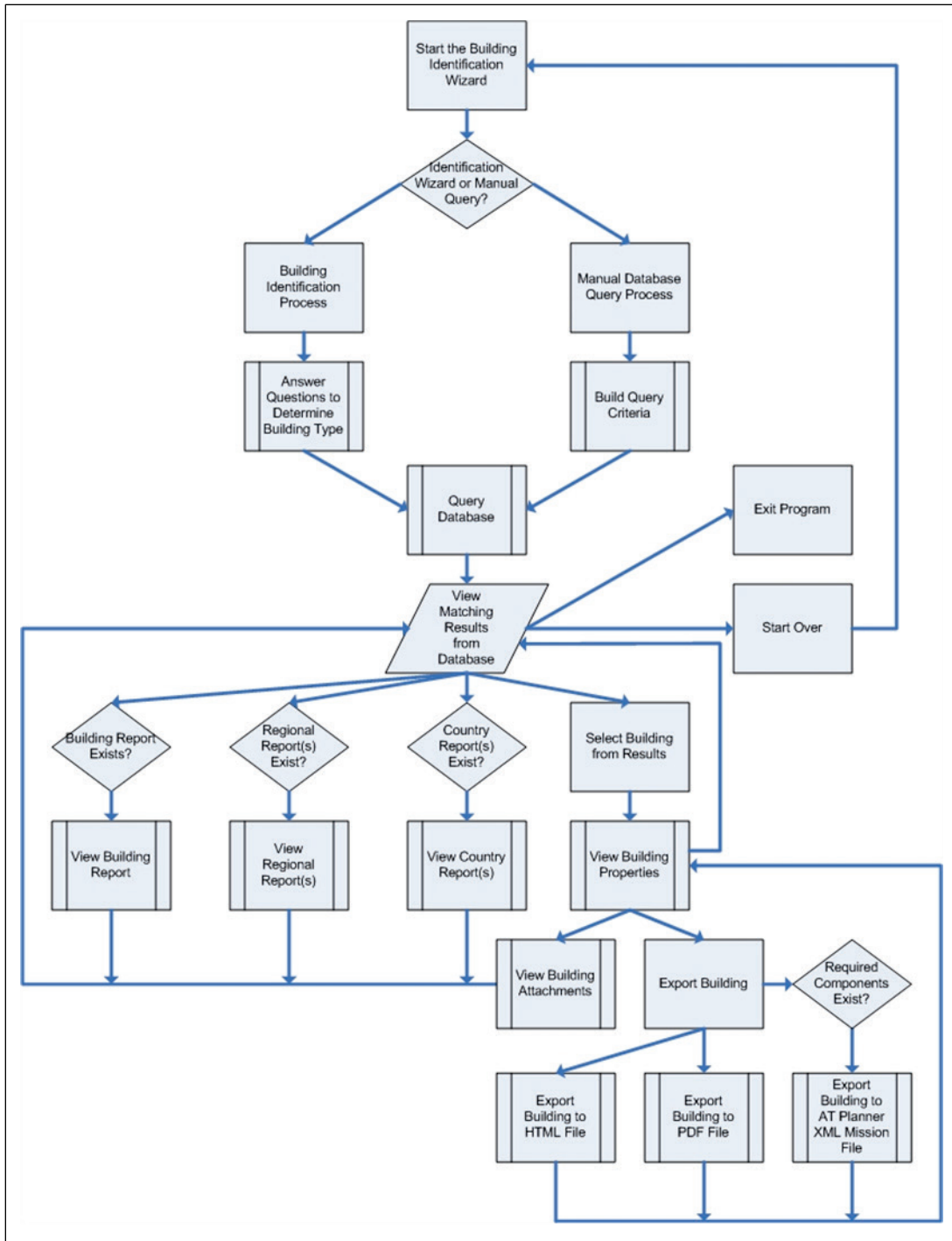
The BIW has the capability of exporting data compiled on a building by producing an extensible markup language (XML) file for use in AT Planner assessments. This reduces the time it takes an AT Planner user to input building data and produces a more realistic assessment. A compilation of city fact sheets and building photographs have been created using hypertext markup language (HTML) format, so users can read about a city or a location's typical construction practices by browsing an HTML CD or by viewing the report through the BIW.

The BIW is built on top of the WCP database that contains building construction information collected from literature and other data sources from around the world. In addition to building construction type identification, the program allows users to view building information from the WCP database and export it to other applications.

Users also have access to other WCP reports from regions of interest that are formatted as HTML and are viewable in any web browser. The WCP database and the associated regional reports are accessible separately from the building identification process, making them quick and easy to use.

Figure 1 illustrates the functions and processes within the BIW.

Figure 1. BIW process flowchart.



## 2 Installation

### 2.1 System requirements

Computing requirements for executing the BIW are rather modest. The application is compiled to run in the Microsoft Windows operating system. Microsoft Windows XP, 800 MHz or greater processor, 256 MB RAM (current testing indicates around 40 MB are used during runtime), and 300 MB free hard drive space are the minimum requirements.

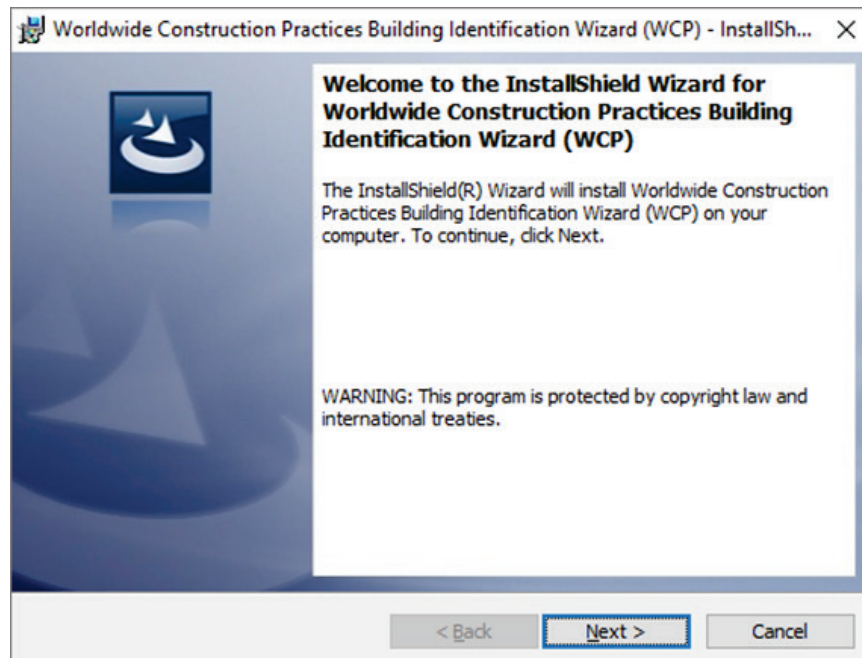
### 2.2 Requesting the software

Users may request the software by sending an email to [wcp@usace.army.mil](mailto:wcp@usace.army.mil) or by visiting the WCP website at <http://wcp.erd.c.usace.army.mil>.

### 2.3 Installation and activation

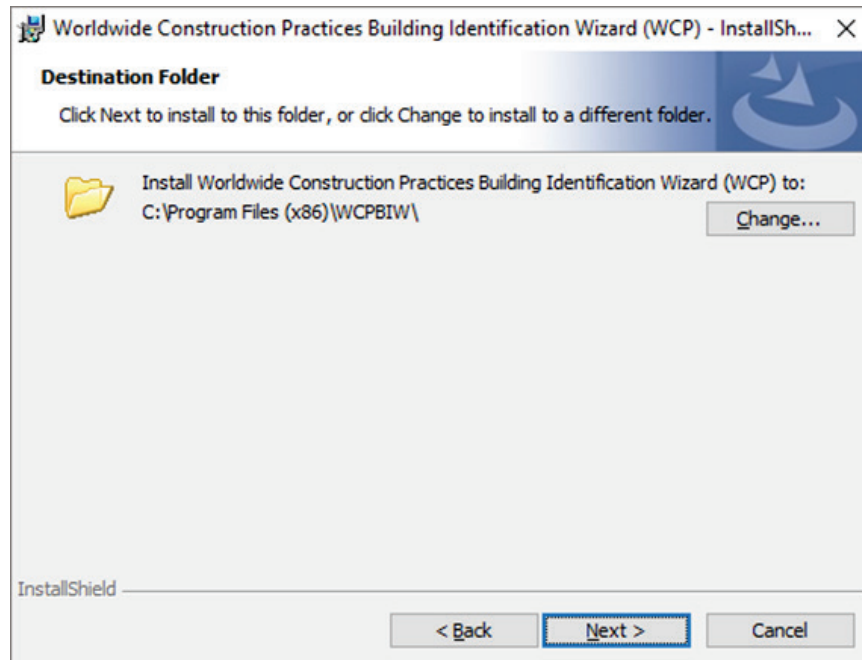
Application installation is performed via an executable created with InstallShield (Figure 2). Some users with limited rights on their computer may require the assistance of their system administrator.

Figure 2. Installing the BIW software.



The user may choose to change the default installation location, although using the default location is recommended (Figure 3).

Figure 3. Choosing the installation location.



During installation, shortcuts to the application are placed in the user's start menu and on the desktop. After installation is complete, the application can be launched from either of these shortcuts.

The program requires an activation key, and the user will be prompted to enter a key on first use (Figures 4 and 5). A hardware fingerprint is generated for activation, and users can request an activation key by sending their name and hardware fingerprint to the same e-mail address they used originally to request the software. A key will be generated and returned to the user via e-mail.

Figure 4. Key Required prompt.

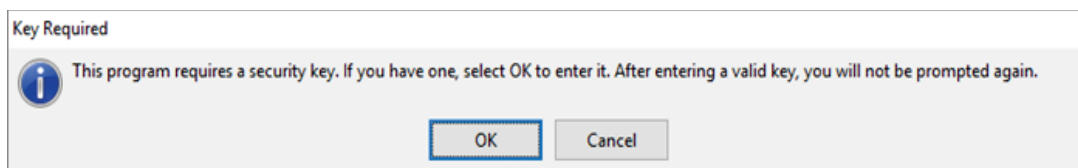
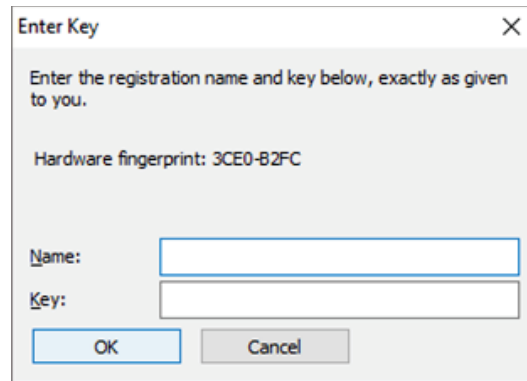


Figure 5. Hardware fingerprint screen.



Enter Key

Enter the registration name and key below, exactly as given to you.

Hardware fingerprint: 3CE0-B2FC

Name:

Key:

OK Cancel

The key is a long, random string of characters; it is recommended that users copy and paste the key into the box. After the user's name and key are entered, the application is unlocked and will continue to launch normally. The application stores the key locally, and the user will not be prompted to enter it again after the initial inquiry.

## **3 User Interface**

### **3.1 Introduction**

The user interface for the BIW utilizes familiar buttons, boxes, and selection objects to guide the user through the identification process. The user interface is designed to conform to whatever custom visual styles the user has made to their Microsoft Windows environment. A consistent font and window size ensure that the application will not be distorted by user-defined styles.

The construction type identification process follows a standard wizard-type approach. The user is presented with a series of question screens and the ability to navigate through those question screens with back, next, and start-over buttons at the bottom of the screen.

Following the successful identification of a building or the direct querying of the WCP database, the application can export the selected building's data to other applications. This exchange of information between applications allows the user to seamlessly transition between applications and accomplish their goals with as little effort and technical expertise as possible.

When viewing or exporting building information, the screens do not follow the wizard type format. They are customized to present the information in the simplest way possible to reduce user confusion.

### **3.2 Screenshots**

A screenshot is an image capture of the current state of an application's windowed graphical interface. The following screenshot images provide a visual illustration of the BIW's user interface.

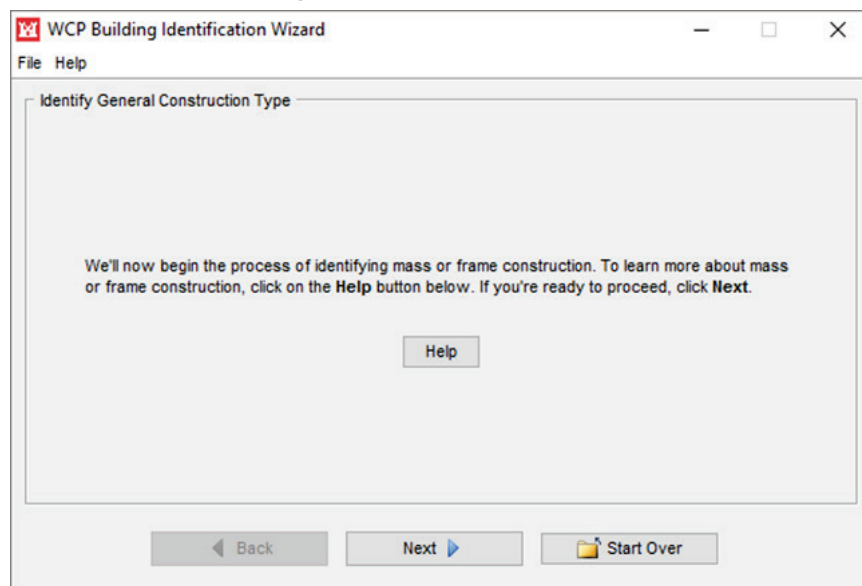
The application startup screen (Figure 6) is the first screen a user sees when they launch the application. From this screen, they have the option to start the building identification process that identifies the potential building construction type, or they may query the database directly to find buildings based on a number of search criteria. The application's help system is also available from the "Help" menu near the top left of the window.

Figure 6. Application startup screen.



The initial wizard screen (Figure 7) is the first screen presented to the user after they have selected to begin the building identification process. This window and all wizard windows following have navigation buttons along the bottom. These buttons allow the user to advance the identification process, go back to a previous screen, or start the entire process over from the start. The “Help” command is also available on this screen (as it is on every screen within the application).

Figure 7. Initial wizard screen.



On the location information screen (Figure 8), the user is asked to supply some basic information about the building's location and the land use characteristics of the area where the building is located.

Figure 8. Location Information screen.

The screenshot shows a software window titled "WCP Building Identification Wizard" with a menu bar containing "File" and "Help". The main content area is titled "Location Information" and contains three input fields with associated "Help" buttons:

- "What country is the building in?" followed by a dropdown menu.
- "What is the building's location?" followed by a text input field and a "Help" button.
- "What urban terrain zone (UTZ) is the building in?" followed by a dropdown menu and a "Help" button.

At the bottom of the window, there are three navigation buttons: "Back" (with a left arrow), "Next" (with a right arrow), and "Start Over" (with a refresh icon).

The following screens (Figures 9 – 14) collect exterior building characteristic information that is used to estimate the building construction type within the SSEBP algorithm. These identifying characteristics and how the algorithm determines potential building types will be discussed in the Building Identification Process section.

Figure 9. Story Height Information screen.

The screenshot shows a software window titled "WCP Building Identification Wizard" with a menu bar containing "File" and "Help". The main content area is titled "Story Height Information" and contains one input field with an associated "Help" button:

- "How many stories does the building have?" followed by a dropdown menu and a "Help" button.

At the bottom of the window, there are three navigation buttons: "Back" (with a left arrow), "Next" (with a right arrow), and "Start Over" (with a refresh icon). The "Start Over" button is highlighted with a blue border.

Figure 10. Window Information screen.

WCP Building Identification Wizard

File Help

Window Information

Does the building have corner windows?  Help

Does the building have windows on two adjacent sides?  Help

Do windows or doors make up more than 1/3 of the wall space of any single wall?  Help

Are the building's windows or doors recessed?  Help

Does the building have arches or lintels over the windows or doors?  Help

Are the building's windows vertically aligned?  Help

Back Next Start Over

Figure 11. Wall Information screen.

WCP Building Identification Wizard

File Help

Wall Information

Does the building have a visible frame or frame pattern?  Help

Does the building have uniformly sized individual cells?  Help

Does the building share one or more walls with another building?  Help

Are the building's lower level walls thicker than the upper level walls?  Help

Does the building have pilasters placed along the exterior wall at periodic intervals?  Help

Back Next Start Over

Figure 12. Material Information screen.

WCP Building Identification Wizard

File Help

Material Information

What material is the building's exterior composed of?  Help

What is the weight of the exterior cladding?  Help

Back Next Start Over

Figure 13. Building Information screen.

WCP Building Identification Wizard

File Help

Building Information

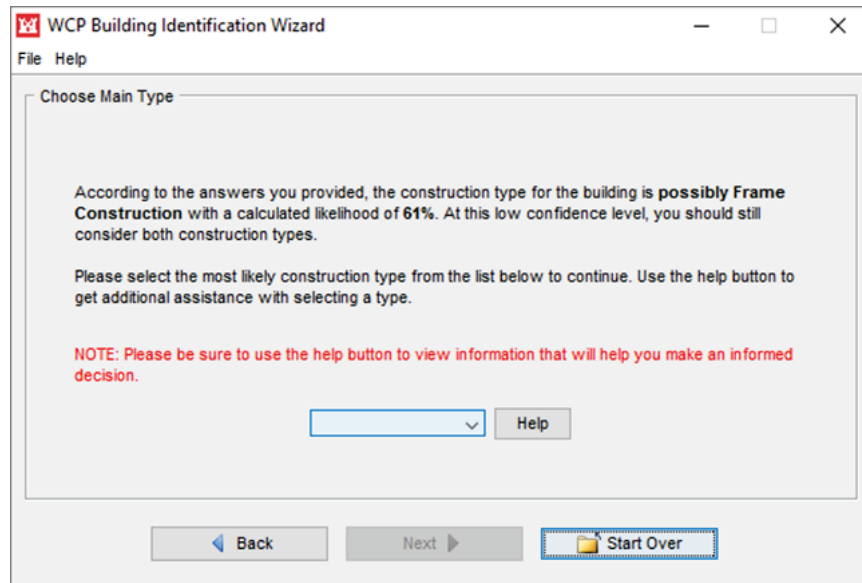
What is the building's footprint?  Help

What is the building's primary function?  Help

What era was the building constructed in?  Help

Back Next Start Over

Figure 14. Choose Main Type screen.



At this point in the building identification process, the application has analyzed the information provided about exterior building characteristics and made a statistical determination of the general construction type. The user is also presented with a confidence value, a percentage of likelihood that the construction type was correctly identified within the algorithm. Below a 60% confidence value threshold, the application asks the user to manually select a construction type. The “Help” function is provided to assist the user in making an informed decision.

Following the successful selection of the general construction type, the wizard continues the identification process by collecting more information from the user in an attempt to identify a more specific type of construction (Figure 15).

The screens that collect data for specific construction type identification are customized to only collect data that are relevant to the general construction type previously identified. Figure 16 is representative of these screens.

At the end of the specific construction type identification process, the algorithm has either successfully identified the specific type or at a minimum narrowed the list of potential types down to a select few. The “Choose Sub Type” screen (Figure 17) asks the user to make an informed decision manually since the algorithm was unable to make a concrete decision based on the user’s input.

Figure 15. Initial Specific Construction Type screen.

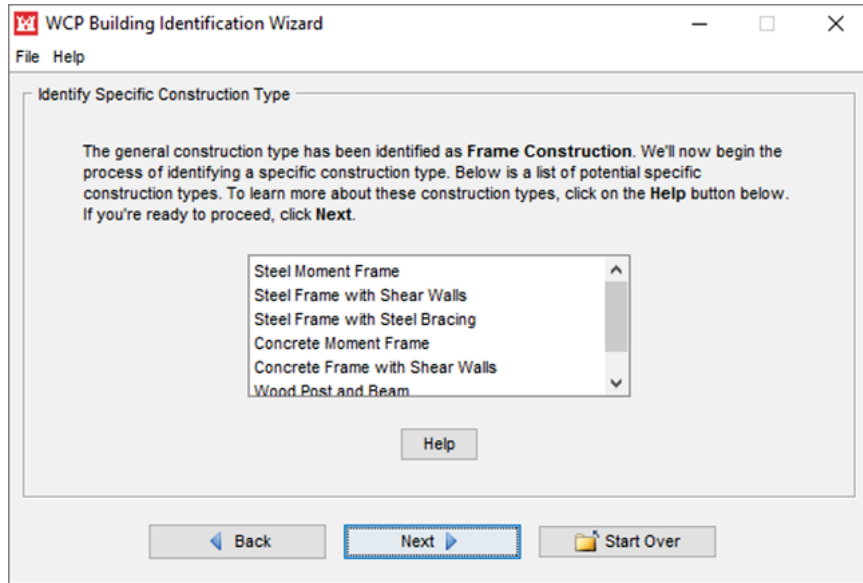


Figure 16. Additional Information screen.

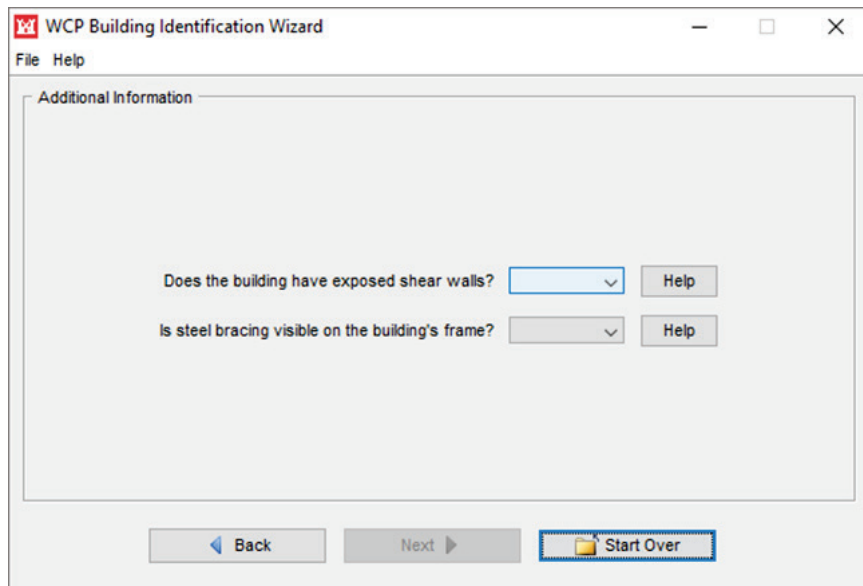
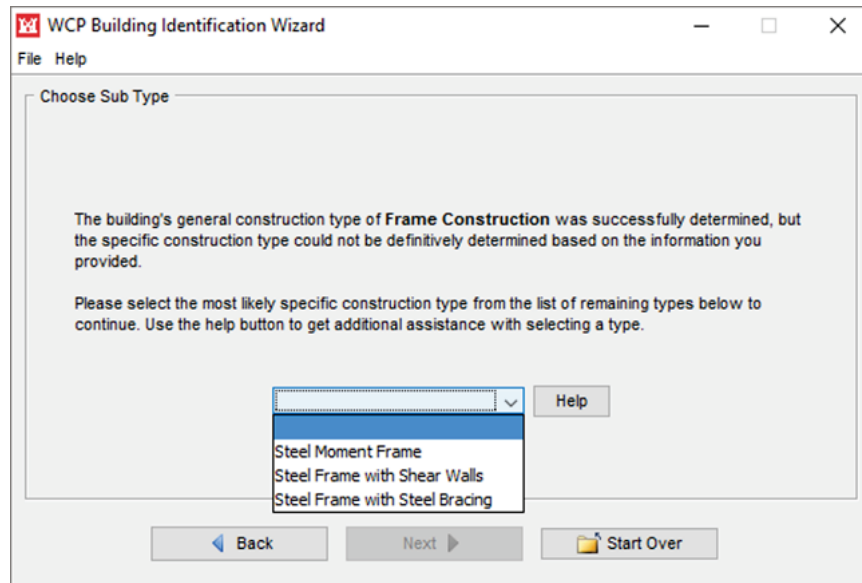
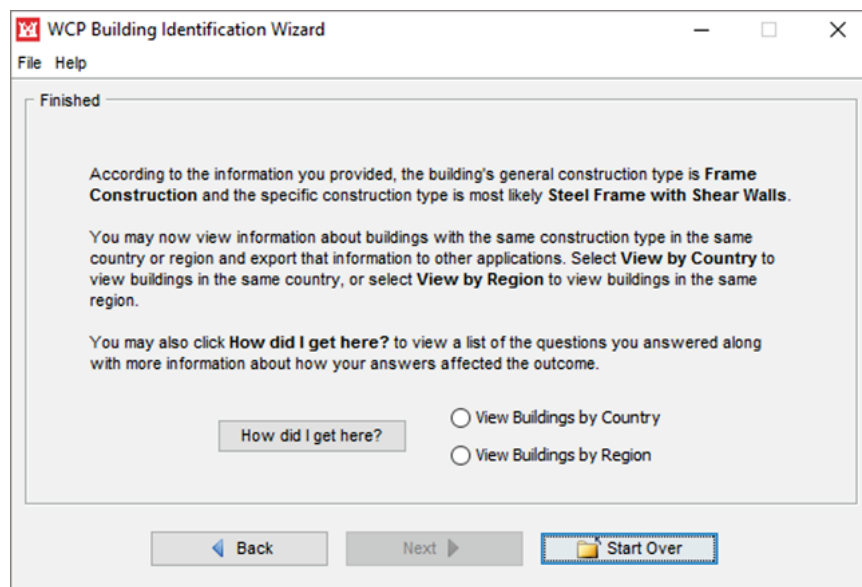


Figure 17. Choose Sub Type screen.



The identification process is complete at this point (Figure 18). The algorithm has either identified a general or specific construction type, or the user has made an informed selection manually. A report is produced that lists each question and the corresponding user-supplied information. This report is accessed by clicking on the “How did I get here?” button.

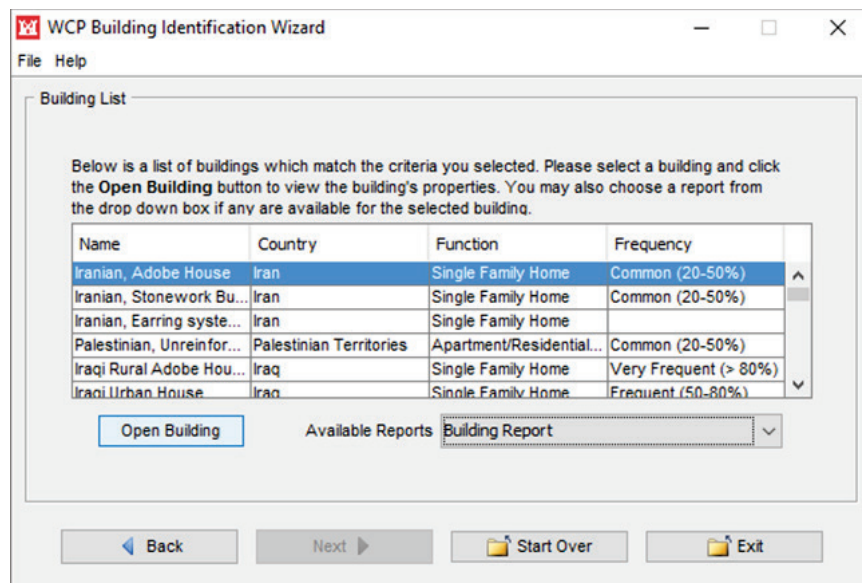
Figure 18. Final identification screen.



The next step in the process is viewing buildings that are stored in the WCP database that match the identified construction type. These results are sorted by country and by region. Country is identified by the user at the beginning of the identification process, and the region is inferred by the application based on the user-supplied country.

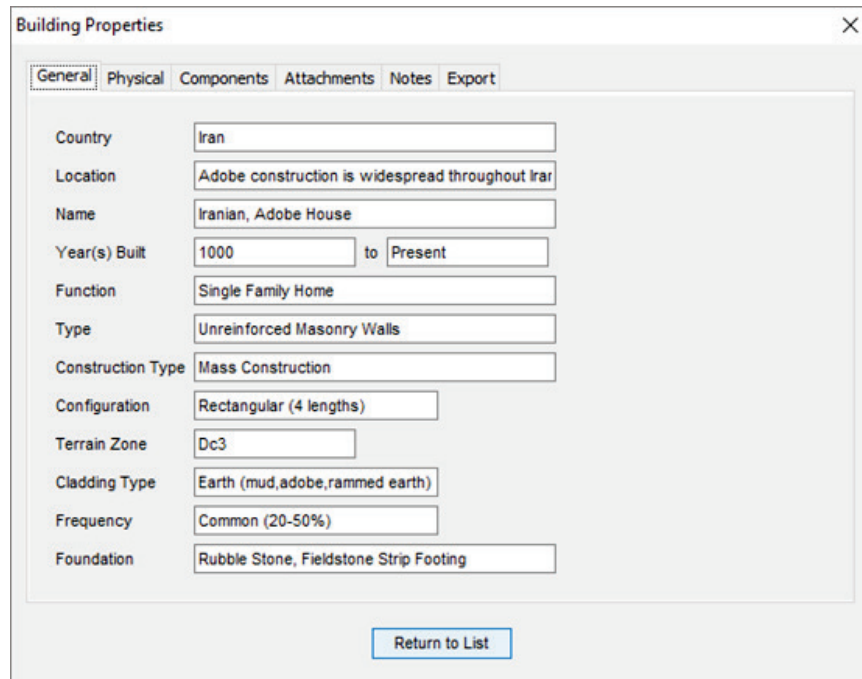
Results from the WCP database are listed on this screen (Figure 19). The user selects a building from the list and, if stored reports are available for that building, they are listed in a drop-down box. Building reports and regional reports are available for many of the buildings stored in the database.

Figure 19. Building List screen.



The user may also open the building to view its specific properties (Figure 20). Tabs across the top of the screen contain many of the buildings' properties, a list of the components that comprise the building, attachments such as pictures or documents, and any additional notes.

Figure 20. Building Properties screen.



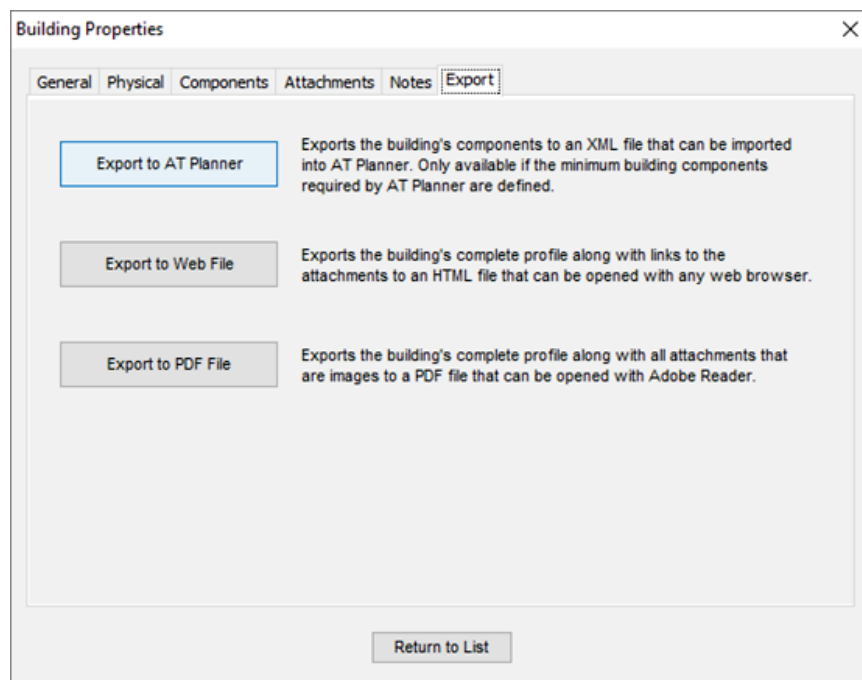
The screenshot shows a window titled "Building Properties" with a close button (X) in the top right corner. The window has several tabs: "General", "Physical", "Components", "Attachments", "Notes", and "Export". The "General" tab is selected. The form contains the following fields:

Country	Iran
Location	Adobe construction is widespread throughout Iran
Name	Iranian, Adobe House
Year(s) Built	1000 to Present
Function	Single Family Home
Type	Unreinforced Masonry Walls
Construction Type	Mass Construction
Configuration	Rectangular (4 lengths)
Terrain Zone	Dc3
Cladding Type	Earth (mud, adobe, rammed earth)
Frequency	Common (20-50%)
Foundation	Rubble Stone, Fieldstone Strip Footing

At the bottom center of the window is a button labeled "Return to List".

The export tab (Figure 21) allows the user to send the building data to files or other external applications. Exporting data in report format to HTML and PDF is supported.

Figure 21. Export tab.



The screenshot shows the same "Building Properties" window, but with the "Export" tab selected. The window contains three export options:

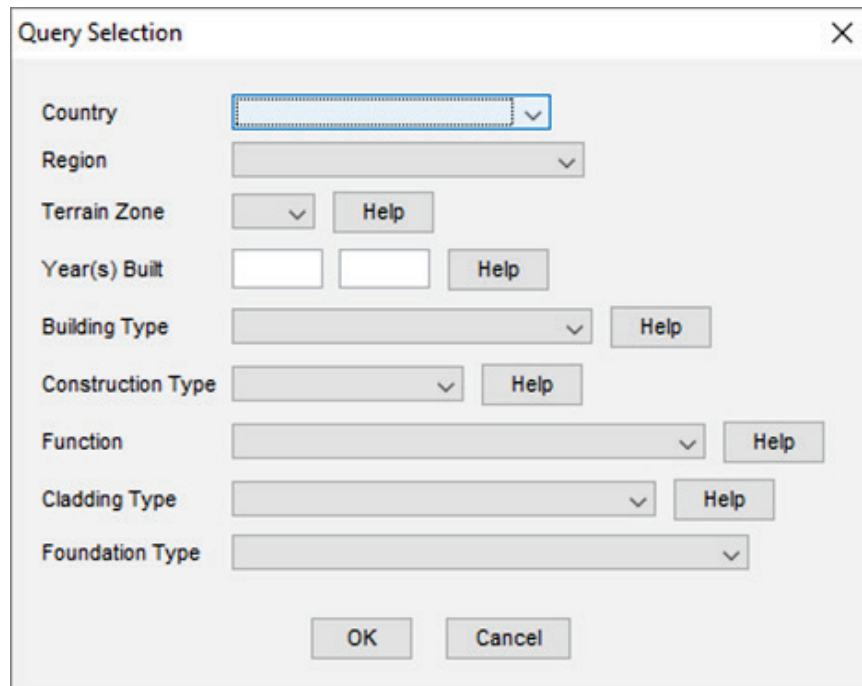
- Export to AT Planner**: Exports the building's components to an XML file that can be imported into AT Planner. Only available if the minimum building components required by AT Planner are defined.
- Export to Web File**: Exports the building's complete profile along with links to the attachments to an HTML file that can be opened with any web browser.
- Export to PDF File**: Exports the building's complete profile along with all attachments that are images to a PDF file that can be opened with Adobe Reader.

At the bottom center of the window is a button labeled "Return to List".

Data may also be exported to the AT Planner application, which is an ERDC product that performs blast and vulnerability analysis on structures, equipment, and personnel.

Lastly, the user may make queries directly to the WCP database without having to go through the building identification process (Figure 22). This process will be discussed in Chapter 4.

Figure 22. Query builder screen.



The image shows a screenshot of a software dialog box titled "Query Selection". The dialog box contains several input fields and buttons. The fields are: "Country" (a dropdown menu with a blue border), "Region" (a dropdown menu), "Terrain Zone" (a dropdown menu with a "Help" button to its right), "Year(s) Built" (two text input boxes with a "Help" button to their right), "Building Type" (a dropdown menu with a "Help" button to its right), "Construction Type" (a dropdown menu with a "Help" button to its right), "Function" (a dropdown menu with a "Help" button to its right), "Cladding Type" (a dropdown menu with a "Help" button to its right), and "Foundation Type" (a dropdown menu). At the bottom of the dialog box are "OK" and "Cancel" buttons.

### 3.3 Automatic updating

The BIW will check for updates automatically during the program's startup phase when the splash screen is displayed. The user may also check for updates manually at any time via the help menu within the program. The computer must have an active internet connection for the update function to work.

The auto update feature, shown in Figure 23, checks for updates on the WCP web server by comparing a byte count of the contents of the files that are installed on the user's machine with a byte count of the current version of files stored on the WCP server. If these byte counts are the same, no updates are required (Figure 24). If the byte counts are not the same, the user is prompted that updates may be available, and the update wizard is run if the user elects to continue with the update function. The user may choose to ignore the update message.

Figure 23. Update application start screen.

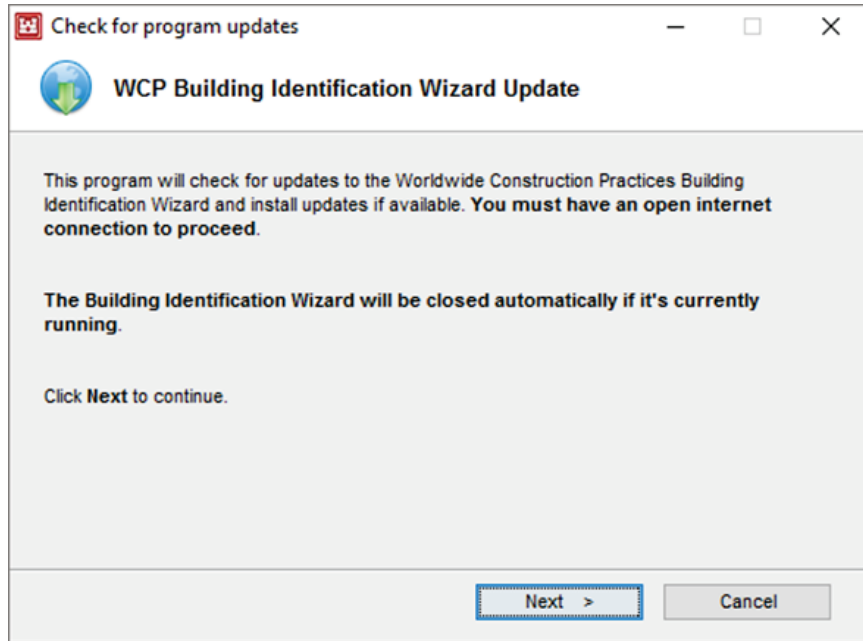
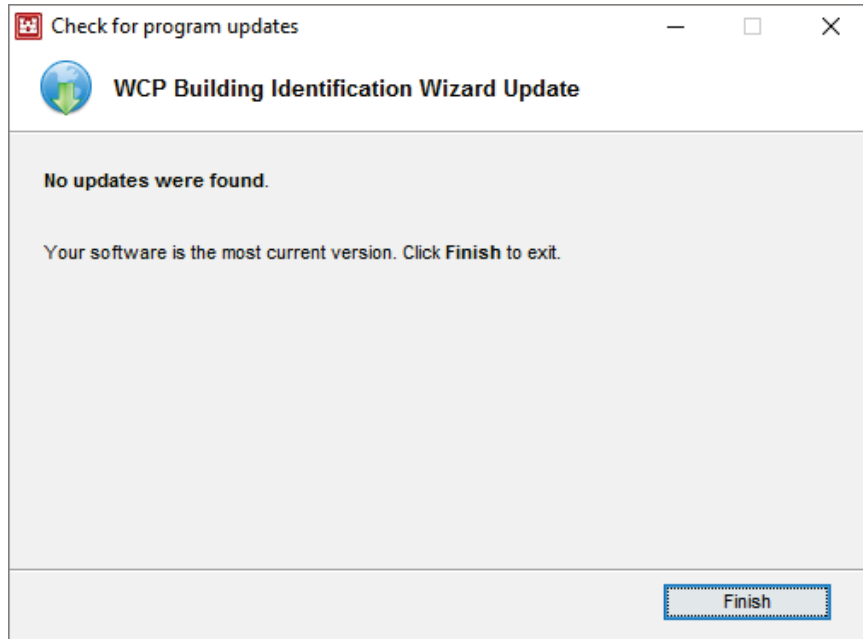


Figure 24. Update application finish screen.



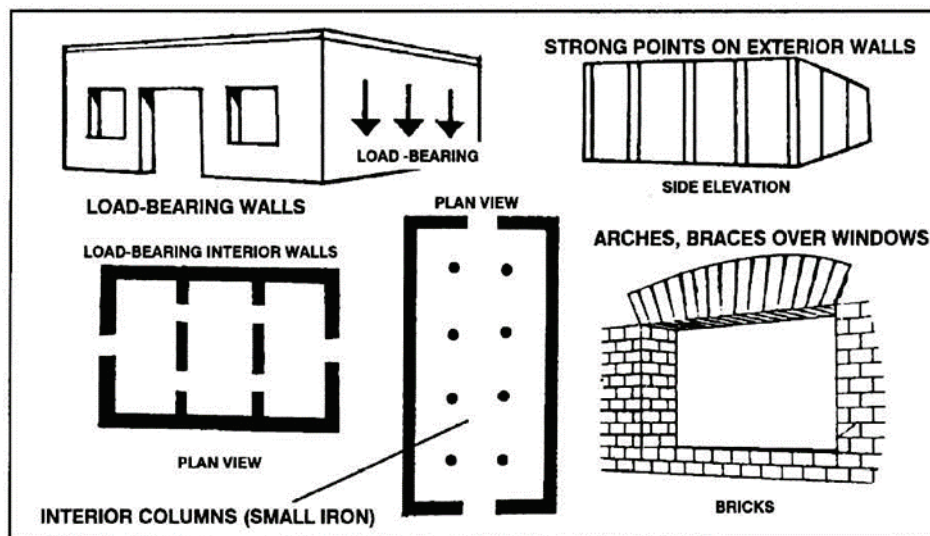
## 4 Building Identification Process

### 4.1 General building construction type

The first step in the building identification process is to determine the general building construction type: either mass or frame. A mass (bearing wall) structure uses mostly solid vertical-load-bearing walls to bear both the live and dead loads of walls, floors, and the roof. A frame structure is made up of beams and columns throughout the entire structure, resisting both vertical and lateral loads and allowing for thin and lightweight walls. Mass construction usually implies heavy walls that are difficult to breach, whereas framed construction implies light-weight, easily breached walls.

Mass construction consists of load-bearing walls (Figure 25), which are usually thick, solid walls that carry the vertical and lateral loads and support structural floor members such as slabs, joists, and beams. Typically, load-bearing walls have more solid areas with little to no wide openings, unless a structural lintel is used. Some bearing wall structures incorporate structural columns or contain partly framed structures. This is especially popular in multi-story commercial buildings in urban locations, where girders and columns are used in the ground floor of a bearing wall structure providing larger openings for retail spaces.

Figure 25. Mass construction building characteristics.

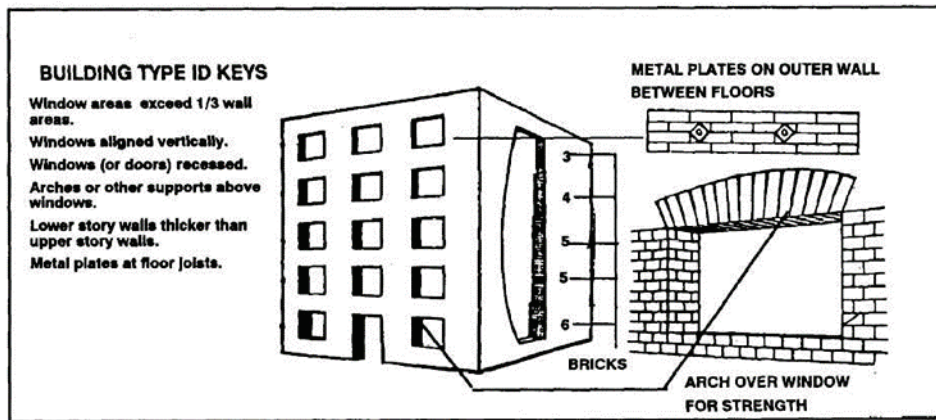


Another example is where the loads are carried by both interior columns and a perimeter wall. Both of these examples should be considered as bearing wall structures, because lateral loads are resisted by the bearing

walls. Bearing wall structures sometimes utilize only two walls for load bearing. The other walls are non-load bearing and, thus, may have large openings. Therefore, the openness of the front elevation should not be used to determine the structure type. The screener should also look at the side and rear facades. If at least two of the four exterior walls appear to be solid, then it is likely that it is a bearing wall structure.

The primary components of a mass construction building are unit masonry and concrete (Figure 26). The walls are usually constructed with stone, adobe, brick, and concrete masonry units (CMUs). To form concrete walls, concrete is typically prefabricated (precast) where the concrete is poured into forms either onsite or in a factory.

Figure 26. Mass construction: Brick buildings.



A bearing wall system (mass structure) can also be called a box system when the box-wall principle construction method using precast concrete is utilized. This is most common when separate, identically sized, individual areas are desired, such as in hotel and apartment construction (Figure 27).

When a building has large openings on all sides, it is probably a frame structure as opposed to a bearing wall structure (Figure 28). A common characteristic of a frame structure is the rectangular grid patterns of the facade, indicating the location of the columns and girders behind the finish material. This is particularly revealing when windows occupy the entire opening in the frame, and no infill wall is used. A newer multistory commercial building should be assumed to be a frame structure.

Figure 27. Mass construction: Box-wall principle building.

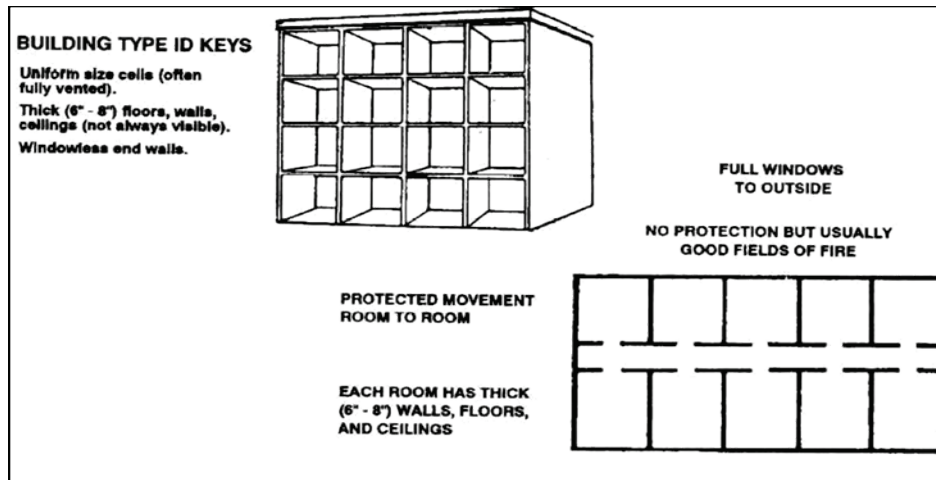
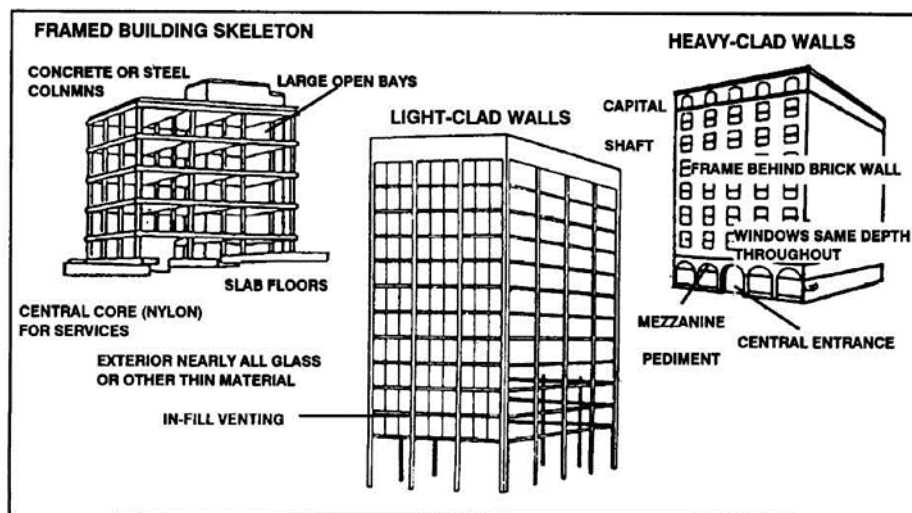


Figure 28. Framed building characteristics.



Window openings in older frame structures can sometimes be misleading. Since wide windows were excessively costly and fragile until relatively recently, several narrow windows separated by thin mullions are often seen in older buildings. These thin mullions are usually not load bearing. When the narrow windows are close together, they constitute a large opening typical of a frame structure, or a window in a bearing wall structure with steel lintels. The primary materials used in frame construction are wood, steel, or reinforced concrete.

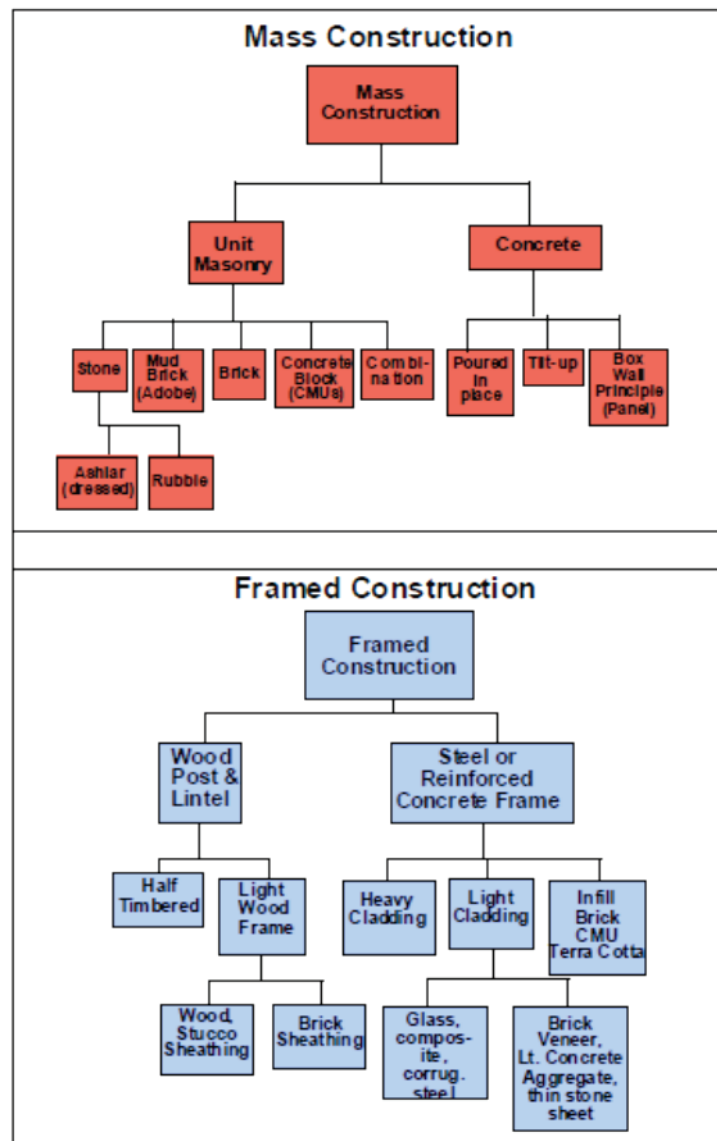
Whereas open facades on all sides clearly indicate a frame structure, solid walls may be indicative of a bearing wall structure or a frame structure with solid infill walls. Bearing walls are usually much thicker than infill walls and increase in thickness in the lower stories of multi-story

buildings. This increase in wall thickness can be detected by comparing the wall thickness at windows on different floors. Thus, solid walls can be identified as bearing or non-bearing walls according to their thickness if the structural material is known.

## 4.2 Specific building construction type

Mass and frame construction are general construction types that define the load bearing characteristics of a building in simple terms. Inside these categories are additional more specific construction types that further define a building's load bearing characteristics (Figure 29).

Figure 29. Mass and framed construction common materials.



The framed construction, general construction category (Figure 29) contains eight specific sub categories: steel moment frame, steel frame with shear walls, steel frame with steel bracing, concrete moment frame, concrete frame with shear walls, pre-engineered metal frame, wood post and beam, and light stud frame/wood walls.

Steel moment frame construction, as shown in Figure 30, utilizes steel columns and beams to carry the building's load. Exterior walls can be of almost any material (i.e., curtain walls, brick masonry, or precast concrete panels.)

**Figure 30. Example of steel moment frame building.**



Steel frame buildings with shear walls, as shown in Figure 31, are an older building type where the infill walls are usually offset from the exterior frame members that wrap around them presenting a smooth masonry exterior with no indication of the frame.

**Figure 31. Example of steel frame building with shear walls.**



Steel frame buildings with steel bracing, as shown in Figure 32, are very similar to steel moment frame buildings with the addition of angular steel bracing to augment the load carrying of the steel frame members. These additional steel members are often visible through the building's glass exterior.

Figure 32. Example of steel frame building with steel bracing.



Concrete moment frame construction, as shown in Figure 33, is also very similar to steel moment frame in function, but the frame members are made of reinforced concrete rather than steel.

Figure 33. Example of concrete moment frame building.



Concrete frame with shear walls construction, as shown in Figure 34, is also very similar to steel frame construction with shear walls, except the frame in this case is also made of reinforced concrete.

Figure 34. Example of concrete frame building with shear walls.



Pre-engineered and prefabricated metal buildings, as shown in Figure 35, utilize roofs and walls consisting of lightweight metal cladding panels. Steel frame load-carrying studs are built in segments and assembled in the field with bolted joints.

Figure 35. Example of pre-engineered metal frame building.



Wood post and beam construction, as shown in Figure 36, is typically utilized in commercial or industrial buildings with a floor area of 5,000 sq. ft. or more with few, if any, interior walls. Load-carrying framing is created by placing large wood beams on wood columns. Exterior walls are typically sheathed with plywood, stucco, plaster, or other paneling. Walls may also contain rod bracing.

Figure 36. Example of wood post and beam building.



Light stud frame construction, as shown in Figure 37, is typically used to construct single-or multiple family dwellings of one or more stories. The load bearing structure contains repetitive framing by wood joists on wood studs. Exterior walls are usually sheathed with plank siding, brick, stucco, plywood, gypsum board, particle board, or fiberboard.

Figure 37. Example of light stud frame/wood walls building.



The mass construction general construction category (Figure 29) contains six specific sub categories, i.e., concrete shear walls, precast/tilt-up concrete walls, reinforced masonry walls, unreinforced masonry walls, confined masonry walls, and cast-in-place concrete walls.

In concrete shear walls construction, as shown in Figure 38, the vertical components of the lateral-force-resisting system are concrete shear walls that are usually bearing walls. In older buildings, the walls are quite extensive, and the wall stresses are low, but reinforcement is light.

Figure 38. Example of concrete shear walls building.



Precast/tilt-up concrete buildings, as shown in Figure 39, have a wood or metal deck roof diaphragm that is often very large and distributes lateral forces to precast concrete shear walls. The walls are thin but relatively heavy while the roofs are relatively light. Older buildings sometimes do not have good wall-to-roof connections. Walls can have numerous openings for doors and windows of such size that the wall looks more like a frame than a shear wall.

Figure 39. Example of precast/tilt-up concrete walls building.



Reinforced masonry buildings, as shown in Figure 40, include structural elements that vary depending on the building's age and geographic location. In buildings constructed before 1900, the majority of floor and roof construction consists of wood sheathing supported by wood sub-framing. In large multi-story buildings, the floors are cast-in-place concrete supported by the unreinforced masonry walls and/or steel or concrete interior framing. In buildings built after 1950, unreinforced masonry buildings with wood floors usually have plywood rather than board sheathing. In regions of lower seismicity, buildings of this type constructed more recently can include floor and roof framing that consists of metal deck and concrete fill supported by steel framing elements. The perimeter walls, and possibly some interior walls, are unreinforced masonry.

Figure 40. Example of reinforced masonry walls building.



Confined masonry can often be mistaken for concrete moment frame with masonry infill (Figure 41). The difference is that in a confined masonry building, the masonry is physically interconnected within the concrete columns/beams, where the two are independent in concrete frame structures.

Figure 41. Example of confined masonry walls building.



Cast-in-place concrete wall buildings (shown in Figure 42) are very similar in load-carrying function to precast/tilt-up wall buildings. The minor difference between the two is the construction method. These walls are cast on site by pouring concrete into forms at the place where they're intended to stand.

Figure 42. Example of cast-in-place concrete walls building.



### 4.3 Identification algorithm

A custom designed algorithm was constructed for the BIW to convert the user's input into a specific construction type in the most efficient manner possible. The SSEBP algorithm makes a series of statistical calculations based on the answers provided by the user. The statistical information is then used to determine a construction type based on a confidence level quantified as a percentage.

The algorithm first follows a nomination routine to try and identify the main construction type of the building. Once that decision has been made, the routine shifts to an elimination mode to try and identify the specific construction type.

The SSEBP algorithm consists of a two-part identification process. The first process is a nomination process used to determine the main construction type of the building. The second process is an elimination process used to determine the specific construction type of the building. A building's construction type is identified by the outcome of these two processes.

For the nomination process, each screen in the series of screens that presents questions about the building to the user has a method that collects the user's input and uses that input to make a series of statistical calculations. A simple average is the main calculation used to determine the main construction type. Other statistical calculations, such as median and mode, are also considered.

There are two main construction types that the algorithm attempts to identify in the first stage of building identification: mass construction and

frame construction. The algorithm will attempt to nominate one of them to the point where confidence is high enough to make a decision on which construction type the building adheres to.

Each answer to a question carries a weight that was assigned based on knowledge collected about general building construction practices. That weight is a numerical representation of the likelihood that the answer indicates one of the two main construction types. The weight scale for each question is 0 to 10, 0 being least likely and 10 being most likely. The weight is added to one of two running totals for the construction types. The total weight that has been distributed to the construction types is also accumulated, and this total is divided by the total for each of the two construction types, yielding a percentage that is used to determine confidence. A count of the total questions answered for a construction type and a list of the weights for each type are also kept for further statistical calculations.

The threshold for confidence in positively determining a construction type is 80%. For example, if the nomination for mass construction reaches 80% based on the weights of the answers given by the user, the process ends, and mass construction is determined to be the building's main construction type; likewise for frame construction.

If by the end of the questioning and nomination process the 80% threshold has not been reached by either construction type, a definitive answer cannot be determined, and the user is presented with the findings along with some other information to help them make a well-informed decision and continue with the specific construction type identification process.

After the selection of a general construction type, the algorithm will attempt to eliminate all but one of the specific construction types within the general construction type category to make a decision on which specific construction type the building utilizes.

Each question at this point does not carry a weight; rather it eliminates construction types that don't apply. For example, if the main construction type has been determined to be mass construction and the user has indicated that the building is composed of brick, those specific construction types that don't apply would be eliminated. This process of elimination

occurs only when a remaining type can without doubt be eliminated based on knowledge collected about specific building construction practices.

The elimination process will continue until all relevant questions have been asked or until only one specific construction type remains. If all questions have been asked and more than one type remains, a definitive answer cannot be determined, and the user is presented with the findings along with other information to help make a well-informed decision and complete the construction identification process.

#### **4.4 Scoring methods**

Several statistical values are analyzed by the algorithm after each question is answered by the user. These values are constantly calculated so that decisions regarding the completion of the identification process or the line of questioning presented to the user can be made at any moment.

As described in earlier sections, the algorithm attempts to identify a building's construction type in two phases, i.e., a nomination process to determine the general construction type and an elimination process to determine the specific construction type.

During the algorithm's nomination process to determine the general construction type, each question presented to the user is weighted on a scale from 1 to 10 based on the construction characteristic it describes. A simple average, median, and mode are calculated and analyzed.

Additional markups are applied to the weighted average of scores for each construction type category based on several factors. One factor influencing the markup for a score is simply the number of questions to which the user answered "Yes" that are more heavily weighted toward a construction type. Additional markup is applied based on the combination of those "Yes" responses. Markup is also added for construction types with higher mode and median values.

The average scores plus any additional markups are used to determine the general construction type confidence value. Once a threshold of 80% confidence is reached, a determination is made, and the line of questioning is ceased. If the threshold is not met and the user has reached the end of questioning, the user must manually make an informed decision to continue.

The algorithm's elimination process begins after the general construction type has either been identified by reaching the 80% threshold or when the user makes a manual construction type selection. Further questioning is presented to the user based on the general construction type in an attempt to identify the specific construction type. Specific construction types are eliminated during this phase of questioning depending on how the user answers the questions. The questions are worded in a manner that answering "Yes" to the building characteristic almost always eliminates at least one type from the list. It is possible, though, that some questions simply lead to additional, more relevant questions.

Once all but one of the specific construction types are eliminated by the algorithm, the process is complete and the specific type is successfully identified. If at the end of questioning more than one type remains, the user must manually make an informed decision to continue.

## 5 Querying the Database

### 5.1 About the database

The WCP database is the source of information for the BIW. The database provides not only the specific building information stored within it but also the content used to populate many of the dropdown selection boxes used in the program.

The WCP database contains very specific information about buildings around the world along with images and technical discussions of building practices and properties.

An open database connection is created during the program's startup phase and is called on periodically to retrieve information from the database using standard Structured Query Language (SQL) queries.

### 5.2 Using the database query function

In addition to the BIW, the application provides an interface to directly query the WCP database. Database queries select records that match only certain user-defined criteria. The BIW provides a query builder that allows users to make queries directly to the WCP database without requiring any knowledge of SQL.

Several fields are available to query on: Country, Region, Terrain Zone, Year(s) Built, Building Type, Construction Type, Function, Cladding Type, and Foundation Type (Figure 43). Any combination of these fields can be used to retrieve buildings from the database that match that criteria. Help documents are provided for some fields to help users make informed decisions.

After the query is built and the user clicks "OK," results from the query are listed in a grid view. In the example in Figure 44, the user selected "Southwest Asia (Middle East)" from the "Region" drop down list. Each result is a building that is stored in the WCP database for that region. When a building row is selected, reports for that building are populated in the "Available Reports" drop down list. Examples of reports are building specific reports and reports describing construction practices that are typical for the country or region in which the building is located.

Figure 43. Query builder.

Query Selection

Country

Region

Terrain Zone  Help

Year(s) Built   Help

Building Type  Help

Construction Type  Help

Function  Help

Cladding Type  Help

Foundation Type

OK Cancel

Figure 44. Query results list.

WCP Building Identification Wizard

File Help

Building List

Below is a list of buildings which match the criteria you selected. Please select a building and click the **Open Building** button to view the building's properties. You may also choose a report from the drop down box if any are available for the selected building.

Name	Country	Function	Frequency
Iranian Semi-rigid stee...	Iran	Apartment	Common (20-50%)
Iranian, confined brick...	Iran	Single Family Home	Uncommon (< 20%)
Iranian, Adobe House	Iran	Single Family Home	Common (20-50%)
Iranian, Stonework Bu...	Iran	Single Family Home	Common (20-50%)
Iranian, Earring syste...	Iran	Single Family Home	
Syrian Reinforced.co...	Syria	Apartment	

Open Building Available Reports

Back Next Start Over Exit

Queries are saved during the application session. Clicking back will allow the user to modify the query without having to start over from the beginning. Queries are lost after the application is closed.

Opening a specific building takes the user to the same building properties screen that is reached through the building identification process. This screen allows the user to view the specific building properties, view attached documents and images, and export the building report or export to AT Planner.

## 6 Exporting Data

The BIW has the ability to export data from the WCP database to other applications following the successful identification of a building type or the direct querying of the database. Users may also export data in the form of HTML pages and PDF documents.

### 6.1 Exporting to a web or PDF File

Exporting a building's information to a file makes that information available outside of the BIW application (Figure 45). The application generates a report containing a building's stored information based on a predefined report template. Figure 46 is an example of that report template format.

Figure 45. Export tab in building properties screen.

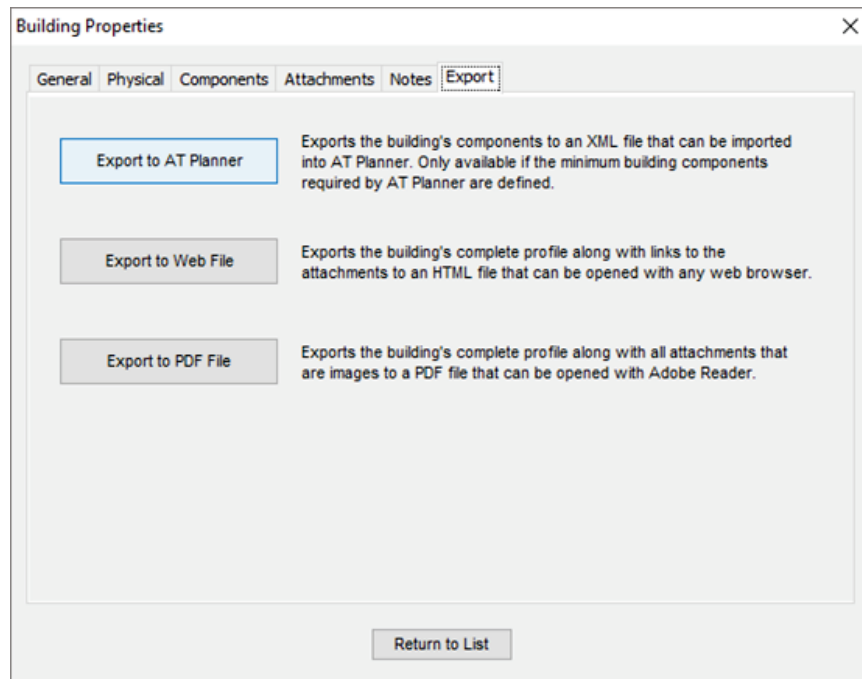
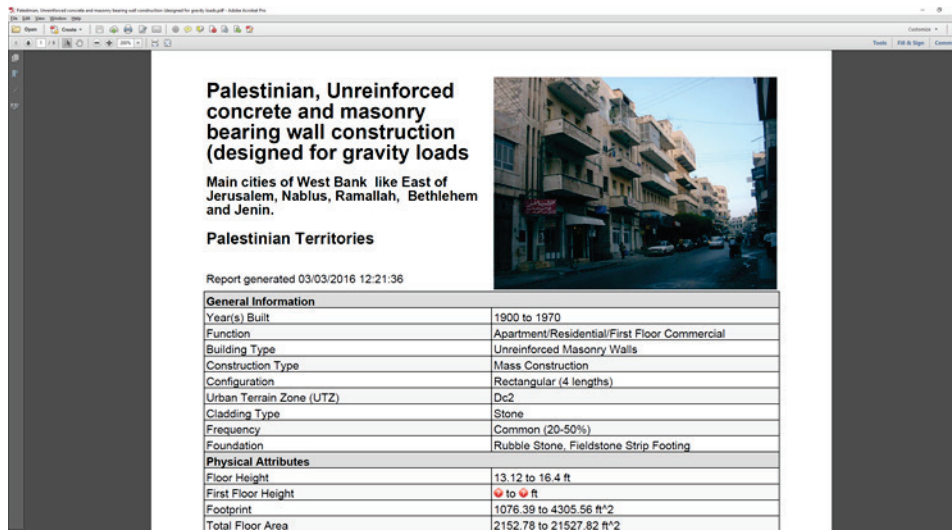


Figure 46. Example of PDF report exported from the application.



**Palestinian, Unreinforced concrete and masonry bearing wall construction (designed for gravity loads)**

Main cities of West Bank like East of Jerusalem, Nablus, Ramallah, Bethlehem and Jenin.

**Palestinian Territories**

Report generated 03/03/2016 12:21:36

General Information	
Year(s) Built	1900 to 1970
Function	Apartment/Residential/First Floor Commercial
Building Type	Unreinforced Masonry Walls
Construction Type	Mass Construction
Configuration	Rectangular (4 lengths)
Urban Terrain Zone (UTZ)	Dc2
Cladding Type	Stone
Frequency	Common (20-50%)
Foundation	Rubble Stone, Fieldstone Strip Footing
Physical Attributes	
Floor Height	13.12 to 16.4 ft
First Floor Height	to ft
Footprint	1076.39 to 4305.56 ft <sup>2</sup>
Total Floor Area	2152.78 to 21527.82 ft <sup>2</sup>

Users can export a report at the end of a successful building identification process in HTML format that is saved locally on the user's computer. Users are prompted to choose a location on their computer to save the file, and the BIW writes the file to that location. The HTML file can then be viewed in the user's web browser (e.g., Internet Explorer).

Another useful format for viewing and exchanging reports is Portable Document Format (PDF) made popular by the Adobe software company. PDF files are relatively small and contain all document formatting within a single file. This makes PDF a popular format for sharing information via e-mail. The BIW has the ability at the end of a successful building identification process to export a report in the PDF format. The user is prompted for location to save the file just as they are when exporting HTML, and the file is written to that location.

## 6.2 Exporting to other applications

Currently, the BIW supports exporting to only one application, the AT Planner. The AT Planner application, which is also an ERDC product, performs blast and vulnerability analyses on structures, equipment, and personnel.

Exporting is performed inside the BIW by creating an XML file to be imported into the AT Planner application. The XML file contains information that defines the building's physical characteristics and follows a template that the AT Planner knows how to interpret.

The AT Planner defines a building by its components (Figure 47). The minimum required components for structure are the building's frame (if frame construction), roof, four walls, and windows.

Figure 47. Selecting AT planner components.

Select AT Planner Components

Below is a list of AT Planner compatible components for the building you selected. Please choose one of each type of component. Use the **Help** button below for additional information.

Frame Component

Frame

Roof Component

Roof

Wall Components

North Wall	<input type="text" value="Adobe Wall"/>	Window	<input type="text" value="None"/>	<input type="button" value="Set Values"/>
West Wall	<input type="text" value="Adobe Wall"/>	Window	<input type="text" value="None"/>	<input type="button" value="Set Values"/>
South Wall	<input type="text" value="Adobe Wall"/>	Window	<input type="text" value="None"/>	<input type="button" value="Set Values"/>
East Wall	<input type="text" value="Adobe Wall"/>	Window	<input type="text" value="None"/>	<input type="button" value="Set Values"/>

Each of these components is required by the AT Planner to have certain dimensions and material properties. On occasion, this detailed information about a building that is required by the AT Planner isn't available in the WCP database. When this occurs, default data are presented to the user based on the building's defined location and general construction materials. The user then manually makes an informed decision on which values to export.

When actual values are present in the database, the application automatically selects those values to be exported (Figure 48). The user also has the option to override this selection with Minimum, Maximum, or Default values for the region in which the building is located.

Figure 48. Select component values.

Select Component Values

Please choose values for **Adobe Wall** from the list below.  
Click the help button at the bottom to view the color coding legend.

	Actual	Minimum	Maximum	Default
Thickness	<input checked="" type="radio"/> 23.62 in	<input type="radio"/> 15.75 in	<input type="radio"/> 31.5 in	<input type="radio"/> 8.0 in
Compressive Strength	<input type="radio"/> [ ] psi	<input type="radio"/> 200.0 psi	<input type="radio"/> 300.0 psi	<input checked="" type="radio"/> 250.0 psi
Tensile Strength	<input type="radio"/> [ ] psi	<input type="radio"/> [ ] psi	<input type="radio"/> [ ] psi	<input checked="" type="radio"/> 200.0 psi
Shell Thickness	<input type="radio"/> [ ] in	<input type="radio"/> [ ] in	<input type="radio"/> [ ] in	<input checked="" type="radio"/> 1.25 in
Height	<input checked="" type="radio"/> 2.76 in	<input type="radio"/> [ ] in	<input type="radio"/> [ ] in	<input type="radio"/> 8.0 in
Width	<input checked="" type="radio"/> 11.81 in	<input type="radio"/> [ ] in	<input type="radio"/> [ ] in	<input type="radio"/> 16.0 in
Weight	<input type="radio"/> [ ] lb	<input type="radio"/> [ ] lb	<input type="radio"/> [ ] lb	<input checked="" type="radio"/> 0.0 lb

Continue Help Cancel

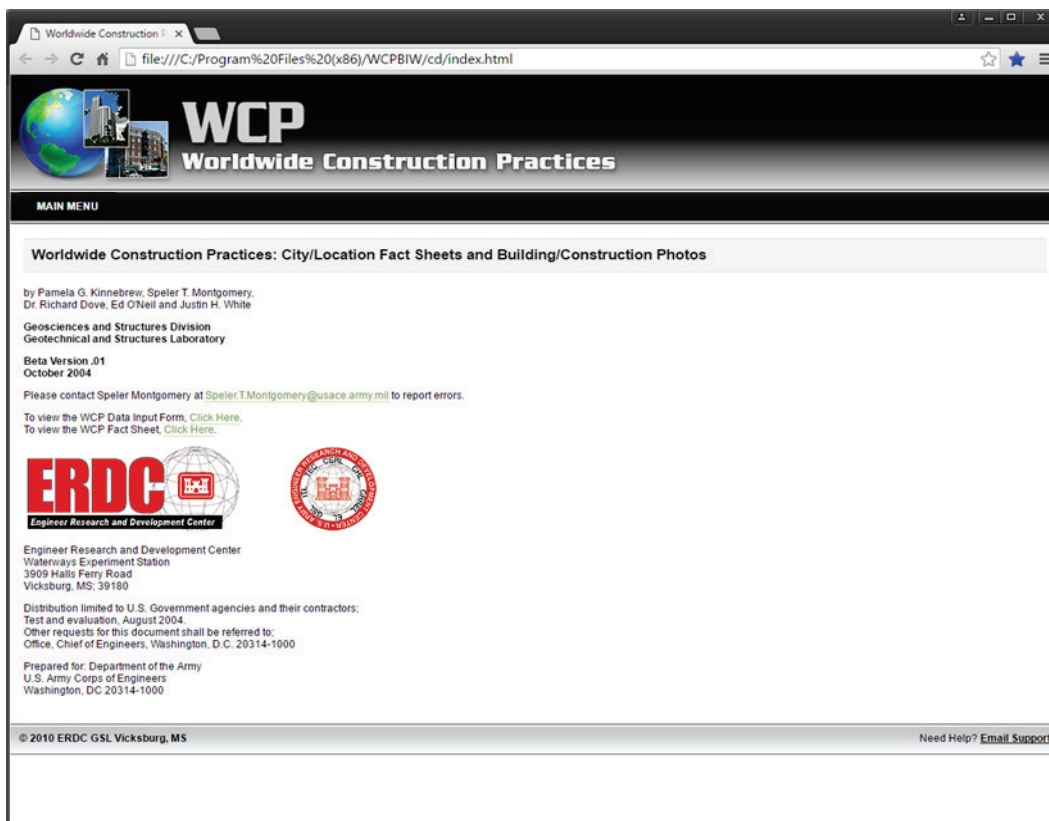
After each component's physical properties are defined, the XML document is built and saved in a location selected by the user. The AT Planner has an import function that will allow the user to bring the XML document into the application as a structure.

For more information about AT Planner and its capabilities, visit <https://atplanner.usace.army.mil>.

## 7 Worldwide Construction Practices Fact Sheets

In addition to the WCP database, the BIW includes fact sheets, reports, and more from the offline version of Worldwide Construction Practices: City/Location Fact Sheets and Building/Construction Photos website on CD (Figure 49). This valuable resource provides additional information about typical construction practices, materials, and socio-cultural factors affecting construction around the world. It can be found on the user's computer in the CD folder inside the application folder where the BIW was in-installed. In this example, the folder path is **C:/Program Files (x86)/WCPBIW/cd/index.html**.

Figure 49. Worldwide construction practices website on CD.



Navigating the website on CD is performed by using the “Main Menu” button near the top left (Figure 50). Information is categorized by continent, region, country, and city. Maps have clickable regions, countries, and cities that allow the user to “drill down” into the data (Figures 51 and 52). Reports and photographs of construction types in various locations are available in PDF and JPEG formats.

Figure 50. Main menu button.

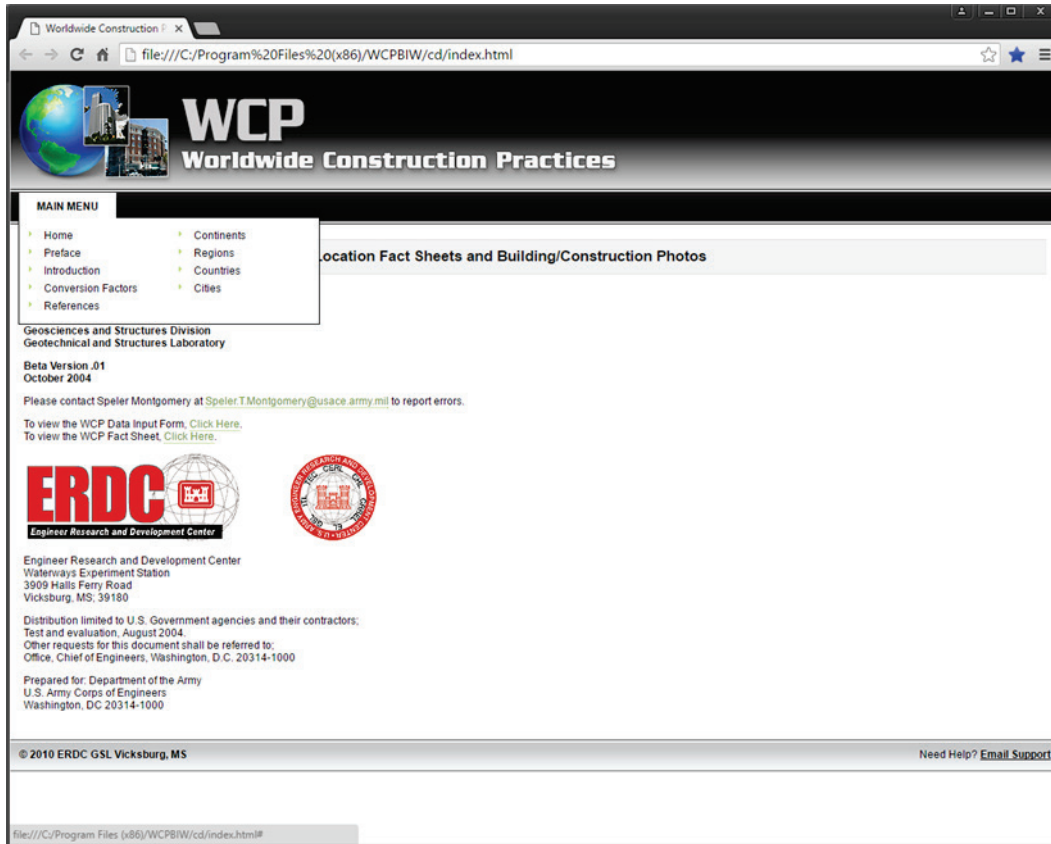
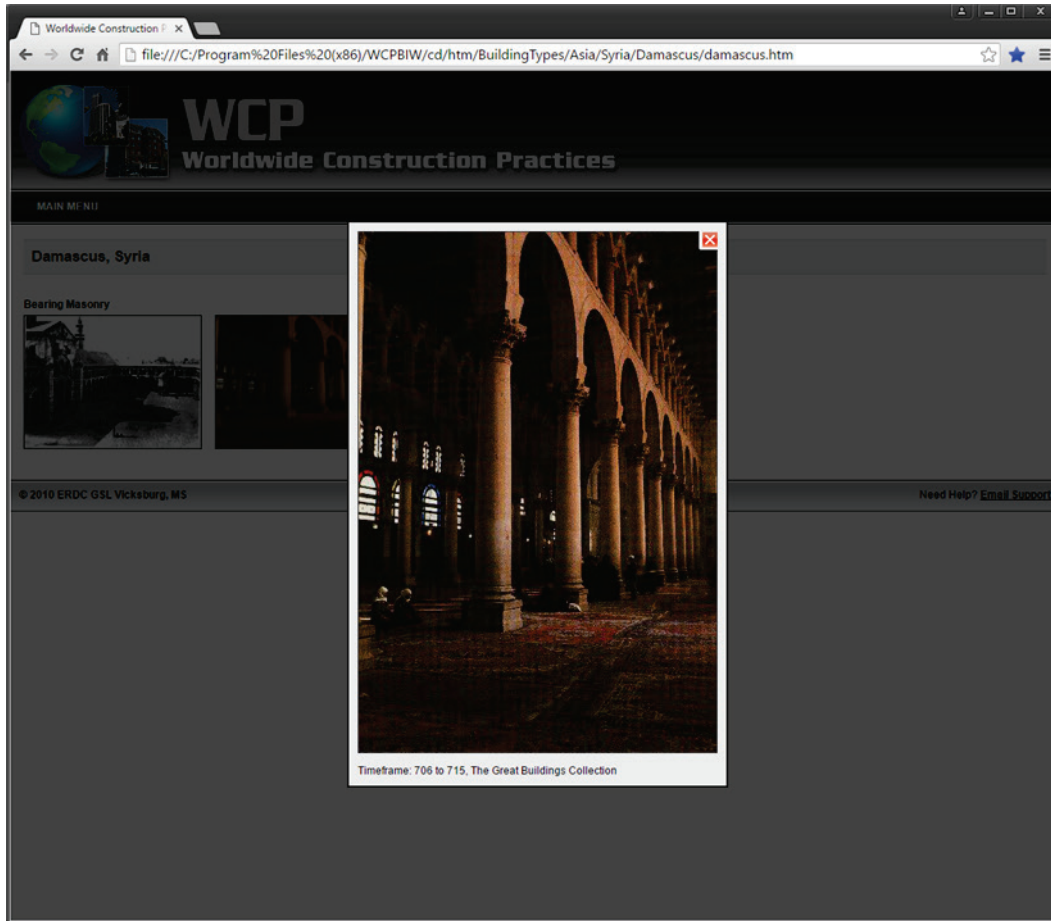


Figure 51. Regional construction practices reports.

The screenshot shows a web browser window displaying the 'Worldwide Construction Practices' website. The browser's address bar shows the URL: `file:///C:/Program%20Files%20(x86)/WCPBIW/cd/htm/regions/Middle_East/middleeast.htm`. The website header features the WCP logo and the text 'Worldwide Construction Practices'. Below the header is a 'MAIN MENU' section. The main content area is titled 'Southwest Asia (Middle East)'. It contains two sections: 'Reports' and 'Countries'. The 'Reports' section lists three items: 'Construction Practices and Material Properties in Turkey', 'Typical Construction Practices and Material Properties in Southwest Asia', and 'Cultural Factors in Architecture, Construction, and Use of Buildings'. The 'Countries' section lists four items: 'Iraq', 'Israel', 'Syria', and 'Turkey'. To the right of the text is a map of the Middle East region, with a yellow highlight at the top of the map area. The map shows major countries including Turkey, Iraq, Iran, Saudi Arabia, Egypt, Sudan, Yemen, and Ethiopia. The map is titled 'MIDDLE EAST' and includes a scale of 1:25,000,000. At the bottom of the page, there is a copyright notice: '© 2010 ERDC GSL Vicksburg, MS' and a link for 'Need Help? Email Support'.

Figure 52. Photo viewer for city buildings.



## References

- Ellefsen, R., A. Carlson, B. Thein, N. Milligna, J. Lein, and A. Kanemoto. 1981. *Urban terrain analysis training aids*. Aberdeen Proving Ground, MD: U.S. Army Human Engineering Laboratory.
- Ellefsen, R. 2005. *Urban terrain building types*. Aberdeen Proving Ground, MD: U.S. Army Human Engineering Laboratory.
- Loechl, P. M., S. I. Ensore, J. L. Webster, and S. K. Loechl. 2010. *Cultural factors in architecture, construction, and use of Muslim buildings: A report for Baghdad, Tehran, Kabul, and Islamabad*. ERDC/CERL TR-10-7. Champaign, IL: U.S. Engineer Research and Development Center.

# REPORT DOCUMENTATION PAGE

*Form Approved*  
**OMB No. 0704-0188**

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. **PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.**

<b>1. REPORT DATE (DD-MM-YYYY)</b> April 2018		<b>2. REPORT TYPE</b> Final		<b>3. DATES COVERED (From - To)</b>	
<b>4. TITLE AND SUBTITLE</b>  Building Identification Wizard: Version 1.5.1				<b>5a. CONTRACT NUMBER</b>	
				<b>5b. GRANT NUMBER</b>	
				<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b>  Byron M. Garton, Speler T. Montgomery, and M. Jason Roth				<b>5d. PROJECT NUMBER</b>	
				<b>5e. TASK NUMBER</b>	
				<b>5f. WORK UNIT NUMBER</b> AT40-SB-003	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b>  Geotechnical and Structures Laboratory U.S. Army Engineer Research and Development Center 3909 Halls Ferry Road Vicksburg, MS 39180-6199				<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>  ERDC SR-18-2	
<b>9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Headquarters, U.S. Army Corps of Engineers Washington, DC 20314-1000				<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b> HQ-USACE	
				<b>11. SPONSOR/MONITOR'S REPORT NUMBER(S)</b>	
<b>12. DISTRIBUTION / AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited.					
<b>13. SUPPLEMENTARY NOTES</b>					
<b>14. ABSTRACT</b>  This document discusses the Worldwide Construction Practices Building Identification Wizard program version 1.5.1, which provides a guided user interface that aids in the identification of building construction types and facilitates access to the Worldwide Construction Practices database. It provides an in-depth look into the program's user interface, the Sequential Statistical Evaluation of Building Parameters (SSEBP) algorithm used to determine building types, the export methods used to link information from the Worldwide Construction Practices database with other Army software, and a technical discussion of the internal components of the program. The intent of this report is to thoroughly explain the Building Identification Wizard and provide an understanding of the program from a technical and user-friendly standpoint.					
<b>15. SUBJECT TERMS</b> Building types Engineering data		Construction industry Construction practices Vulnerability		Building Buildings Building materials Computer programs	
<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b>	<b>18. NUMBER OF PAGES</b>  51	<b>19a. NAME OF RESPONSIBLE PERSON</b>
<b>a. REPORT</b> Unclassified	<b>b. ABSTRACT</b> Unclassified	<b>c. THIS PAGE</b> Unclassified			<b>19b. TELEPHONE NUMBER (include area code)</b>