High-Rise Database-Assisted Design (HR_DAD)

DAD Software for Flexible Buildings

Updated: Oct. 01, 2007

n How to download and install the software:

The **HR_DAD** software has been developed using the MATLAB® language and can be accessed via the internet site http://www.nist.gov/wind. Within the site, click the link "Wind Effects for Flexible Buildings". This opens the main page "HR_DAD - DAD Software for High-Rise Buildings" (direct access: http://www.itl.nist.gov/div898/winds/hr_dad/hr_dad.htm). The files available for download are all in the bulleted list under the heading "*Files Available for Download*". In the following, reference is made to each set of files to be downloaded by the name of the associated bullet.

From the list, first consider the "Files for **HR_DAD** software" bullet. Next to the title of the bullet item, there is a link to the self-extracting file zip file "hr_dad.exe", which contains the 34 MATLAB files required to run the software. The user should download this *.exe file[1] and proceed to extract the 34 files to the folder "HR_DAD" which will be stored at a location specified by the user (*e.g.*, "C:\HR_DAD"). The user should then add this directory to the MATLAB search path.

After making sure that the "Current Directory" field in MATLAB's main window is the same as the directory of folder "HR_DAD", the user can simply type 'HR_DAD' in the MATLAB command window. This action runs the script file "HR_DAD.m", which opens the ten figure windows ('Page_Open', 'Page_Main', 'Page_One', 'Page_Two' … 'Page_Eight') that form the graphical user interface (GUI).

n Basics of using the **HR_DAD** software:

The ten figure windows (i.e., the "pages") opened above are used primarily to (1) assign values to the variables[2] used by the **HR_DAD** software ('Page_One' through 'Page_Five'), (2) to perform the calculations ('Page_Six'), and (3) view the results graphically ('Page_Seven').

Variable values can be assigned in any order in 'Page_One' through 'Page_Five'. The variable names within **HR_DAD** are typically shown in parentheses before the input box on each page. In several instances, a saved MATLAB file is opened within a page to load variables that contain vectors or matrices. Purple help icons  are located next to the input boxes for key variables. For a given variable, clicking on the associated help icon will open a separate window that provides information such as the variable name, the required variable size, a description of the variable and the specific organization of the variable's contents (for vector or matrix variables).

[1] Users using UNIX/Linux platforms should download the non-self-extracting zip file "hr_dad.zip" instead.
[2] Note that all variables are initially assigned an empty set in the script file "HR_DAD.m".

The actual computations of the **HR_DAD** software are performed by two separate script files, "Program1.m" and "Program2.m", which are executed consecutively.

Once all the variables in 'Page_One' through 'Page_Five' have been assigned values by the user, the first script file of the **HR_DAD** program, "Program1.m", is run by clicking 'RUN1' on 'Page Six'. The results of this first run are saved to the locations specified by clicking the two 'Save As' buttons at the top of 'Page_Six'. Tables of peak wind effects (saved to the location specified by the lower 'Save As' button) *must* be saved. These tables are used by the second script file, "Program2.m", to calculate the mean recurrence intervals of the peak wind effects. Note that saving the time histories of the wind effects to the location specified by clicking the upper 'Save As' button is *optional*. The 'Save' checkbox implements this choice.

Before "Program2.m" can be run, a wind speed database is required. Toward this end, a set of simulated hurricane wind speeds may be downloaded via the link besides the "Simulated Directional Hurricane Wind Speed Data" bullet. The user should first download the self-extracting zip file[3] "hurr_files.exe" and then extract the files to a conveniently named folder (*e.g.*, "C:\SimulatedDirectionalHurricaneDataSet"). The particular file from this folder that is used by the **HR_DAD** software depends on the value of the variable 'Hmp' on 'Page_Five'. The value of this variable corresponds to the hurricane milepost where the building being analyzed is assumed to lie. The data in this file is used in conjunction with the tables of peak wind effects by "Program2.m" to estimate the mean recurrence intervals of the peak wind effect.

"Program2.m" can now be run by clicking 'RUN2' on 'Page Six'. The results are saved to the location specified by the 'Save As' button nearest the bottom of 'Page_Six'. These results can be viewed graphically by clicking 'OUTPUT' on 'Page_Seven'. The plots (one for each structural member) show the observed and/or estimated maximum/minimum peak wind effects as a function of the mean recurrence interval (MRI).

Finally, 'Page_Eight' allows the user to save the current variable set at any point in the assignment process ('SAVE') or load a previously saved set of variables into the software ('LOAD').

n Example for the HR_DAD software:

The example provided with the **HR_DAD** software consists of a 60-story building of constant rectangular cross-section. Corresponding directional wind tunnel measurements are also provided. Some key properties of the 60-story building are listed in Table 1.

Table 1.

Plan dimensions ($D \times B$)	30.48 m × 45.72 m
Height	182.88 m
Natural frequencies (mode 1, mode 2, mode 3)	(0.17 Hz, 0.18 Hz, 0.19 Hz)
Damping (mode 1, mode 2, mode 3)	(1.5 %, 1.5 %, 1.5 %)

[3] Users using UNIX/Linux platforms should download the non-self-extracting zip file "hurr_files.zip" instead. Alternatively, users of both Windows and UNIX/Linux platforms can download the individual ASCII files one at a time.

A typical cross-section of the building is shown in Figure 1.

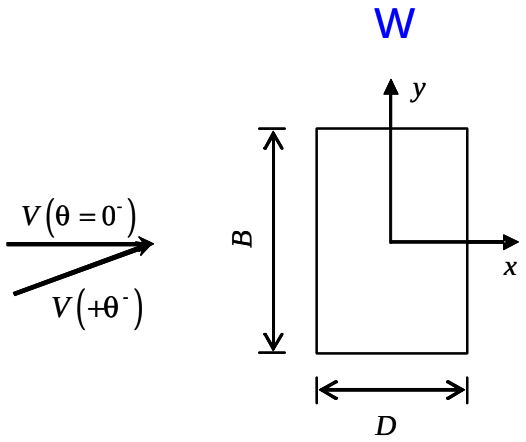

Figure 1. Cross-section, axes *x* and *y*, and orientation of the building with respect to the flow direction. D = 30.48 m, B = 45.72 m, and W = West.

The example can be conveniently downloaded in two stages:

1. Downloading the self-extracting zip file[4] "Ex_60story.exe" by clicking the link beside the "The 60-story Example" bullet. Once the files are extracted into a folder (e.g., "C:\HR_DAD\Ex_60story") that has been added to the MATLAB search path, the user should type 'HR_DAD' in the MATLAB command window to open the GUI. Next, he/she should load the file "Input.mat" from the newly created folder via 'Page_Eight' of the software (see section **Basics of using the HR_DAD software**). This updates all variable values and the displayed values within the pages.
2. The second stage involves downloading the 36 pressure coefficient time history files corresponding to directional wind tunnel measurements ($0^{\circ} \le \theta \le 360^{\circ}$ in 10° increments) that are available for two types of terrain. The files are downloaded by first clicking the link in the "The pressure time series for the 60 story building" bullet. The ensuing page lists the 36 files corresponding to *suburban terrain* in the left column and the 36 files corresponding to *open terrain* in the right column.

   The files in a given column should be downloaded one by one into a folder that appropriately indicates the corresponding terrain type in its name. For example, "C:\HR_DAD\Ex_60story\Cp_suburban" might be used to store the 36 files in the *suburban terrain* column. The user specifies the appropriate folder to use, and thus the terrain type, when he/she assigns a value to variable 'flnCp' on 'Page_Two' of the GUI.

   For each terrain type, the mean wind speed at the top of the wind tunnel model is different. Depending on the terrain type, the values of the input variable 'Vm' must be entered on 'Page_Two' of the GUI as show in Table 2.

[4] Users using UNIX/Linux platforms should download the non-self-extracting zip file "Ex_60story.zip" instead.

Table 2.

Terrain type	[Mean] Wind Speed @ model roof (Vm)
Suburban	23.2 m/s
Open	22.2 m/s

Consistency between the variables ‘flnCp’ and ‘Vm’ is of paramount importance.

NOTE:
The variable ‘taps’ is loaded from the file specified as the value of variable ‘flnTaps’ at the top of ‘Page_Two’. As indicated by the help icon ? next to the box, the variable ‘taps’ is a matrix of size Ntaps × 5, where variable ‘Ntaps’ has value 120 in this example. The first row of variable ‘taps’ gives the X, Y, Z coordinates of tap # 1 in the first three columns, the value of parameter ‘Tap_Direction’ in the fourth, and the tap tributary area in the fifth column. The second row gives the values for tap # 2, the third row the value for tap # 3, and so on. Given that it is probably difficult for the user to get a feel for the tap arrangement from the X, Y, Z coordinates of the taps, Figure 2 is provided as an aid.

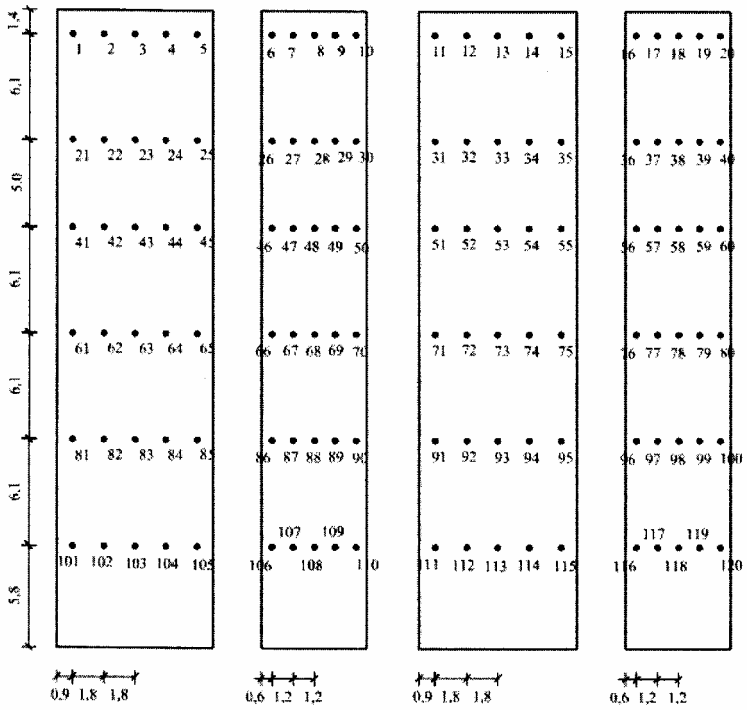

Figure 2. Tap numbering scheme. From left to right, the South (**S**), East (**E**), North (**N**), and West (**W**) faces. Dimensions shown are in centimeters and correspond to the dimensions on the model building. Multiply by 500 to obtain dimensions on the full-scale building.

After the above two stages are completed, the example is ready to be run. Simply click ‘RUN1’ on ‘Page_Six’ to begin!