

Multi-hazard Loss Estimation Methodology

*Hurricane Model*

HAZUS<sup>®</sup>*MH* MR3

## Technical Manual - Appendices

*Developed by:*

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Federal Emergency Management Agency  
Mitigation Division  
Washington, D.C.

*Under a contract with:*

National Institute of Building Sciences  
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## FOREWORD

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## MESSAGE TO USERS

The HAZUS Hurricane Model is designed to produce loss estimates for use by federal, state, regional and local governments in planning for hurricane risk mitigation, emergency preparedness, response and recovery. The methodology deals with important aspects of the built environment, and a wide range of different types of losses. Extensive national databases are embedded within HAZUS, containing information such as demographic aspects of the population in a study region, square footage for different occupancies of buildings, and numbers and locations of bridges. Embedded parameters have been included as needed. Using this information, users can carry out general loss estimates for a region. The HAZUS methodology and software are flexible enough so that locally developed inventories and other data that more accurately reflect the local environment can be substituted, resulting in increased accuracy.

Uncertainties are inherent in any loss estimation methodology. They arise in part from incomplete scientific knowledge concerning hurricanes and their effects upon buildings and facilities. They also result from the approximations and simplifications that are necessary for comprehensive analyses. Incomplete or inaccurate inventories of the built environment, demographics and economic parameters add to the uncertainty. Where inventories, demographics and economic parameters track closely those assumed and built into the basic methodology, estimates of loss should be within a factor of two. Where one or more of these parameters are incomplete or inaccurate the range of uncertainty may exceed a factor of two or more.

The hurricane loss estimation methodology is based on sound scientific and engineering principals and experimental and experience data. The methodology has been tested against the judgment of experts and, to the extent possible, against records from several past hurricanes. However, limited and incomplete data about actual hurricane damage precludes complete calibration of the methodology. Nevertheless, when used with embedded inventories and parameters, the HAZUS Hurricane Model has provided a credible estimate of such aggregated losses as the total cost of damage.

Users should be aware of the following specific limitations:

- While the HAZUS Hurricane Model can be used to estimate losses for an individual building, the results must be considered as average for a group of similar buildings. It is frequently noted that nominally similar buildings have experienced vastly different damage and losses during a hurricane.
- The Hurricane model contains definitions and assumptions regarding building strengths that represent a norm for construction in hurricane zones. These norms are defined in the technical manual. Where construction quality is known to be different from the defined norms, larger uncertainties in loss projections may be realized.

HAZUS should still be regarded as a work in progress. Additional damage and loss data from actual hurricanes and further experience in using the software will contribute to

improvements in future releases. To assist us in further improving HAZUS, users are invited to submit comments on methodological and software issues by letter, fax or e-mail to:

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## LIMITATIONS OF THE HAZUS-MH MR3 SOFTWARE

### Installation

- HAZUS-MH MR3 is certified to run on ArcGIS 9.2 SP2. Tests have shown that HAZUS-MH MR3 is unable to fully function on the ArcGIS 9.2 platform only. SP1 is required, but SP2 is preferable. ArcGIS 9.2 SP2 is available from the ESRI website.
- HAZUS-MH MR3 is certified to run on MS Windows 2000 SP2, SP3 and SP 4 and Windows XP SP1 and SP2. A user is allowed to install HAZUS-MH MR2 on MS Windows 2000 and XP for Service Packs higher than SP4 and SP2 respectively, but HAZUS-MH MR2 is not certified to work flawlessly with those service packs.
- HAZUS-MH MR3 must be uninstalled only with the Windows Add/Remove Programs utility. For details on uninstalling, please consult the User Manuals.
- Users who plan to operate HAZUS-MH MR3 in a network environment will be able to perform HAZUS operations, such as importing, but not study region creation.

### Study Region Size

- The database management system of HAZUS-MH MR3 is SQL 2005 Express. This system has a size limit of 4 GB per database, which limits the size of the regions to about 3,000 census tracts, equivalent to an area with a population of about 9 million. For a multi-hazard study region that includes data for all three hazards, the 4 GB limit will permit an even smaller study region. To work around this, the full version of Microsoft SQL Server 2005 Workgroup Standard Edition must be used (see Appendix F in the Hurricane User Manual).
- Multihazard loss analysis capability is limited to the 23 states that experience hurricane, flood and earthquake hazards and requires that the user first run annualized losses for each of the three hazards.
- To maximize the size of a study region that may be analyzed, set the virtual memory size from a minimum of *2048 MB* to a maximum of *4096 MB*. For the earthquake model, the virtual memory size may be increased from a minimum of *1024 MB* to a maximum of *2048 MB* for optimal operation. Here are the steps for setting the virtual memory size:
  1. Click on Start | Settings | Control Panel | System |
  2. Click on the Advanced Tab
  3. Click on the Performance Options button
  4. Click the Change button under Virtual Memory
  5. Replace the initial and maximum values
  6. Click Apply
- The HAZUS-MH MR3 installation allows the user to specify the folder where the state data will be copied through the "Choose Data Path" dialog in the installation

wizard. If, at the time of installation, the user specifies the folder where the data will be copied after installation, they only need to perform Step 1 as described below. If at the time of installation the User does not specify the folder where the state data will be copied by the user after installation, or if they want to change the folder specified during installation, then Steps 2 through 4 for updating the Registry should be completed.

NOTE: The "Choose Data Path" dialog in the installation process only specifies the folder where the state data will be copied by the user from the DVD after installation has completed. This dialog doesn't copy the data from the DVD to the specified folder; that has to be done manually by the user after installation.

1. Copy one or more of the state data folders (e.g., NC1), both the DVD identification files (e.g., D1.txt ^ 4.txt) and "syBoundary.mdb" from the Data DVD to a folder on your hard drive (e.g., D:\HAZUSData\). As an example, the following graphic illustrates how the data for the state of South Carolina would be organized under the HAZUS Data folder.

2. Next, point the program to the data folder on your local hard drive. To do this, click the "Start" button and select "Run" to open the Run window, type "regedit" in the Run window edit box and click the "OK" button to open the Registry Editor. Navigate through the folders listed in the Registry Editor to the following location:

HKEY\_LOCAL MACHINE | SOFTWARE | FEMA | HAZUS-MH | General

3. Now look at the right side of the window and find the entry called "DataPath1". Double click on "DataPath1" to open the Edit String window and enter the full name of the folder on the hard drive that contains the data copied from the DVDs in the edit box. Click the OK button to update the DataPath1 value.

IMPORTANT: Make sure the path ends with a "\" and do not change any of the other registry settings.

4. Close the Registry Editor by choosing Exit from the File menu of the Registry Editor.

## Capabilities

- Transferring data, including importing study regions, from HAZUS99, HAZUS99-SR1, HAZUS99-SR2, HAZUS-MH and HAZUS-MH MR1 to HAZUS-MH MR3 will require the assistance of technical support.
- Inventory data and subsequently the Level 1 analysis functionality are unavailable for the US held territories.
- Components of independently developed data sets in the default inventory data might not line up on maps, for example, the placement of bridges and roads, and facilities. This situation can be addressed by updating the default inventory data with user supplied data.
- The Hurricane Model can be run for 22 states on the Gulf and Atlantic coasts and for the state of Hawaii. Default tree inventory data is not available for Hawaii.

- Loss estimates for large study regions of 2,000 census tracts or blocks might require 4 hours analysis time.

### **Technical Support**

- Technical support is available via telephone, e-mail, or FAX. The numbers and addresses are listed on the HAZUS software package and under the Help menu in the software. Information on HAZUS updates, software patches, and FAQs are available at [www.fema.gov/hazus/](http://www.fema.gov/hazus/).



## WHAT'S NEW IN HAZUS-MH MR1 – HURRICANE MODEL

### Data

- Updated valuations for the general building stock.

### Methodology

- Capability to assess hurricane mitigation options for multi-unit buildings and manufactured housing.
- Capability to define hurricanes with NWS forecasts/advisories downloaded directly from the Internet.

### Other Features

- Operation on the new ArcGIS 9.0 SP1 platform.
- Capability to utilize third-party tools.
- Optimized software for rapid loss assessment.



## WHAT'S NEW IN HAZUS-MH MR 2 – HURRICANE MODEL

### Data

- 2005 valuation data for all occupancy classes.
- Means location factors for residential and non-residential occupancies on a county basis.
- Updated and validated valuation data for single-family residential housing and manufactured housing based on comparisons with other national databases.
- Zeros substituted for any negative values calculated for the daytime, nighttime, working commercial, working industrial and commuting populations.
- Construction age and values by decade for every census block with floor area (square footage).

### Methodology

- Availability of mitigation analysis options for all building classes and capability to specify the percentages of each building class that have one or more mitigation features.
- Capability to estimate tree debris weight or volume that is likely to be collected and discarded at public expense.
- Capability through an “Automatic Outputs” tool in the analysis options window to specify a standard set of summary reports and map layers that will be generated after each analysis and automatically exported to the study region folder.
- Capability to generate a range, representing the 5<sup>th</sup> and 95<sup>th</sup> percentiles, of potential damage and loss estimates for a given hurricane forecast, based on track and intensity errors in forecast advisories issued during the past 12 years, and to include the results in a new rapid loss summary report.
- Minor adjustments to the Hurricane Model Summary Reports to improve consistency among the three models.

### Other Features

- Keyboard operation of all user interface operations with some exceptions.
- Operation on the ArcView 9.1 SP1 platform.
- Certified on Windows XP SP2.
- Operation on the MDAC 2.8 data access engine from Microsoft.



## WHAT'S NEW IN HAZUS-MH MR 3 – HURRICANE MODEL

### Data

- Commercial data updated to Dun & Bradstreet 2006.
- Building valuations updated to R.S. Means 2006.
- Building counts based on census housing unit counts for RES1 (single-family dwellings) and RES2 (manufactured housing) instead of calculated building counts.

### Methodology

- Storms for 2004 and 2005 added to the historic storms database and updates made for several existing historic storms.
- Use of NOAA hurricane advisory data to model storms restored with an adjustment feature for calculating building damage and loss.
- New probabilistic storm set reflecting updates to the Holland pressure profile model and filling model.
- Updated wind field model for user-defined storms.
- New vulnerability functions to permit calculation of additional losses to manufactured housing due to tree blowdown.

### Other Features

- Operation on the ArcView 9.2 SP2 platform.
- Operation on Microsoft SQL 2005 Express.
- Operation on the MDAC 2.8 SP1 data access engine from Microsoft.
- Operation on FarPoint Spread 7 – Spreadsheet
- Operation on Crystal Reports 11.
- Enhancements to the existing aggregation routines to reflect improved procedures for processing study region information.



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**Appendix A.**  
**Damage State Functions for Residential Buildings**

## Appendix A. Damage State Functions for Residential Buildings

This appendix presents damage state curves for residential buildings (see Section 6.4). The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.4-1 for damage state definitions). Table A.1 summarizes the figures included in this appendix.

**Table A.1. Sample Damage State Functions for Residential Buildings**

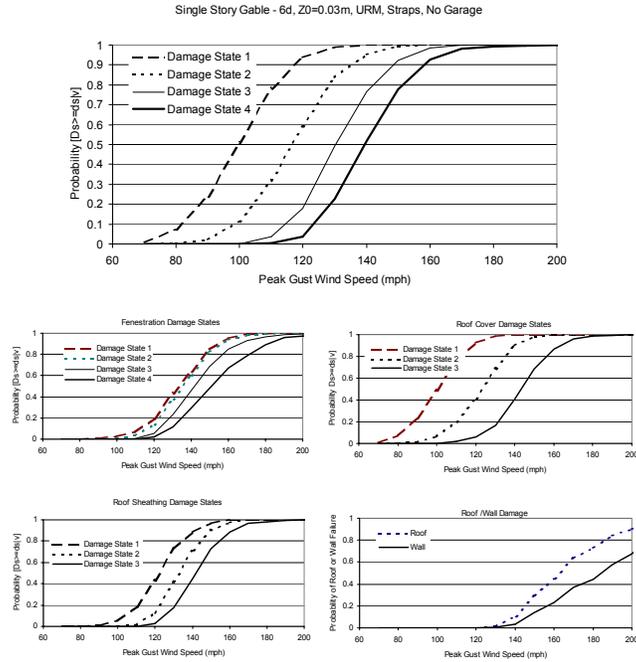
Figure	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Terrain
A.1	URM	1	No	Gable	6d	Strap	No	No	0.03
A.2	URM	1	No	Gable	6d	Strap	No	No	0.35
A.3	URM	1	No	Gable	6d	Strap	No	No	0.70
A.4	URM	1	No	Gable	6d	Strap	No	No	1.00
A.5	URM	1	No	Hip	6d	Strap	No	No	0.03
A.6	URM	1	No	Hip	6d	Strap	No	No	0.35
A.7	URM	1	No	Hip	6d	Strap	No	No	0.70
A.8	URM	1	No	Hip	6d	Strap	No	No	1.00
A.9	URM	1	No	Gable	6d	Toe-Nail	No	No	0.03
A.10	URM	1	No	Gable	6d	Toe-Nail	No	No	0.35
A.11	URM	1	No	Gable	6d	Toe-Nail	No	No	0.70
A.12	URM	1	No	Gable	6d	Toe-Nail	No	No	1.00
A.13	URM	1	No	Hip	6d	Toe-Nail	No	No	0.03
A.14	URM	1	No	Hip	6d	Toe-Nail	No	No	0.35
A.15	URM	1	No	Hip	6d	Toe-Nail	No	No	0.70
A.16	URM	1	No	Hip	6d	Toe-Nail	No	No	1.00
A.17	WFR	2	No	Gable	6d	Strap	No	No	0.03
A.18	WFR	2	No	Gable	6d	Strap	No	No	0.35
A.19	WFR	2	No	Gable	6d	Strap	No	No	0.70
A.20	WFR	2	No	Gable	6d	Strap	No	No	1.00
A.21	WFR	2	No	Hip	6d	Strap	No	No	0.03
A.22	WFR	2	No	Hip	6d	Strap	No	No	0.35
A.23	WFR	2	No	Hip	6d	Strap	No	No	0.70
A.24	WFR	2	No	Hip	6d	Strap	No	No	1.00
A.25	WFR	2	No	Gable	6d	Toe-Nail	No	No	0.03
A.26	WFR	2	No	Gable	6d	Toe-Nail	No	No	0.35
A.27	WFR	2	No	Gable	6d	Toe-Nail	No	No	0.70
A.28	WFR	2	No	Gable	6d	Toe-Nail	No	No	1.00
A.29	WFR	2	No	Hip	6d	Toe-Nail	No	No	0.03
A.30	WFR	2	No	Hip	6d	Toe-Nail	No	No	0.35
A.31	WFR	2	No	Hip	6d	Toe-Nail	No	No	0.70
A.32	WFR	2	No	Hip	6d	Toe-Nail	No	No	1.00

**Table A.1. Sample Damage State Functions for Residential Buildings (continued)**

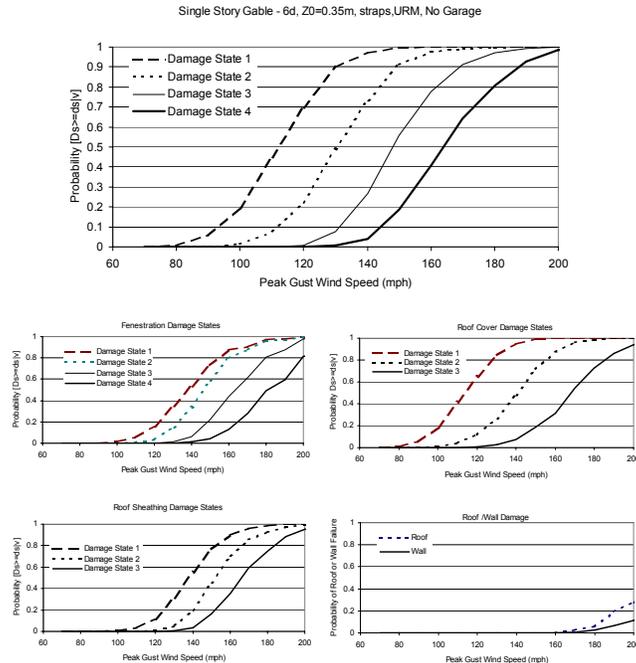
Figure	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Terrain
A.33	URM	2	No	Gable	6d	Strap	No	No	0.03
A.34	URM	2	No	Gable	6d	Strap	No	No	0.35
A.35	URM	2	No	Gable	6d	Strap	No	No	0.70
A.36	URM	2	No	Gable	6d	Strap	No	No	1.00
A.37	URM	2	No	Hip	6d	Strap	No	No	0.03
A.38	URM	2	No	Hip	6d	Strap	No	No	0.35
A.39	URM	2	No	Hip	6d	Strap	No	No	0.70
A.40	URM	2	No	Hip	6d	Strap	No	No	1.00
A.41	URM	2	No	Gable	6d	Toe-Nail	No	No	0.03
A.42	URM	2	No	Gable	6d	Toe-Nail	No	No	0.35
A.43	URM	2	No	Gable	6d	Toe-Nail	No	No	0.70
A.44	URM	2	No	Gable	6d	Toe-Nail	No	No	1.00
A.45	URM	2	No	Hip	6d	Toe-Nail	No	No	0.03
A.46	URM	2	No	Hip	6d	Toe-Nail	No	No	0.35
A.47	URM	2	No	Hip	6d	Toe-Nail	No	No	0.70
A.48	URM	2	No	Hip	6d	Toe-Nail	No	No	1.00
A.49	URM	1	No	Gable	8d	Strap	No	No	0.03
A.50	URM	1	No	Gable	8d	Strap	No	No	0.35
A.51	URM	1	No	Gable	8d	Strap	No	No	0.70
A.52	URM	1	No	Gable	8d	Strap	No	No	1.00
A.53	URM	1	No	Hip	8d	Strap	No	No	0.03
A.54	URM	1	No	Hip	8d	Strap	No	No	0.35
A.55	URM	1	No	Hip	8d	Strap	No	No	0.70
A.56	URM	1	No	Hip	8d	Strap	No	No	1.00
A.57	URM	1	No	Gable	8d	Toe-Nail	No	No	0.03
A.58	URM	1	No	Gable	8d	Toe-Nail	No	No	0.35
A.59	URM	1	No	Gable	8d	Toe-Nail	No	No	0.70
A.60	URM	1	No	Gable	8d	Toe-Nail	No	No	1.00
A.61	URM	1	No	Hip	8d	Toe-Nail	No	No	0.03
A.62	URM	1	No	Hip	8d	Toe-Nail	No	No	0.35
A.63	URM	1	No	Hip	8d	Toe-Nail	No	No	0.70
A.64	URM	1	No	Hip	8d	Toe-Nail	No	No	1.00
A.65	URM	1	No	Gable	8d	Strap	Yes	No	0.03
A.66	URM	1	No	Gable	8d	Strap	Yes	No	0.35
A.67	URM	1	No	Gable	8d	Strap	Yes	No	0.70
A.68	URM	1	No	Gable	8d	Strap	Yes	No	1.00
A.69	URM	1	No	Hip	8d	Strap	Yes	No	0.03
A.70	URM	1	No	Hip	8d	Strap	Yes	No	0.35
A.71	URM	1	No	Hip	8d	Strap	Yes	No	0.70
A.72	URM	1	No	Hip	8d	Strap	Yes	No	1.00
A.73	URM	1	No	Gable	8d	Toe-Nail	Yes	No	0.03
A.74	URM	1	No	Gable	8d	Toe-Nail	Yes	No	0.35
A.75	URM	1	No	Gable	8d	Toe-Nail	Yes	No	0.70
A.76	URM	1	No	Gable	8d	Toe-Nail	Yes	No	1.00

**Table A.1. Sample Damage State Functions for Residential Buildings (concluded)**

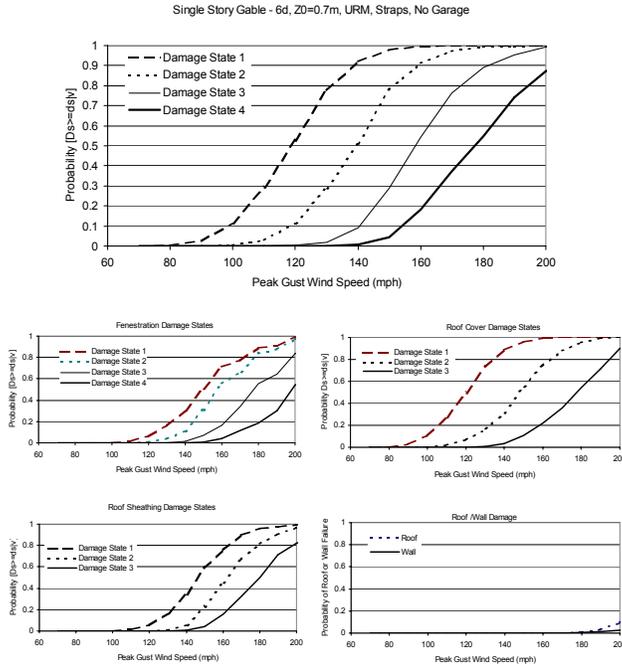
Figure	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Terrain
A.77	URM	1	No	Hip	8d	Toe-Nail	Yes	No	0.03
A.78	URM	1	No	Hip	8d	Toe-Nail	Yes	No	0.35
A.79	URM	1	No	Hip	8d	Toe-Nail	Yes	No	0.70
A.80	URM	1	No	Hip	8d	Toe-Nail	Yes	No	1.00
A.81	URM	1	No	Gable	8d	Strap	No	Yes	0.03
A.82	URM	1	No	Gable	8d	Strap	No	Yes	0.35
A.83	URM	1	No	Gable	8d	Strap	No	Yes	0.70
A.84	URM	1	No	Gable	8d	Strap	No	Yes	1.00
A.85	URM	1	No	Hip	8d	Strap	No	Yes	0.03
A.86	URM	1	No	Hip	8d	Strap	No	Yes	0.35
A.87	URM	1	No	Hip	8d	Strap	No	Yes	0.70
A.88	URM	1	No	Hip	8d	Strap	No	Yes	1.00
A.89	URM	1	No	Gable	8d	Toe-Nail	No	Yes	0.03
A.90	URM	1	No	Gable	8d	Toe-Nail	No	Yes	0.35
A.91	URM	1	No	Gable	8d	Toe-Nail	No	Yes	0.70
A.92	URM	1	No	Gable	8d	Toe-Nail	No	Yes	1.00
A.93	URM	1	No	Hip	8d	Toe-Nail	No	Yes	0.03
A.94	URM	1	No	Hip	8d	Toe-Nail	No	Yes	0.35
A.95	URM	1	No	Hip	8d	Toe-Nail	No	Yes	0.70
A.96	URM	1	No	Hip	8d	Toe-Nail	No	Yes	1.00
A.97	URM	1	No	Gable	8d	Strap	Yes	Yes	0.03
A.98	URM	1	No	Gable	8d	Strap	Yes	Yes	0.35
A.99	URM	1	No	Gable	8d	Strap	Yes	Yes	0.70
A.100	URM	1	No	Gable	8d	Strap	Yes	Yes	1.00
A.101	URM	1	No	Hip	8d	Strap	Yes	Yes	0.03
A.102	URM	1	No	Hip	8d	Strap	Yes	Yes	0.35
A.103	URM	1	No	Hip	8d	Strap	Yes	Yes	0.70
A.104	URM	1	No	Hip	8d	Strap	Yes	Yes	1.00
A.105	URM	1	No	Gable	8d	Toe-Nail	Yes	Yes	0.03
A.106	URM	1	No	Gable	8d	Toe-Nail	Yes	Yes	0.35
A.107	URM	1	No	Gable	8d	Toe-Nail	Yes	Yes	0.70
A.108	URM	1	No	Gable	8d	Toe-Nail	Yes	Yes	1.00
A.109	URM	1	No	Hip	8d	Toe-Nail	Yes	Yes	0.03
A.110	URM	1	No	Hip	8d	Toe-Nail	Yes	Yes	0.35
A.111	URM	1	No	Hip	8d	Toe-Nail	Yes	Yes	0.70
A.112	URM	1	No	Hip	8d	Toe-Nail	Yes	Yes	1.00



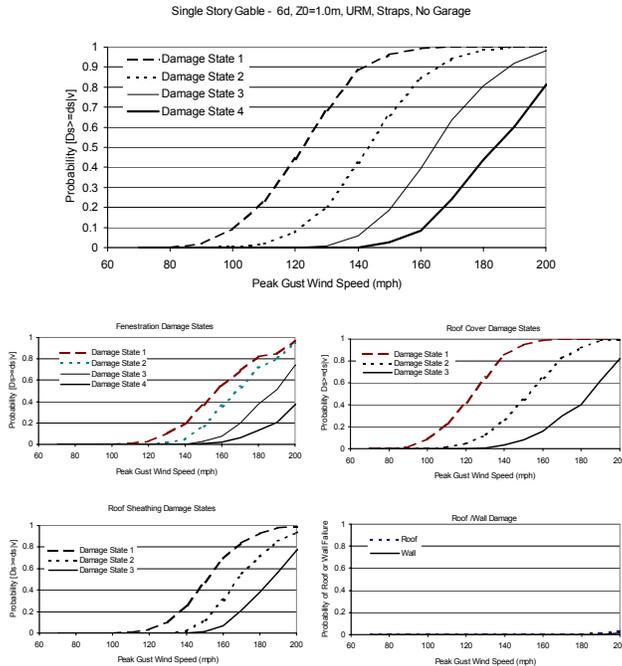
**Figure A.1. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



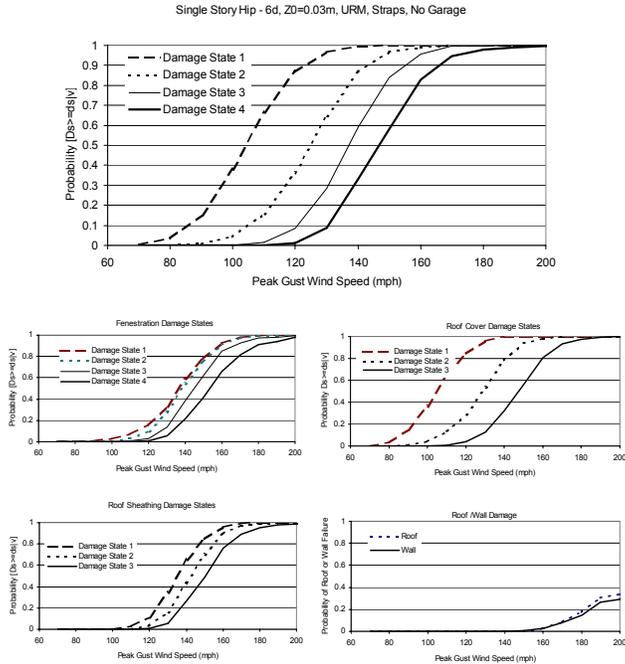
**Figure A.2. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



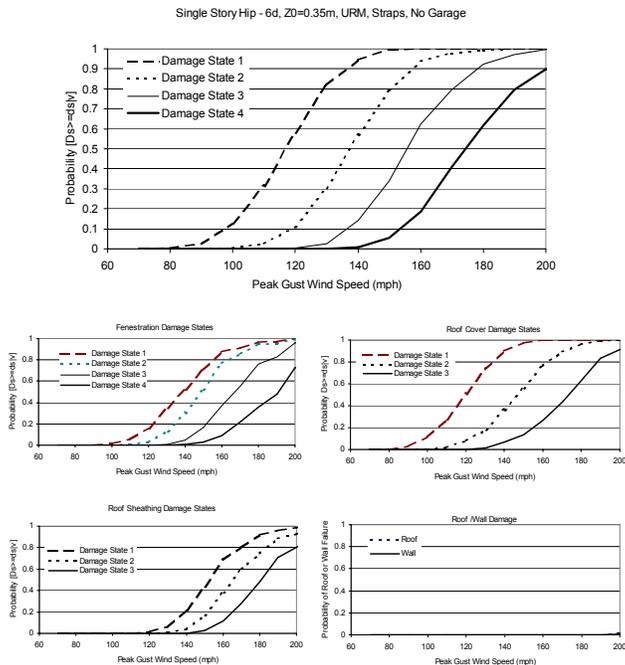
**Figure A.3. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



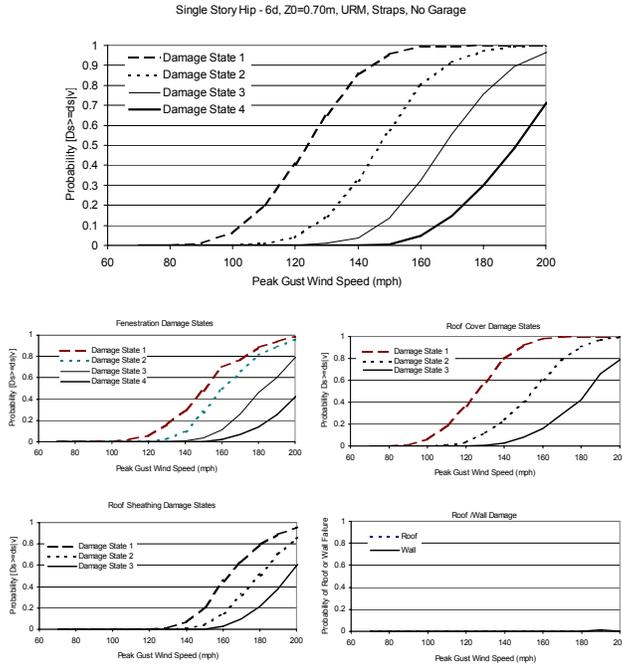
**Figure A.4. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



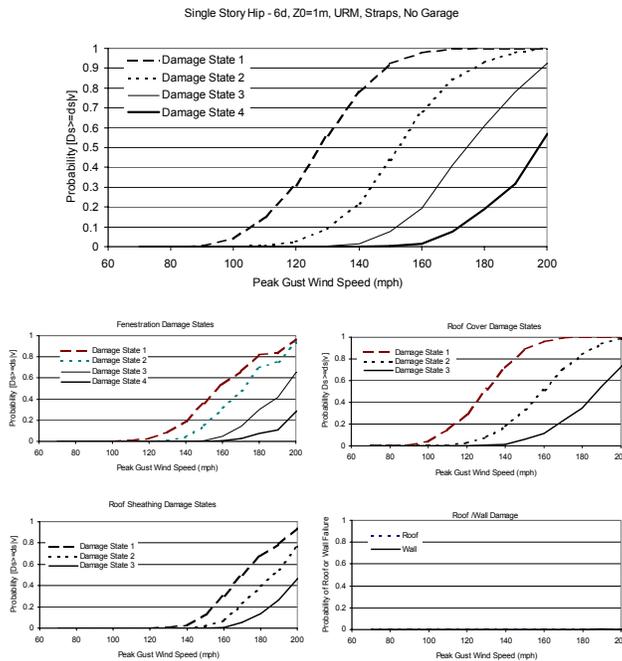
**Figure A.5. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



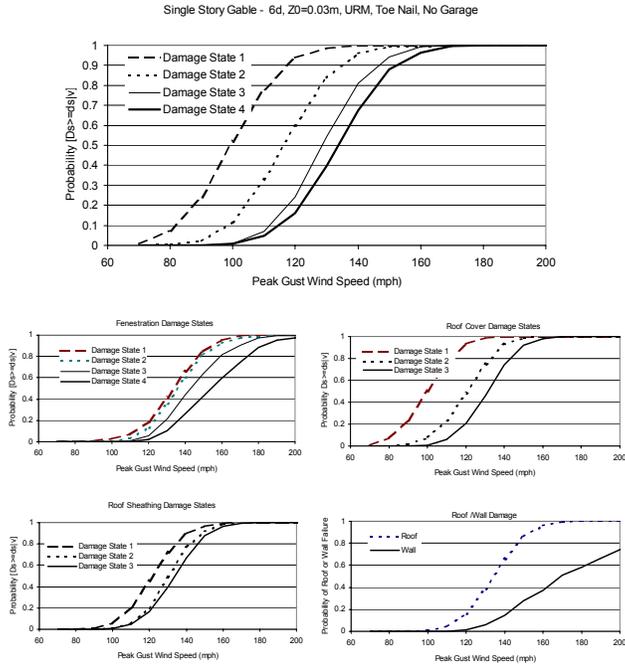
**Figure A.6. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



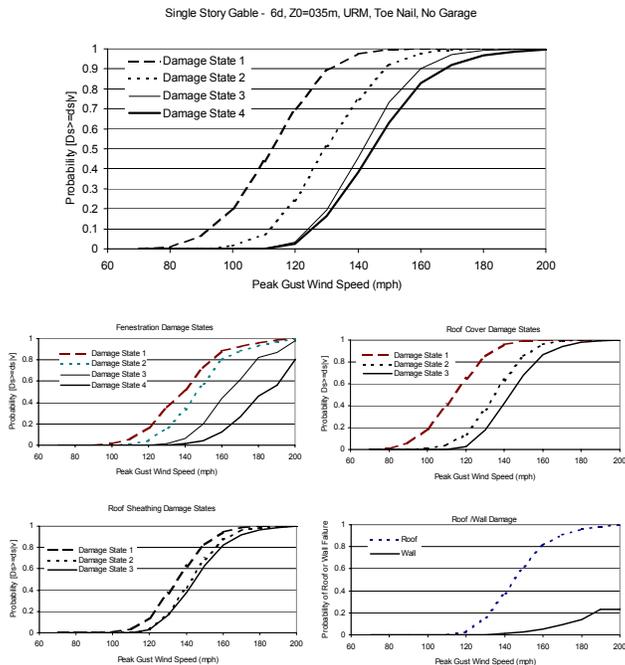
**Figure A.7. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



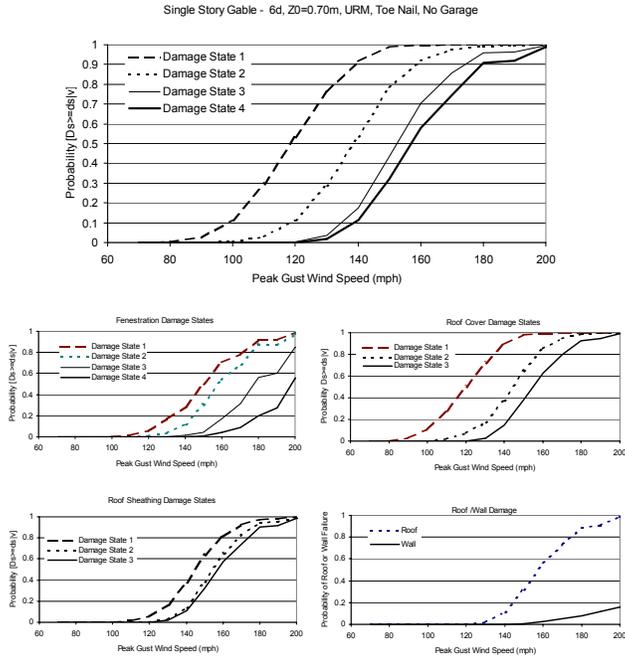
**Figure A.8. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



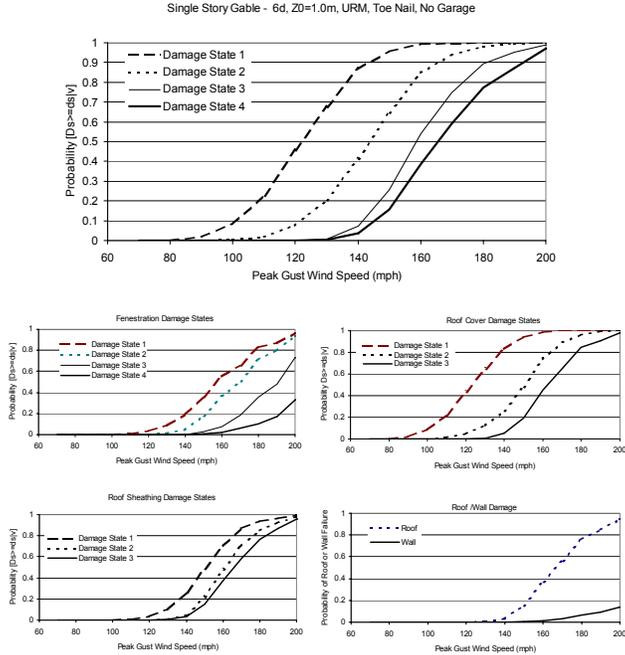
**Figure A.9. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



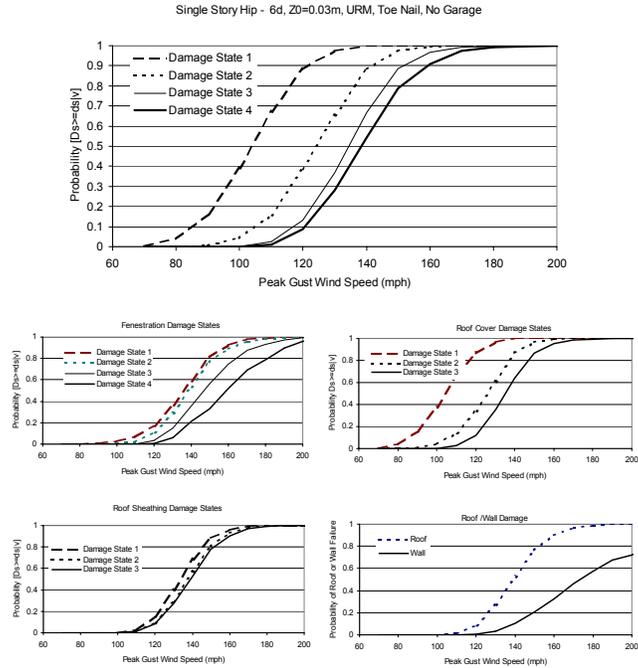
**Figure A.10. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



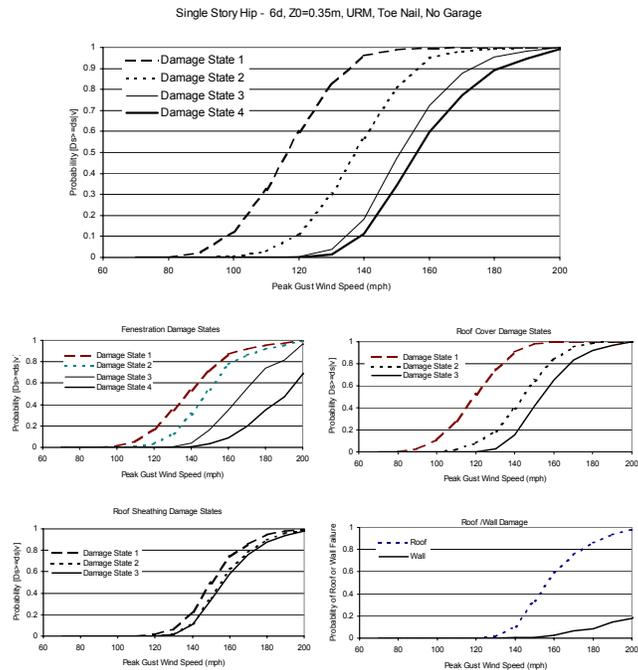
**Figure A.11. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



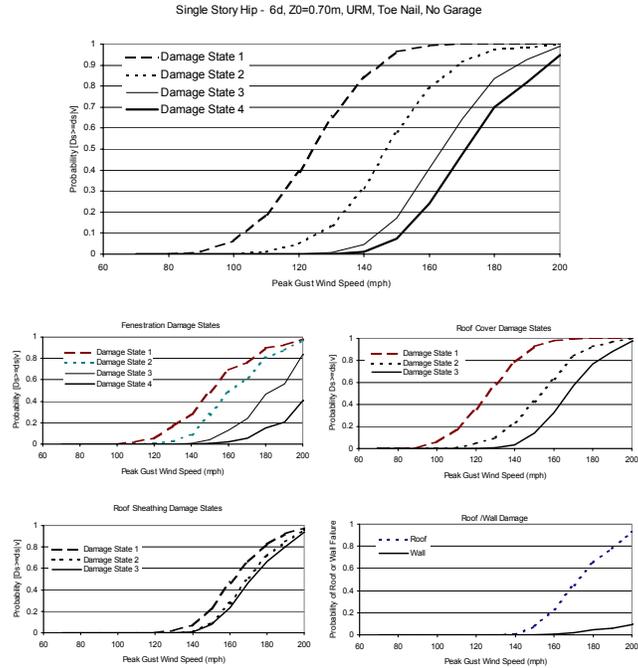
**Figure A.12. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



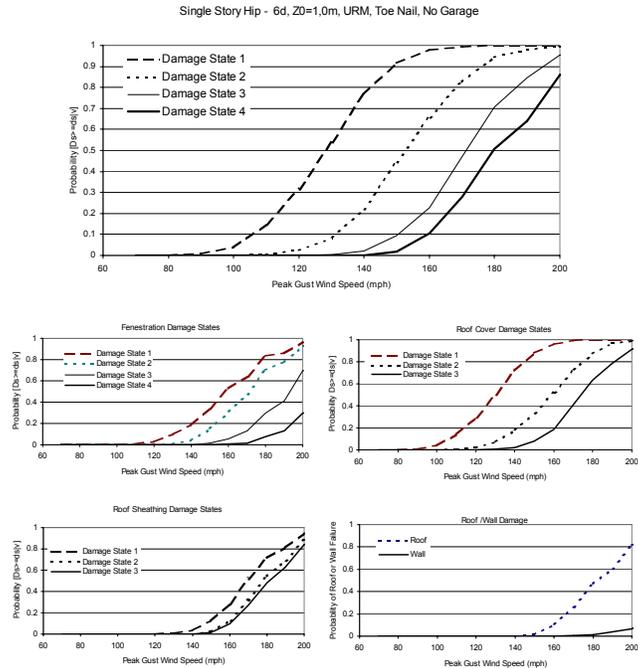
**Figure A.13. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



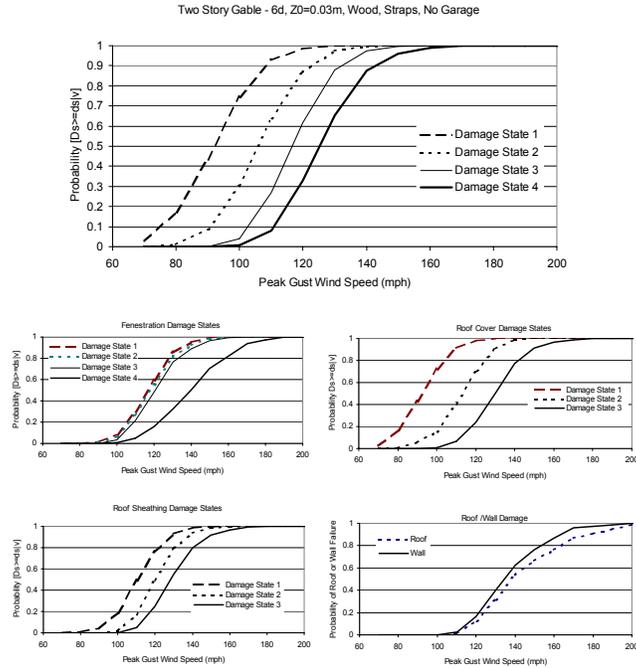
**Figure A.14. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



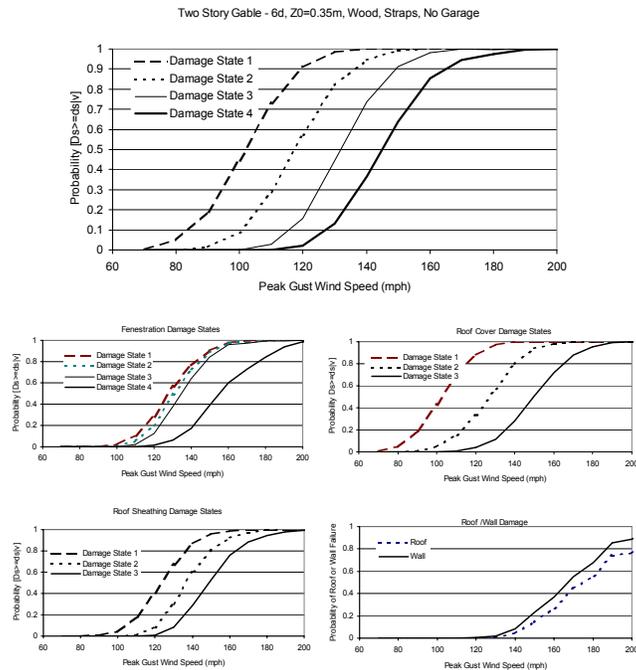
**Figure A.15. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



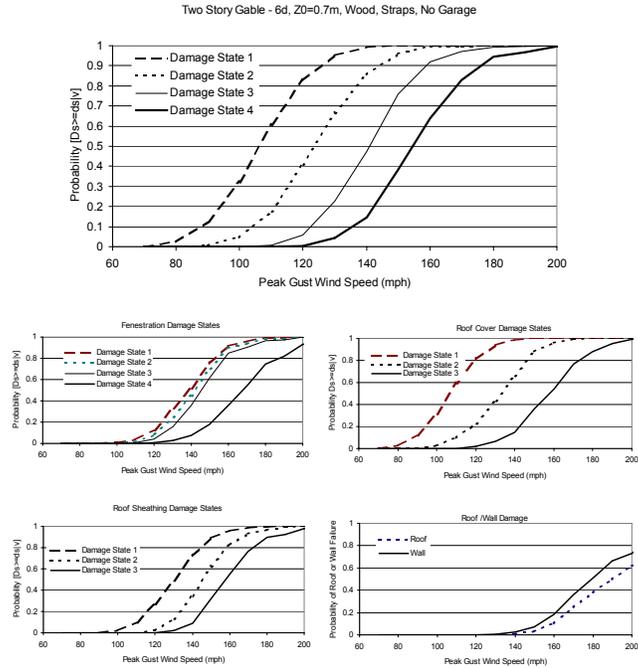
**Figure A.16. Damage States versus Maximum Peak Gust Wind Speed – One Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



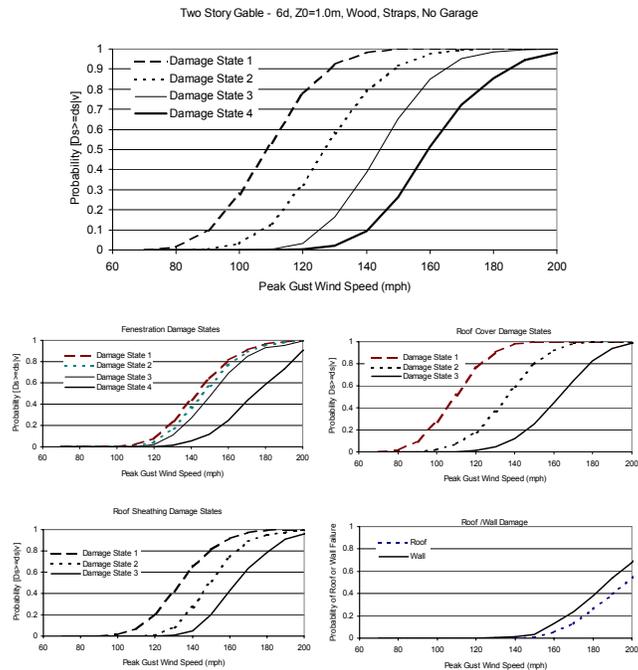
**Figure A.17. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.03$  m.**



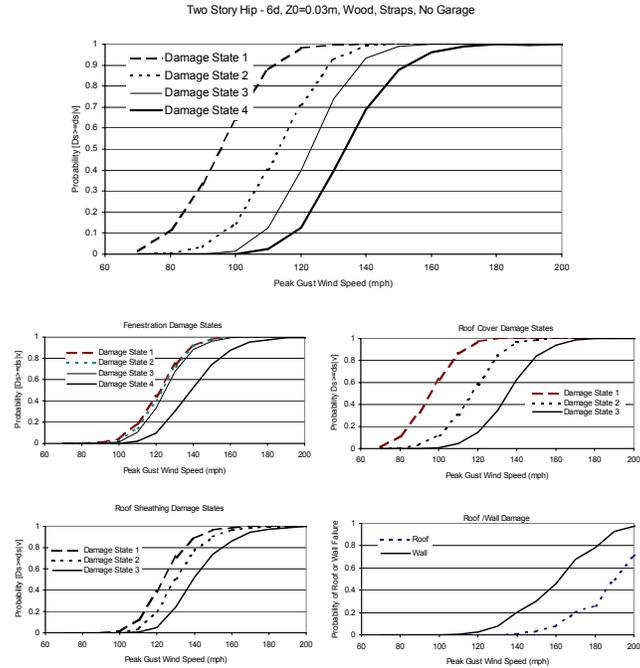
**Figure A.18. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.35$  m.**



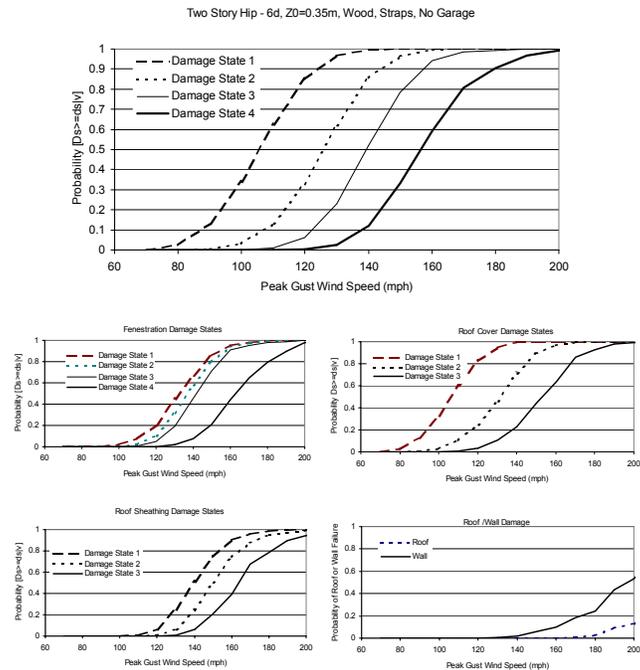
**Figure A.19. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.70$  m.**



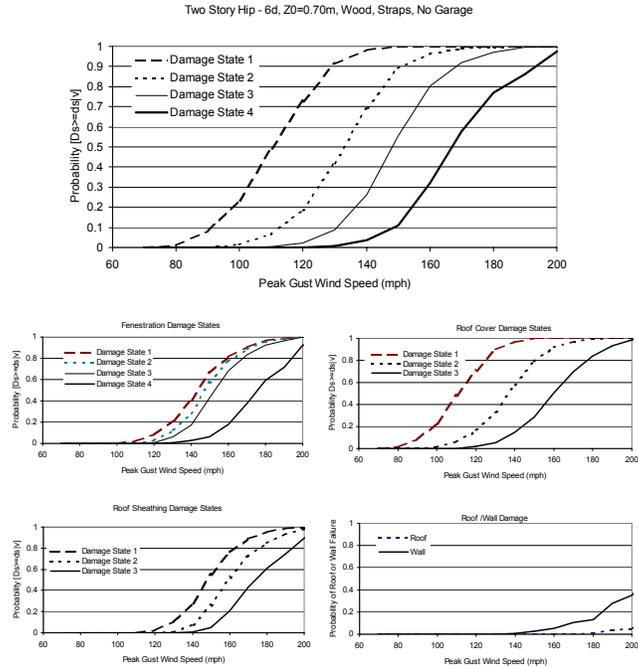
**Figure A.20. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 1.0$  m.**



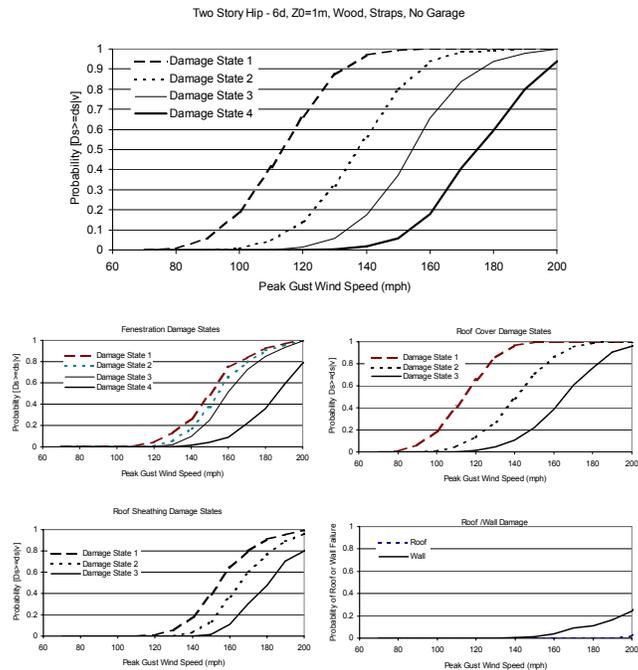
**Figure A.21. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.03$  m.**



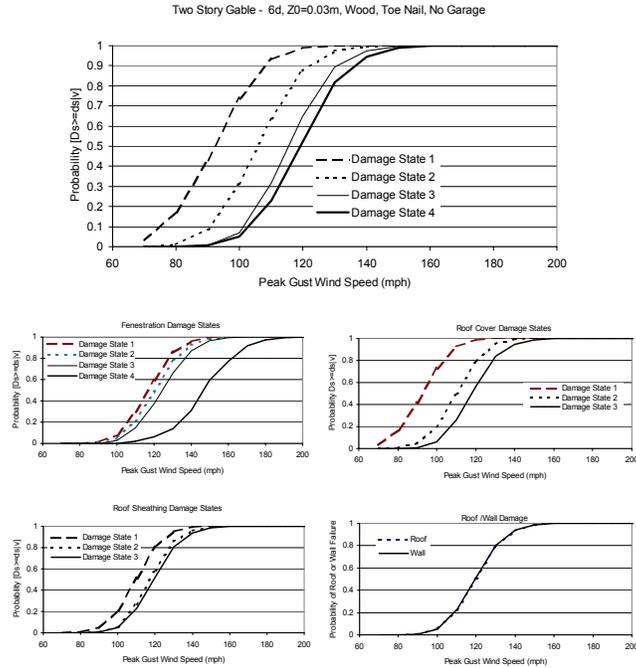
**Figure A.22. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.35$  m.**



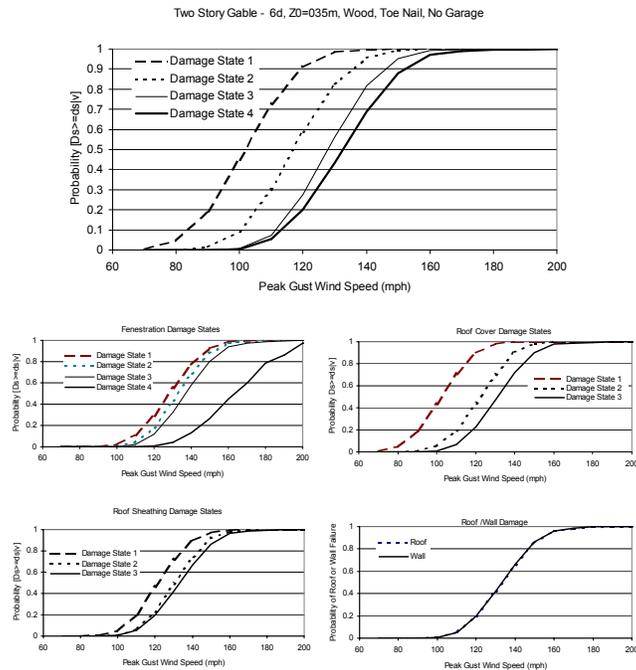
**Figure A.23. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.70$  m.**



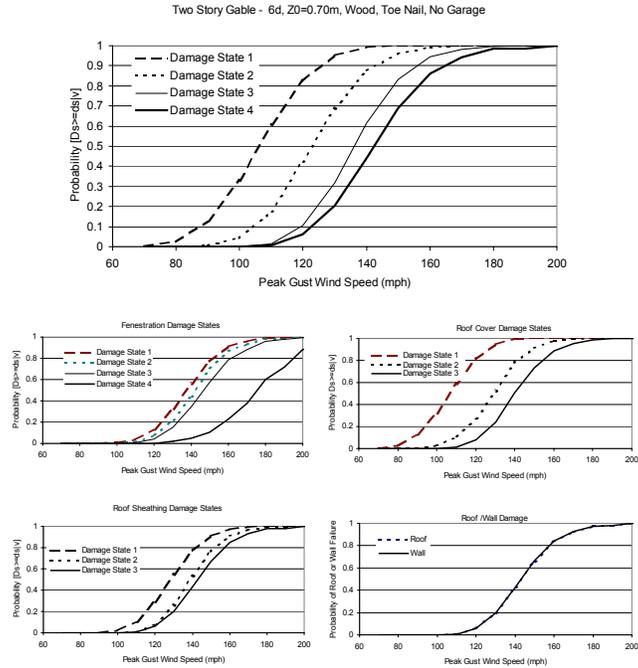
**Figure A.24. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 1.0$  m.**



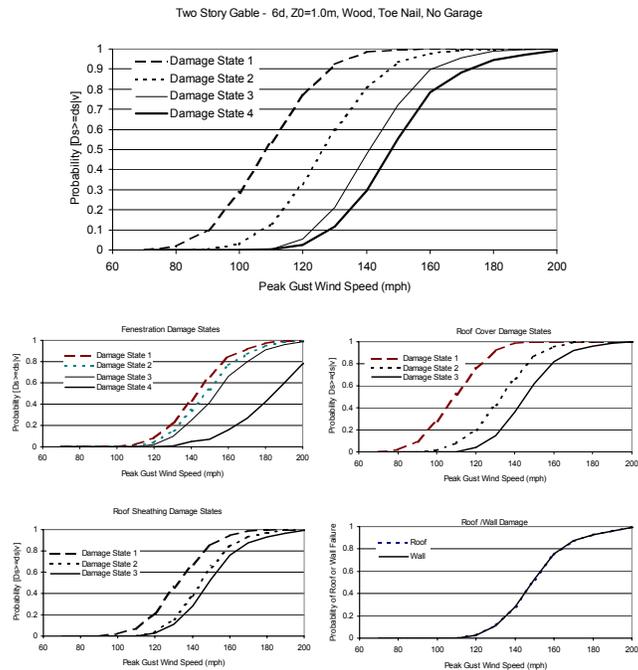
**Figure A.25. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.03$  m.**



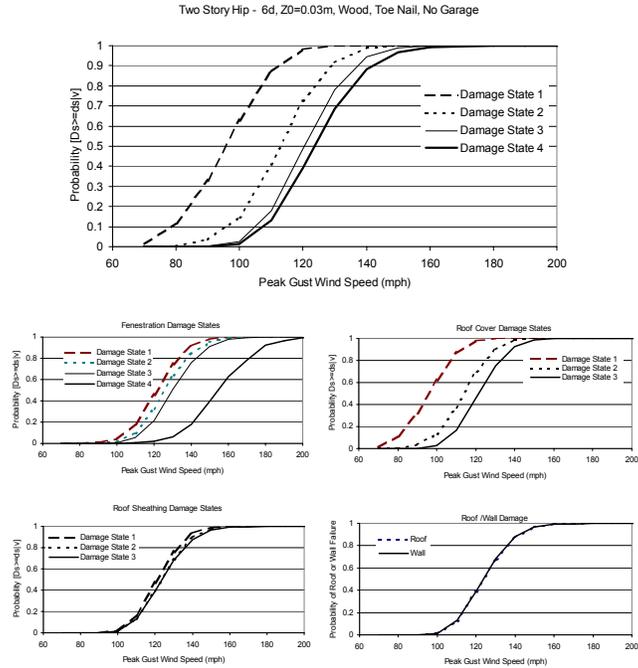
**Figure A.26. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.35$  m.**



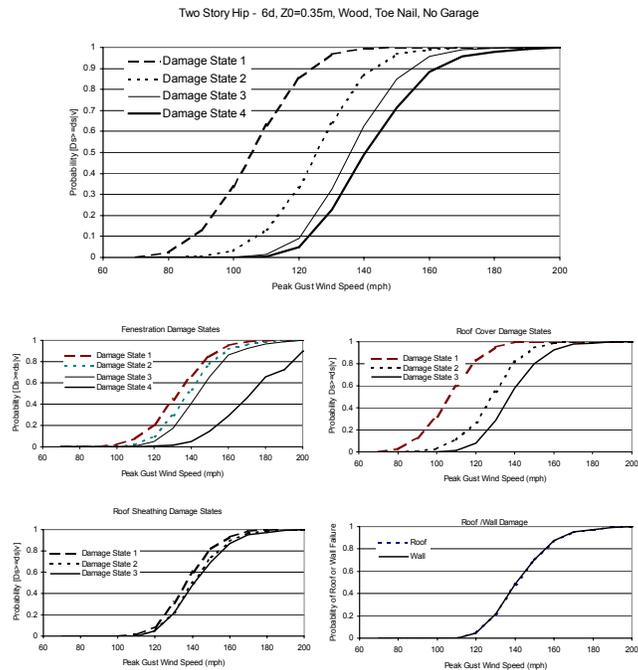
**Figure A.27. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 0.70$  m.**



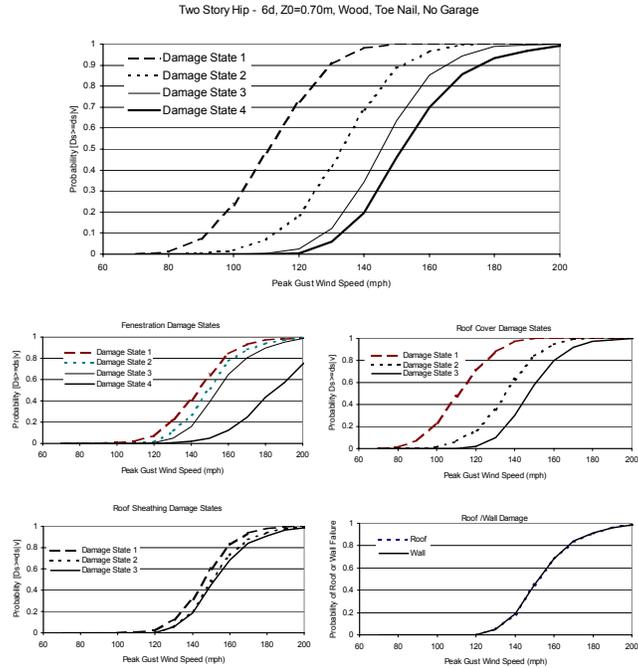
**Figure A.28. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Wood Frame Walls,  $z_0 = 1.0$  m.**



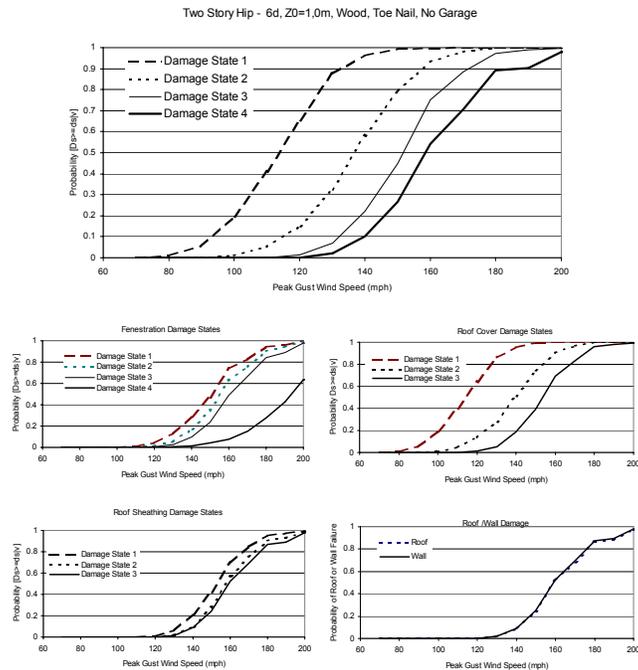
**Figure A.29. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.03$  m.**



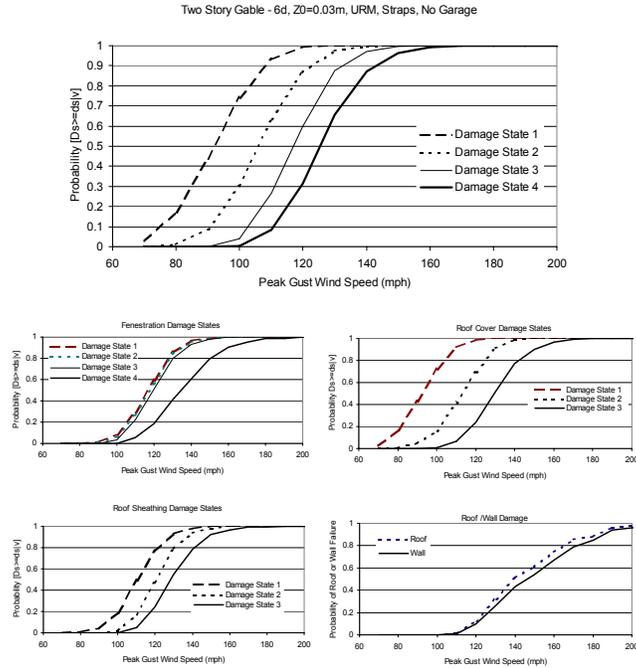
**Figure A.30. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.35$  m.**



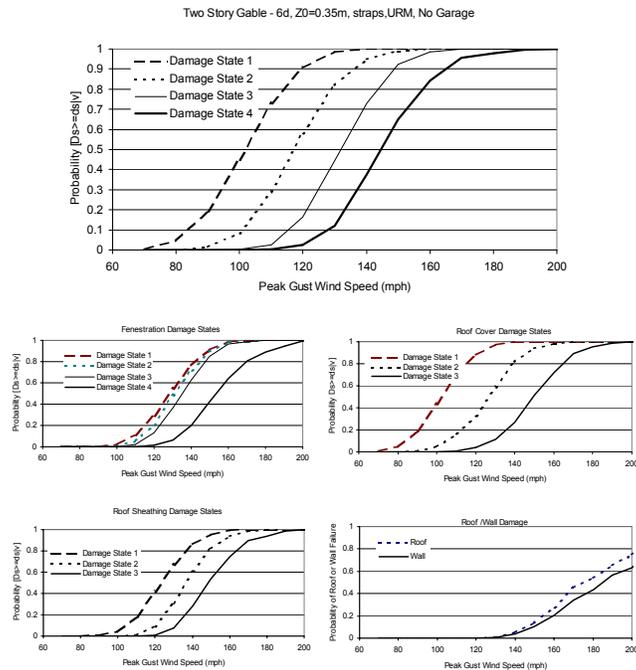
**Figure A.31. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 0.70$  m.**



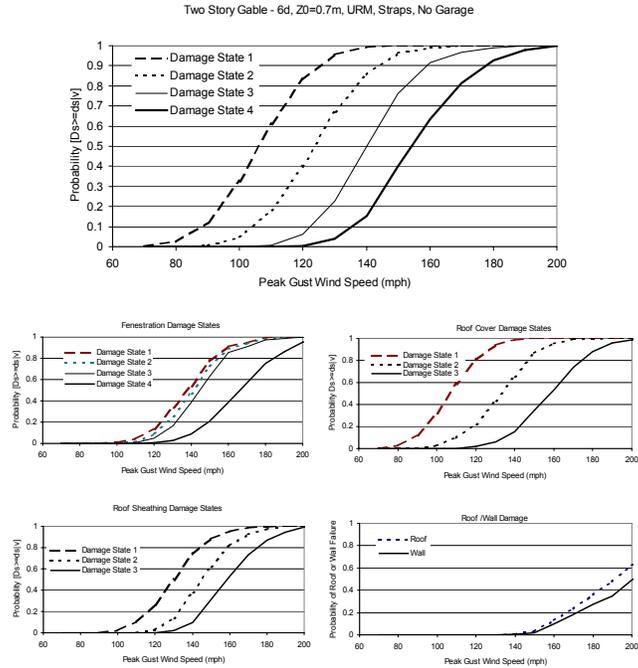
**Figure A.32. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Wood Frame Walls,  $z_0 = 1.0$  m.**



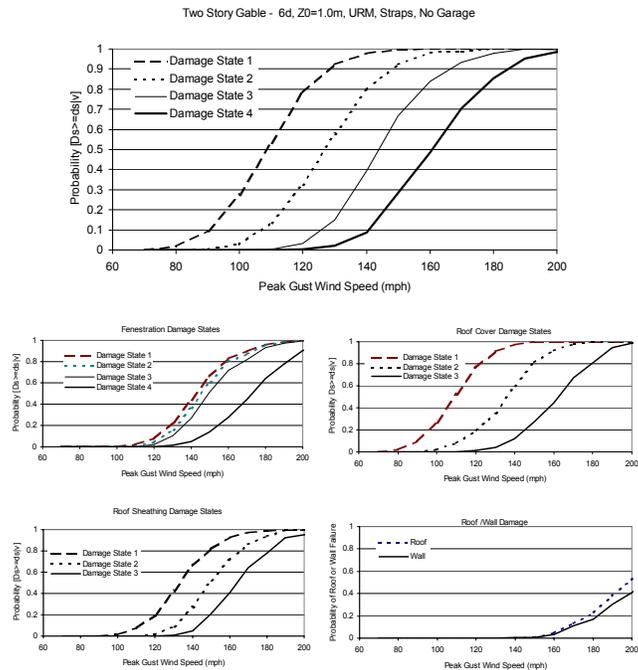
**Figure A.33. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



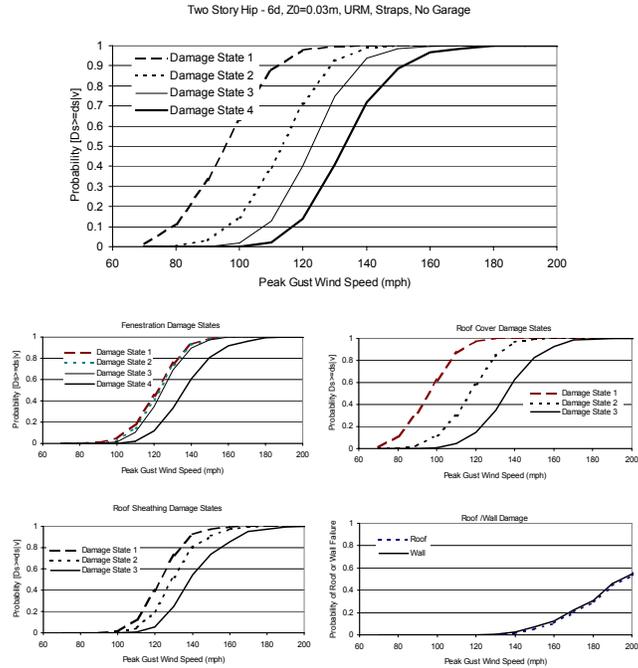
**Figure A.34. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



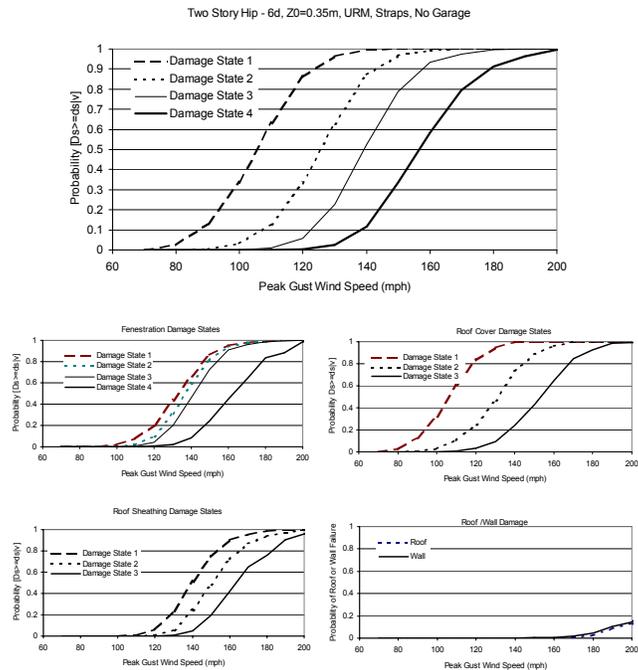
**Figure A.35. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



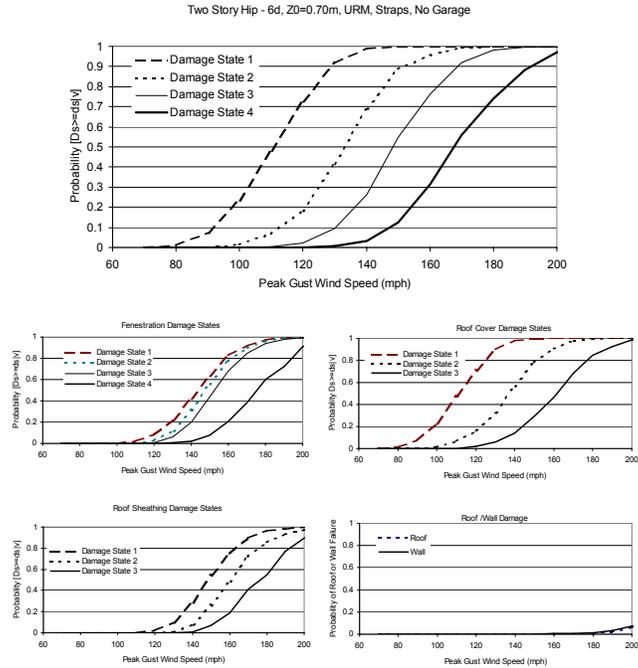
**Figure A.36. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



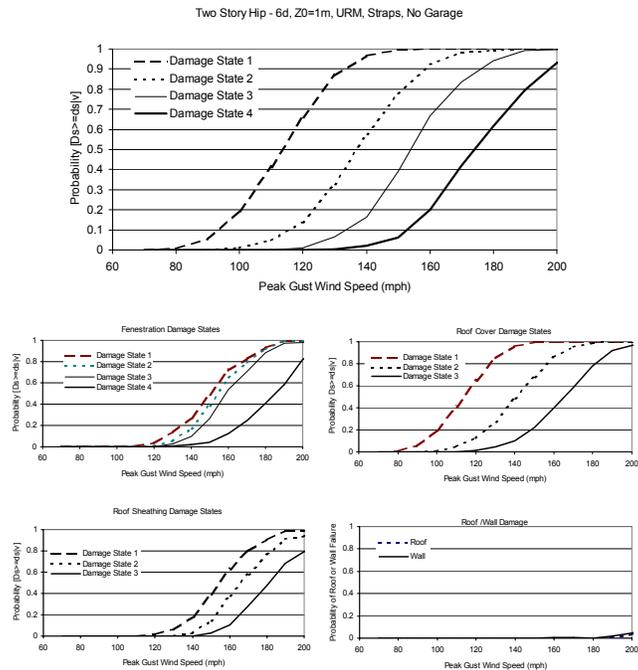
**Figure A.37. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



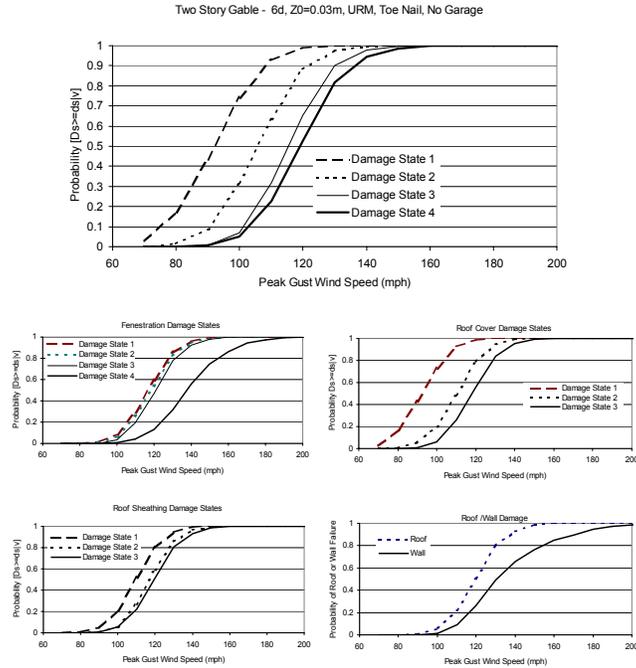
**Figure A.38. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



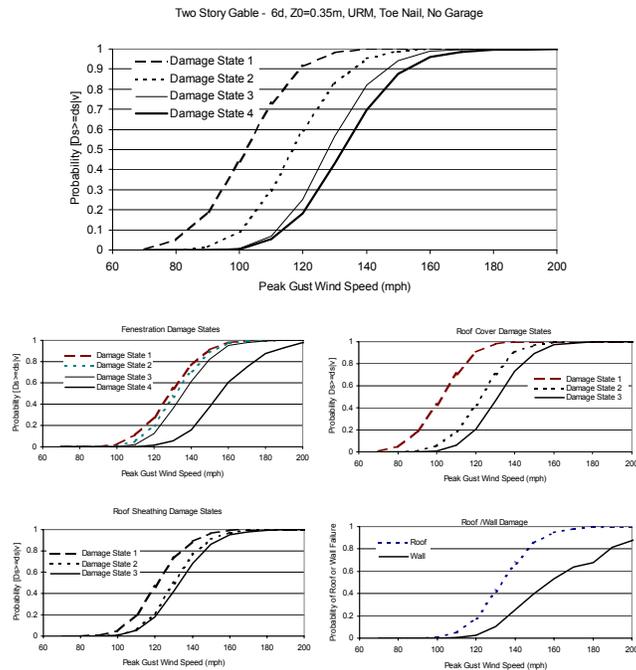
**Figure A.39. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



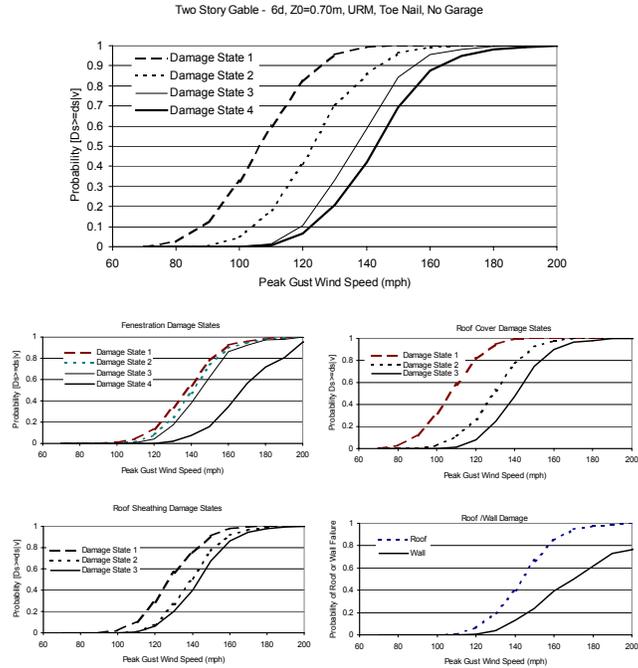
**Figure A.40. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



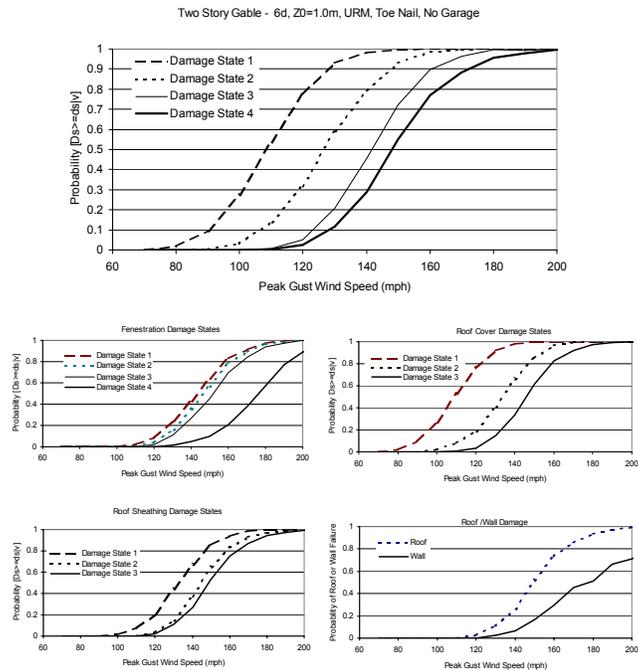
**Figure A.41. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



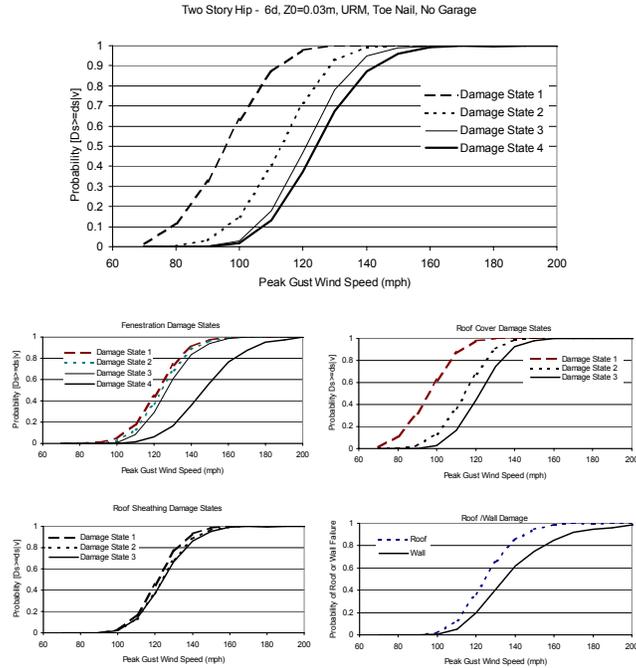
**Figure A.42. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



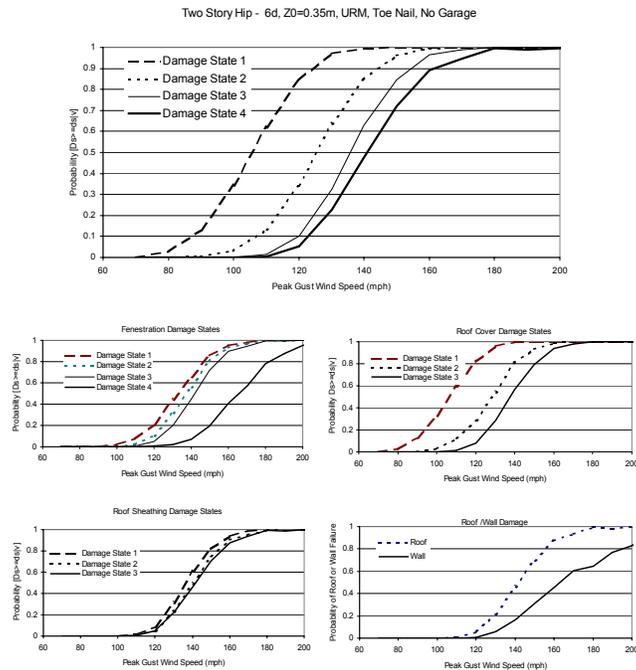
**Figure A.43. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



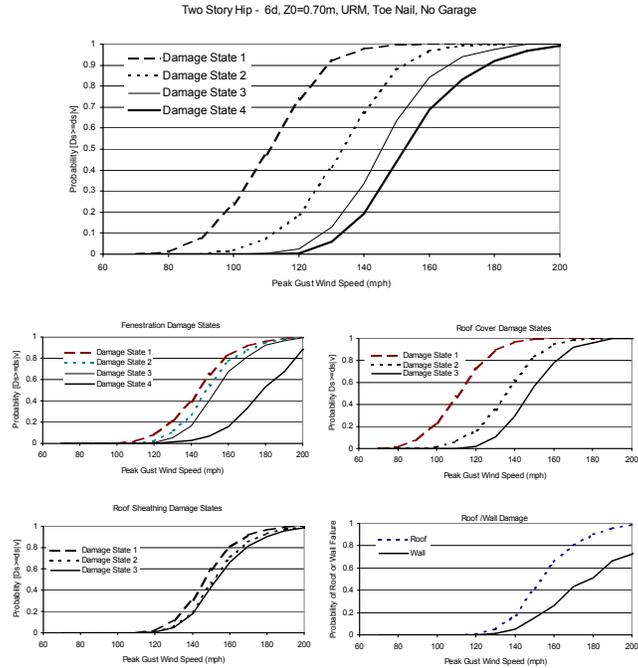
**Figure A.44. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



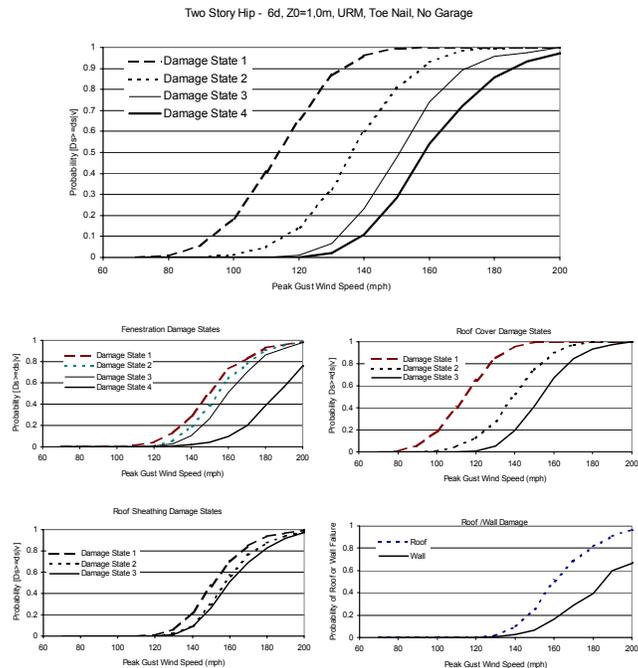
**Figure A.45. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



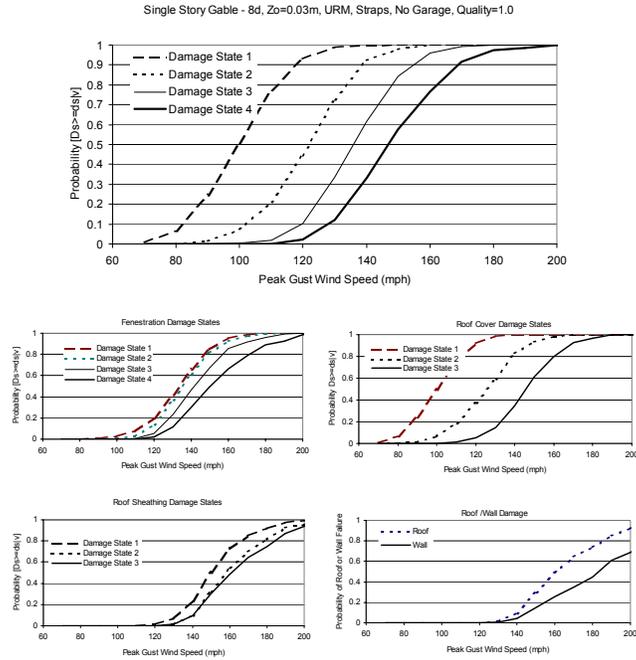
**Figure A.46. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



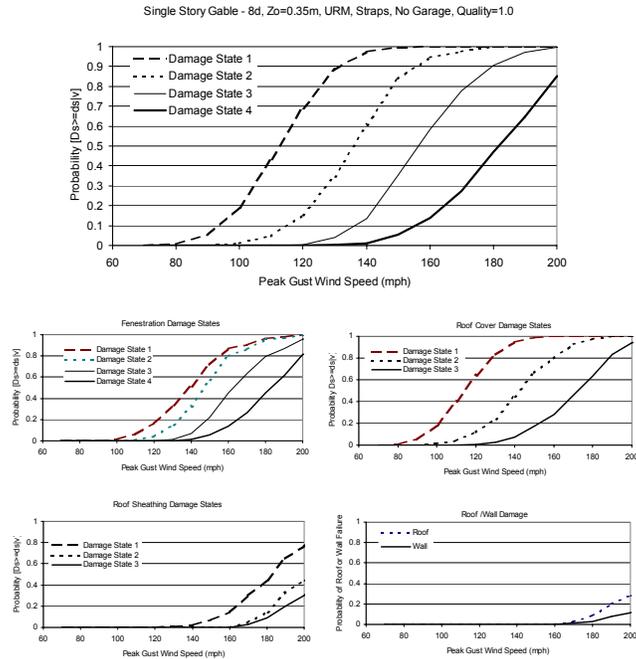
**Figure A.47. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



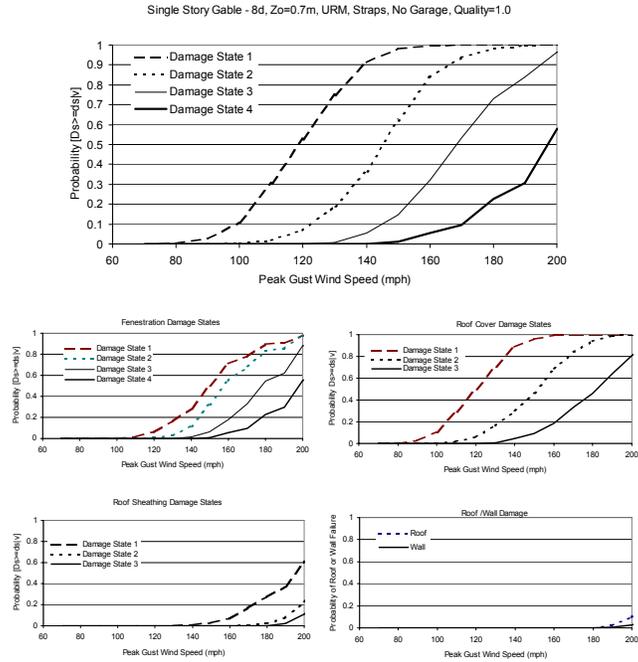
**Figure A.48. Damage States versus Maximum Peak Gust Wind Speed – Two Story, 6d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



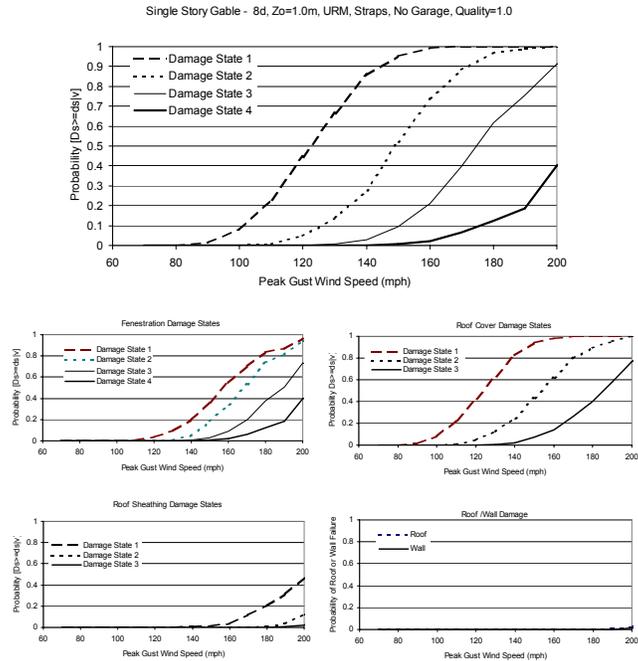
**Figure A.49. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



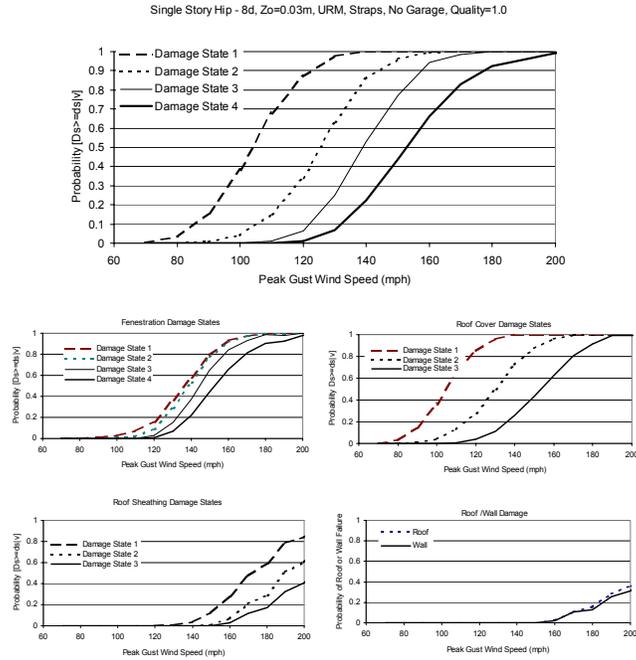
**Figure A.50. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



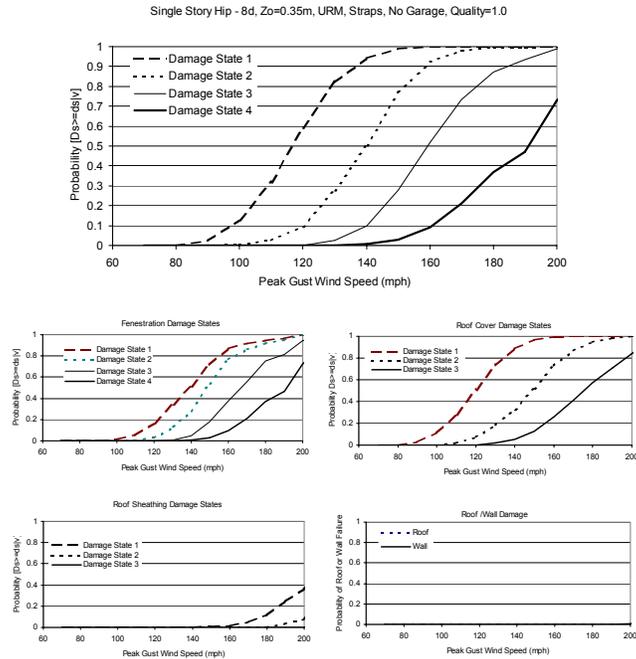
**Figure A.51. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70\text{ m}$ .**



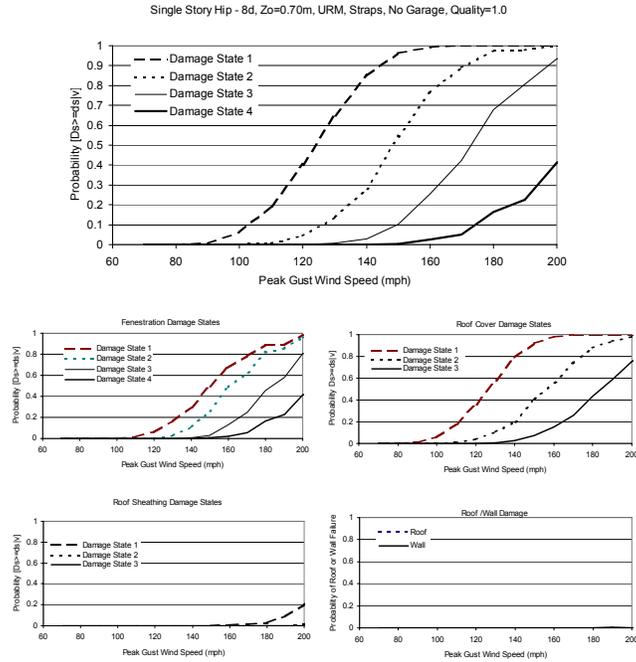
**Figure A.52. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0\text{ m}$ .**



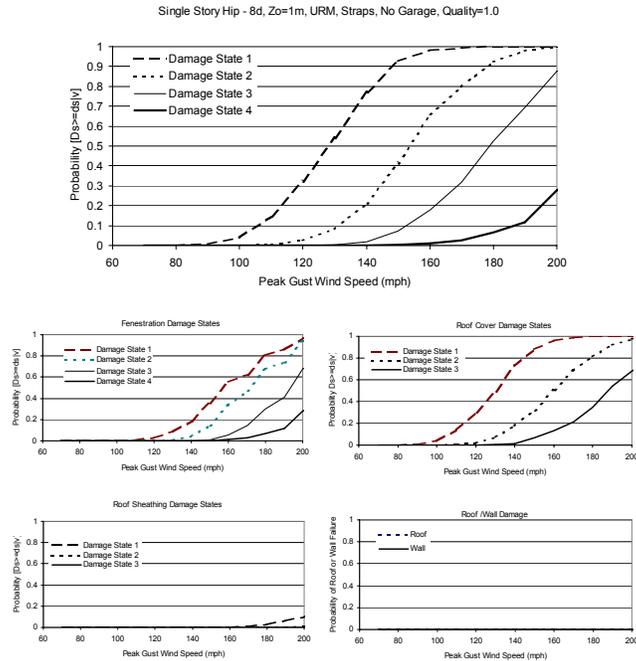
**Figure A.53. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**



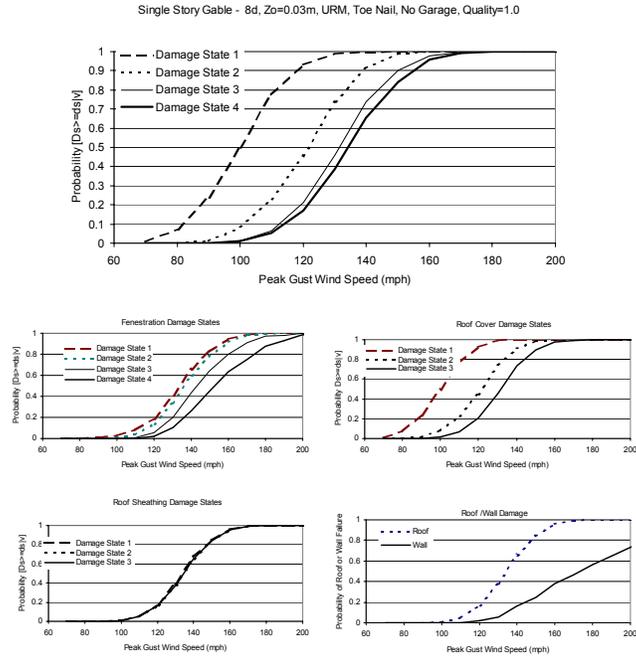
**Figure A.54. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



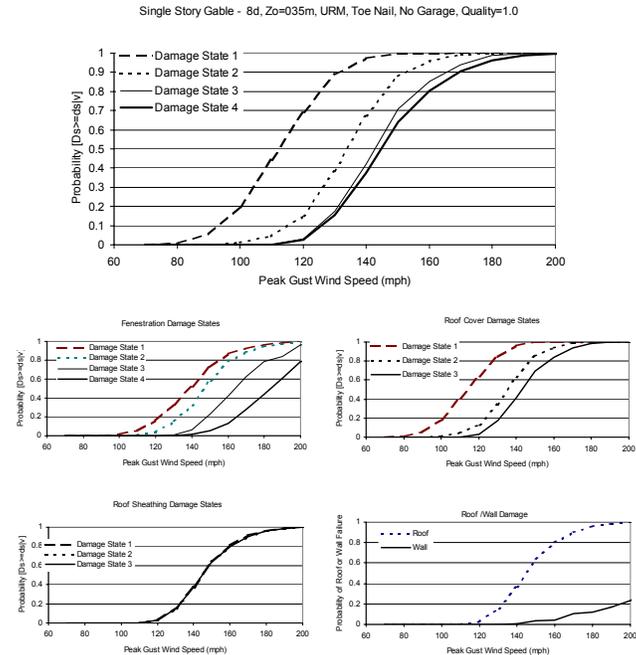
**Figure A.55. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



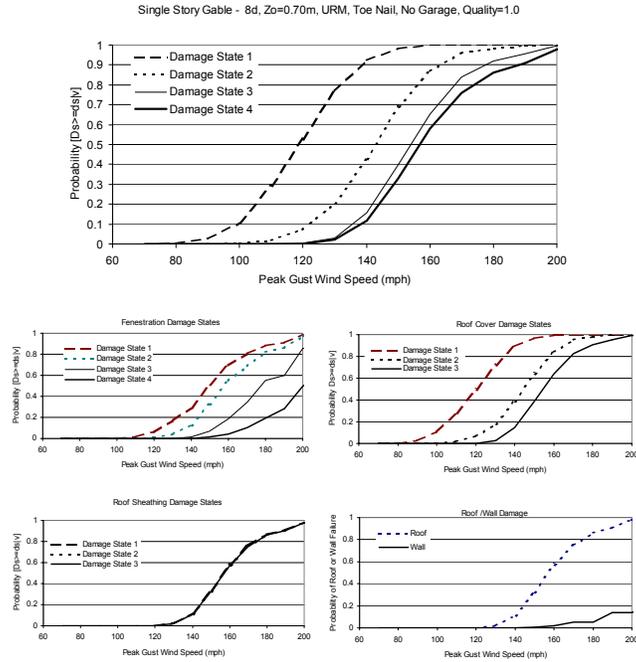
**Figure A.56. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



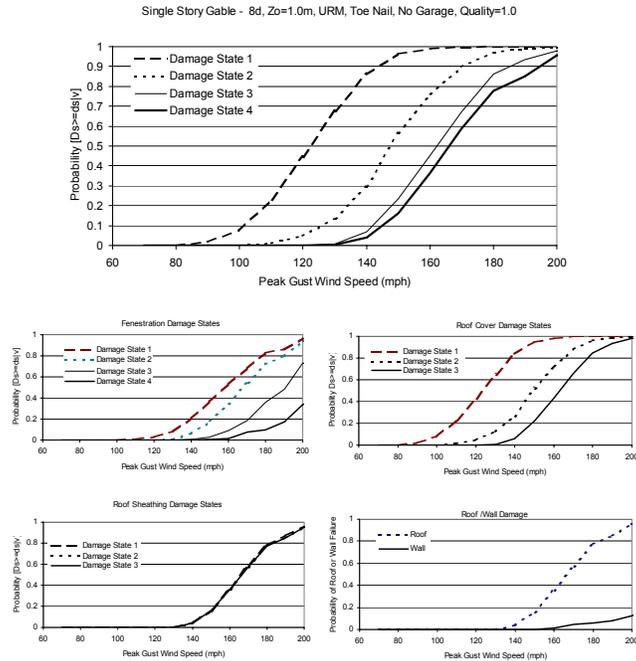
**Figure A.57. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03 m$ .**



**Figure A.58. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35 m$ .**

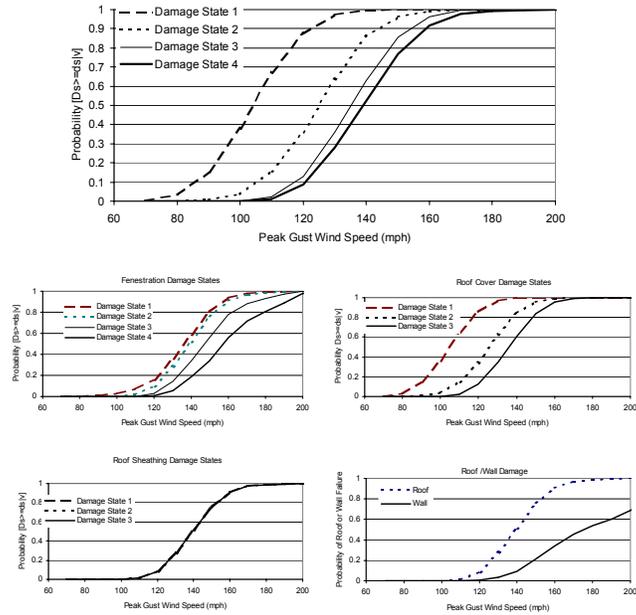


**Figure A.59. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70\text{ m}$ .**



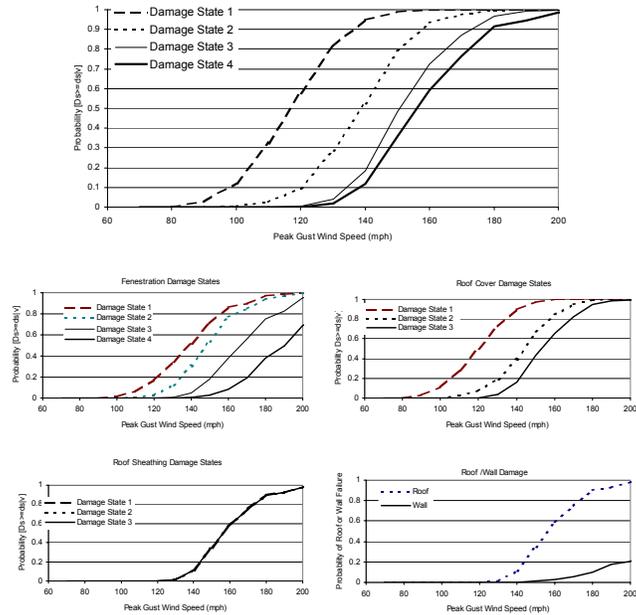
**Figure A.60. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0\text{ m}$ .**

Single Story Hip - 8d,  $Z_0=0.03\text{m}$ , URM, Toe Nail, No Garage, Quality=1.0

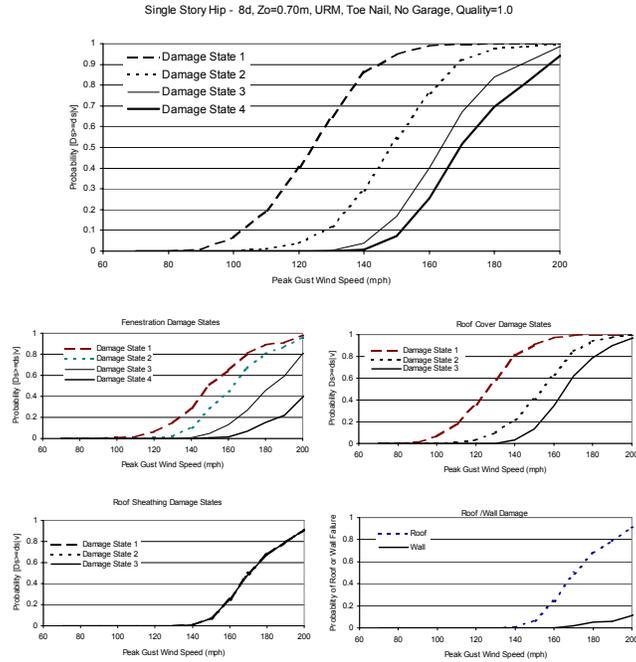


**Figure A.61. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m.**

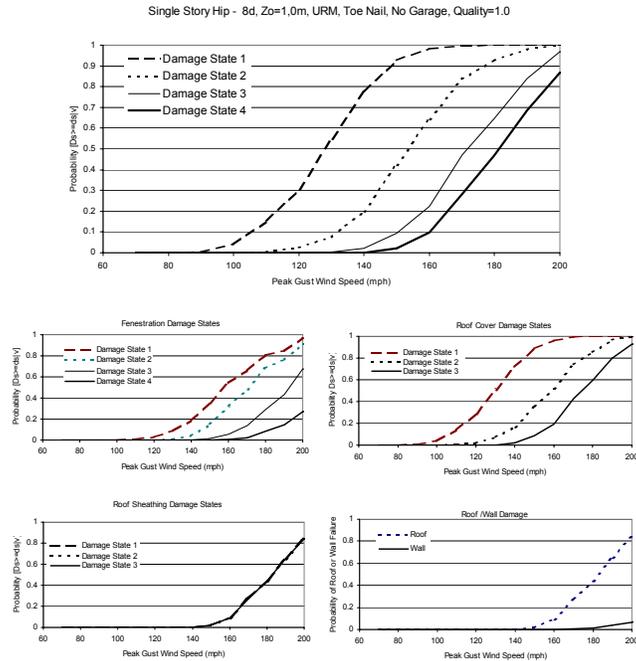
Single Story Hip - 8d,  $Z_0=0.35\text{m}$ , URM, Toe Nail, No Garage, Quality=1.0



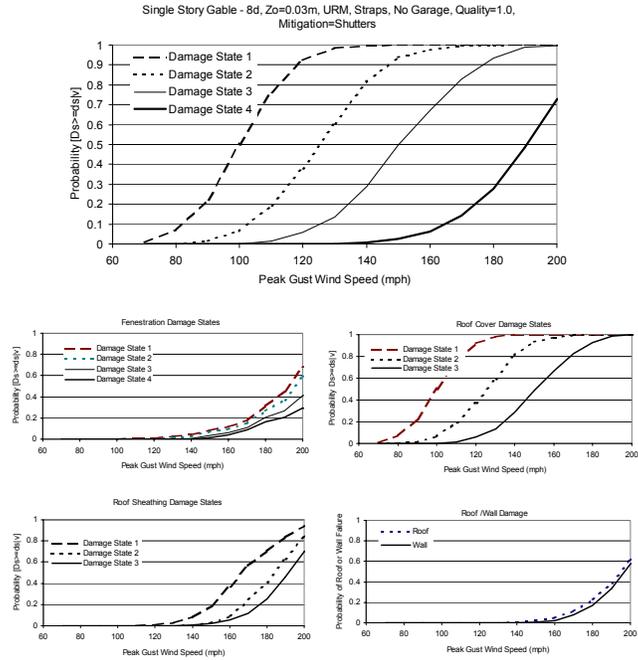
**Figure A.62. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m.**



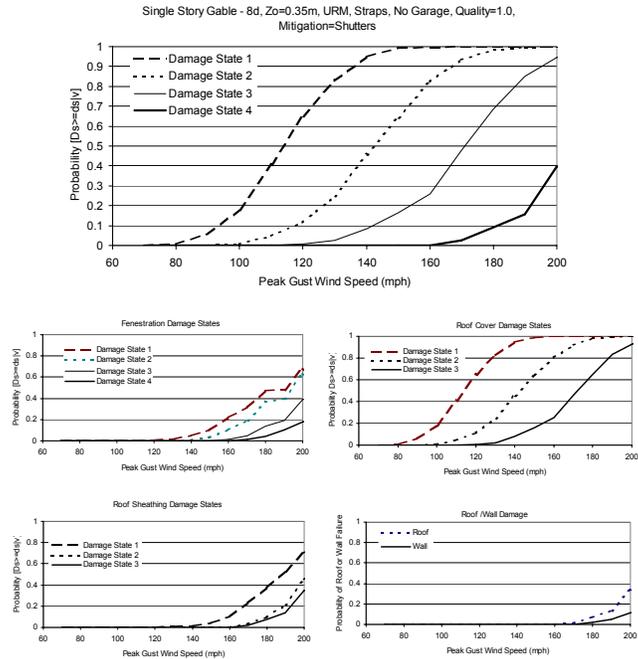
**Figure A.63. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m.**



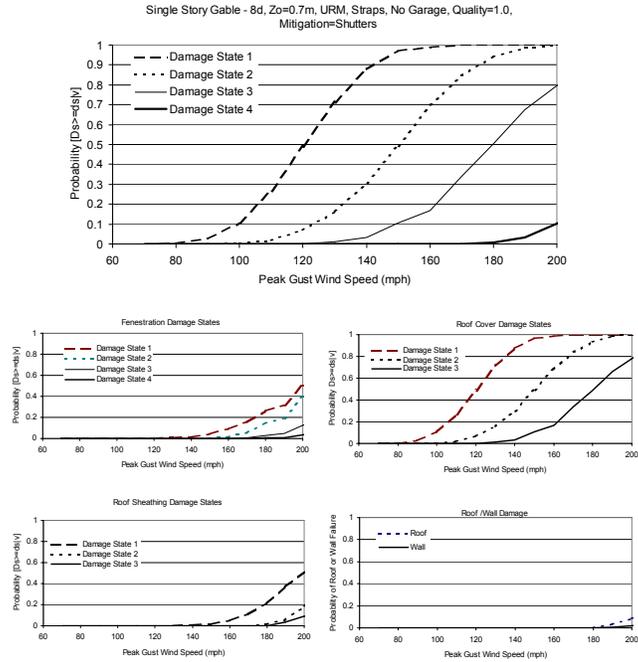
**Figure A.64. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m.**



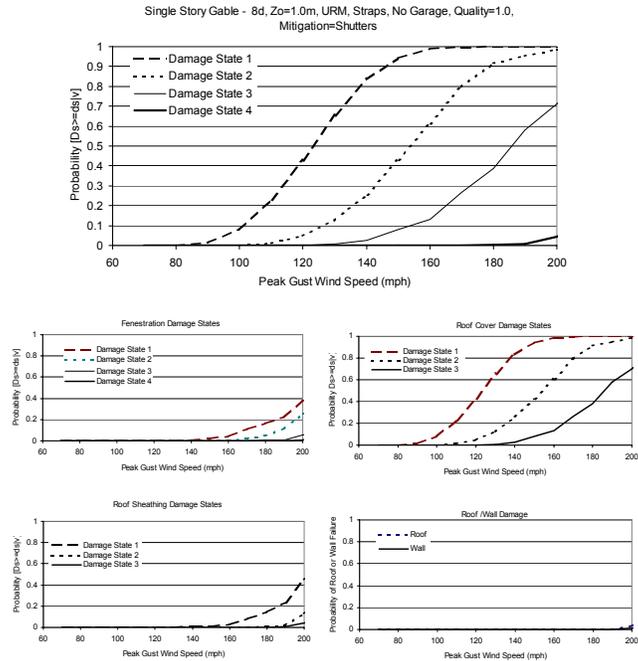
**Figure A.65. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters**



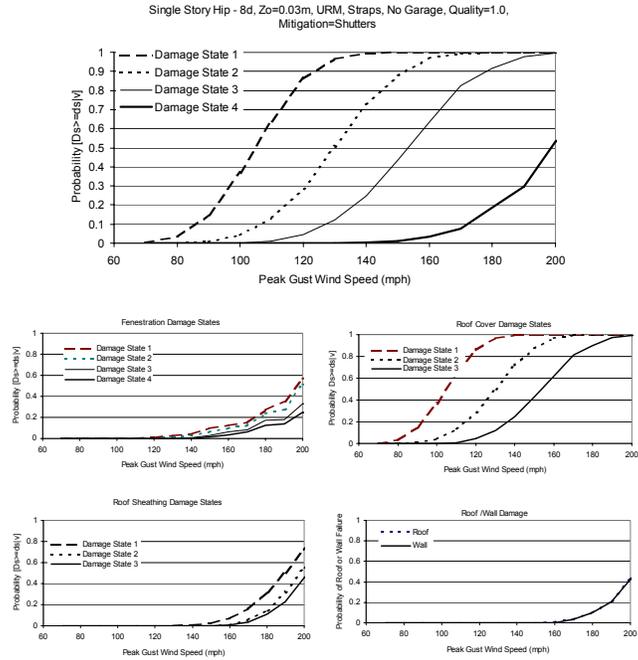
**Figure A.66. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters**



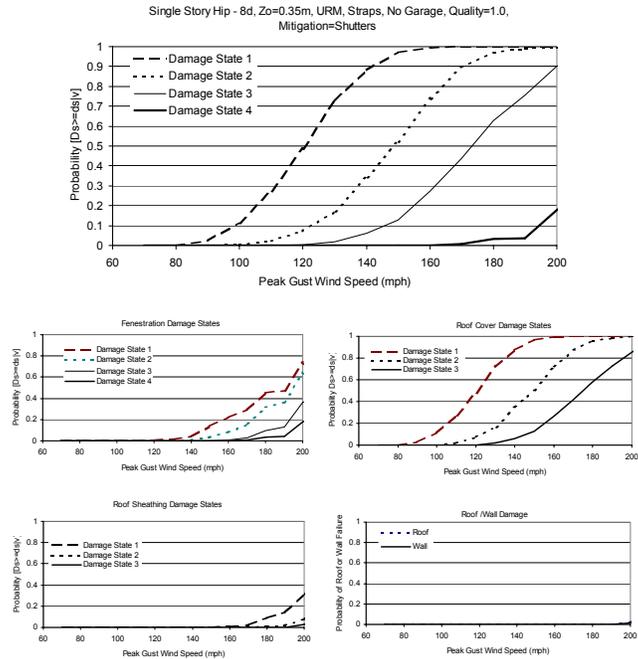
**Figure A.67. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters**



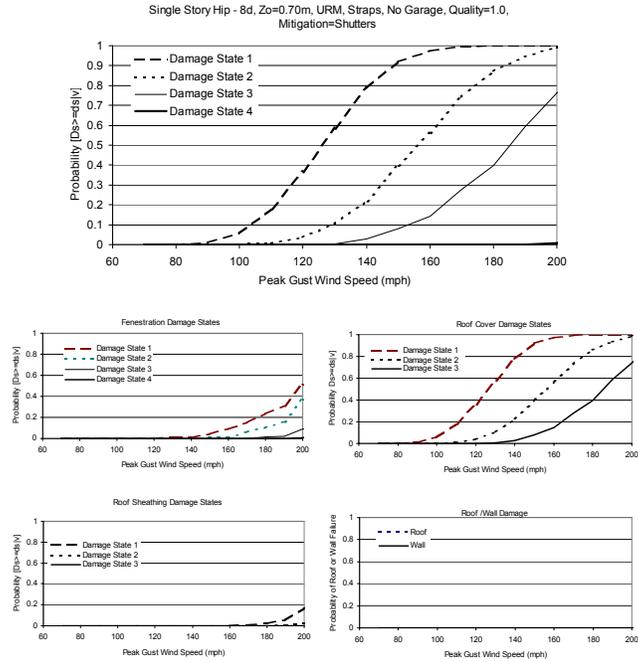
**Figure A.68. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters**



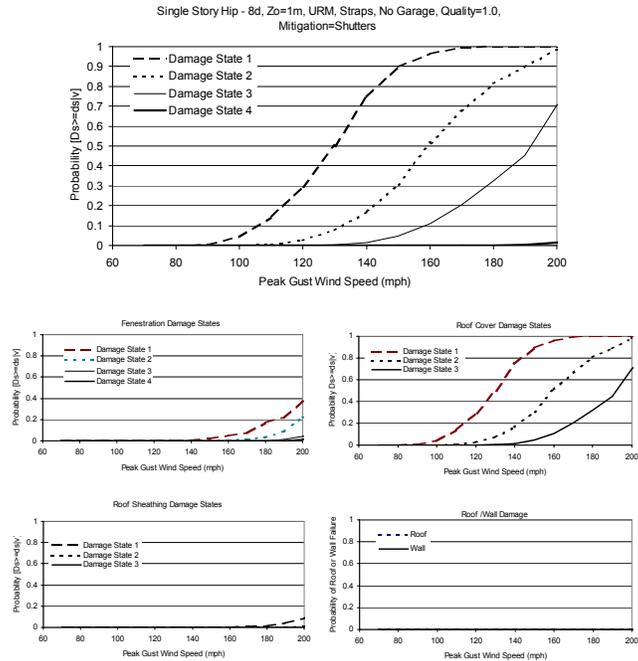
**Figure A.69. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters**



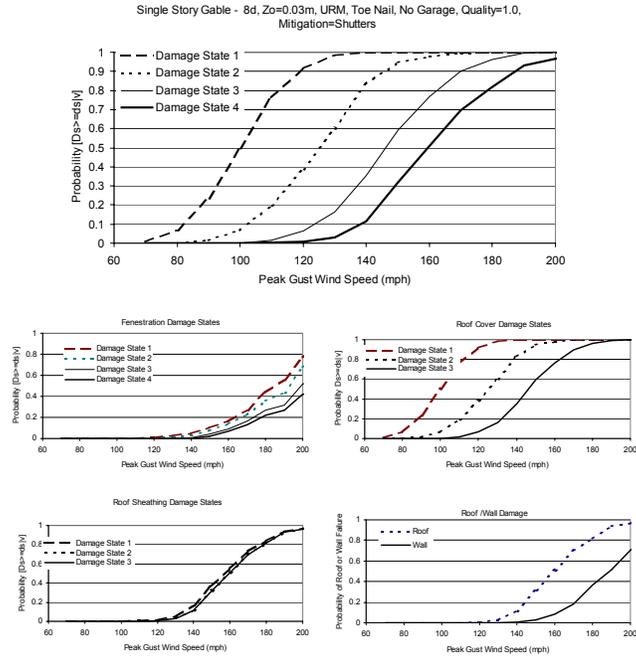
**Figure A.70. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters**



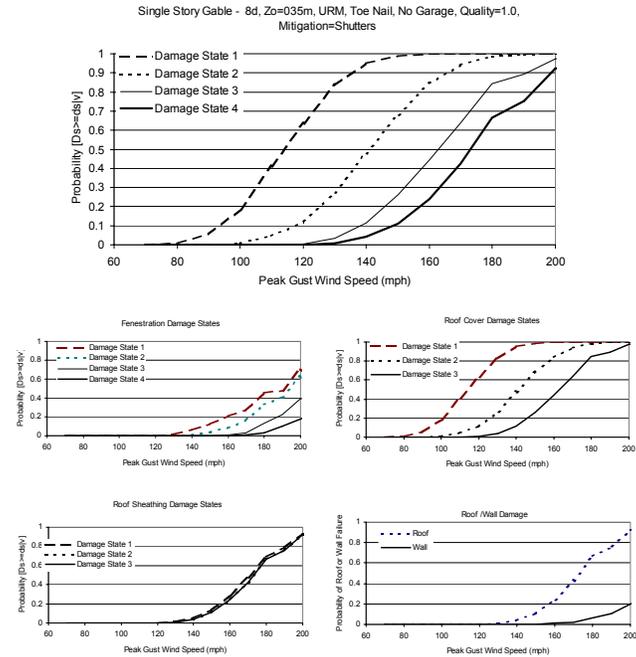
**Figure A.71. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters**



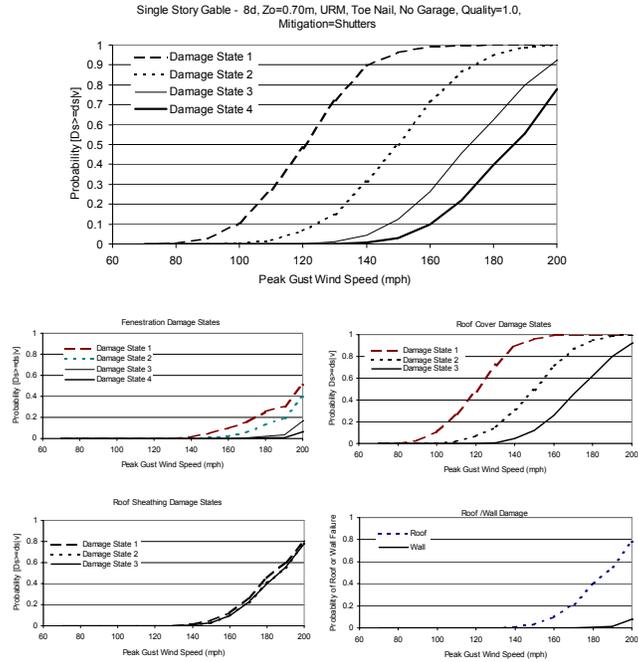
**Figure A.72. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters**



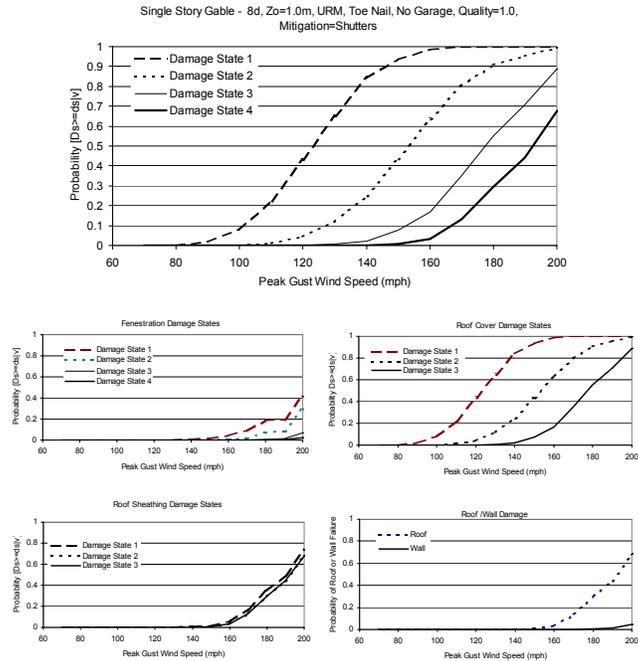
**Figure A.73. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters**



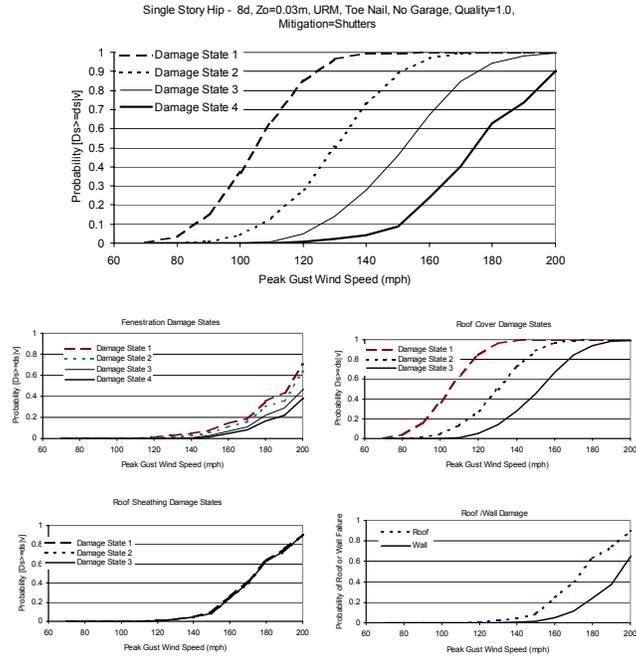
**Figure A.74. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters**



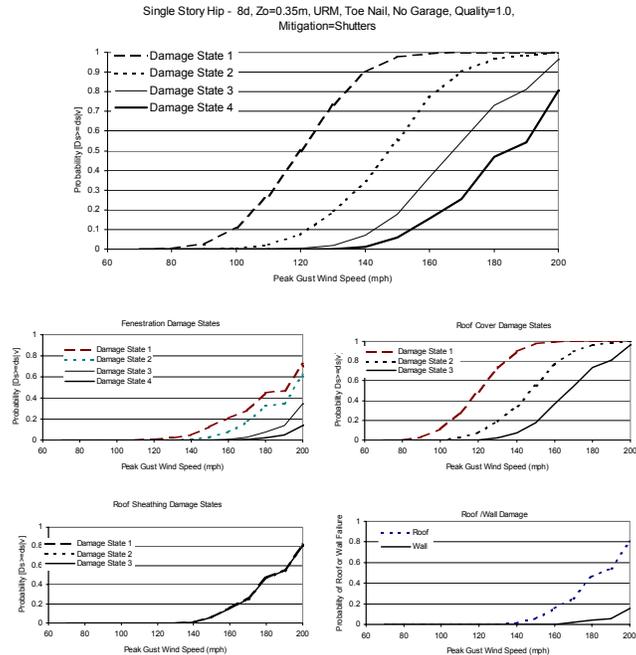
**Figure A.75. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters**



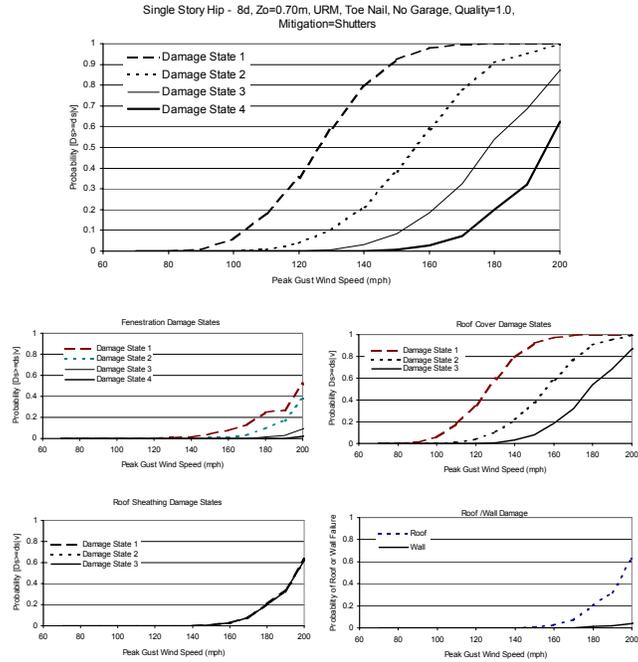
**Figure A.76. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters**



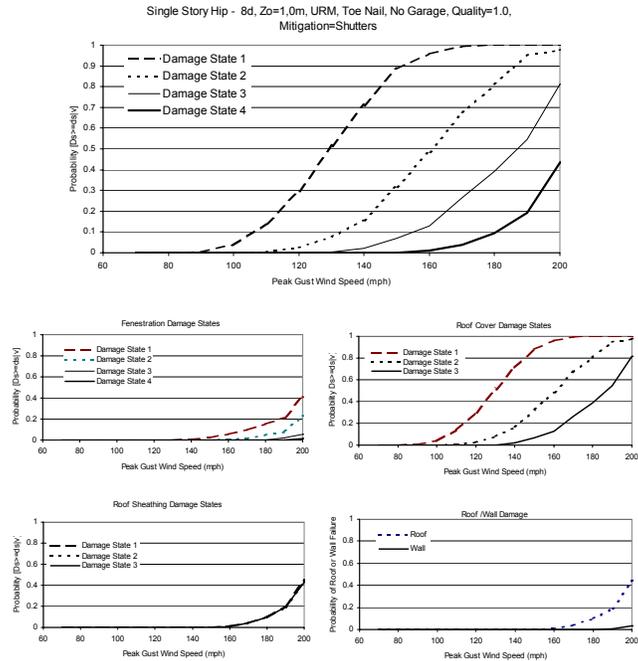
**Figure A.77. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters**



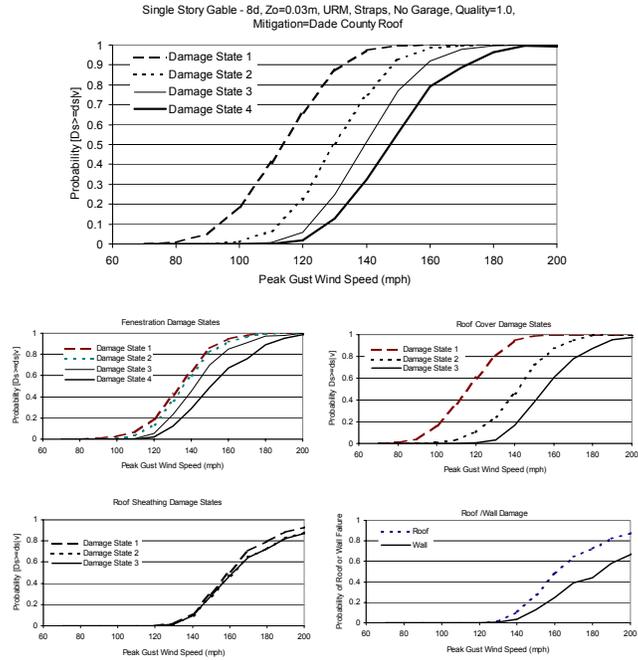
**Figure A.78. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters**



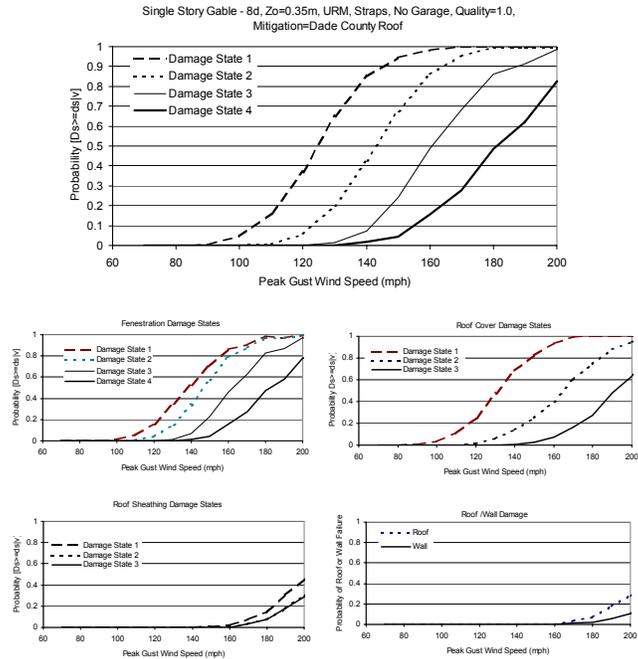
**Figure A.79. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters**



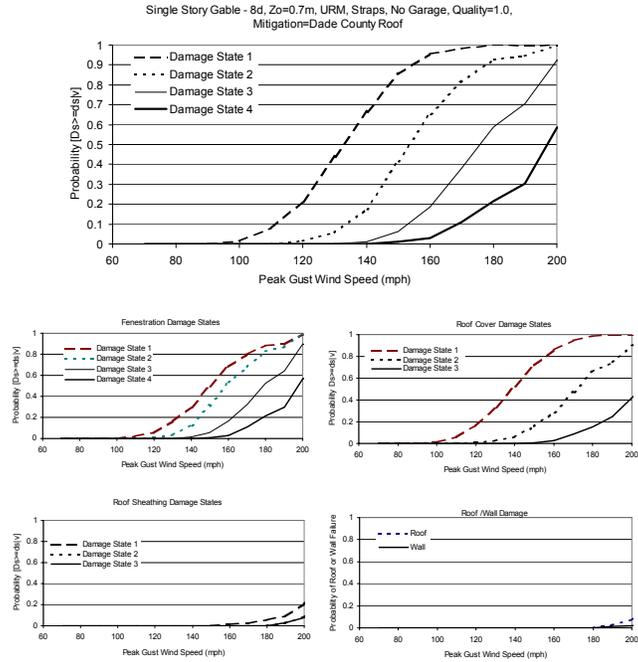
**Figure A.80. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters**



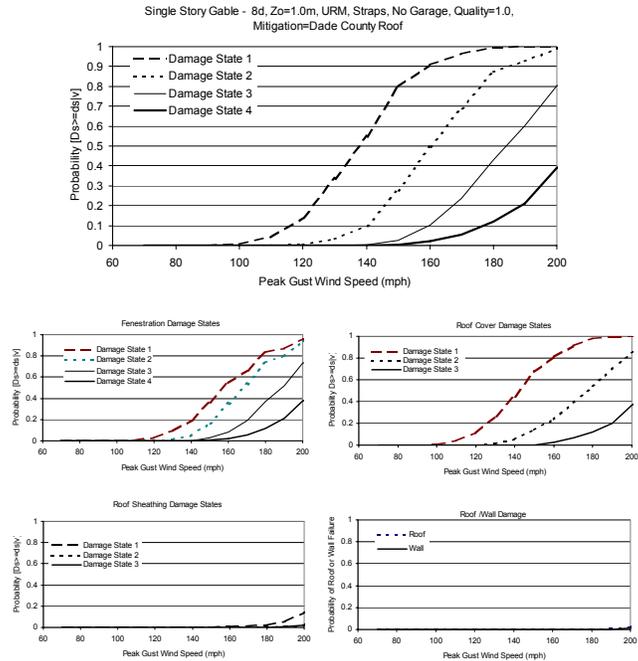
**Figure A.81. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03 \text{ m}$ , Dade County Roof**



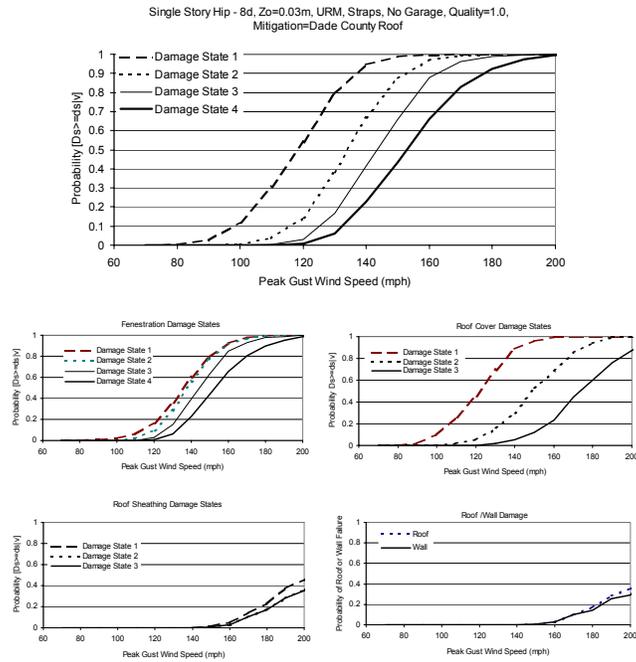
**Figure A.82. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35 \text{ m}$ , Dade County Roof**



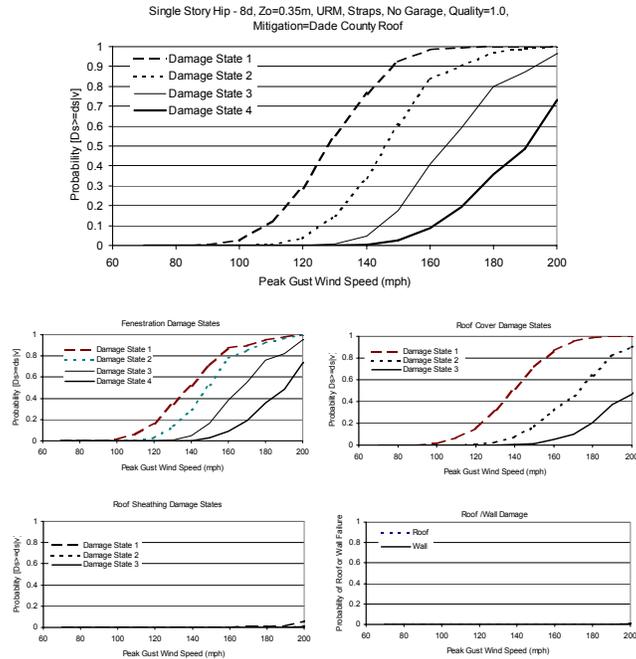
**Figure A.83. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Dade County Roof**



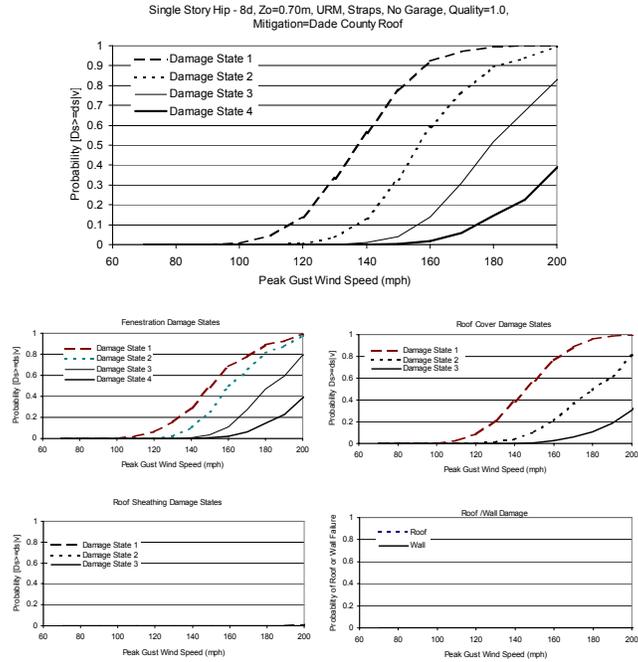
**Figure A.84. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Dade County Roof**



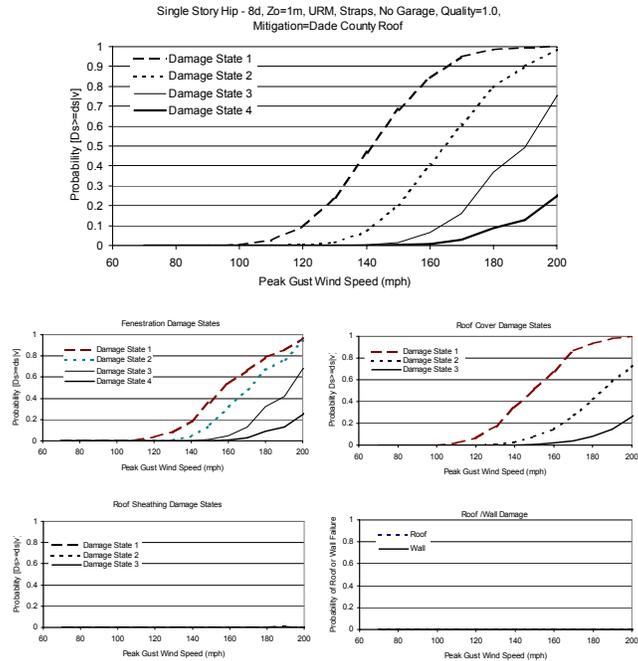
**Figure A.85. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Dade County Roof**



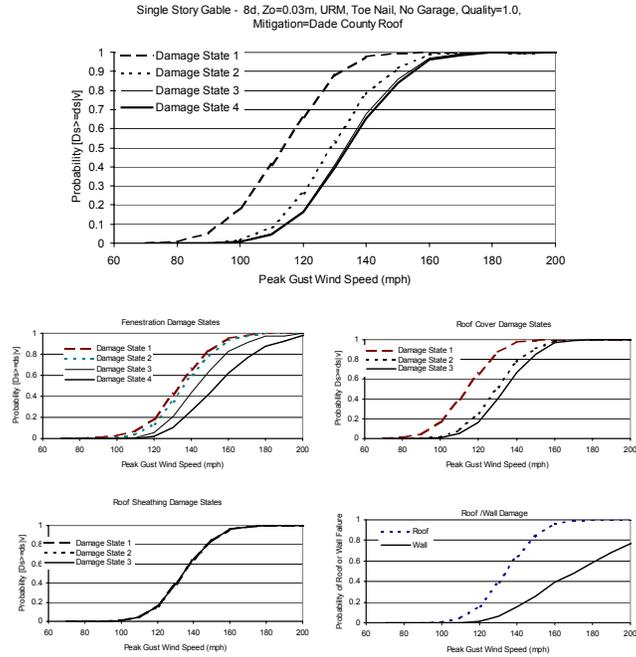
**Figure A.86. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Dade County Roof**



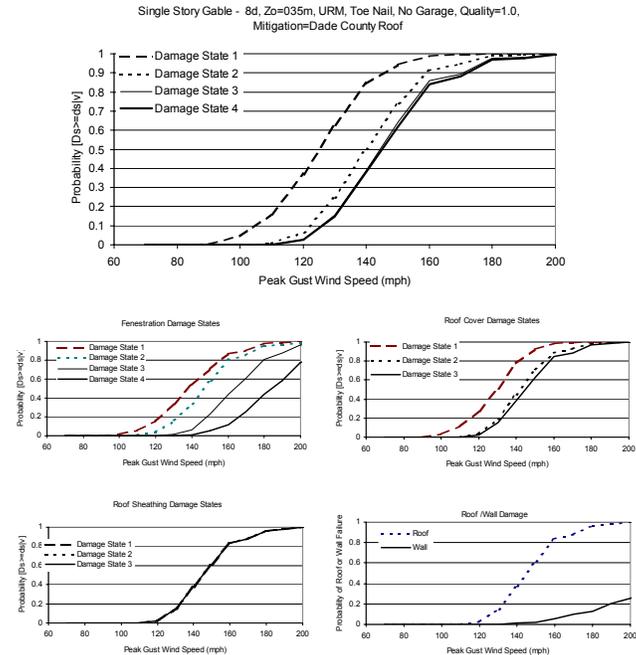
**Figure A.87. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70\text{ m}$ , Dade County Roof**



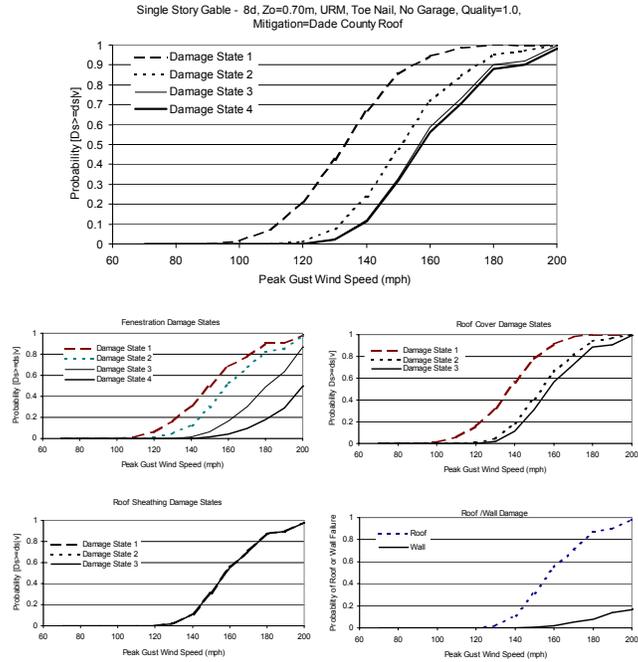
**Figure A.88. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0\text{ m}$ , Dade County Roof**



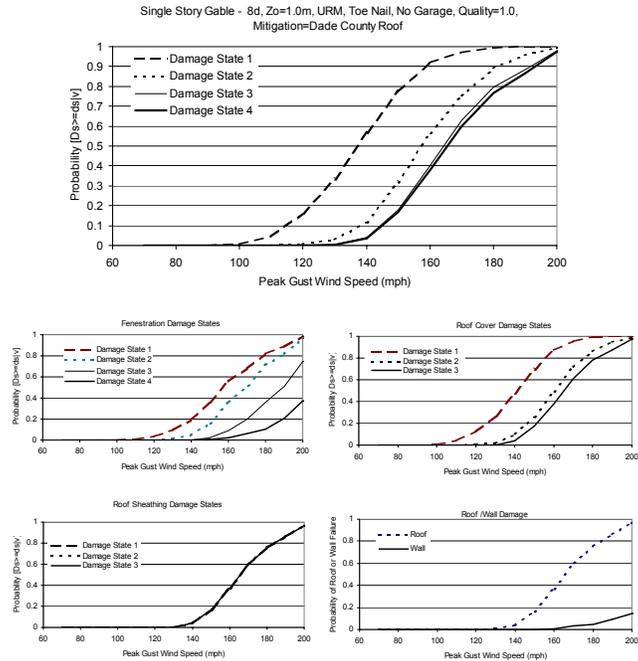
**Figure A.89. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03\text{ m}$ , Dade County Roof**



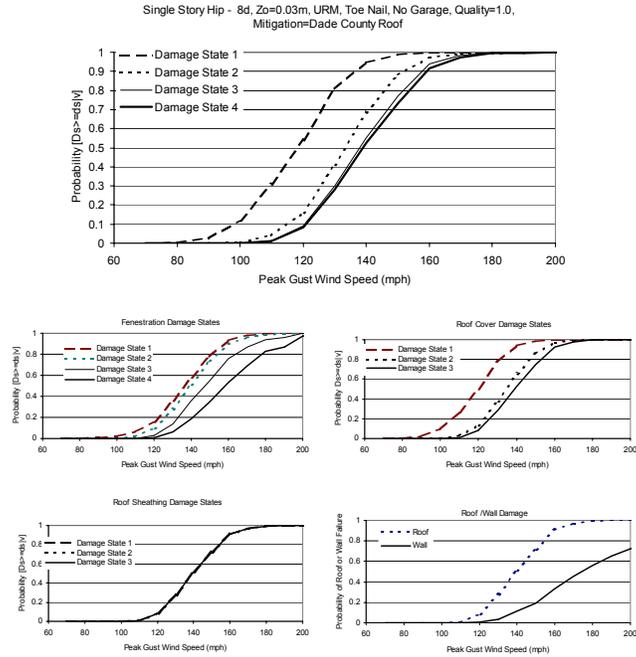
**Figure A.90. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35\text{ m}$ , Dade County Roof**



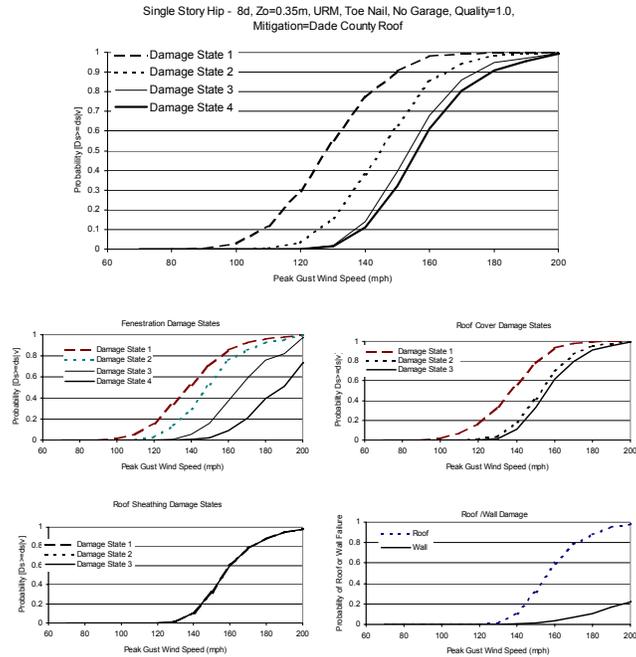
**Figure A.91. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70\text{ m}$ , Dade County Roof**



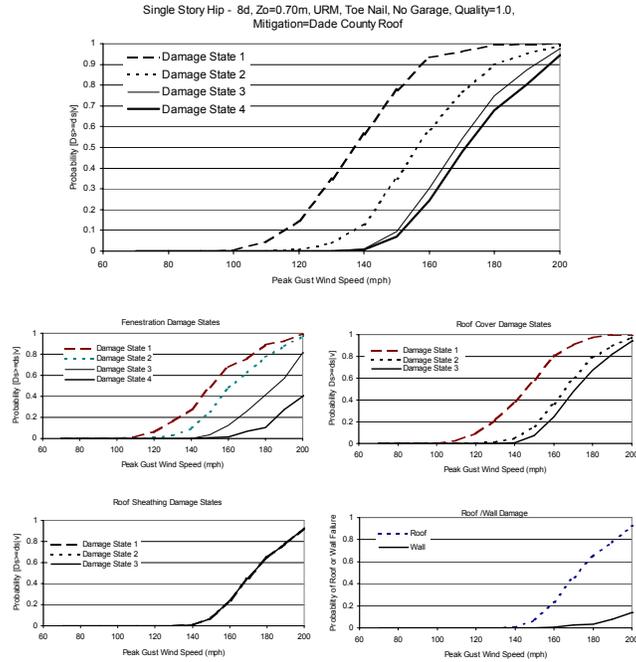
**Figure A.92. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0\text{ m}$ , Dade County Roof**



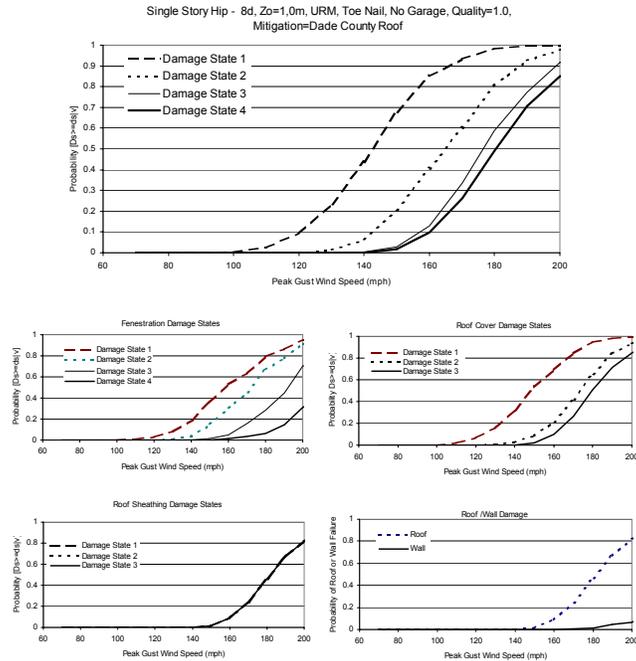
**Figure A.93. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Dade County Roof**



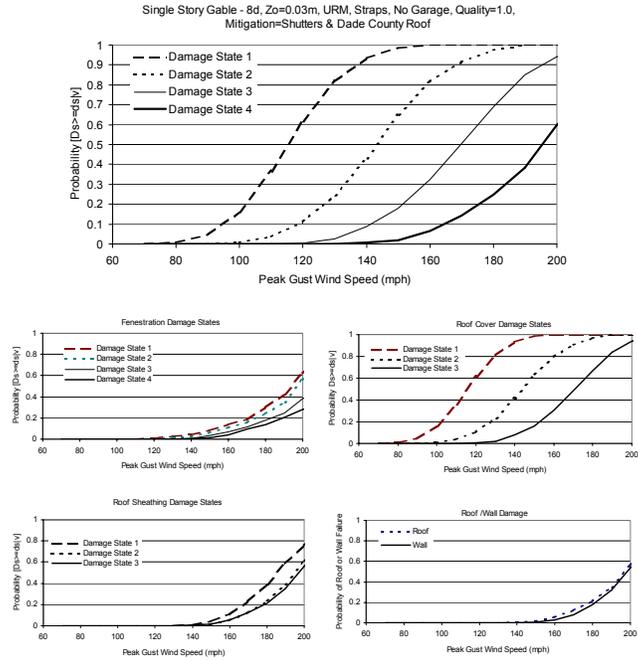
**Figure A.94. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Dade County Roof**



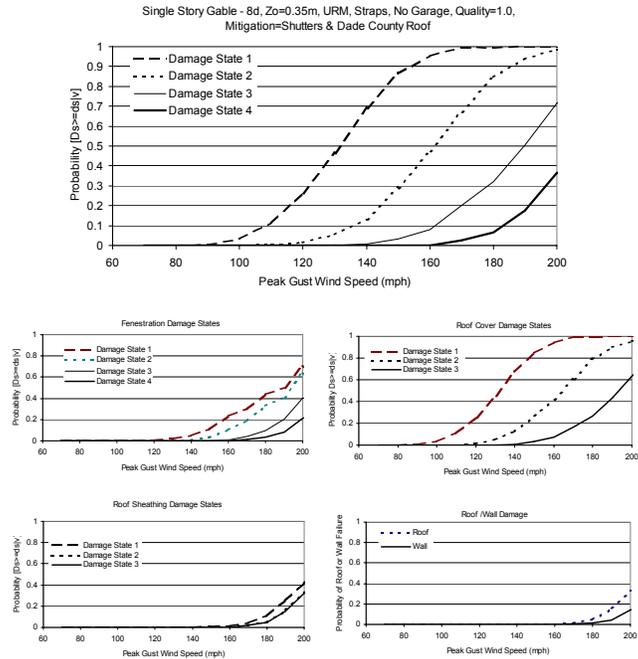
**Figure A.95. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Dade County Roof**



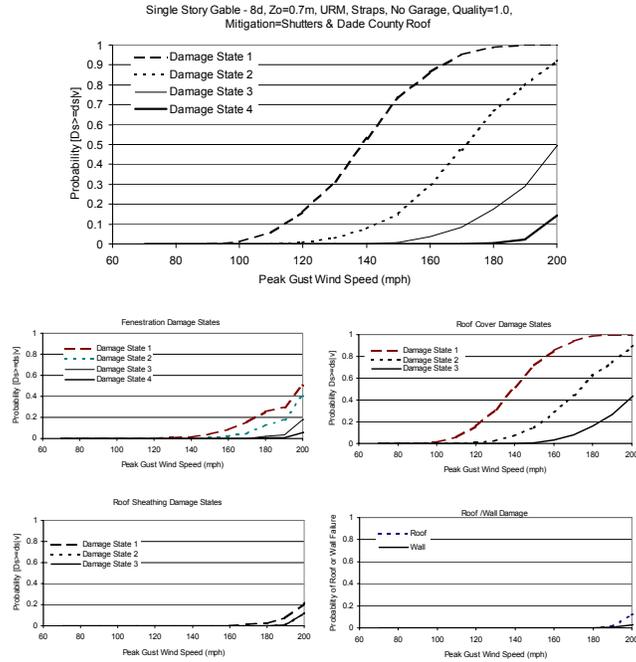
**Figure A.96. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Dade County Roof**



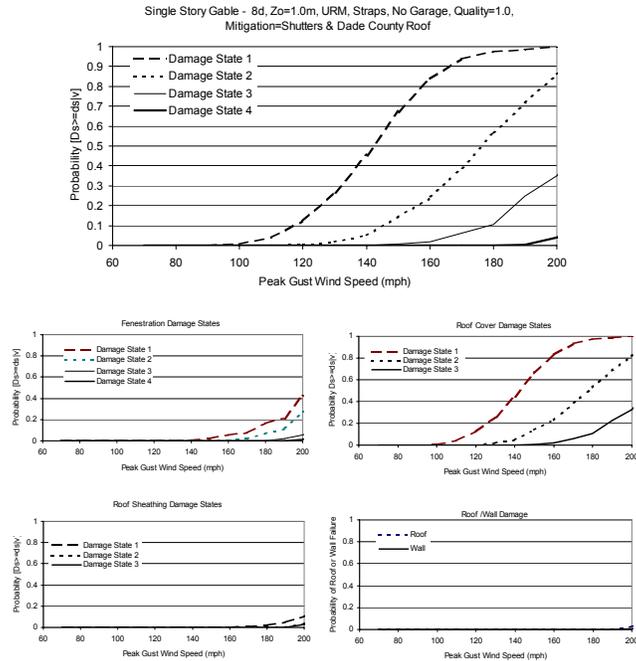
**Figure A.97. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters and Dade County Roof**



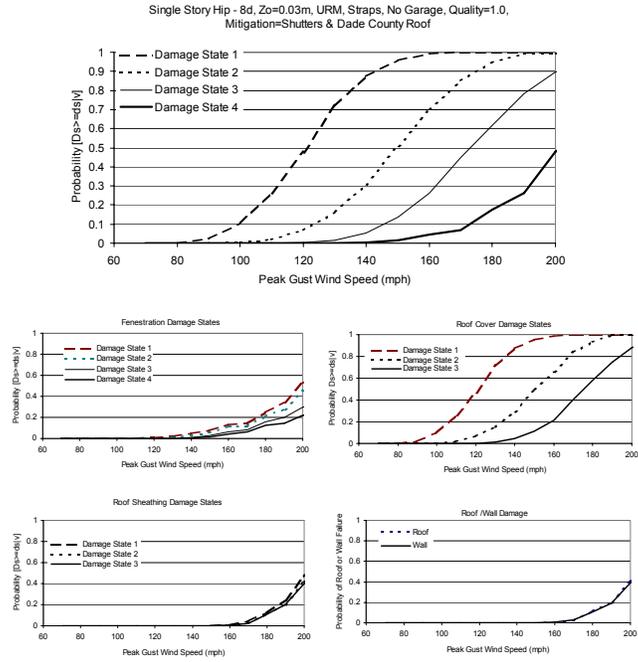
**Figure A.98. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters and Dade County Roof**



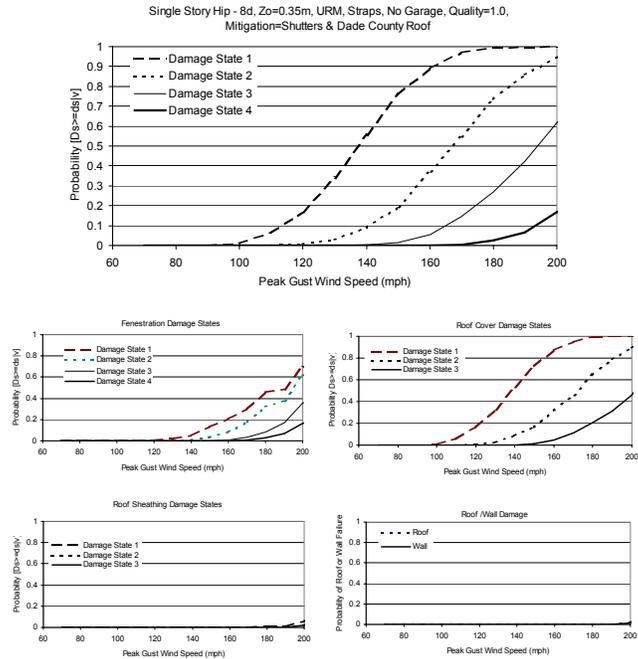
**Figure A.99. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters and Dade County Roof**



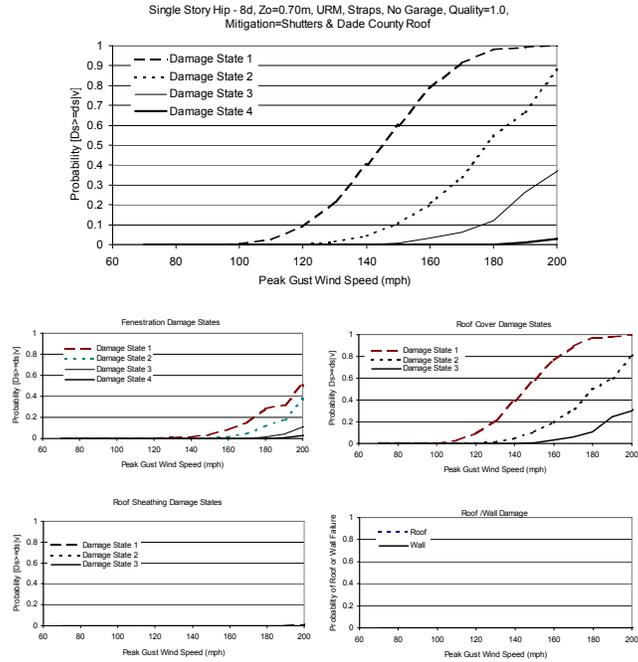
**Figure A.100. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters and Dade County Roof**



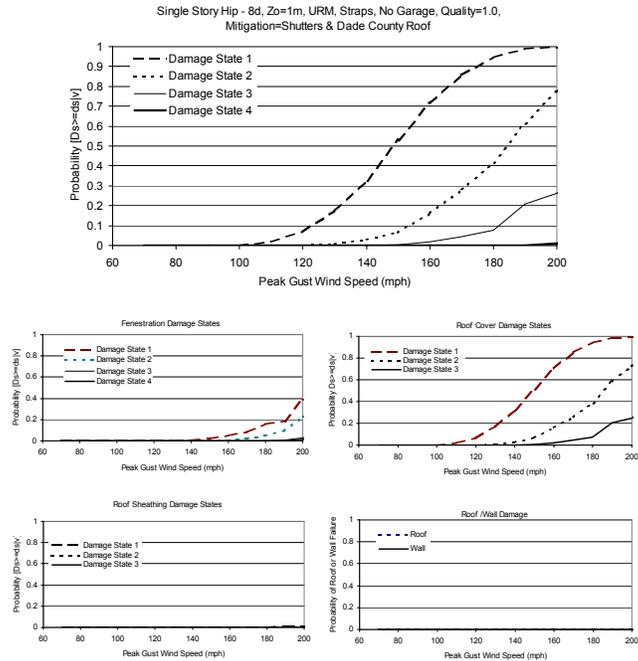
**Figure A.101. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters and Dade County Roof**



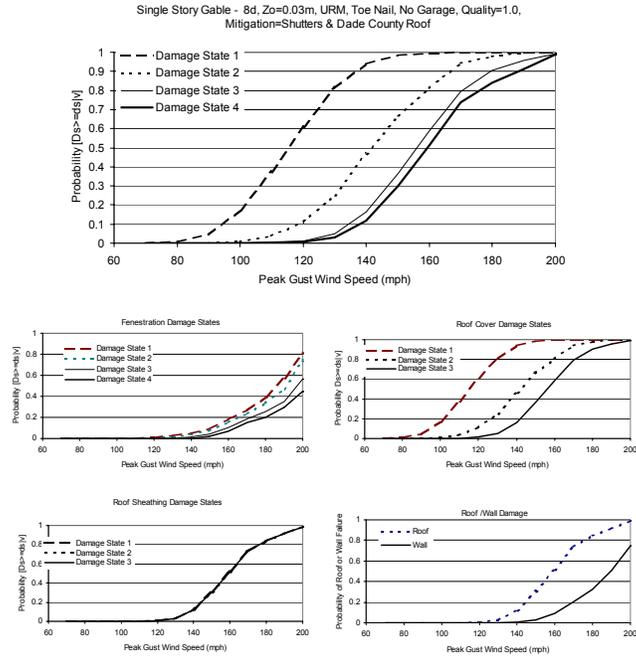
**Figure A.102. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters and Dade County Roof**



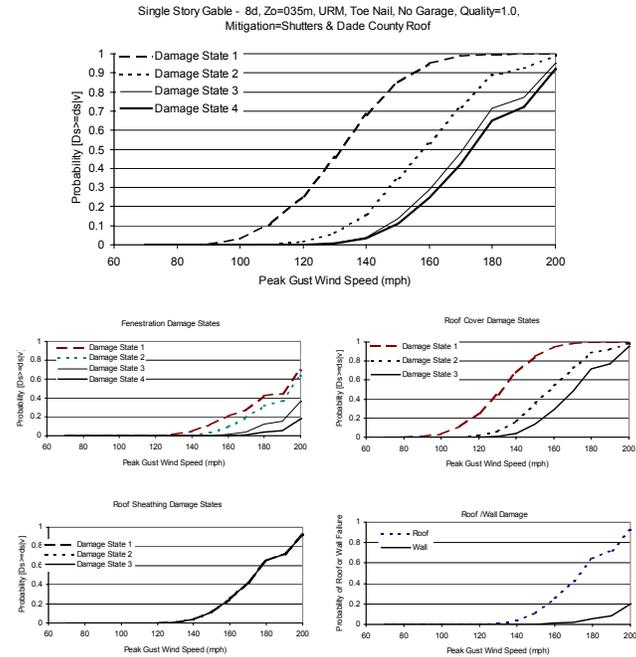
**Figure A.103. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters and Dade County Roof**



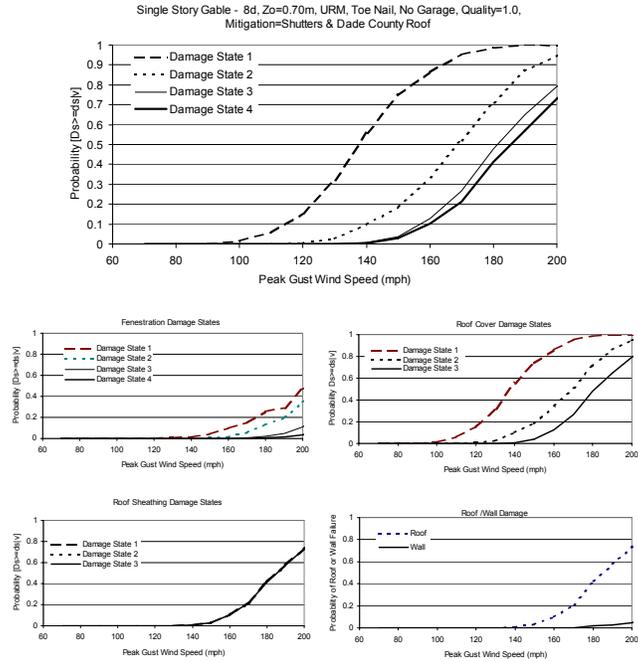
**Figure A.104. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Strapped Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters and Dade County Roof**



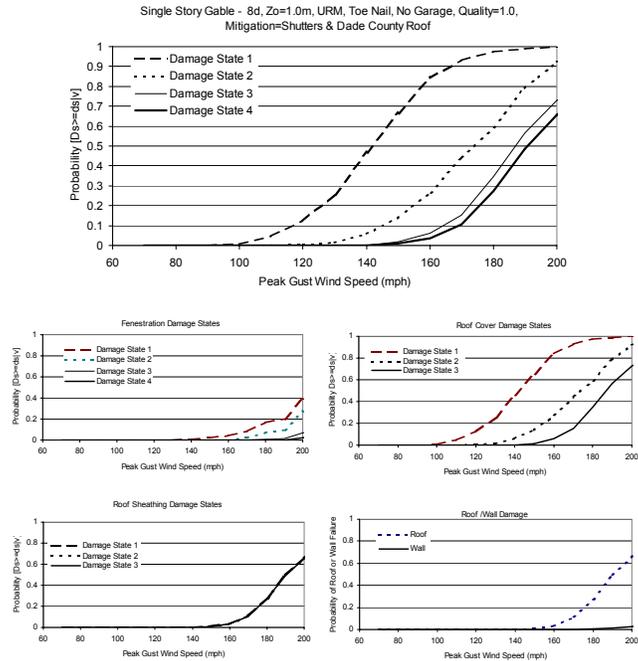
**Figure A.105. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters and Dade County Roof**



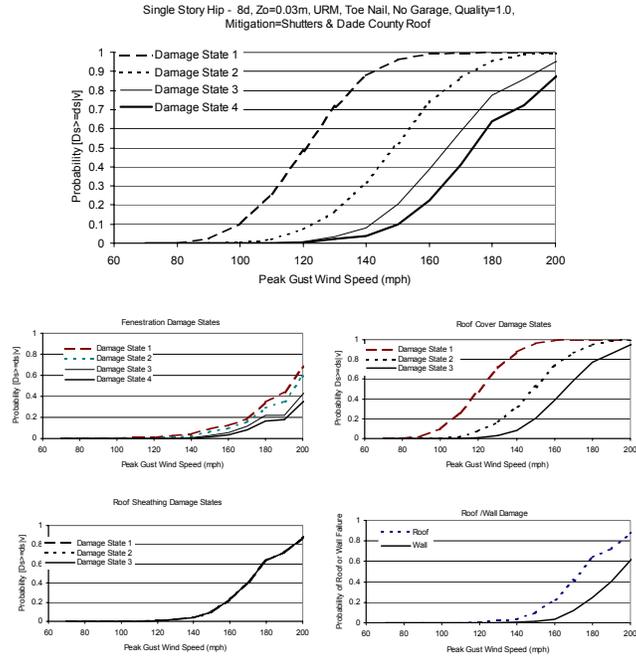
**Figure A.106. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters and Dade County Roof**



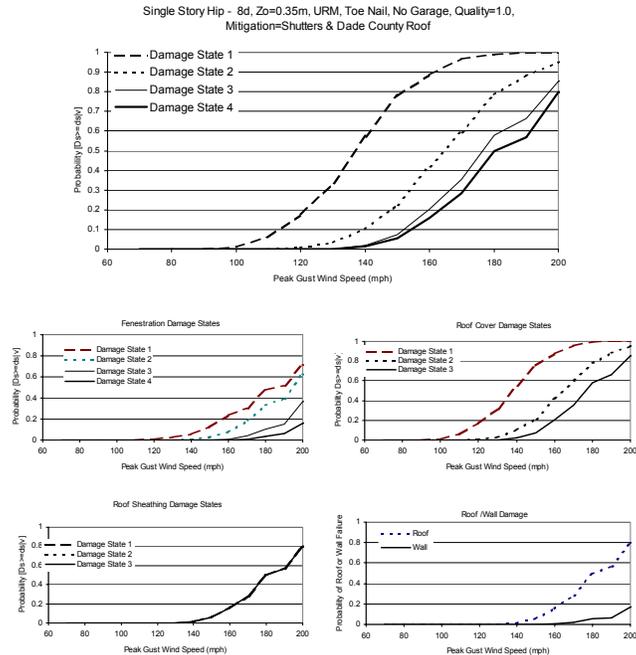
**Figure A.107. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters and Dade County Roof**



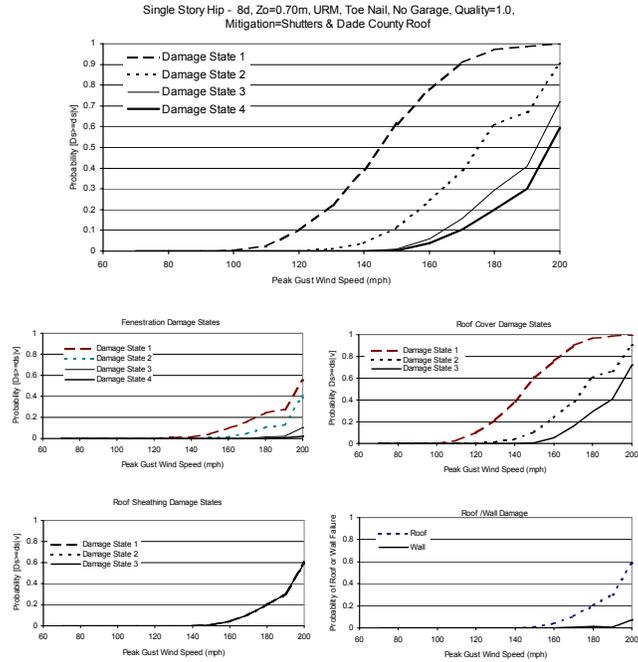
**Figure A.108. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Gable Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters and Dade County Roof**



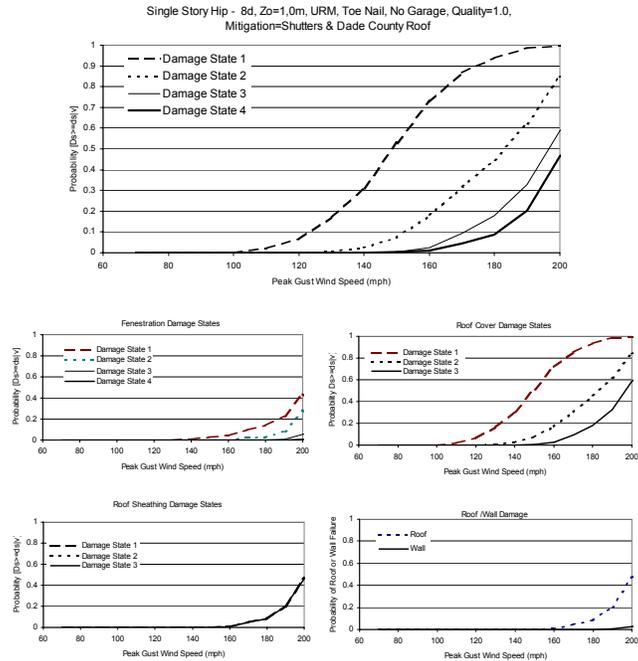
**Figure A.109. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.03$  m, Shutters and Dade County Roof**



**Figure A.110. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.35$  m, Shutters and Dade County Roof**



**Figure A.111. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 0.70$  m, Shutters and Dade County Roof**



**Figure A.112. Damage States versus Maximum Peak Gust Wind Speed – One Story, 8d Roof Sheathing Nails, Toe-Nailed Roof Trusses, Hip Roof, No Garage, Unreinforced Masonry Walls,  $z_0 = 1.0$  m, Shutters and Dade County Roof**

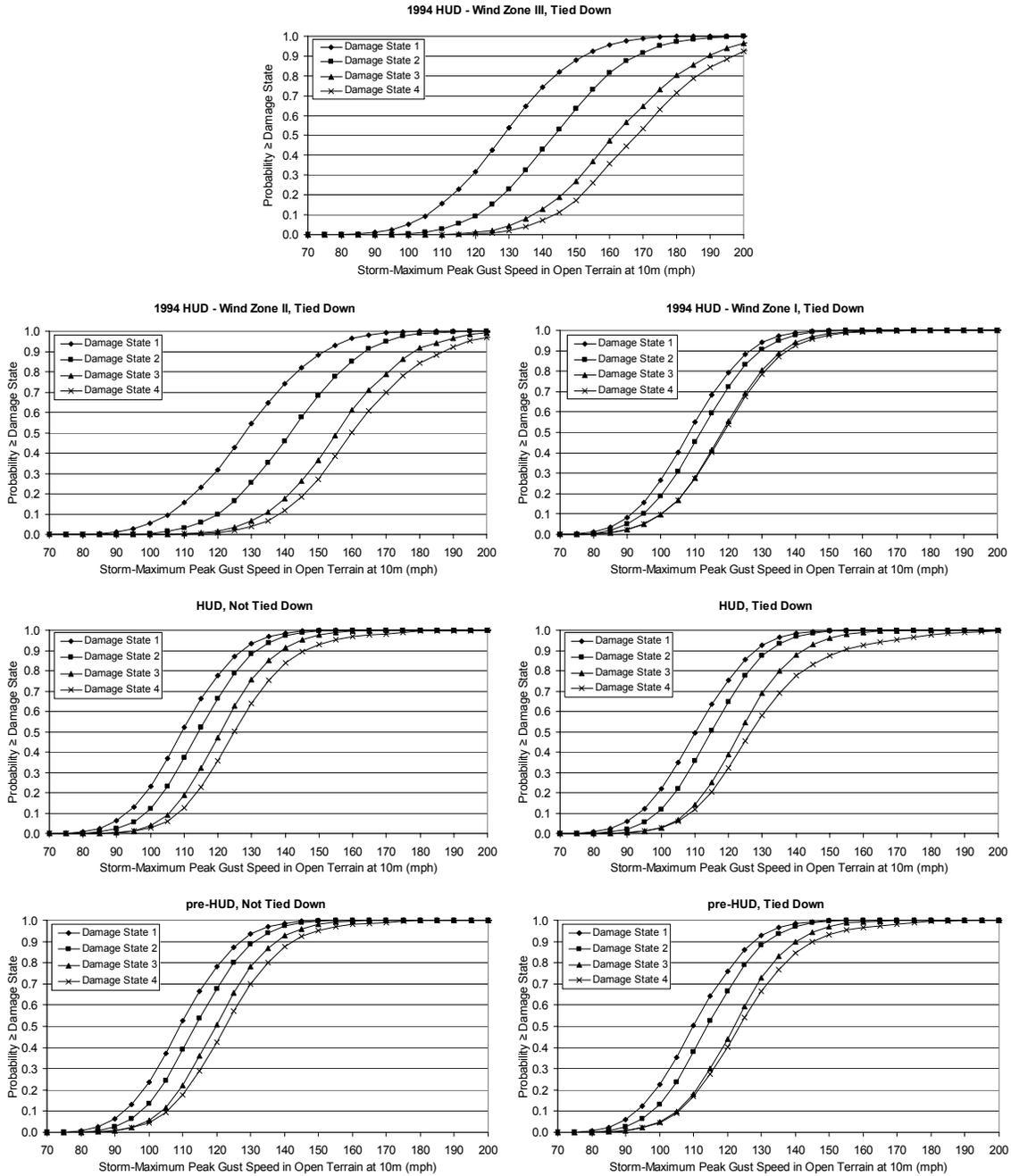
**Appendix B.**  
**Damage State Functions for Manufactured Homes**

## Appendix B. Damage State Functions for Manufactured Homes

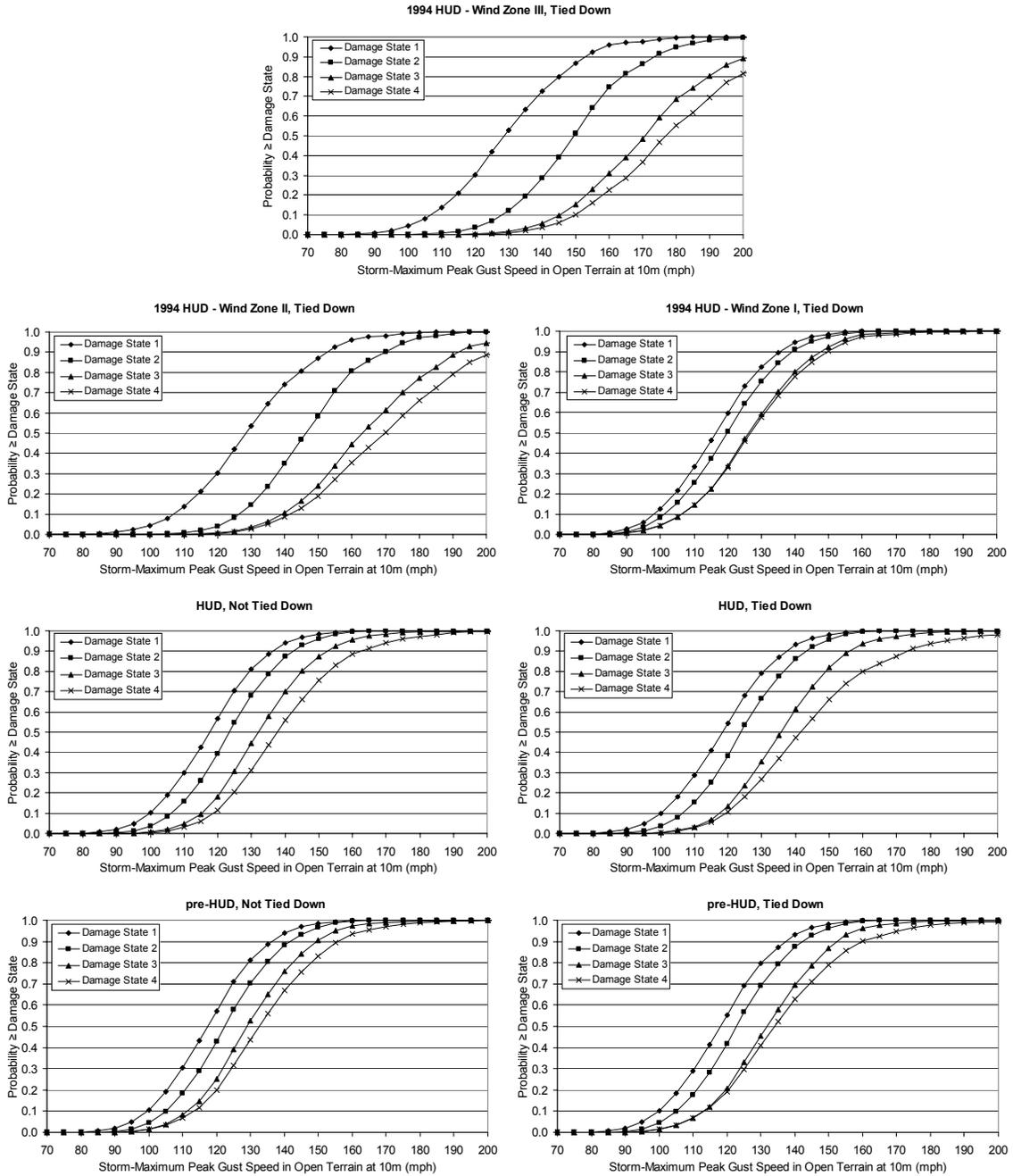
This appendix presents damage state curves for manufactured homes (see Section 6.5). The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.5-6 for damage state definitions). As shown in Table B.1, separate figures are provided for five different terrains.

**Table B.1. Damage State Functions for Manufactured Homes**

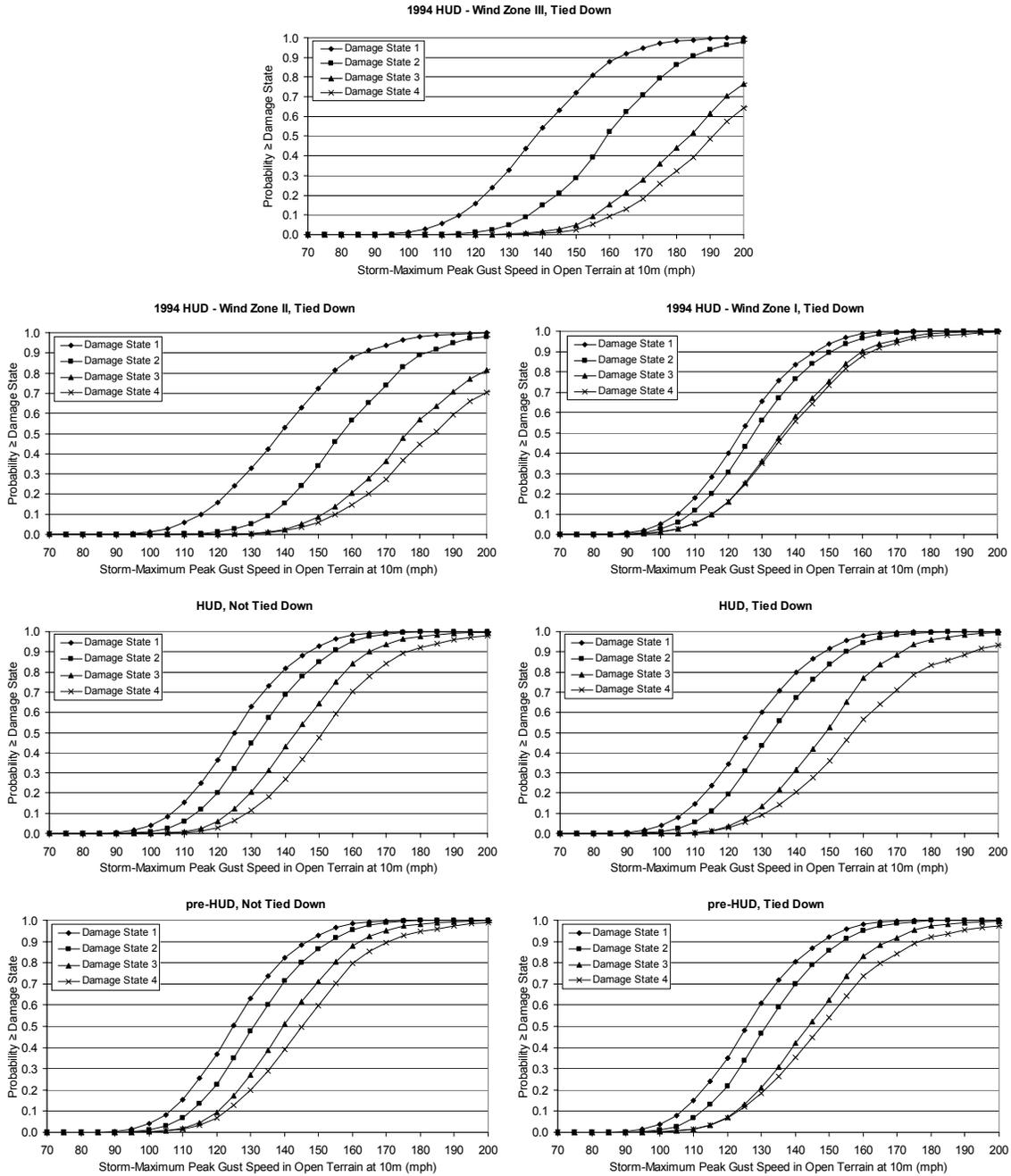
Figure	Terrain
B.1	0.03
B.2	0.15
B.3	0.35
B.4	0.70
B.5	1.00



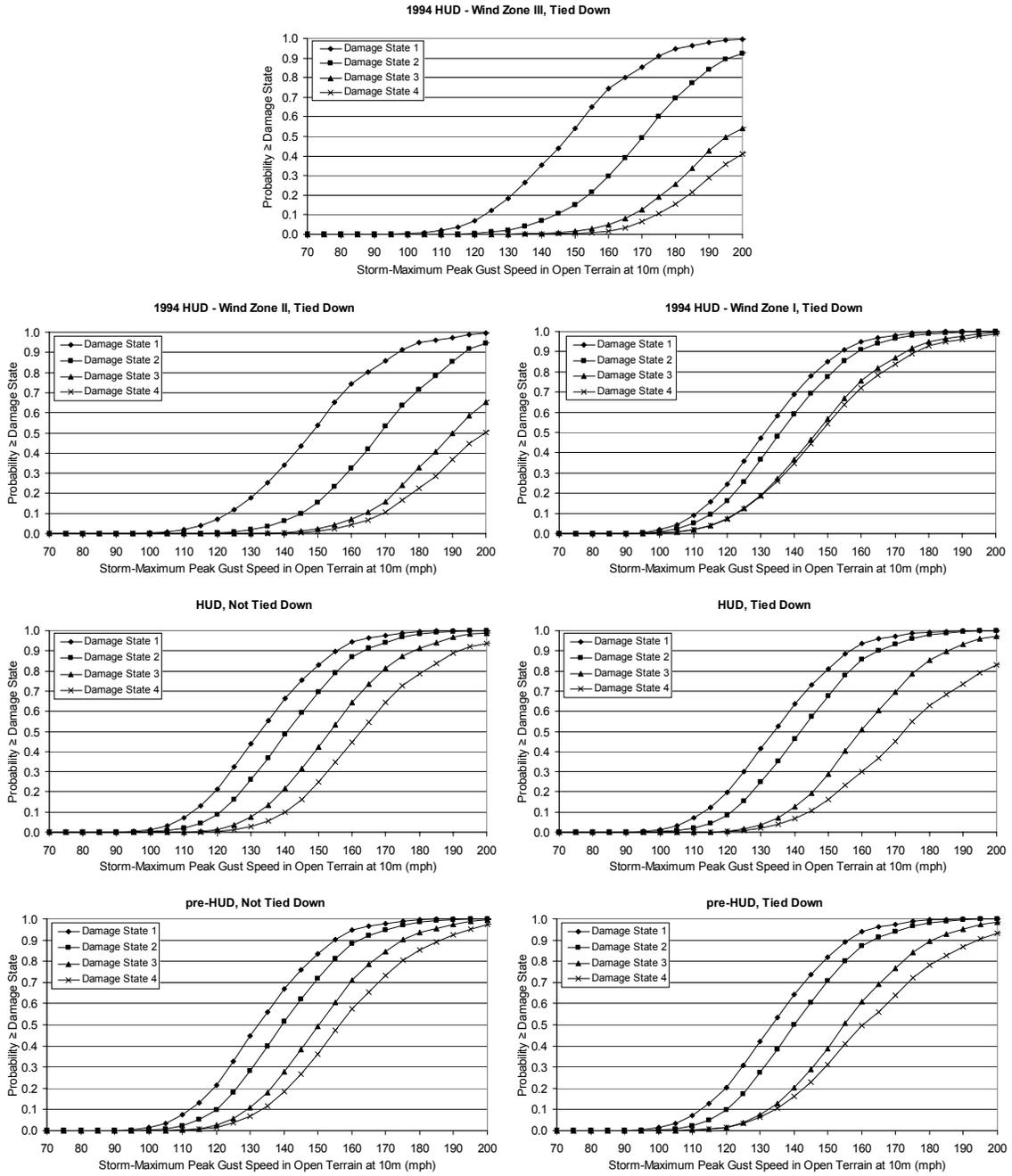
**Figure B.1. Damage State Curves for Manufactured Homes Located in Typical Open Terrain described by  $z_0 = 0.03$  m.**



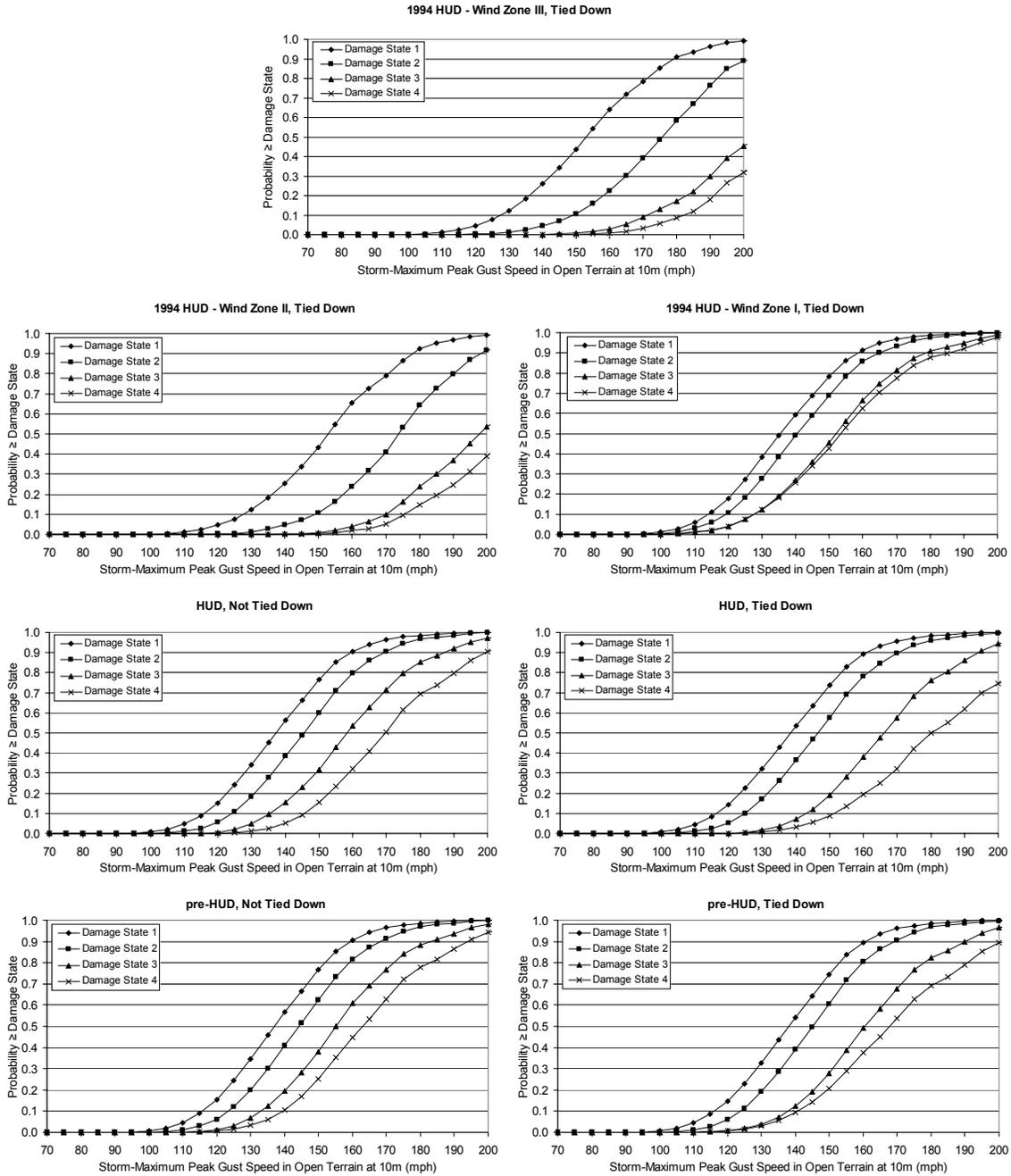
**Figure B.2. Damage State Curves for Manufactured Homes Located in a Relatively Open Terrain Described by  $z_0 = 0.15$  m.**



**Figure B.3. Damage State Curves for Manufactured Homes Located in Typical Suburban Terrain Described by  $z_0 = 0.35$  m.**



**Figure B.4. Damage State Curves for Manufactured Homes Located in Lightly Treed Terrain Described with  $z_0 = 0.70$  m.**



**Figure B.5. Damage State Curves for Manufactured Homes Located in Typical Treed Terrain Described with  $z_0 = 1.0$  m.**



**Appendix C.**  
**Damage State Functions for Marginally- or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings**

## **Appendix C. Damage State Functions for Marginally- or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings**

This appendix presents damage state curves for marginally-engineered or non-engineered hotel/motel and multi-family/residential buildings (see Section 6.9). The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.4-1 for damage state definitions).

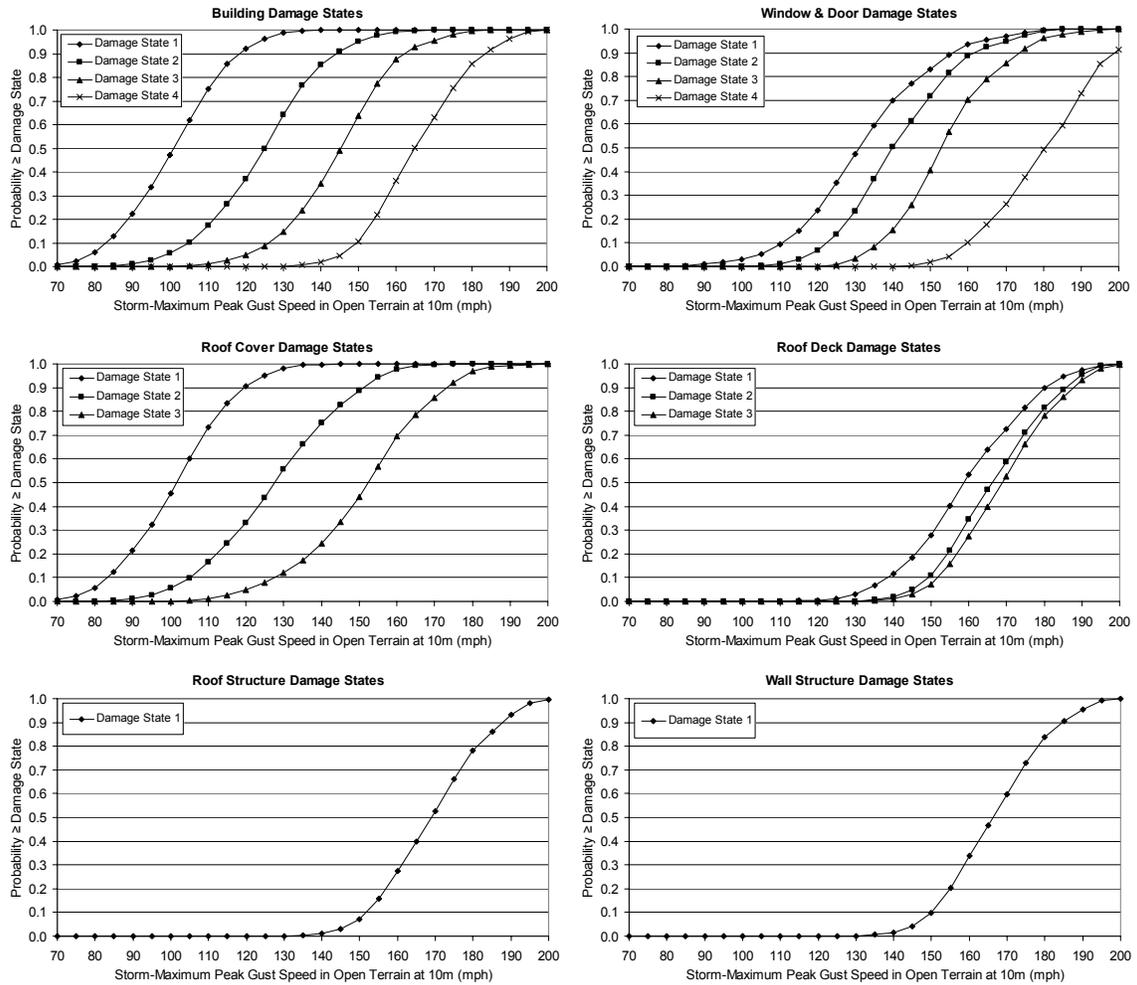
As shown in Table C.1, two sets of thirteen figures are given in this appendix. The first set of thirteen figures (Figures C.1 through C.13) are for buildings located in an open terrain ( $z = 0.03$  m) and the second set (Figures C.14 through C.26) are for buildings situated in a typical suburban environment ( $z_0 = 0.35$  m). The first figure in each set of thirteen shows damage state results for a one-story building with 8d roof sheathing nails, strapped roof-wall connections, wood frame walls and a gable roof with shingles. The remaining twelve plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). Figures C.27 and C.28 show the reference building situated in two additional terrain environments (i.e.,  $z_0 = 0.7$  m and 1.0 m).

**Table C.1. Sample Damage State Functions for Marginally or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings**

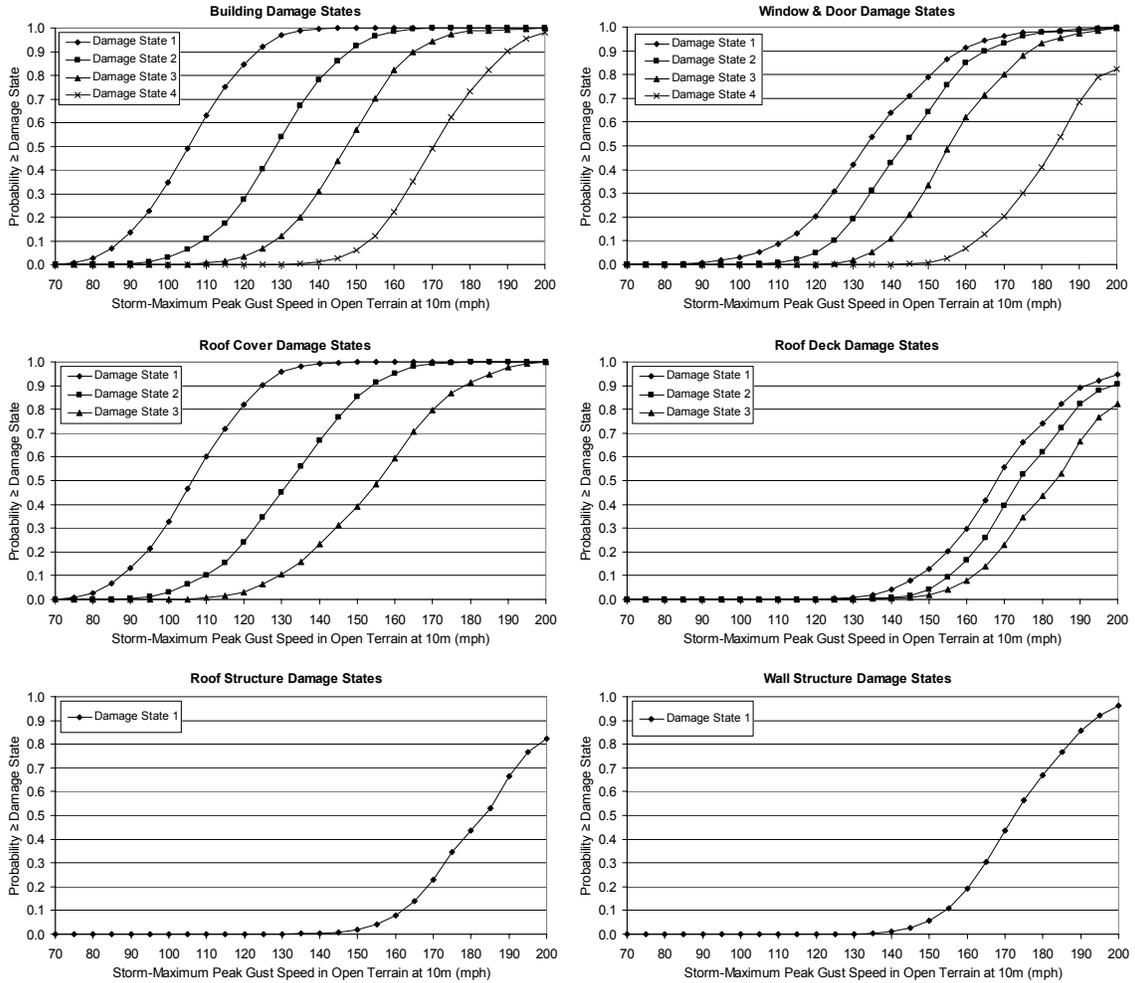
Figure	Walls	Stories	Sheathing	Roof/Wall	Roof Shape	Roof Cover	Terrain
C.1	WFR	1	8d	Strap	Gable	Shingles	0.03
C.2	WFR	1	8d	Strap	<b>Hip</b>	Shingles	0.03
C.3	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Average</b>	0.03
C.4	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Poor</b>	0.03
C.5	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Average</b>	0.03
C.6	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Poor</b>	0.03
C.7	WFR	1	<b>6d</b>	Strap	Gable	Shingles	0.03
C.8	WFR	1	8d	<b>Toe-Nail</b>	Gable	Shingles	0.03
C.9	<b>URM</b>	1	8d	Strap	Gable	Shingles	0.03
C.10	<b>RM</b>	1	8d	Strap	Gable	Shingles	0.03
C.11	WFR	<b>2</b>	8d	Strap	Gable	Shingles	0.03
C.12	WFR	<b>3</b>	8d	Strap	Gable	Shingles	0.03
C.13	WFR	<b>4</b>	8d	Strap	Gable	Shingles	0.03

**Table C.1. Sample Damage State Functions for Marginally or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings (concluded)**

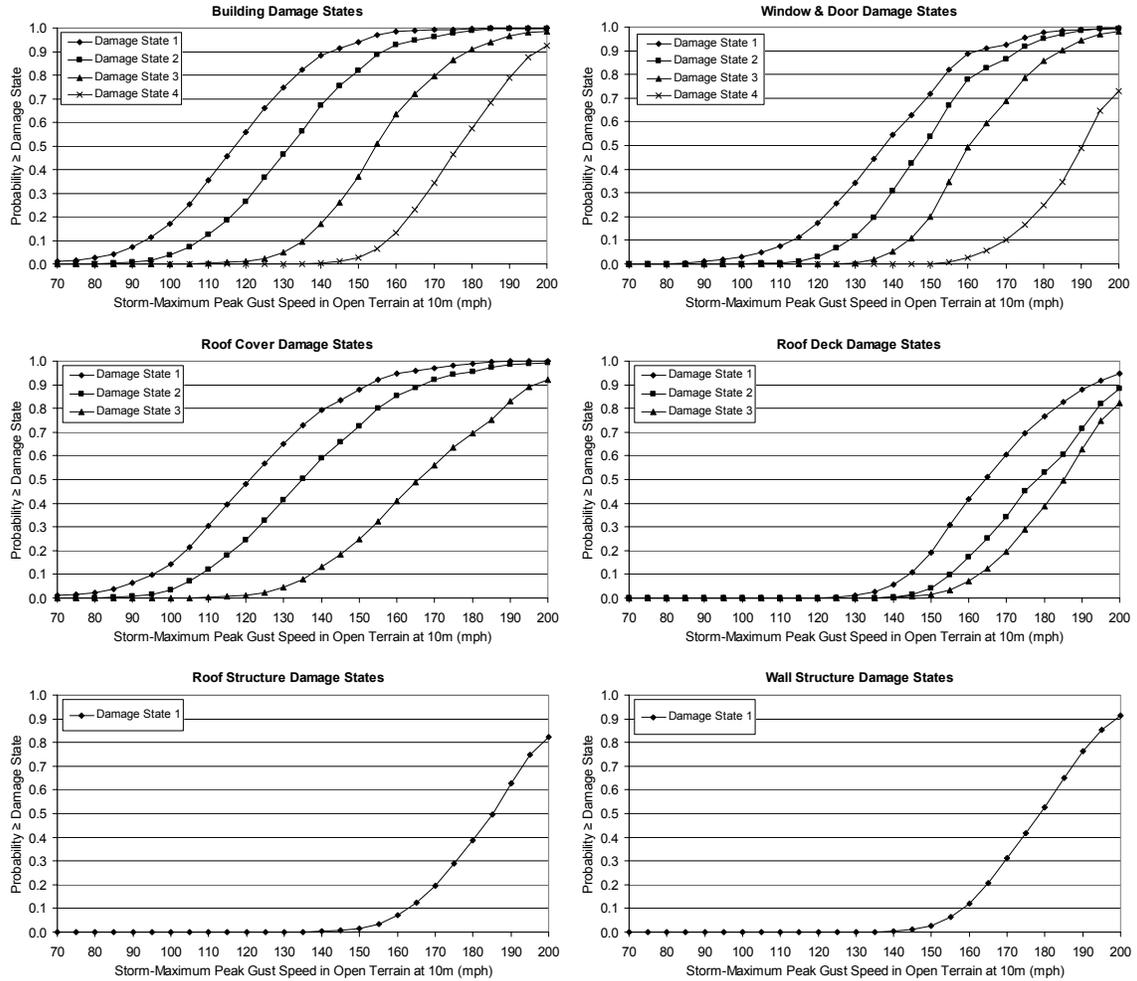
Figure	Walls	Stories	Sheathing	Roof/Wall	Roof Shape	Roof Cover	Terrain
C.14	WFR	1	8d	Strap	Gable	Shingles	<b>0.35</b>
C.15	WFR	1	8d	Strap	<b>Hip</b>	Shingles	0.35
C.16	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Average</b>	0.35
C.17	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Poor</b>	0.35
C.18	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Average</b>	0.35
C.19	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Poor</b>	0.35
C.20	WFR	1	<b>6d</b>	Strap	Gable	Shingles	0.35
C.21	WFR	1	8d	<b>Toe-Nail</b>	Gable	Shingles	0.35
C.22	<b>URM</b>	1	8d	Strap	Gable	Shingles	0.35
C.23	<b>RM</b>	1	8d	Strap	Gable	Shingles	0.35
C.24	WFR	<b>2</b>	8d	Strap	Gable	Shingles	0.35
C.25	WFR	<b>3</b>	8d	Strap	Gable	Shingles	0.35
C.26	WFR	<b>4</b>	8d	Strap	Gable	Shingles	0.35
C.27	WFR	1	8d	Strap	Gable	Shingles	<b>0.70</b>
C.28	WFR	1	8d	Strap	Gable	Shingles	<b>1.00</b>



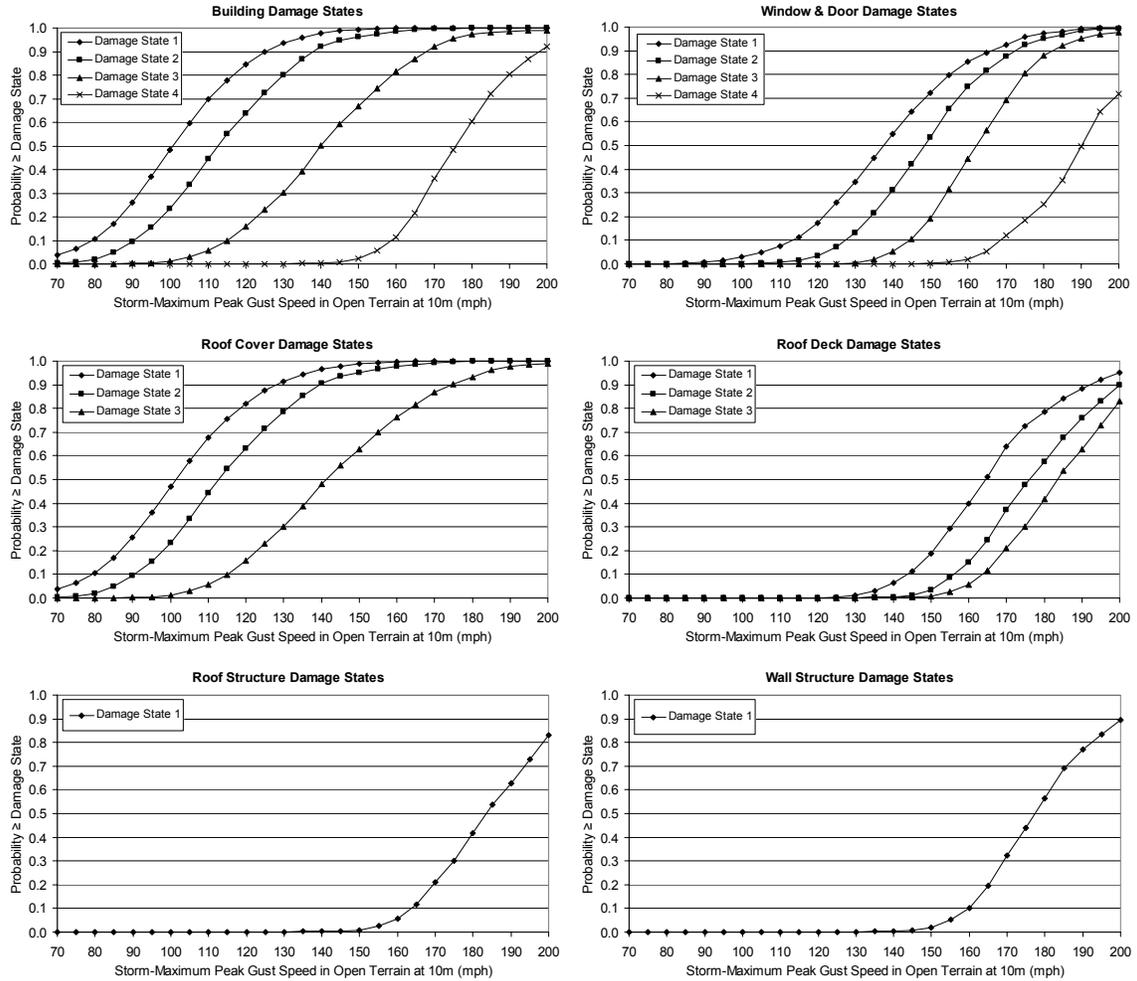
**Figure C.1. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.03$  m.**



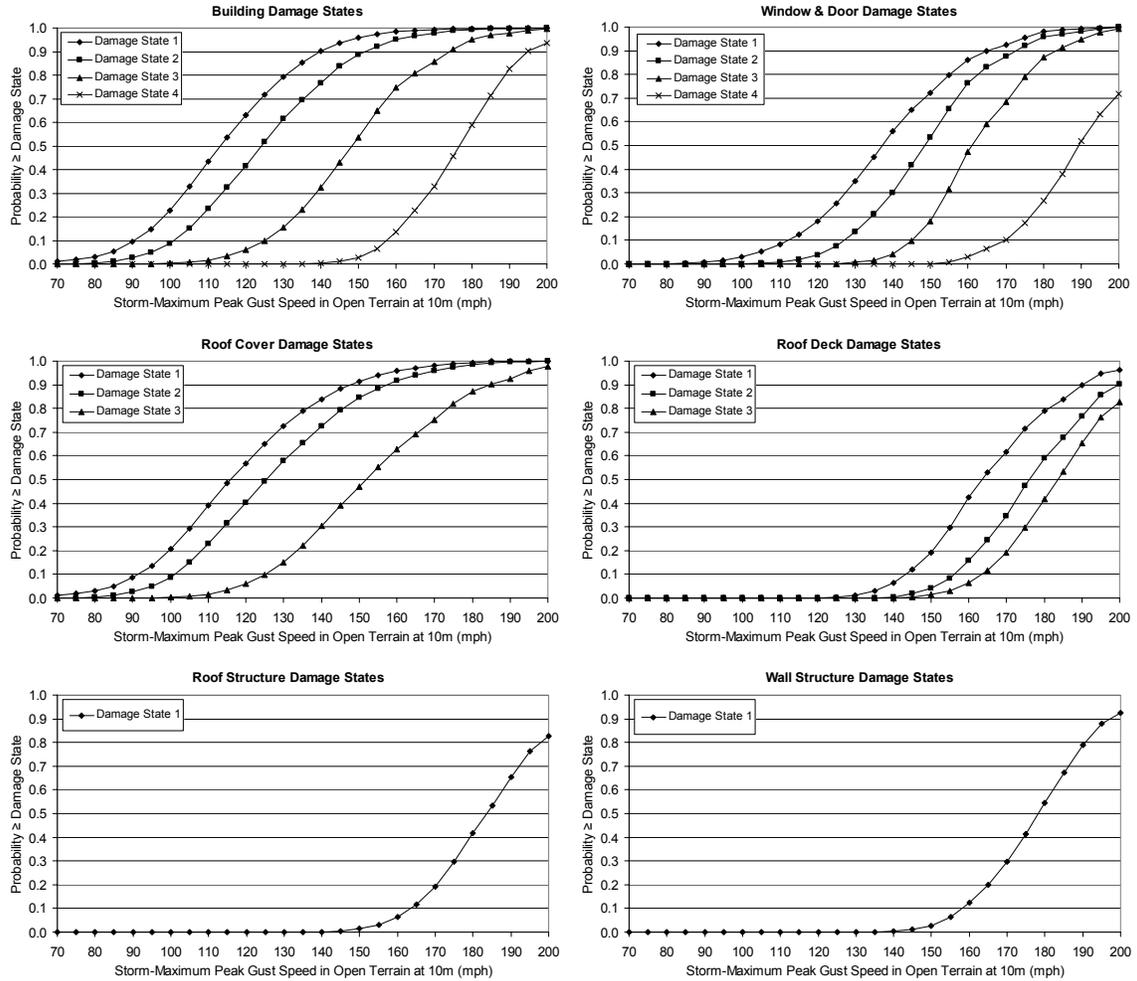
**Figure C.2. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Hip Roof with Shingles,  $z_{\theta}=0.03$  m.**



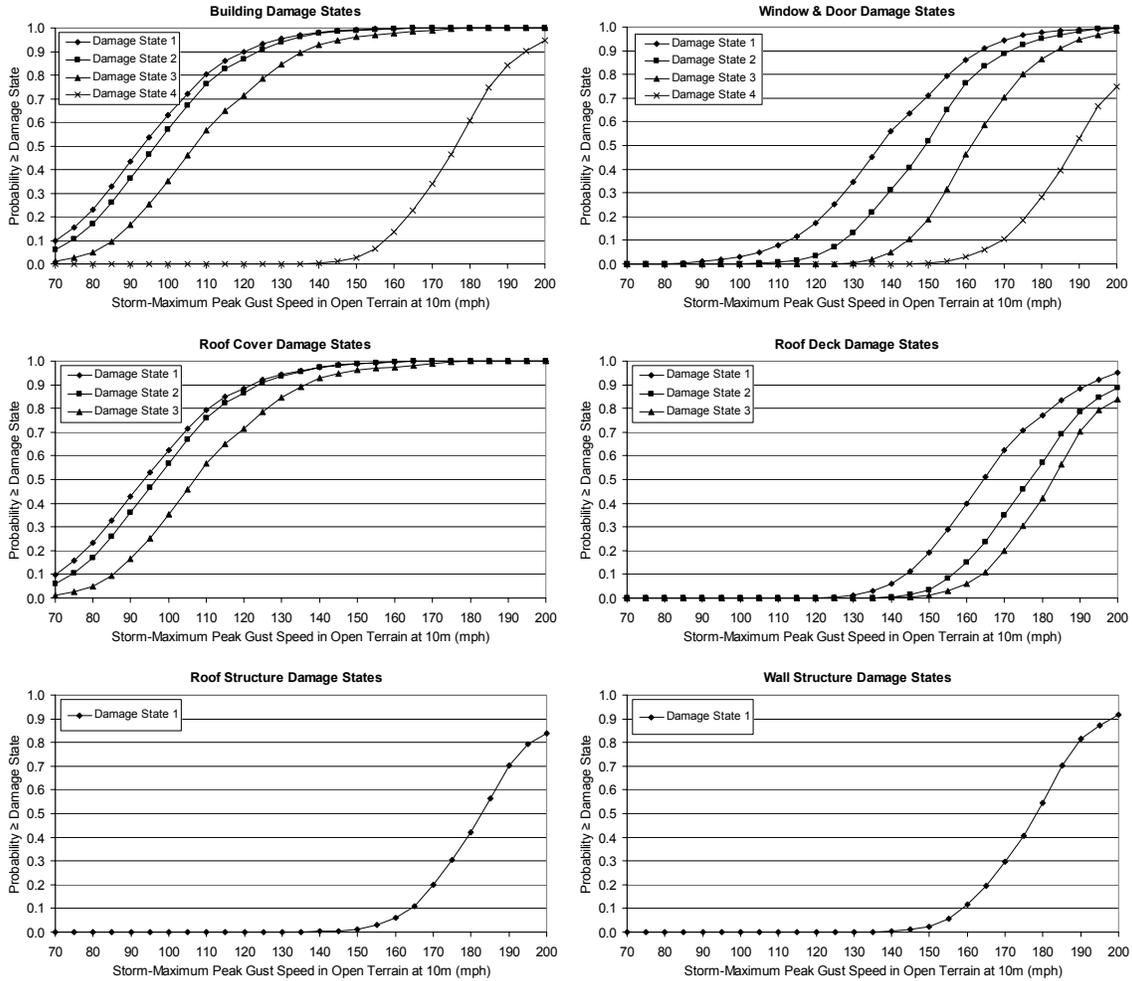
**Figure C.3. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality BUR,  $z_0=0.03$  m.**



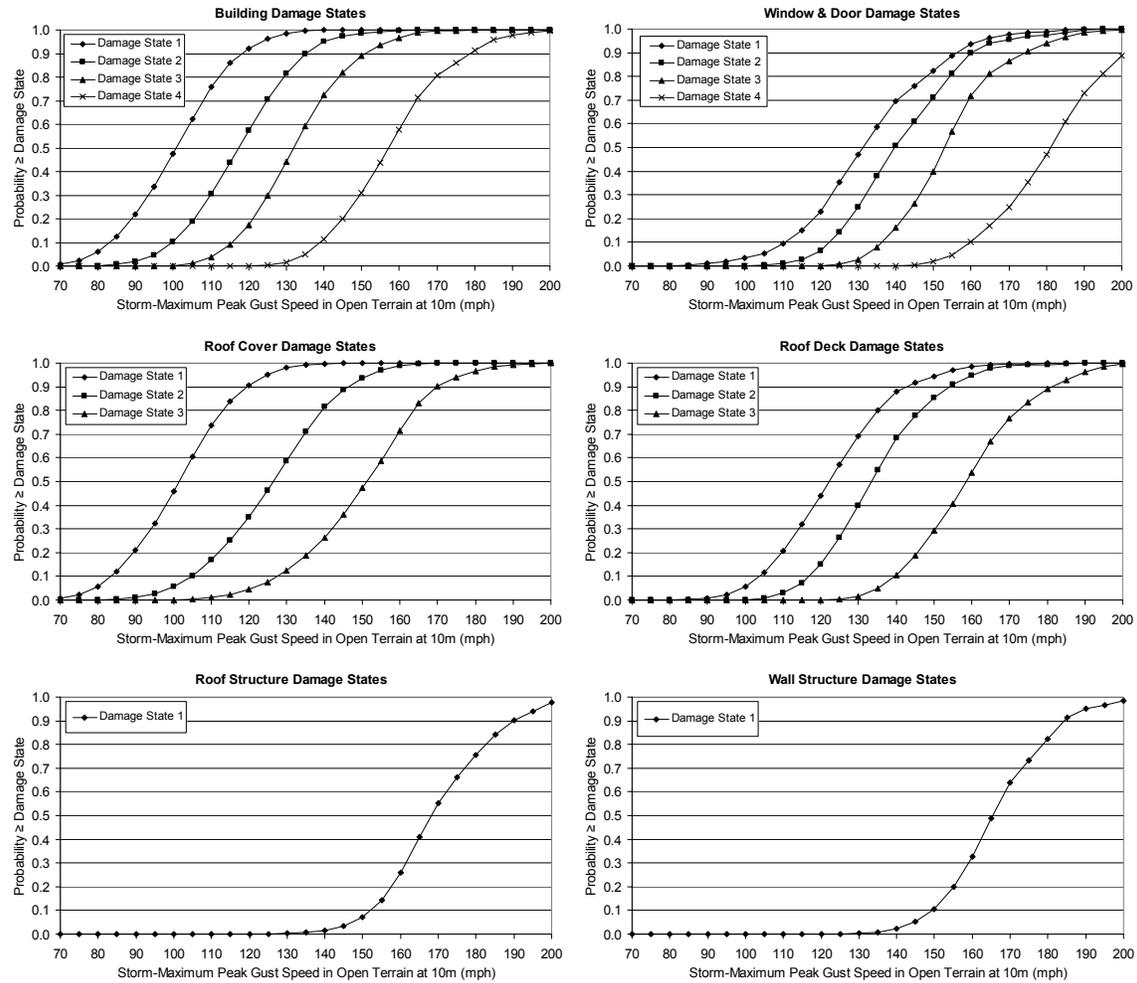
**Figure C.4. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality BUR,  $z_{\theta}=0.03$  m.**



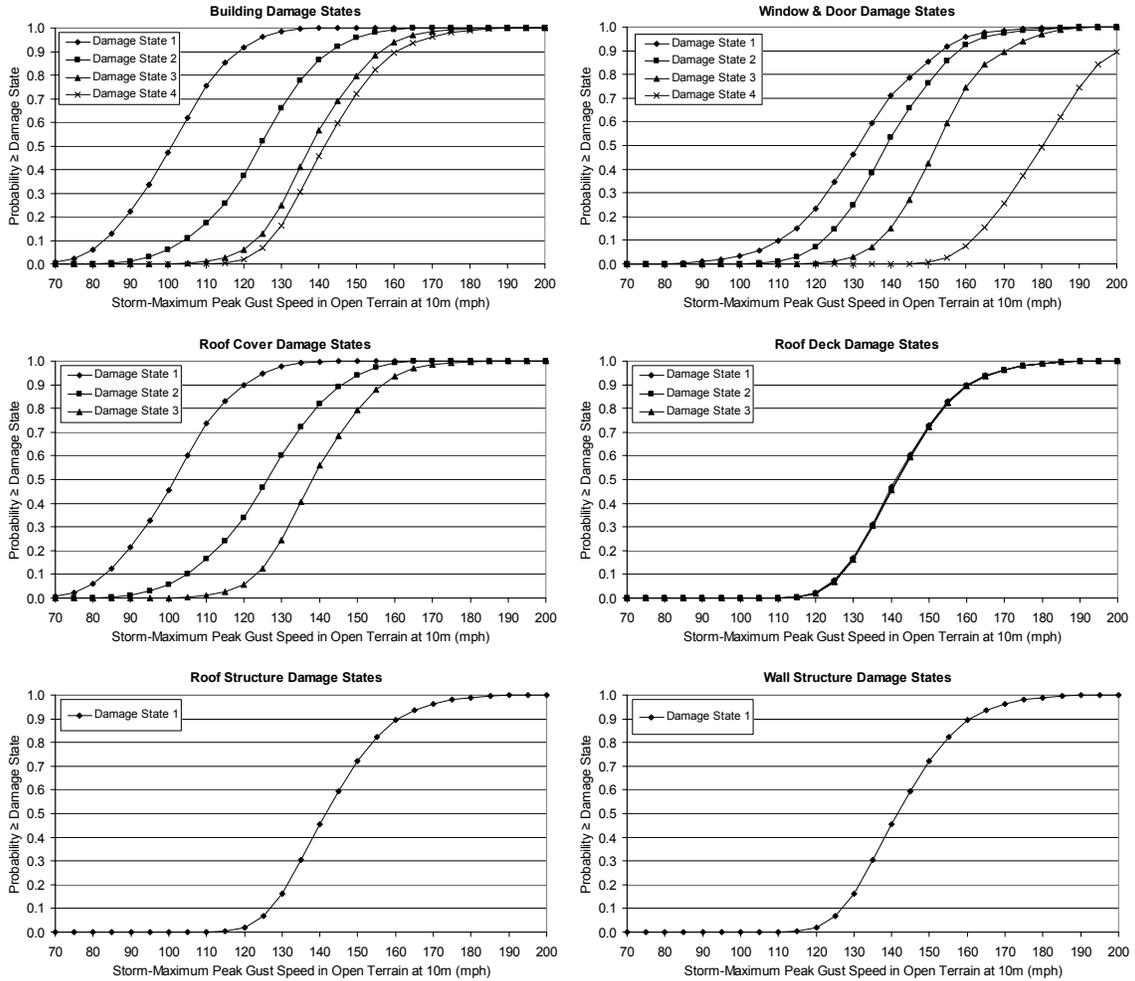
**Figure C.5. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality EPDM,  $z_0=0.03$  m.**



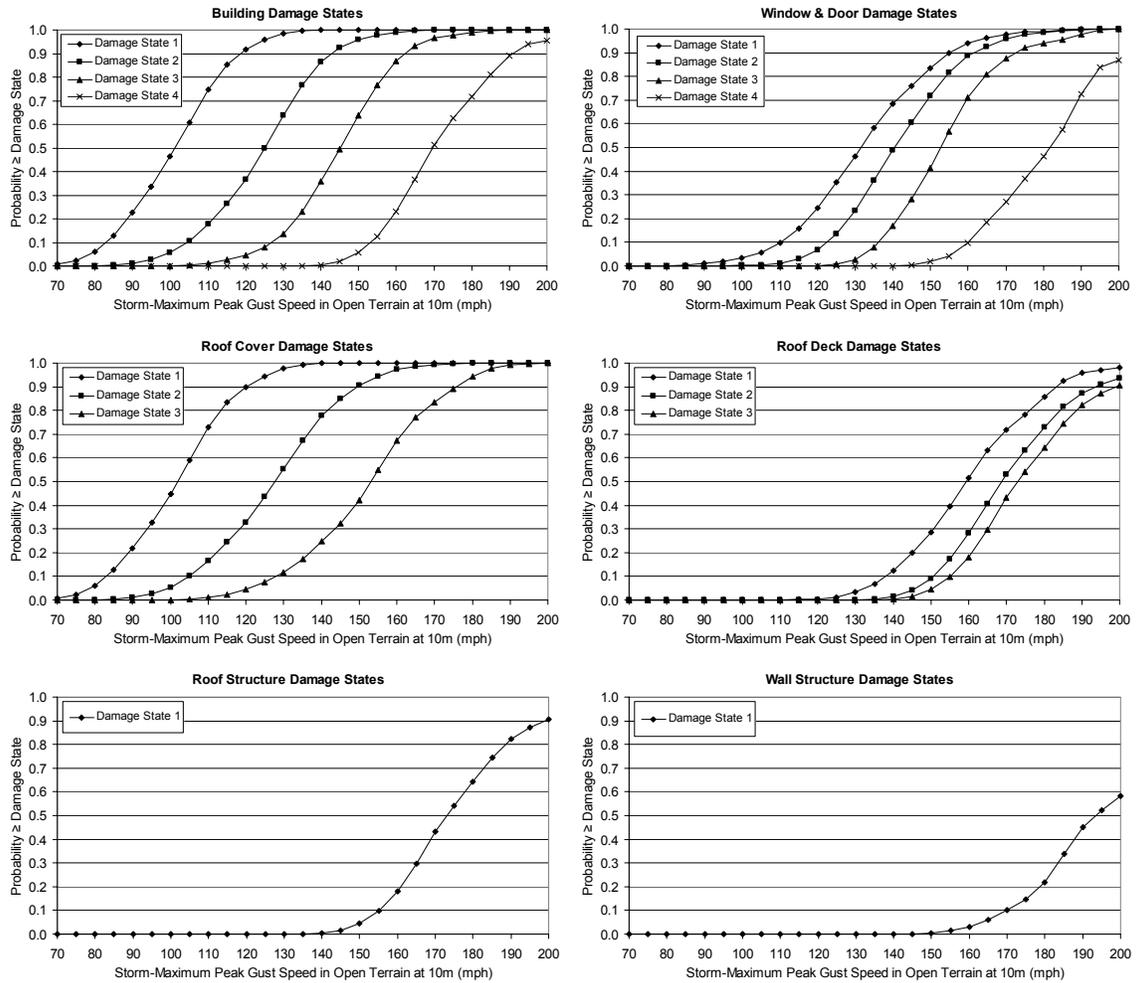
**Figure C.6. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality EPDM,  $z_0=0.03$  m.**



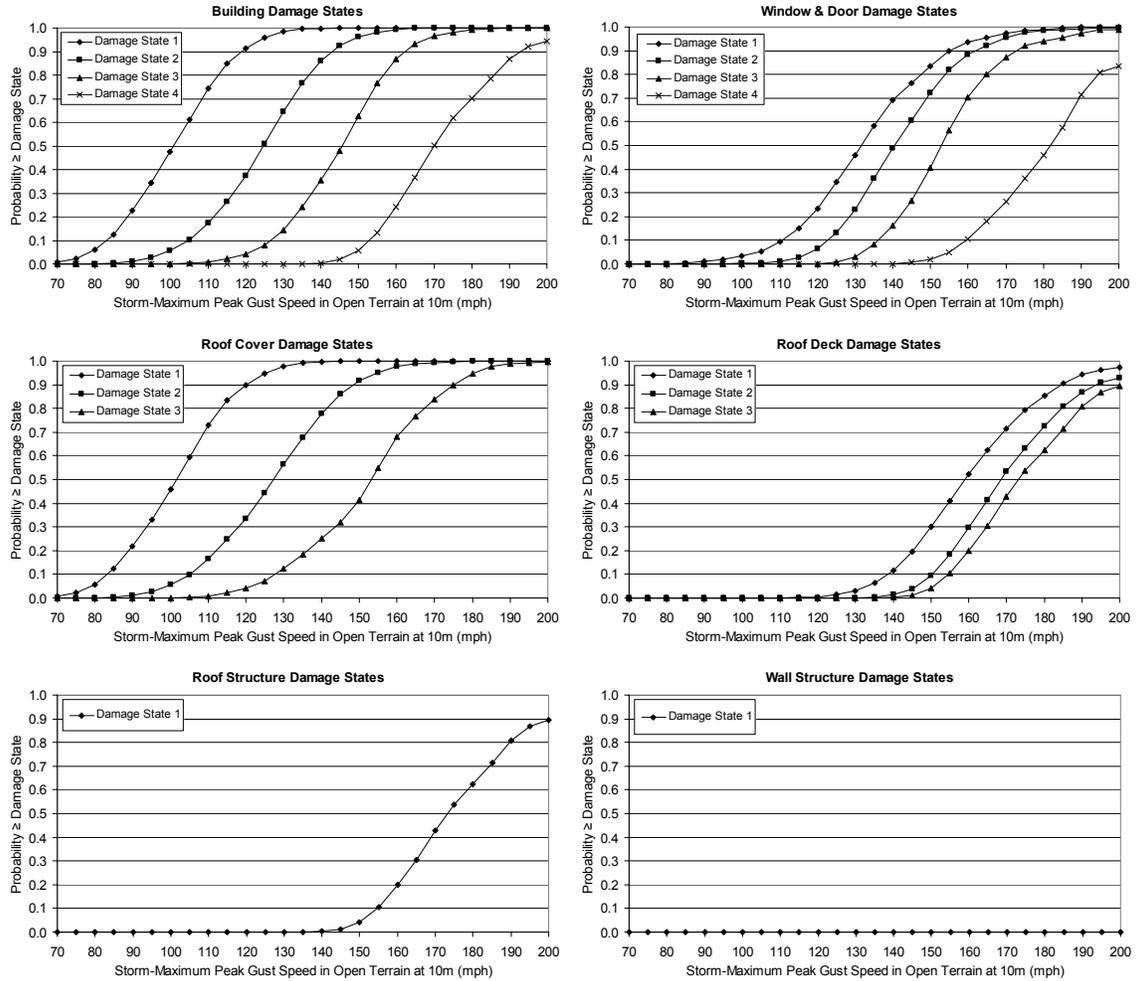
**Figure C.7. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 6d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.03$  m.**



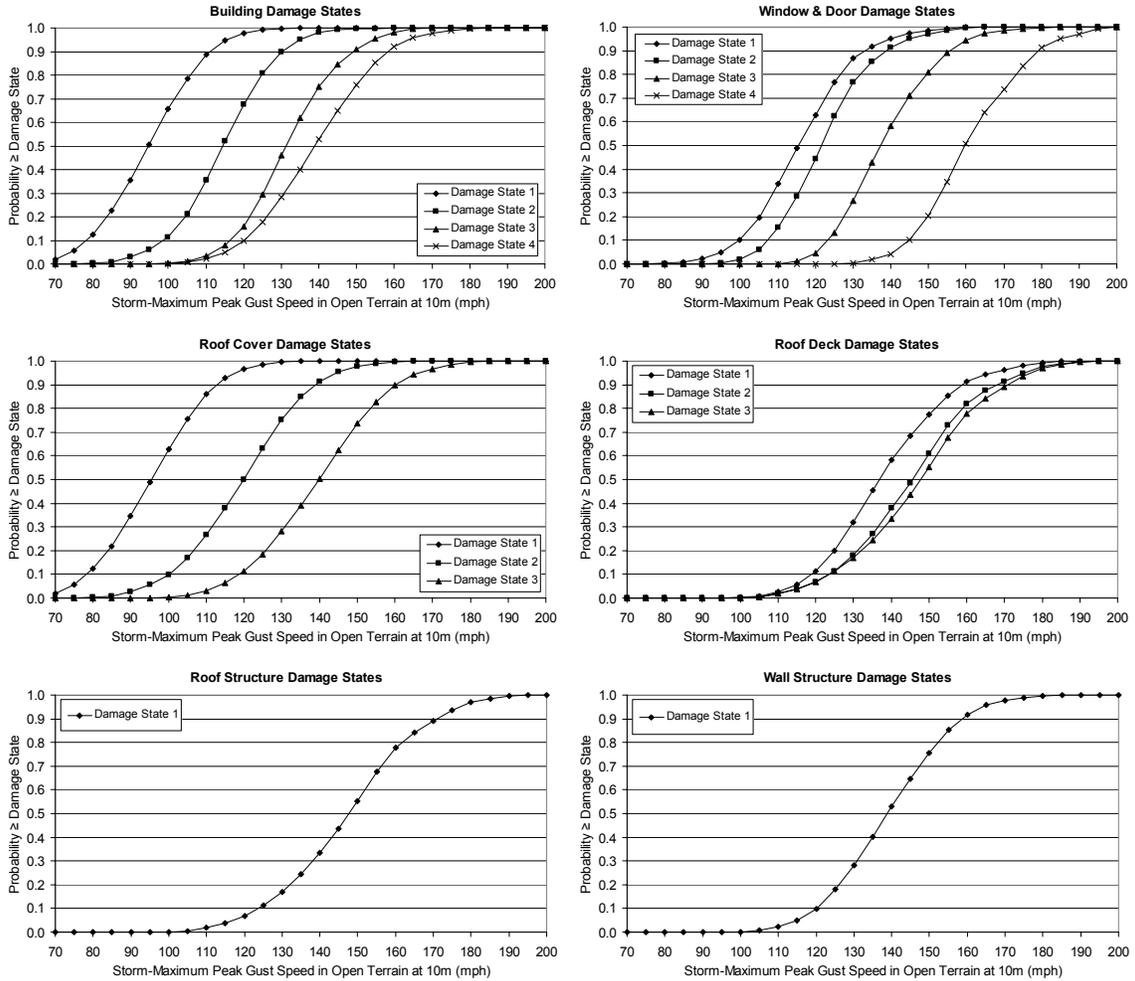
**Figure C.8. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Toe-Nailed Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.03$  m.**



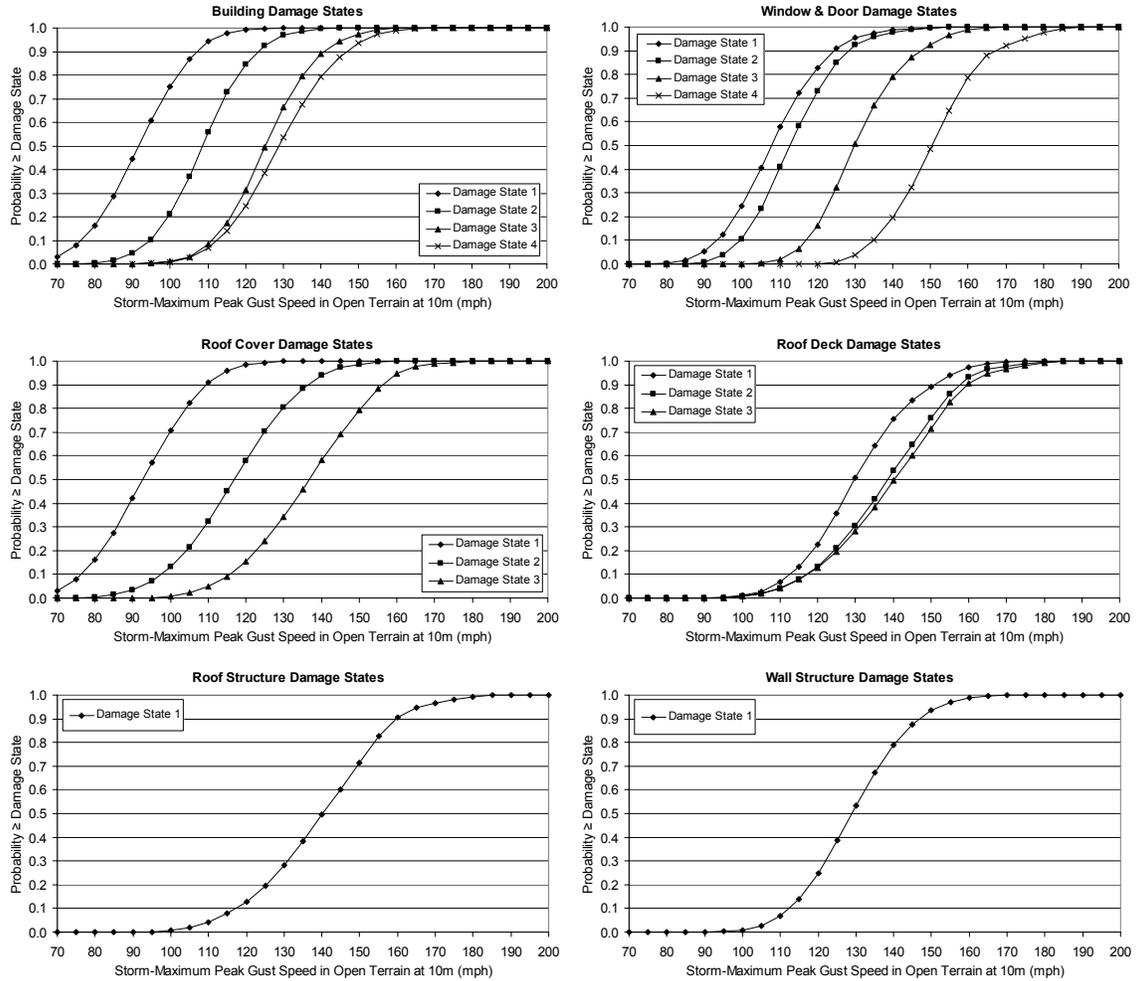
**Figure C.9. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Unreinforced Masonry Walls, Gable Roof with Shingles,  $z_0=0.03$  m.**



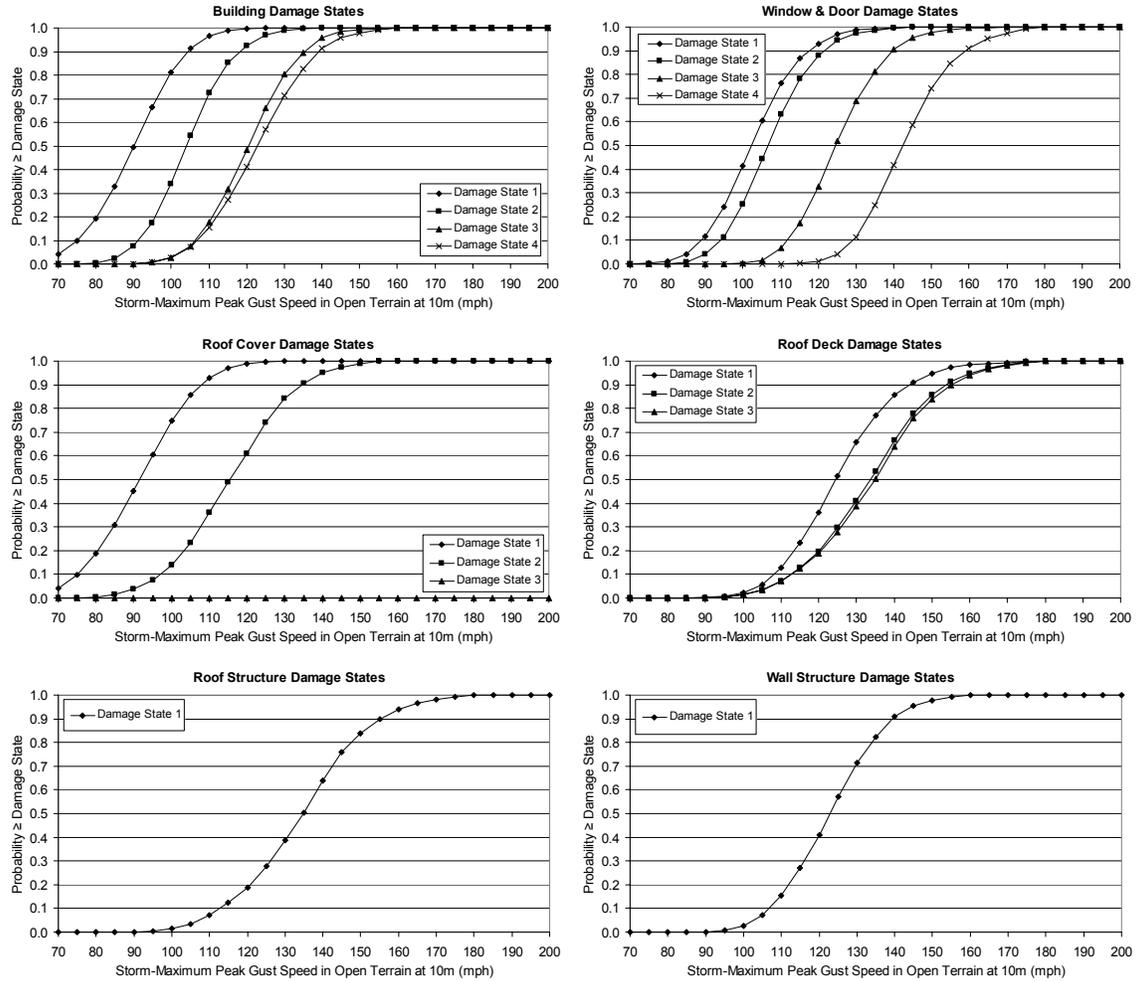
**Figure C.10. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Reinforced Masonry Walls, Gable Roof with Shingles,  $z_0=0.03$  m.**



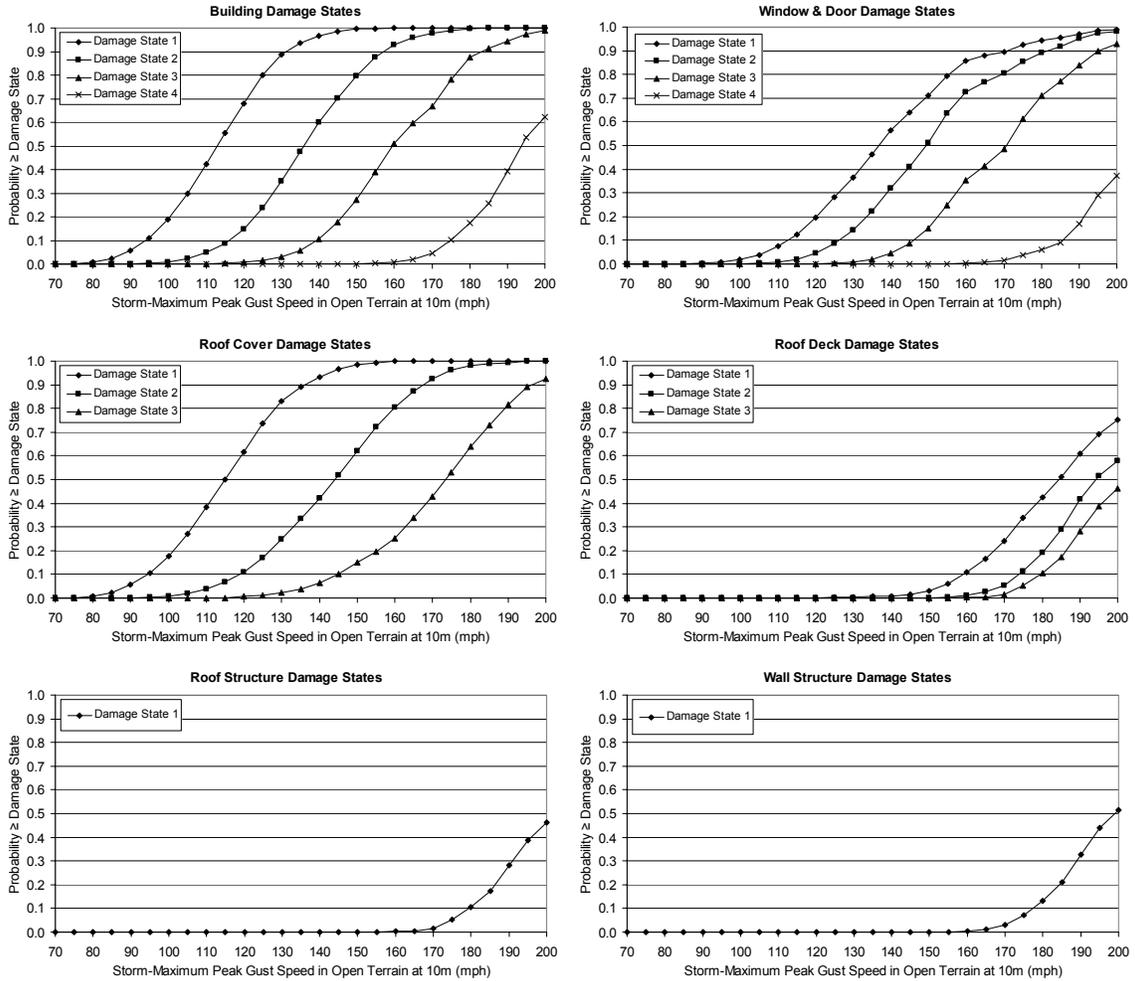
**Figure C.11. Damage States vs. Maximum Peak Gust Wind Speed – Two-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.03$  m.**



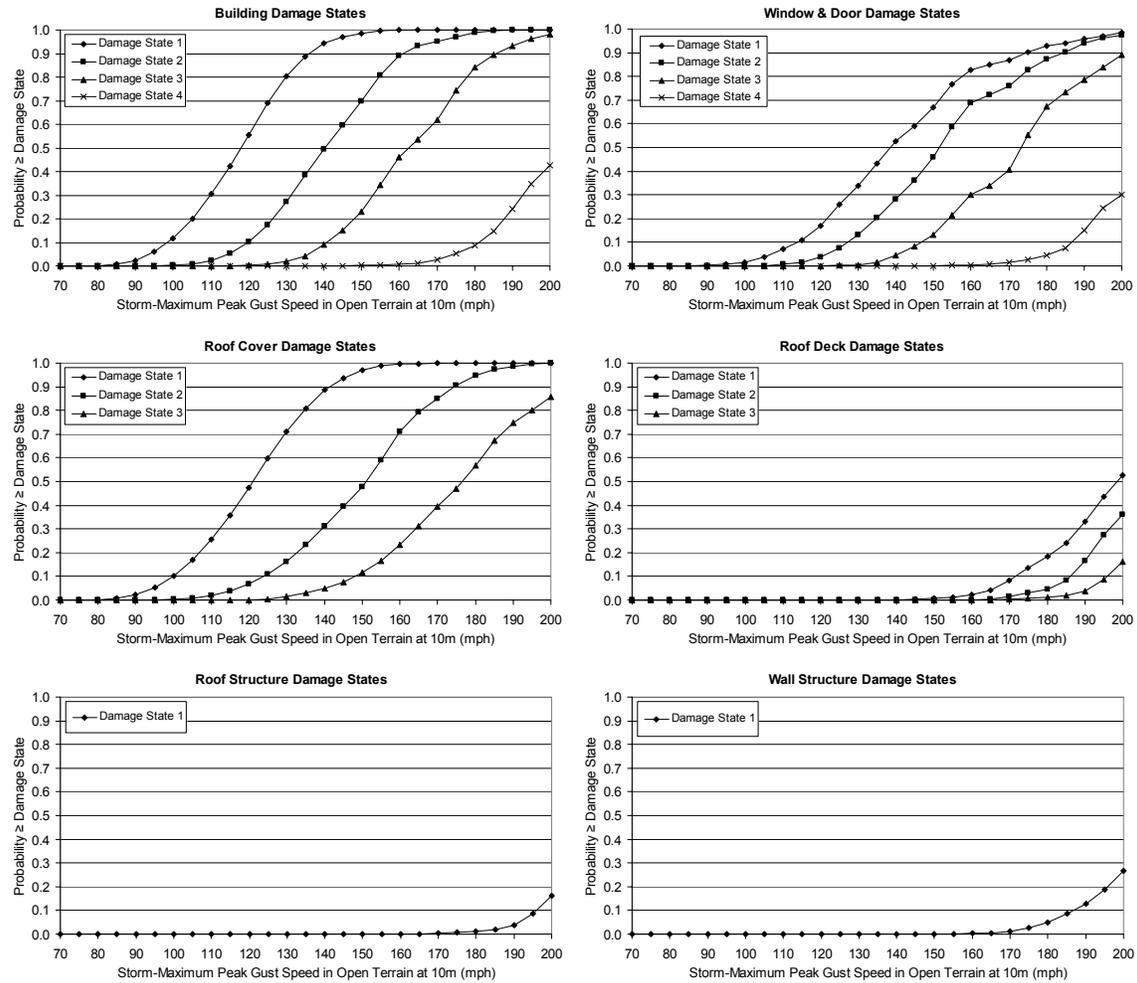
**Figure C.12. Damage States vs. Maximum Peak Gust Wind Speed – Three-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{0}=0.03$  m.**



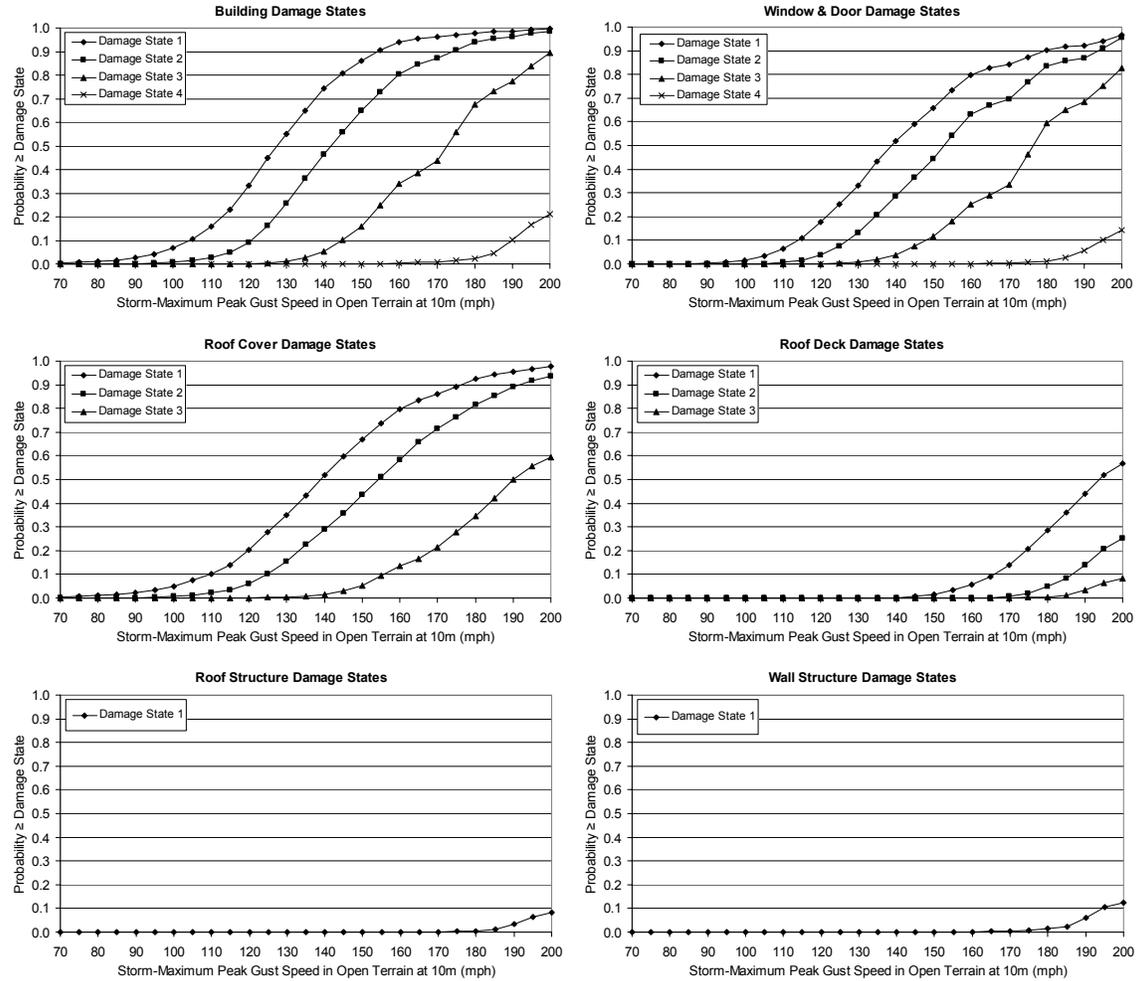
**Figure C.13. Damage States vs. Maximum Peak Gust Wind Speed – Four-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.03$  m.**



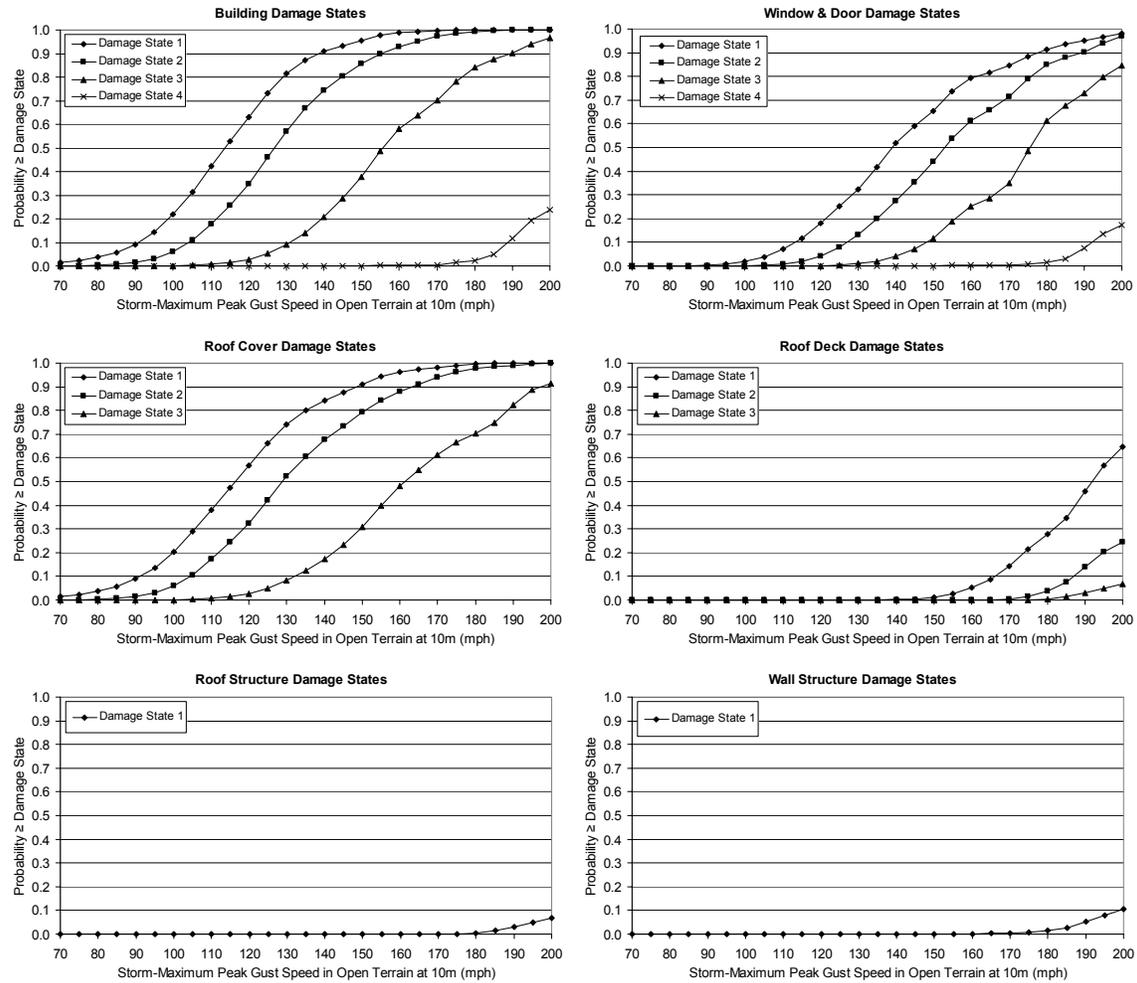
**Figure C.14. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.35$  m.**



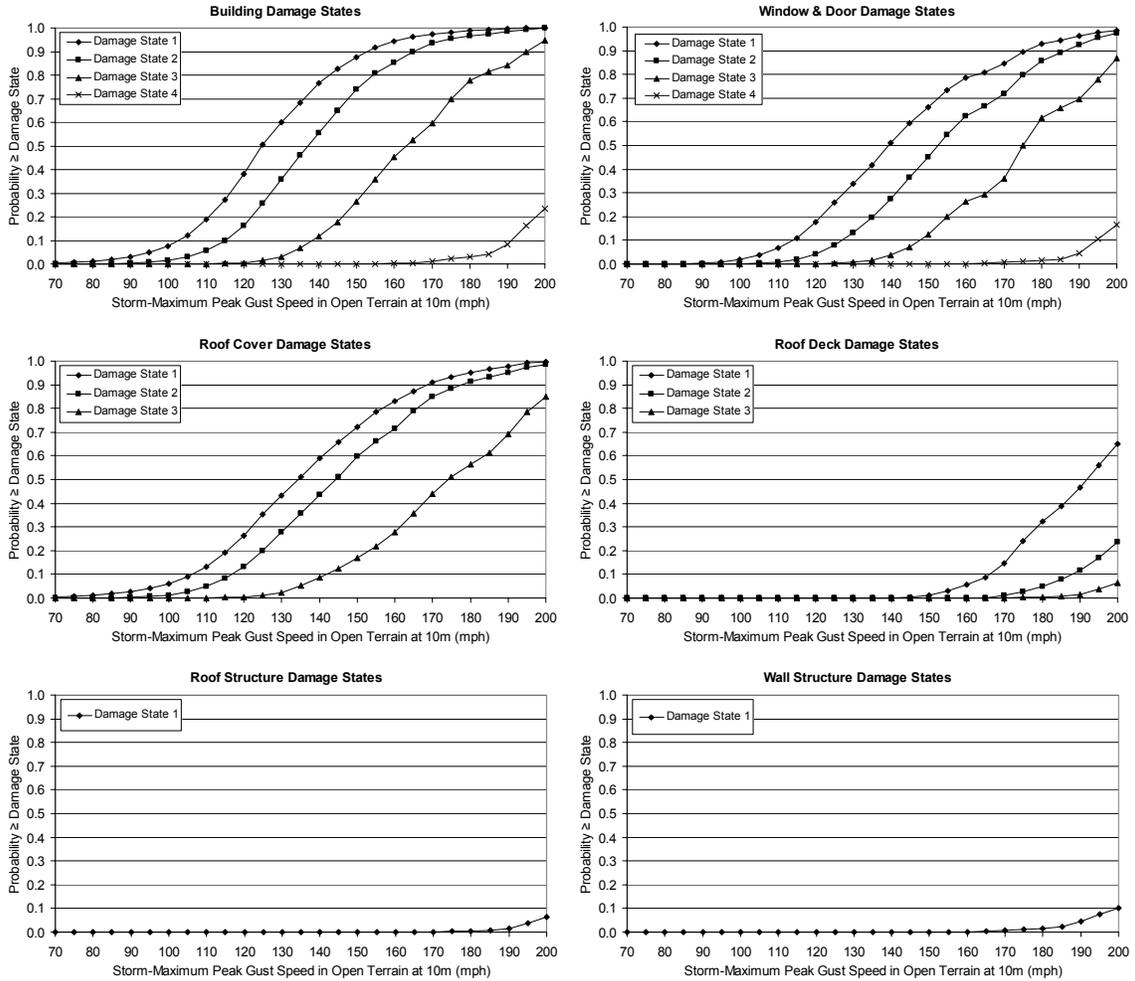
**Figure C.15. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Hip Roof with Shingles,  $z_{\theta}=0.35$  m.**



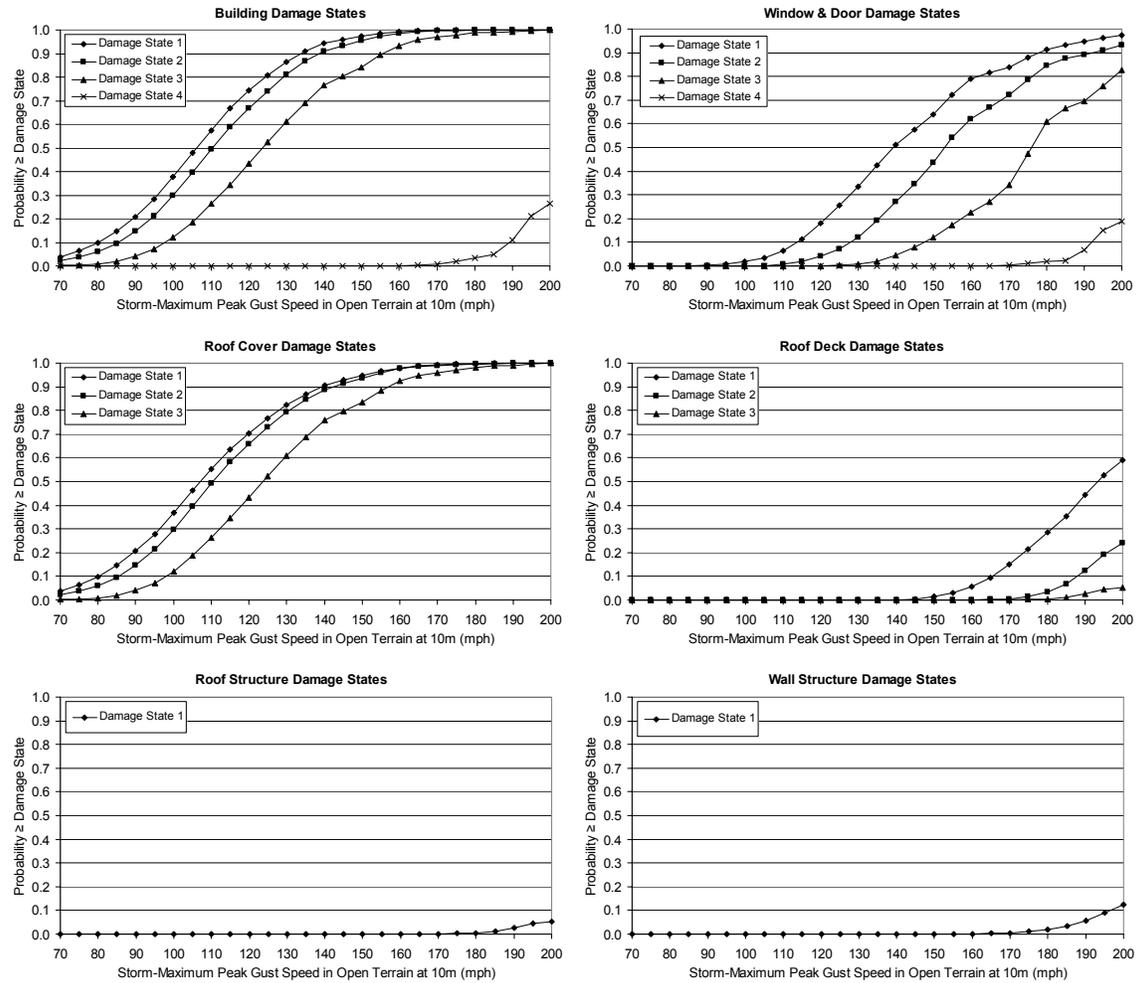
**Figure C.16. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality BUR,  $z_0=0.35$  m.**



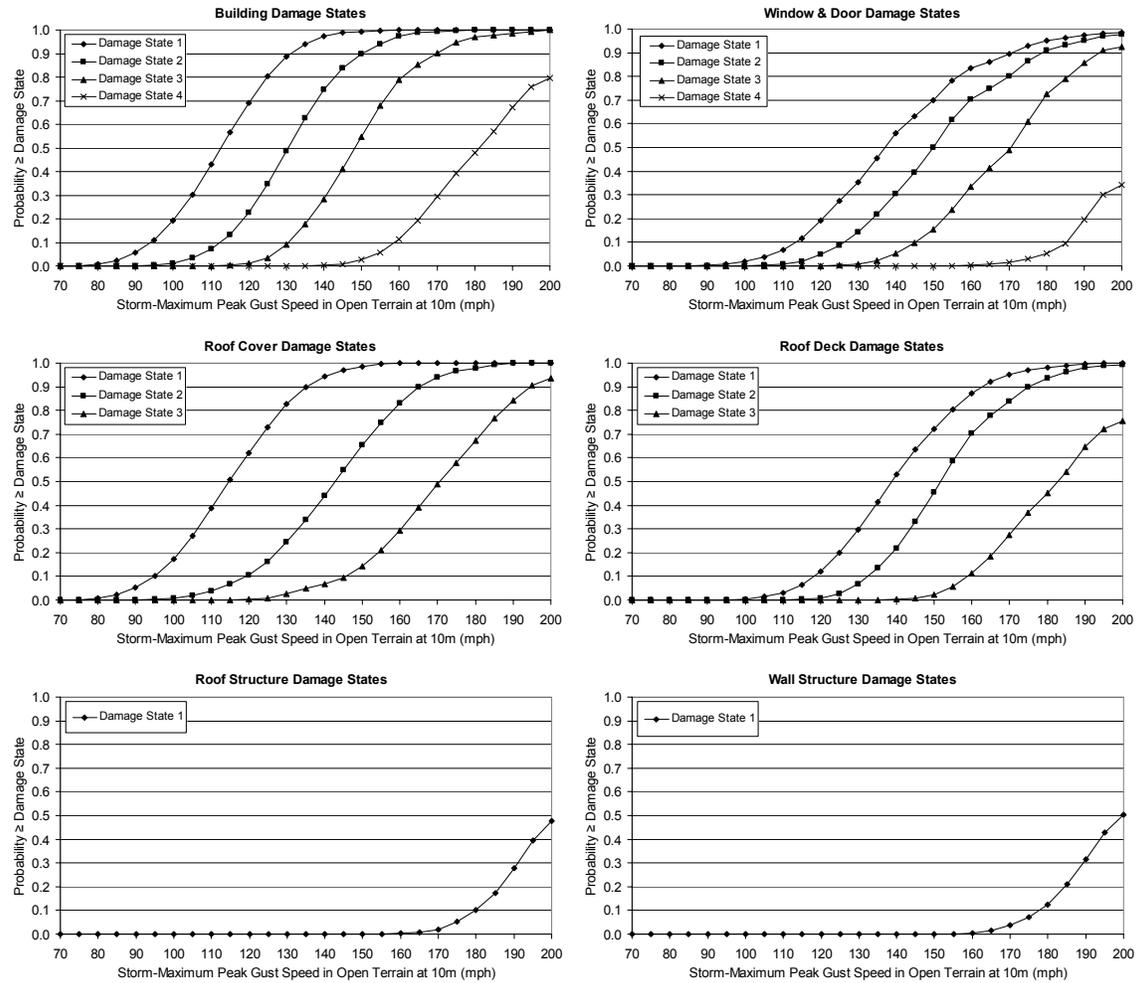
**Figure C.17. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality BUR,  $z_0=0.35$  m.**



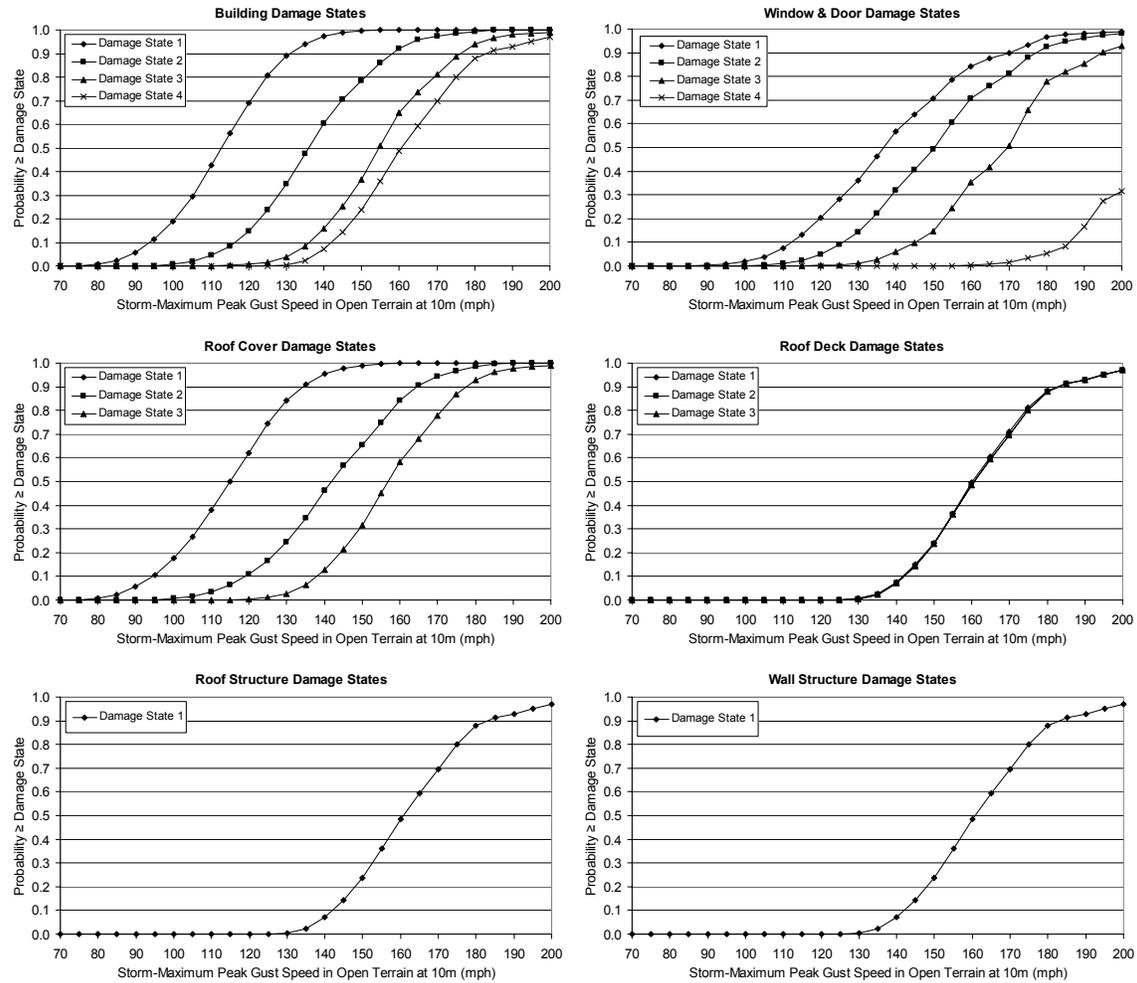
**Figure C.18. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality EPDM,  $z_0=0.35$  m.**



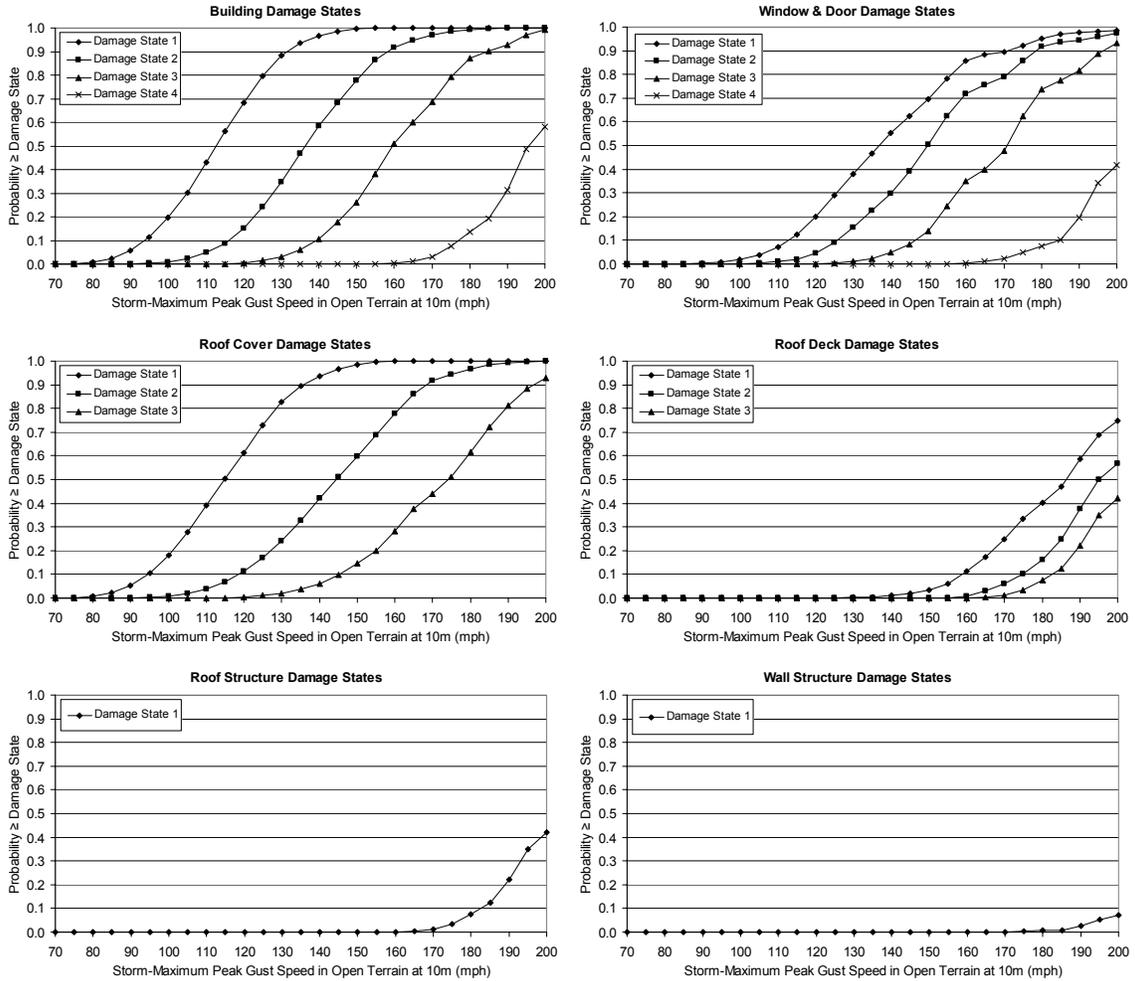
**Figure C.19. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality EPDM,  $z_0=0.35$  m.**



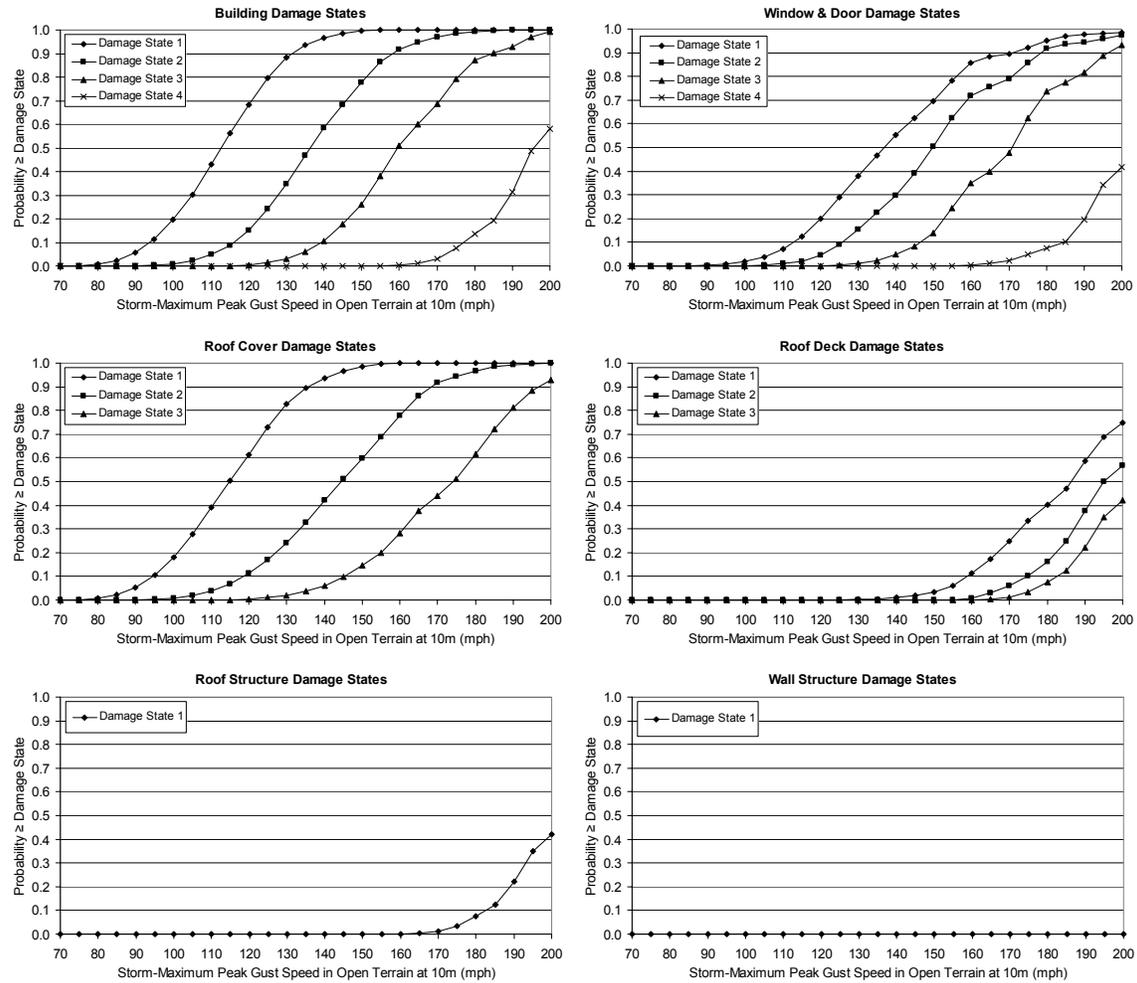
**Figure C.20. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 6d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.35$  m.**



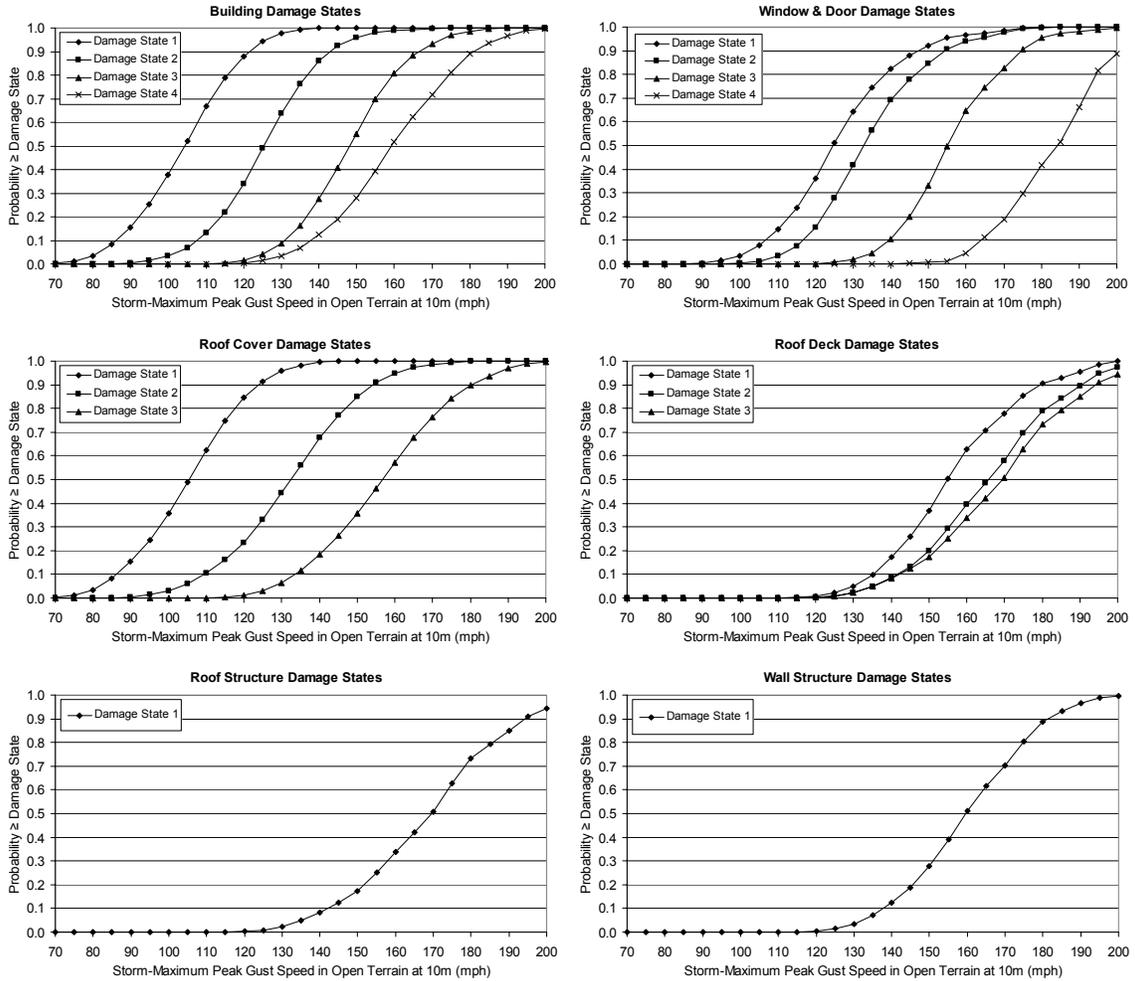
**Figure C.21. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Toe-Nailed Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{0}=0.35$  m.**



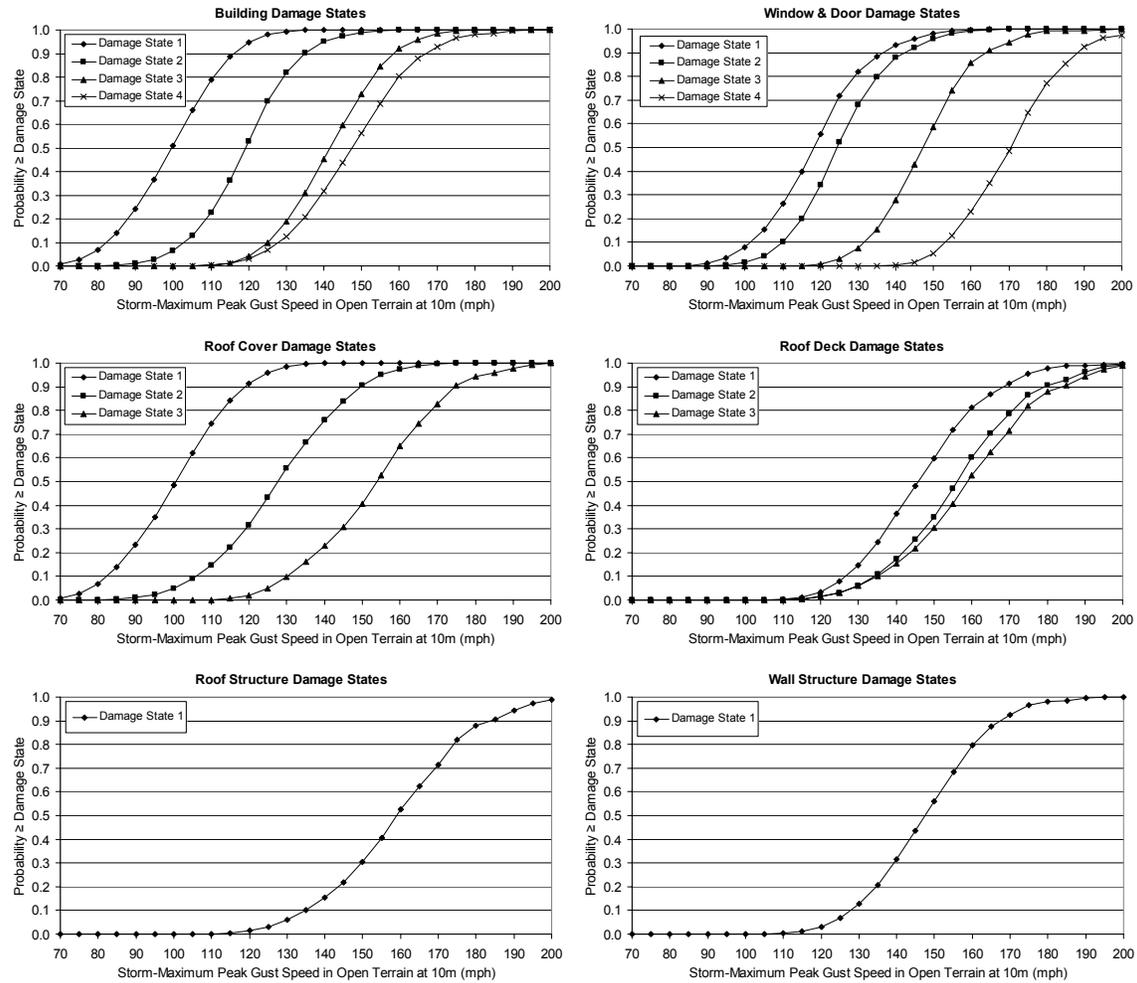
**Figure C.22. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Unreinforced Masonry Walls, Gable Roof with Shingles,  $z_0=0.35$  m.**



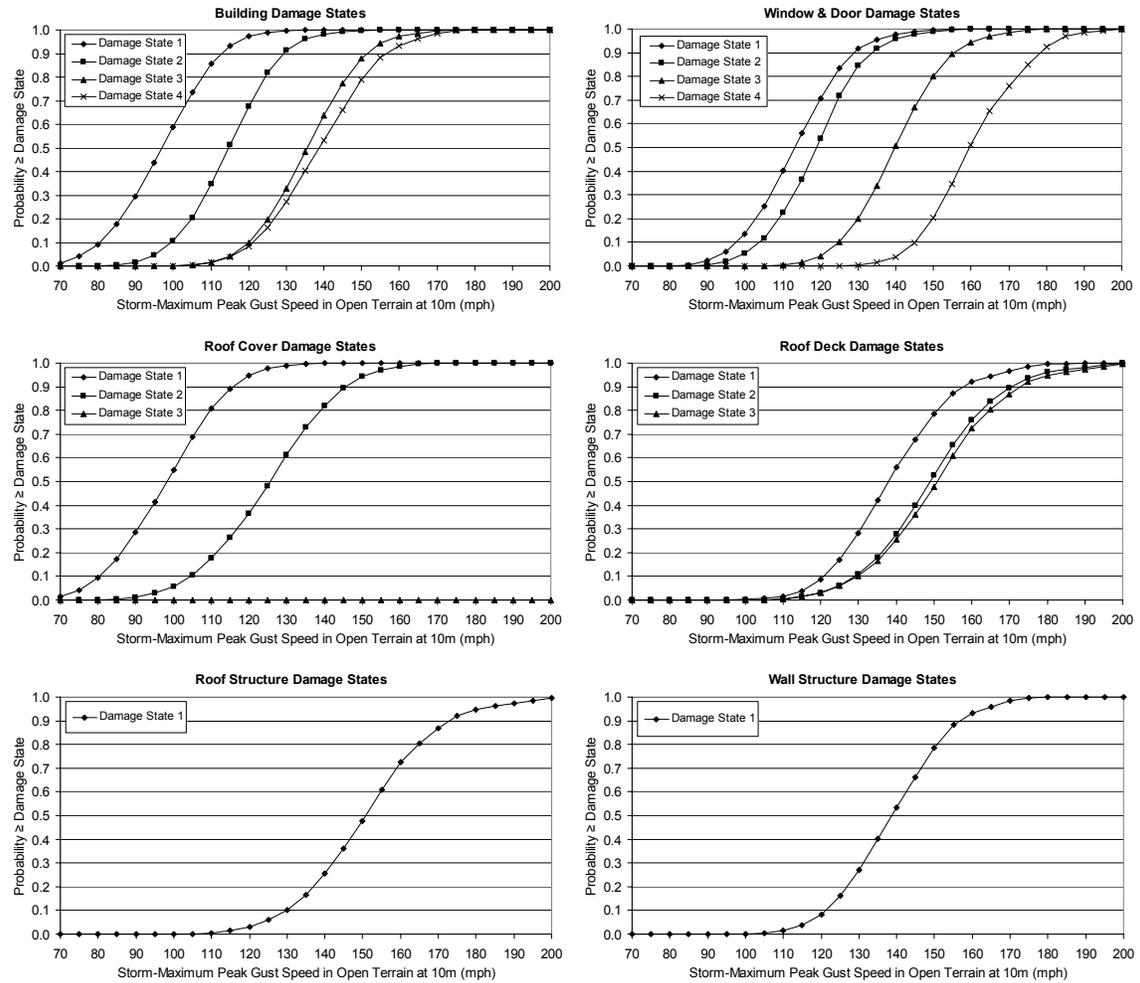
**Figure C.23. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Reinforced Masonry Walls, Gable Roof with Shingles,  $z_0=0.35$  m.**



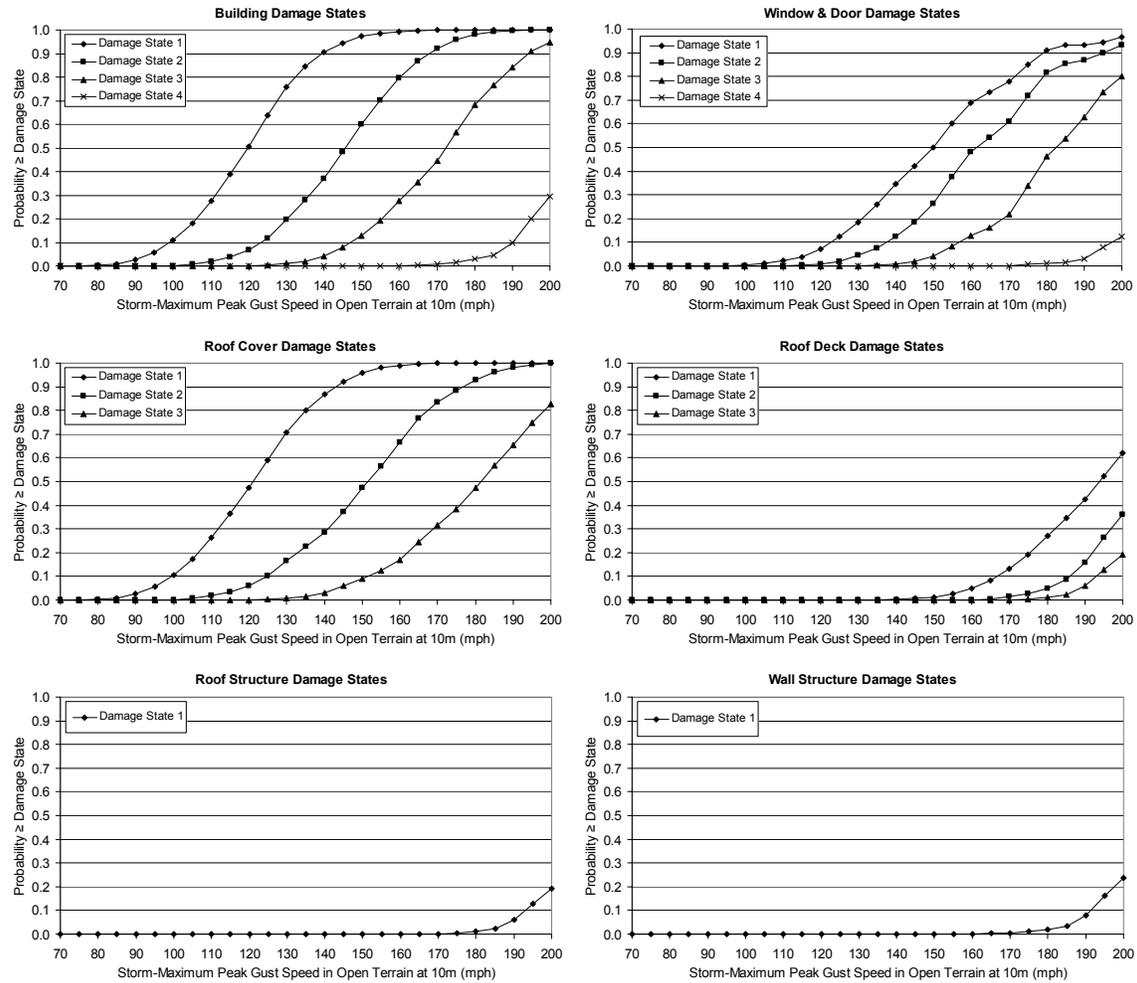
**Figure C.24. Damage States vs. Maximum Peak Gust Wind Speed – Two-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.35$  m.**



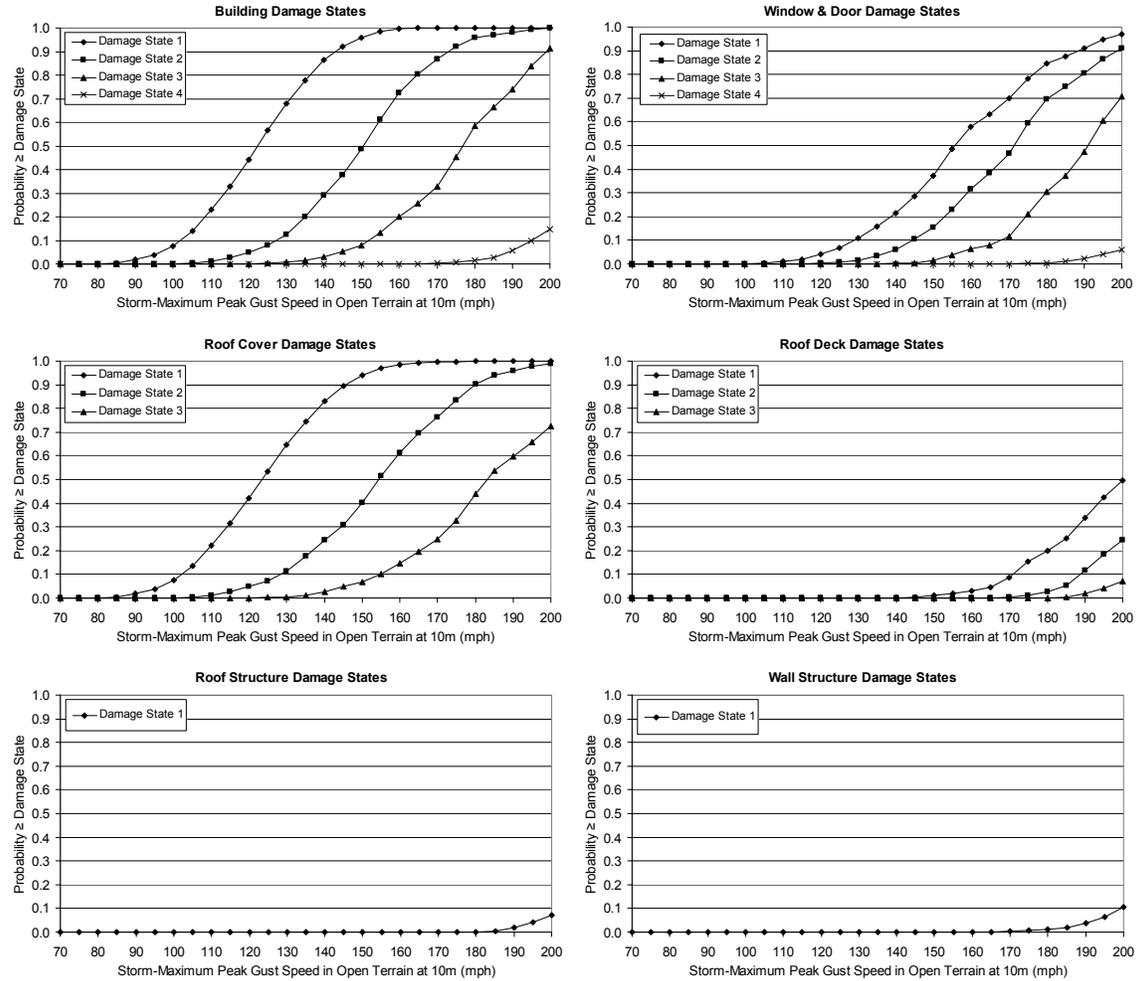
**Figure C.25. Damage States vs. Maximum Peak Gust Wind Speed – Three-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.35$  m.**



**Figure C.26. Damage States vs. Maximum Peak Gust Wind Speed – Four-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.35$  m.**



**Figure C.27. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_{\theta}=0.70$  m.**



**Figure C.28. Damage States vs. Maximum Peak Gust Wind Speed – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles,  $z_0=1.0$  m.**



**Appendix D.**  
**Damage State Functions for Low Rise Masonry Strip**  
**Mall Buildings**

## Appendix D. Damage State Functions for Low Rise Masonry Strip Mall Buildings

This appendix presents damage state curves for low rise masonry strip mall buildings. The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.10-1 for damage state definitions). As shown in Table D.1, Figures D.1 through D.20 give example results for buildings modeled with a wood roof system. Figures D.21 through D.44 give example results for buildings modeled with a steel roof system.

**Table D.1. Sample Damage State Functions for Low Rise Masonry Strip Mall Buildings**

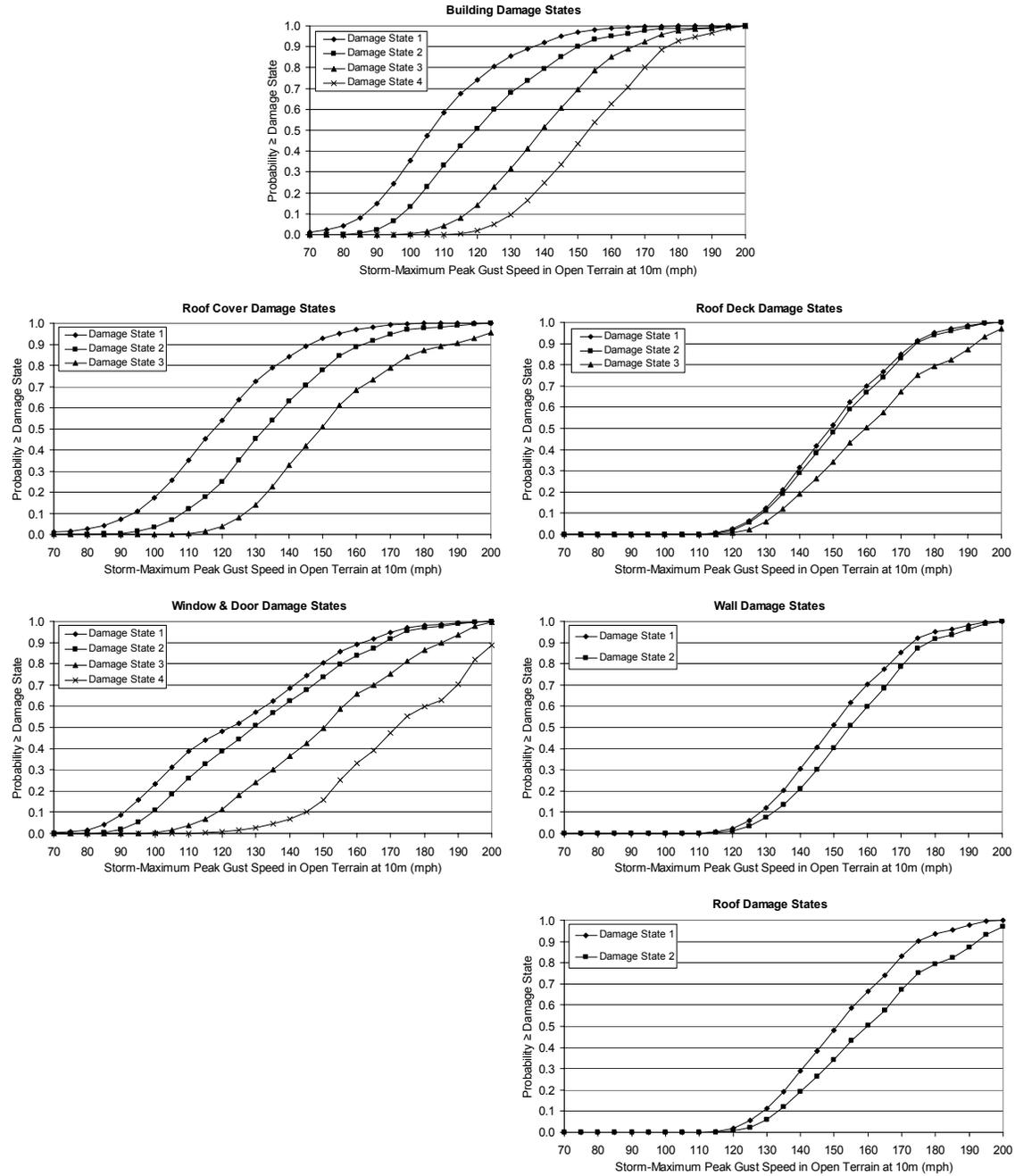
Figure	Walls	Height	Number of Units	Roof Frame	Frame Spacing	Roof/Wall	Deck Mat'l.	Deck Attachment	Design Code	Roof Cover	Missile Environ.	Terrain
D.1	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	0.03
D.2	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>B</b>	0.03
D.3	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>C</b>	0.03
D.4	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>D</b>	0.03
D.5	URM	12'	6	Wood	2'	Strap	Wood	8d	-	<b>EPDM</b>	A	0.03
D.6	URM	12'	6	Wood	2'	Strap	Wood	<b>6d</b>	-	BUR	A	0.03
D.7	<b>RM</b>	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	0.03
D.8	URM	12'	6	Wood	2'	<b>Toe-Nail</b>	Wood	8d	-	BUR	A	0.03
D.9	URM	<b>20'</b>	6	Wood	2'	Strap	Wood	8d	-	BUR	A	0.03
D.10	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	<b>0.35</b>
D.11	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>B</b>	0.35
D.12	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>C</b>	0.35
D.13	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>D</b>	0.35
D.14	URM	12'	6	Wood	2'	Strap	Wood	8d	-	<b>EPDM</b>	A	0.35
D.15	URM	12'	6	Wood	2'	Strap	Wood	<b>6d</b>	-	BUR	A	0.35
D.16	<b>RM</b>	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	0.35
D.17	URM	12'	6	Wood	2'	<b>Toe-Nail</b>	Wood	8d	-	BUR	A	0.35
D.18	URM	<b>20'</b>	6	Wood	2'	Strap	Wood	8d	-	BUR	A	0.35
D.19	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	<b>0.70</b>
D.20	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A	<b>1.00</b>
D.21	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.22	URM	20'	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.23	URM	20'	<b>1</b>	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.24	URM	<b>12'</b>	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.25	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>B</b>	0.03
D.26	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>C</b>	0.03
D.27	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>D</b>	0.03
D.28	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	<b>EPDM</b>	A	0.03

**Table D.1. Sample Damage State Functions for Low Rise Masonry Strip Mall Buildings (concluded)**

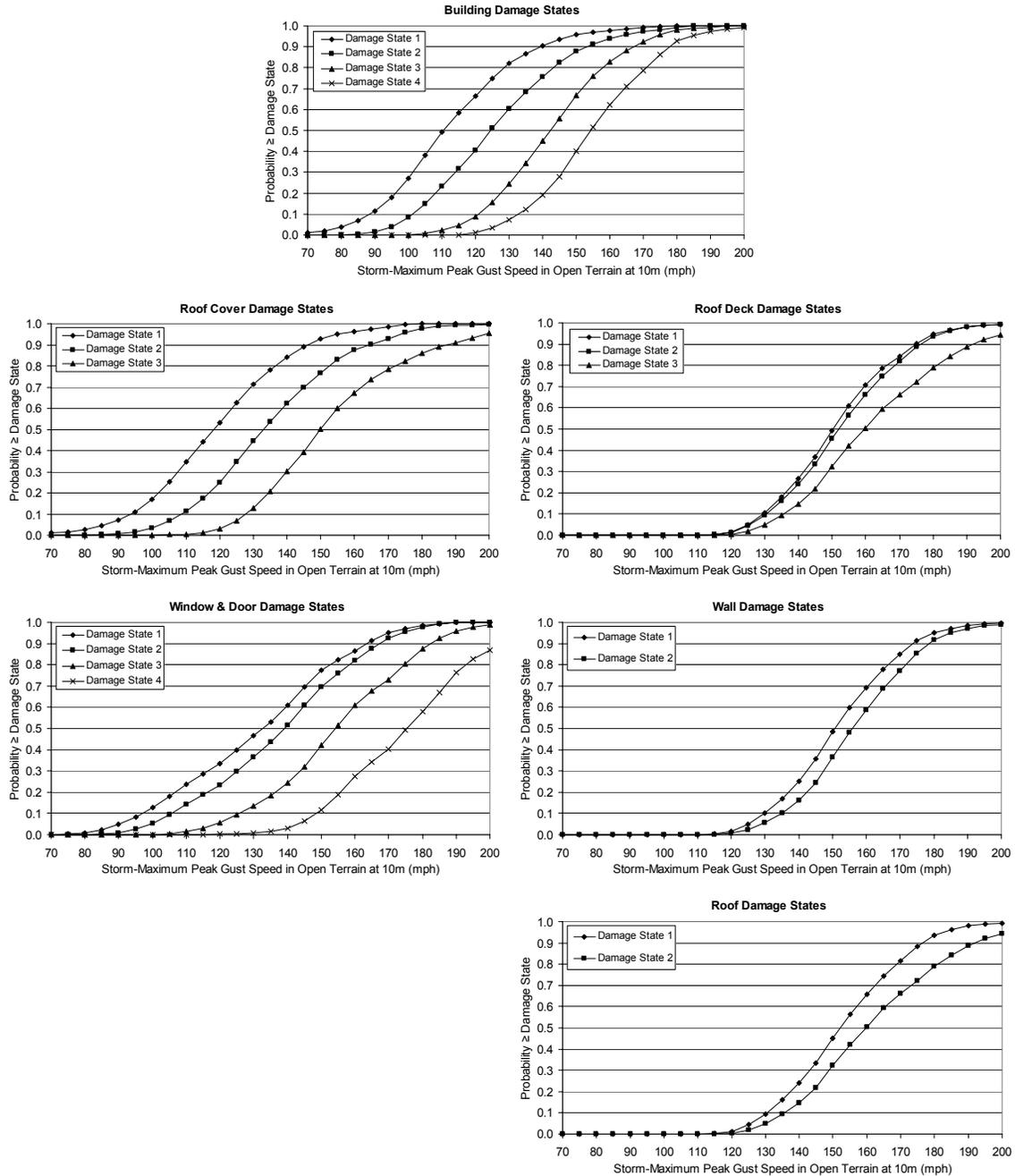
Figure	Walls	Height	Number of Units	Roof Frame	Frame Spacing	Roof/Wall	Deck Mat'l.	Deck Attachment	Design Code	Roof Cover	Missile Environ.	Terrain
D.29	URM	20'	6	OWSJ	6'	-	Metal	<b>Weld, 50%</b>	SBCCI, 100	BUR	A	0.03
D.30	URM	20'	6	OWSJ	6'	-	Metal	<b>Screw</b>	SBCCI, 100	BUR	A	0.03
D.31	URM	20'	6	OWSJ	6'	-	Metal	Weld	<b>ASCE, 100</b>	BUR	A	0.03
D.32	<b>RM</b>	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.33	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	<b>0.35</b>
D.34	URM	20'	6	OWSJ	<b>4'</b>	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.35	URM	20'	<b>1</b>	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.36	URM	<b>12'</b>	6	OWSJ	<b>4'</b>	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.37	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>B</b>	0.03
D.38	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>C</b>	0.03
D.39	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>D</b>	0.03
D.40	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	<b>EPDM</b>	A	0.03
D.41	URM	20'	6	OWSJ	6'	-	Metal	<b>Weld, 50%</b>	SBCCI, 100	BUR	A	0.03
D.42	URM	20'	6	OWSJ	6'	-	Metal	<b>Screw</b>	SBCCI, 100	BUR	A	0.03
D.43	URM	20'	6	OWSJ	6'	-	Metal	Weld	<b>ASCE, 100</b>	BUR	A	0.03
D.44	<b>RM</b>	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	0.03
D.45	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	<b>0.70</b>
D.46	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A	<b>1.00</b>

Two sets of nine figures are given for the buildings modeled with a wood roof system. The first set of nine figures (Figures D.1 through D.9) are for buildings located in an open terrain ( $z_0=0.03$  m) and the second set (Figures D.10 through D.18) are for buildings situated in a typical suburban environment ( $z_0=0.35$  m). The first figure in each set of nine shows damage state results for the 12' high building with 6 units, 8d roof sheathing nails, strapped roof-wall connections, built-up roof cover, Unreinforced masonry walls, and situated in Missile Environment A. The remaining eight plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). Figures D.19 and D.20 show results of the reference building situated in two additional terrain environments (i.e.,  $z_0=0.70$  m and 1.0 m).

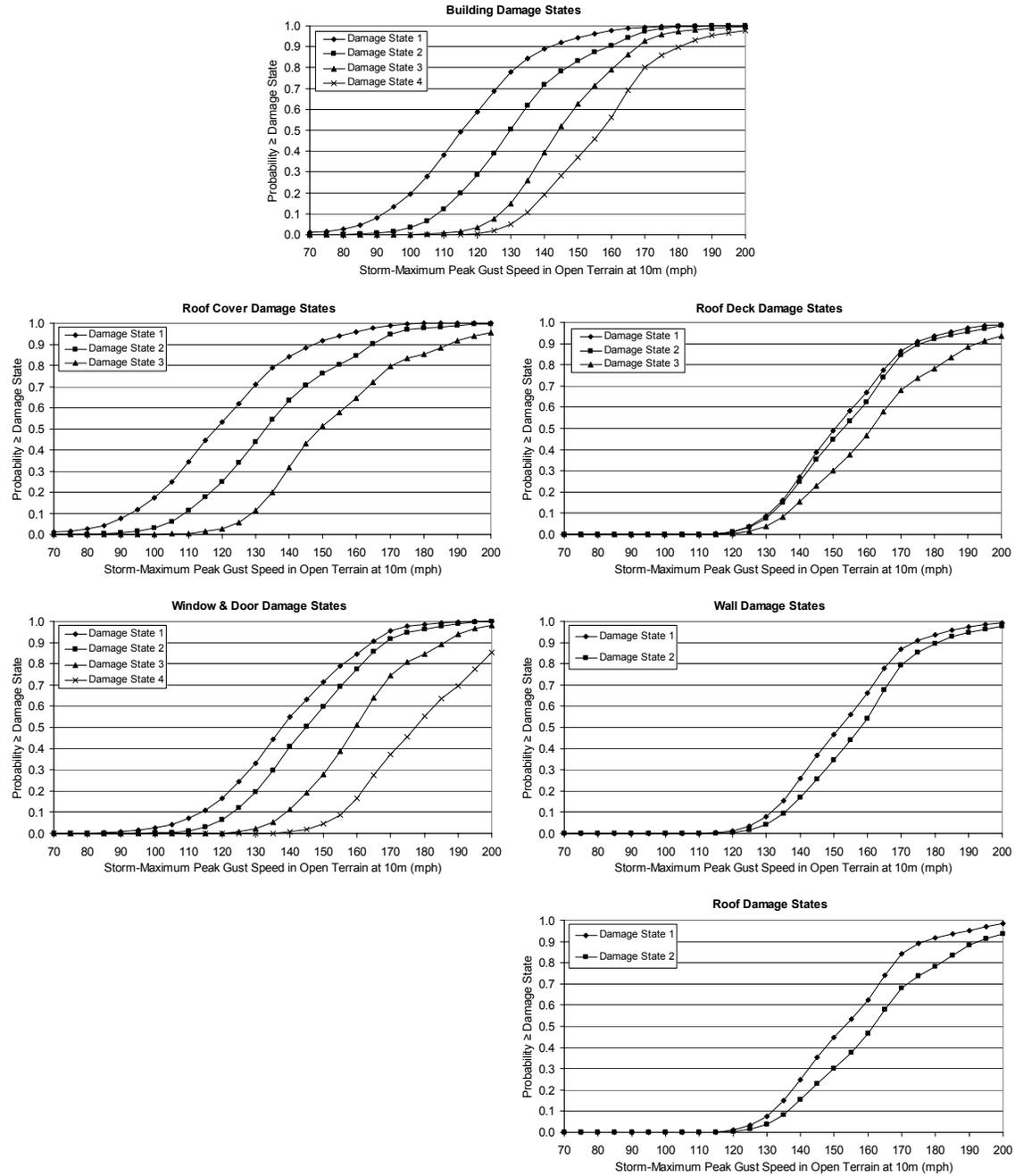
Two sets of twelve figures are given for the buildings modeled with a metal roof system. The first set of twelve figures (Figures D.21 through D.32) are for buildings located in an open terrain ( $z_0=0.03$  m) and the second set (Figures D.33 through D.44) are for buildings situated in a typical suburban environment ( $z_0=0.35$  m). The first figure in each set of twelve shows damage state results for the 20' high building with 6 units, a joist spacing of 6', metal deck fastened with welds, SBCCI roof design criteria, built-up roof cover, Unreinforced masonry walls, and situated in Missile Environment A. The remaining eleven plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). Figures D.45 and D.46 show results of the reference building situated in two additional terrain environments (i.e.,  $z_0=0.70$  m and 1.0 m).



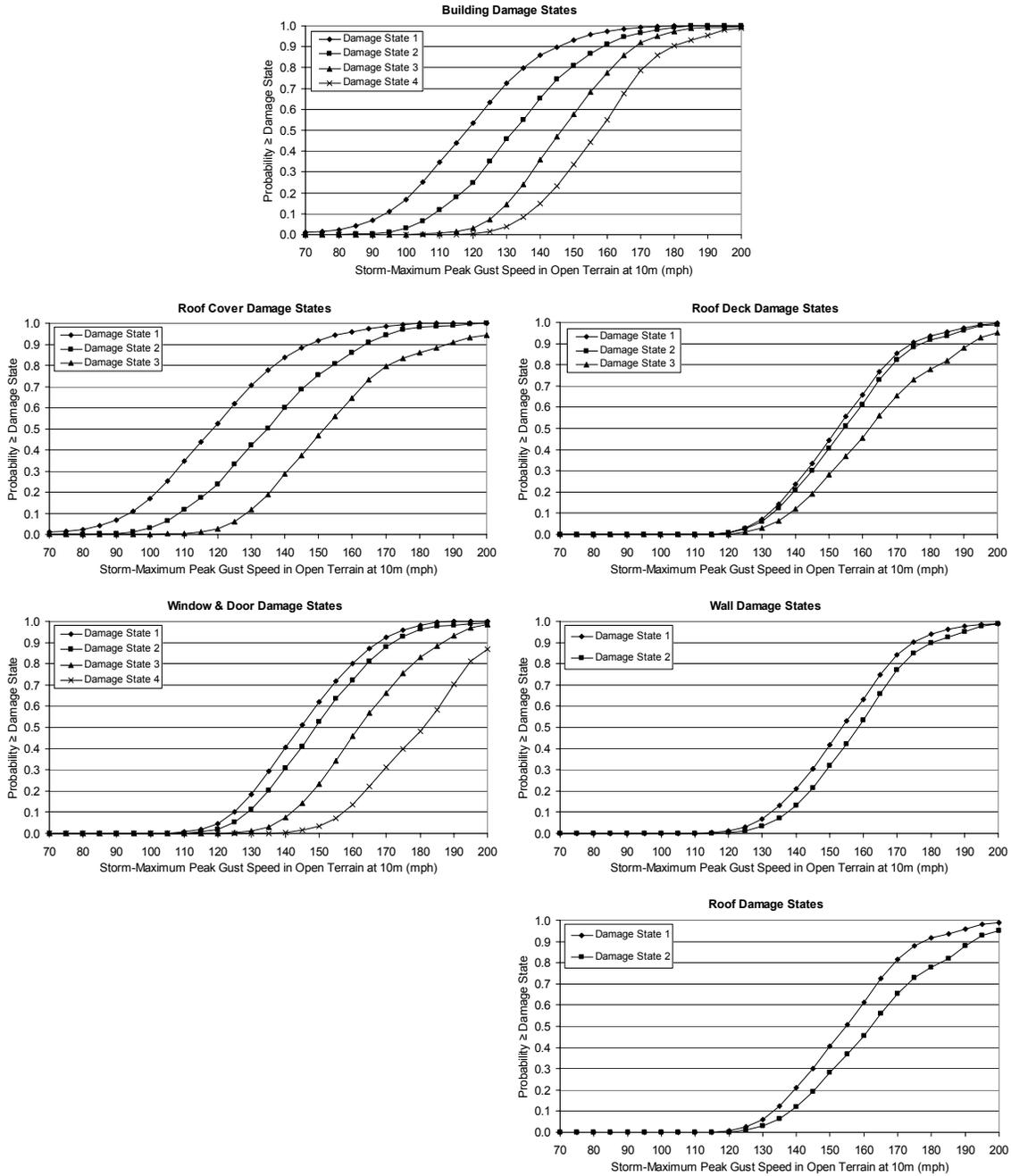
**Figure D.1. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



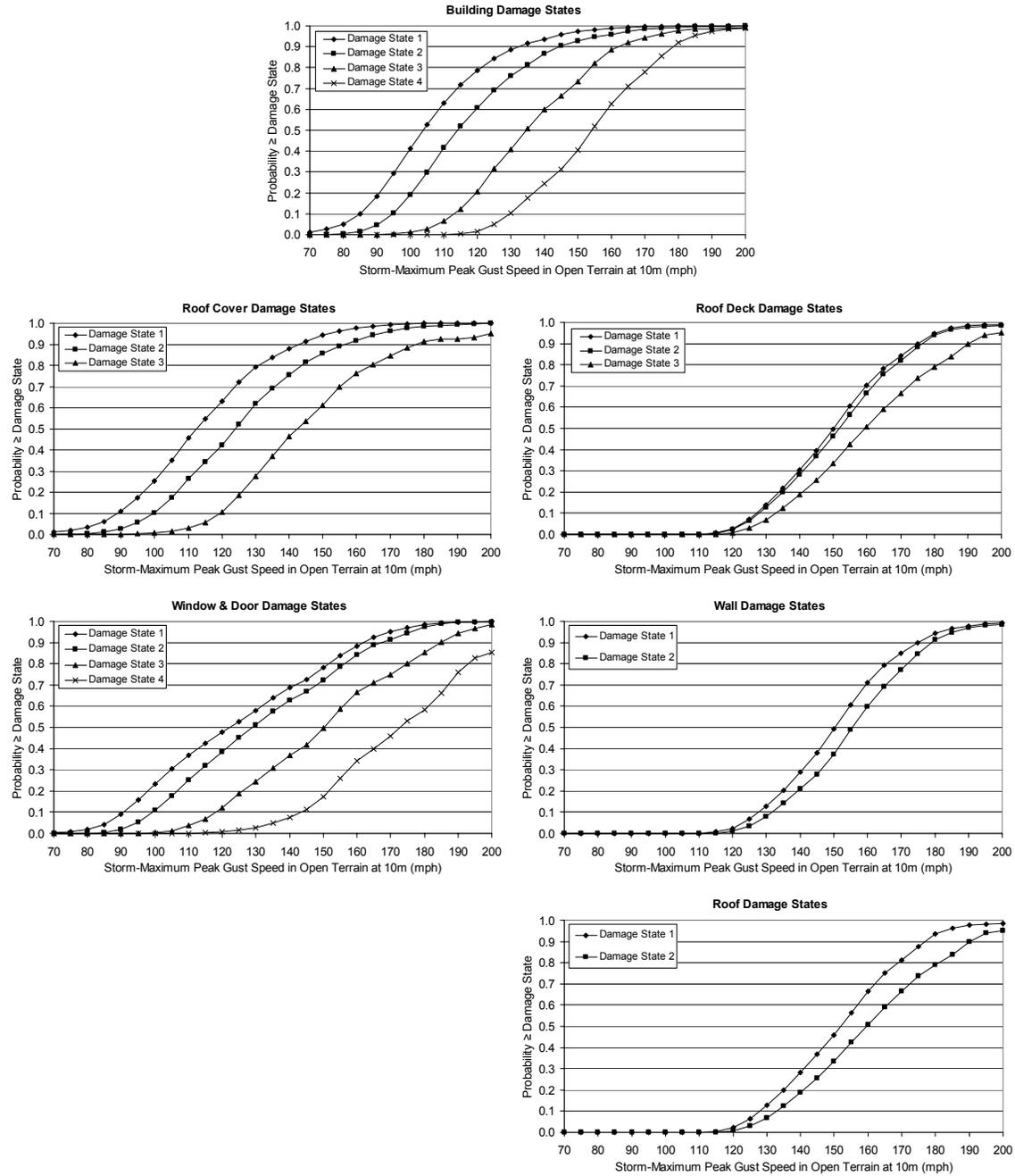
**Figure D.2. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B,  $z_0=0.03$  m.**



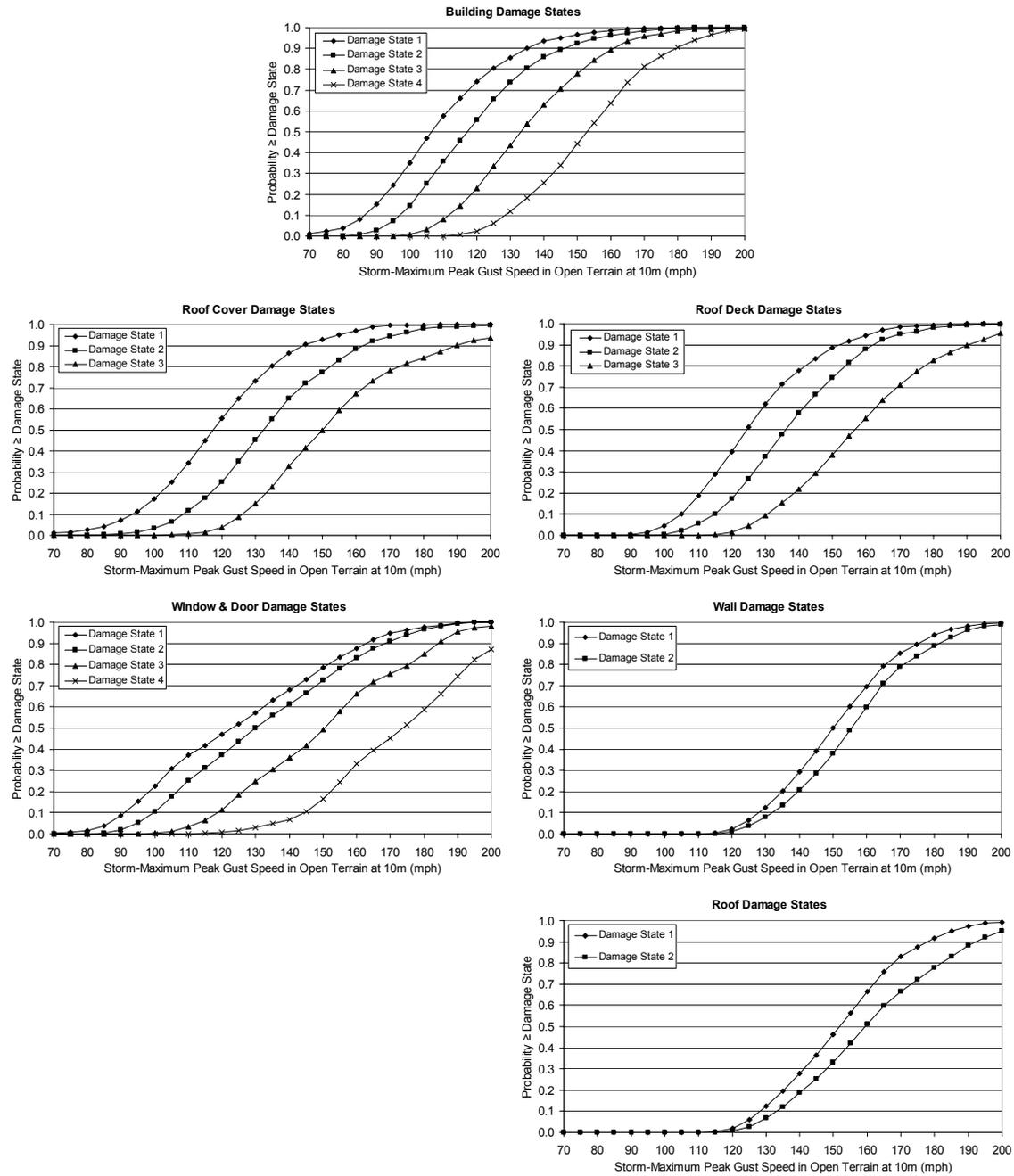
**Figure D.3. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C,  $z_0=0.03$  m.**



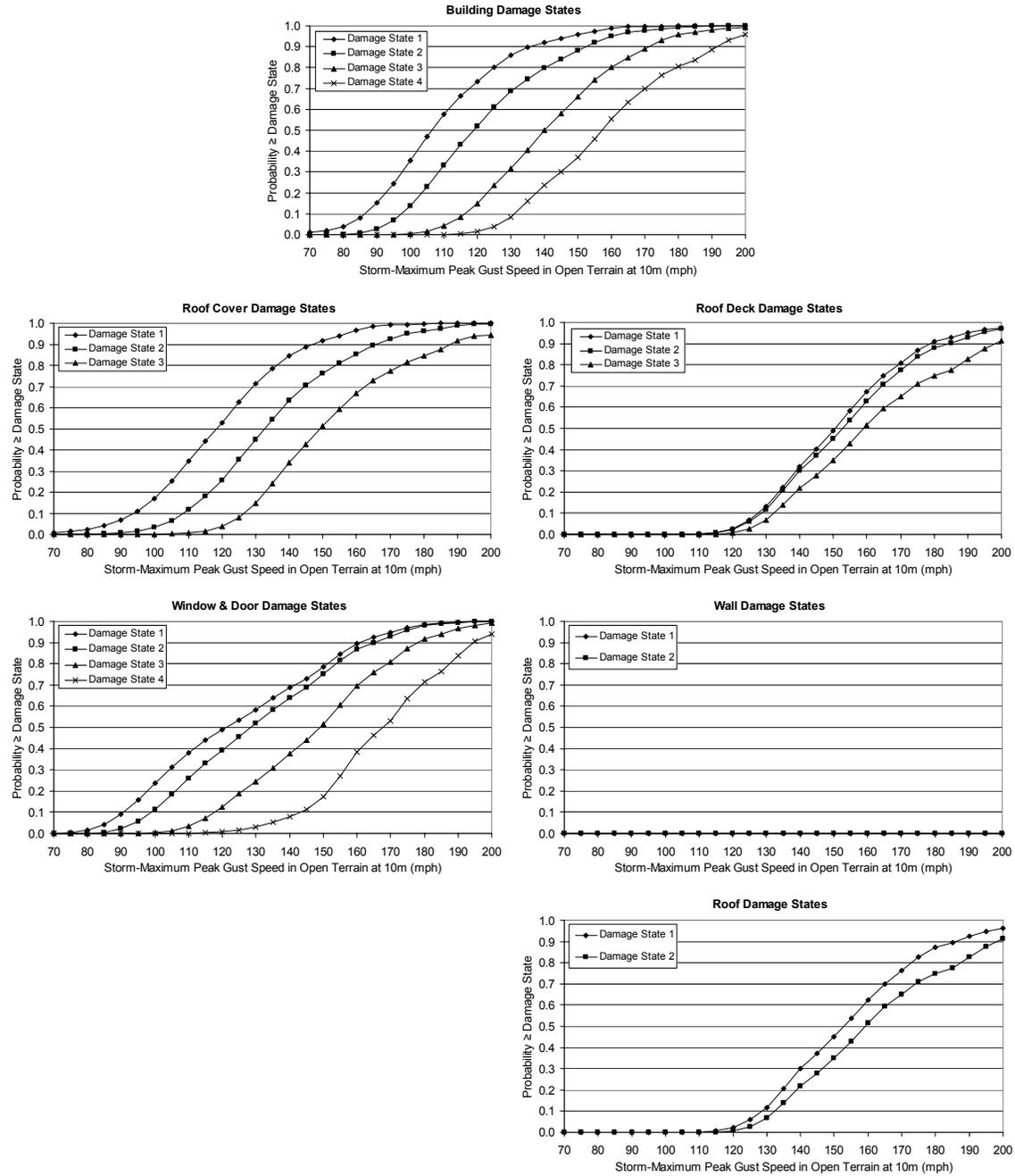
**Figure D.4. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D,  $z_0=0.03$  m.**



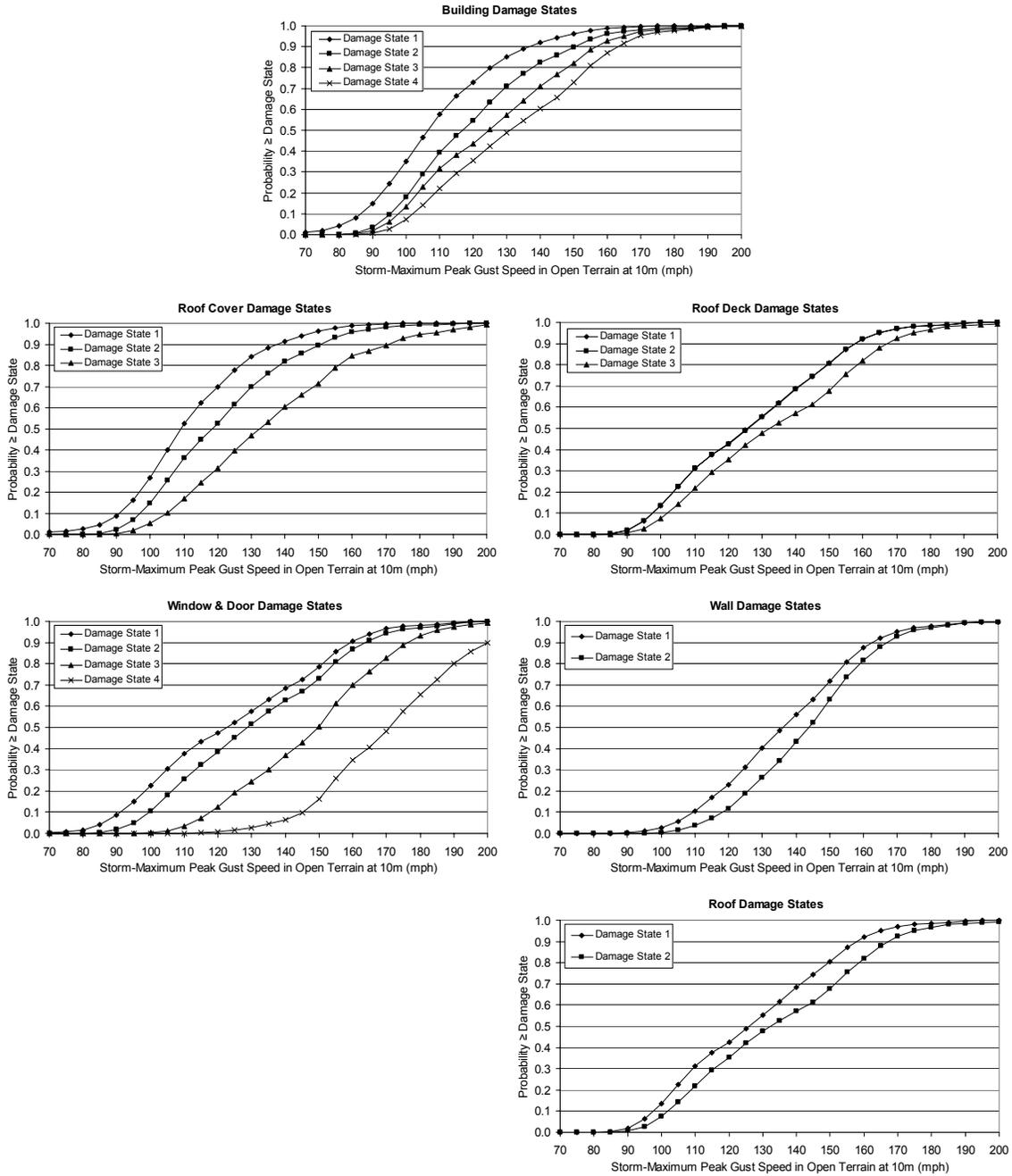
**Figure D.5. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



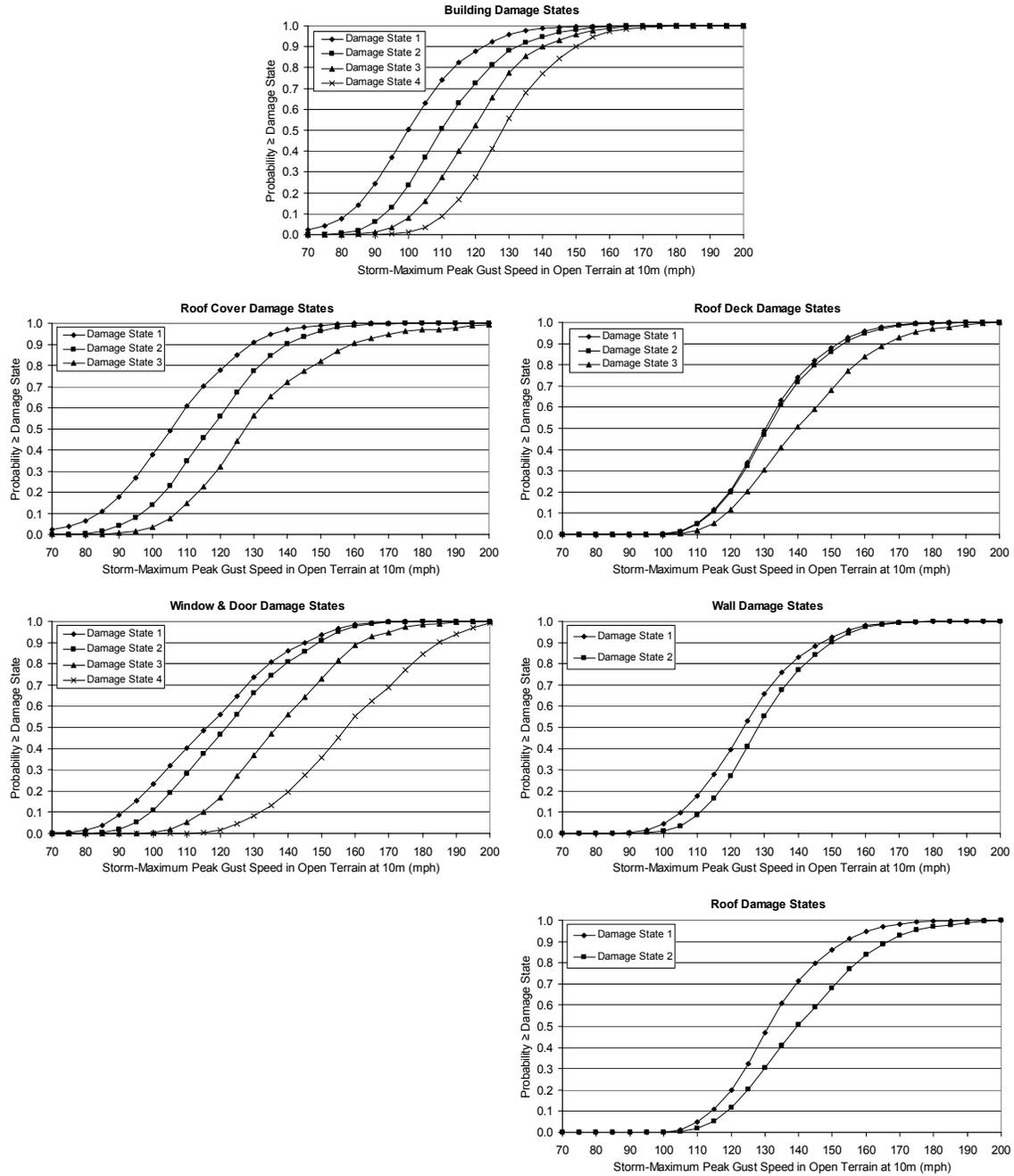
**Figure D.6. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 6d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



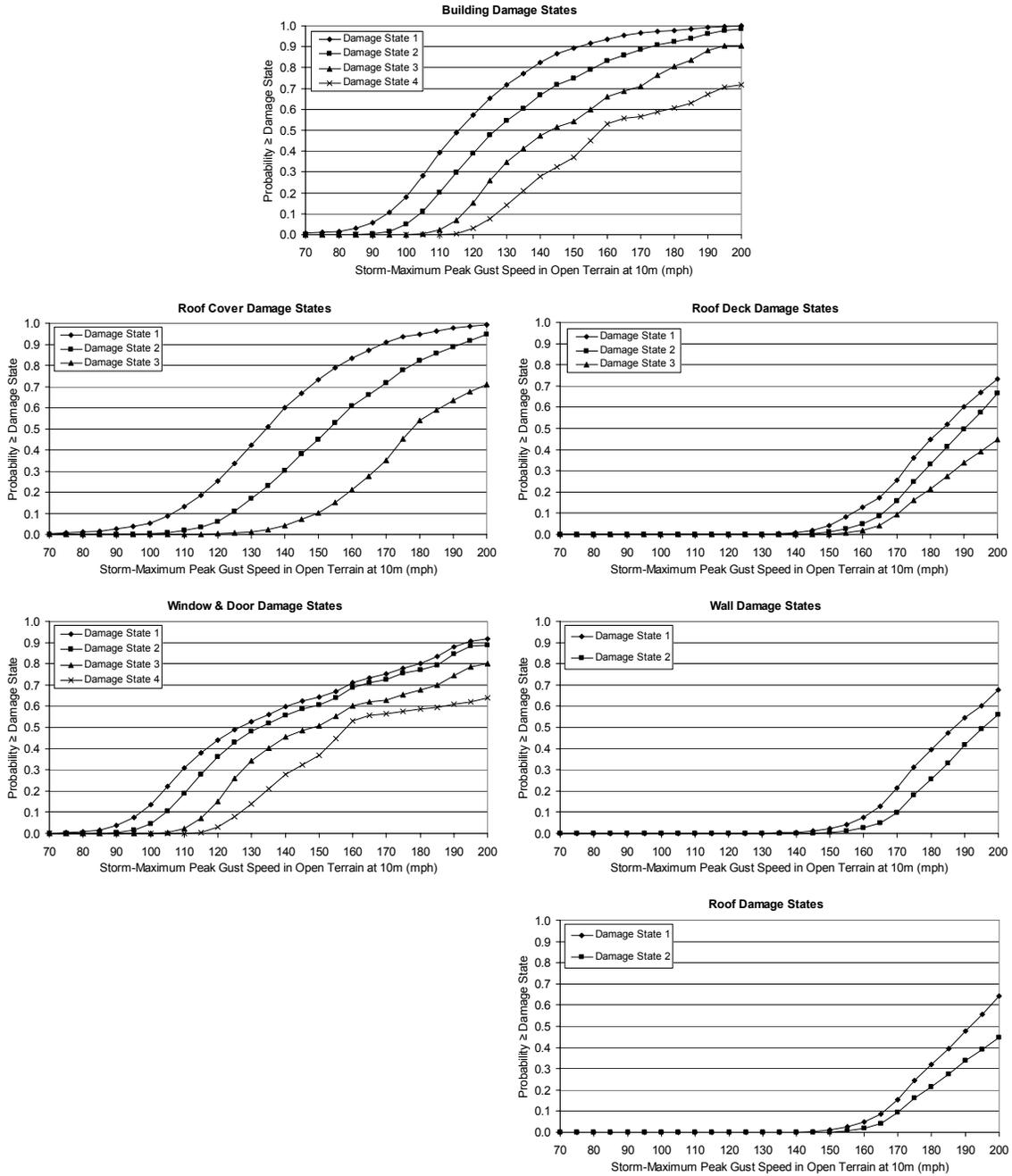
**Figure D.7. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



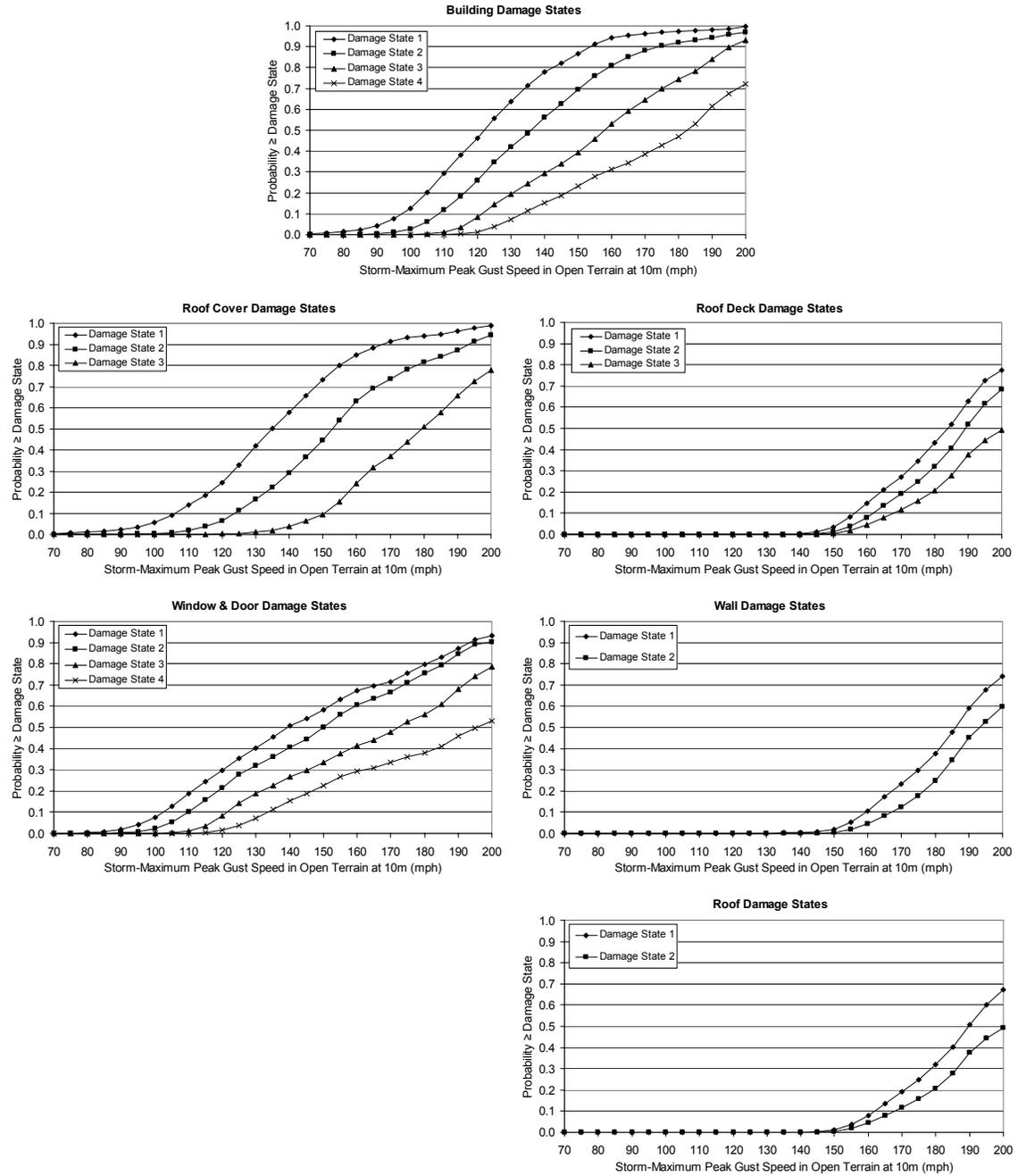
**Figure D.8. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Toe-Nailed Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



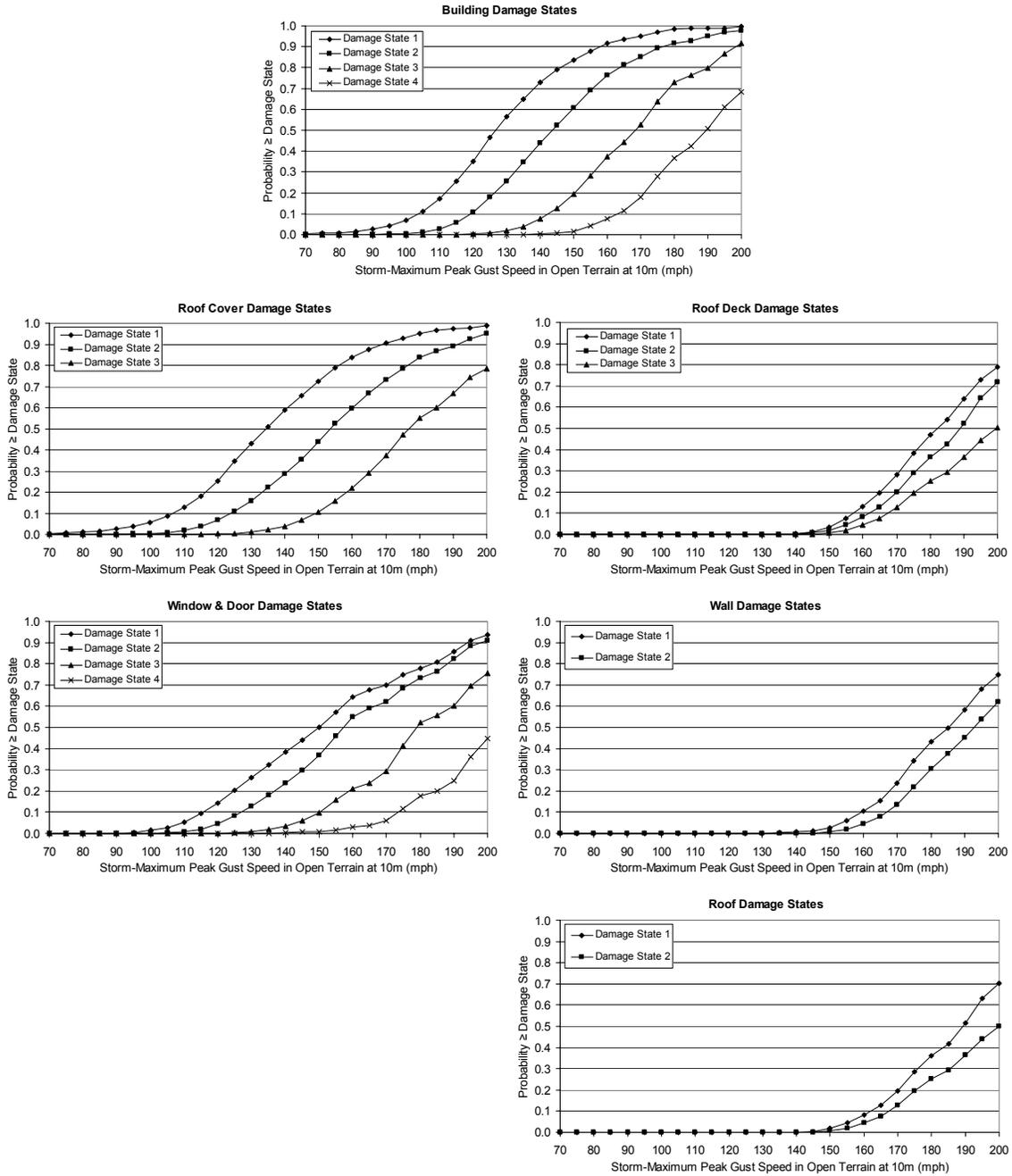
**Figure D.9. Damage States vs. Peak Gust Wind Speed – Strip Mall Building B – Height=20', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



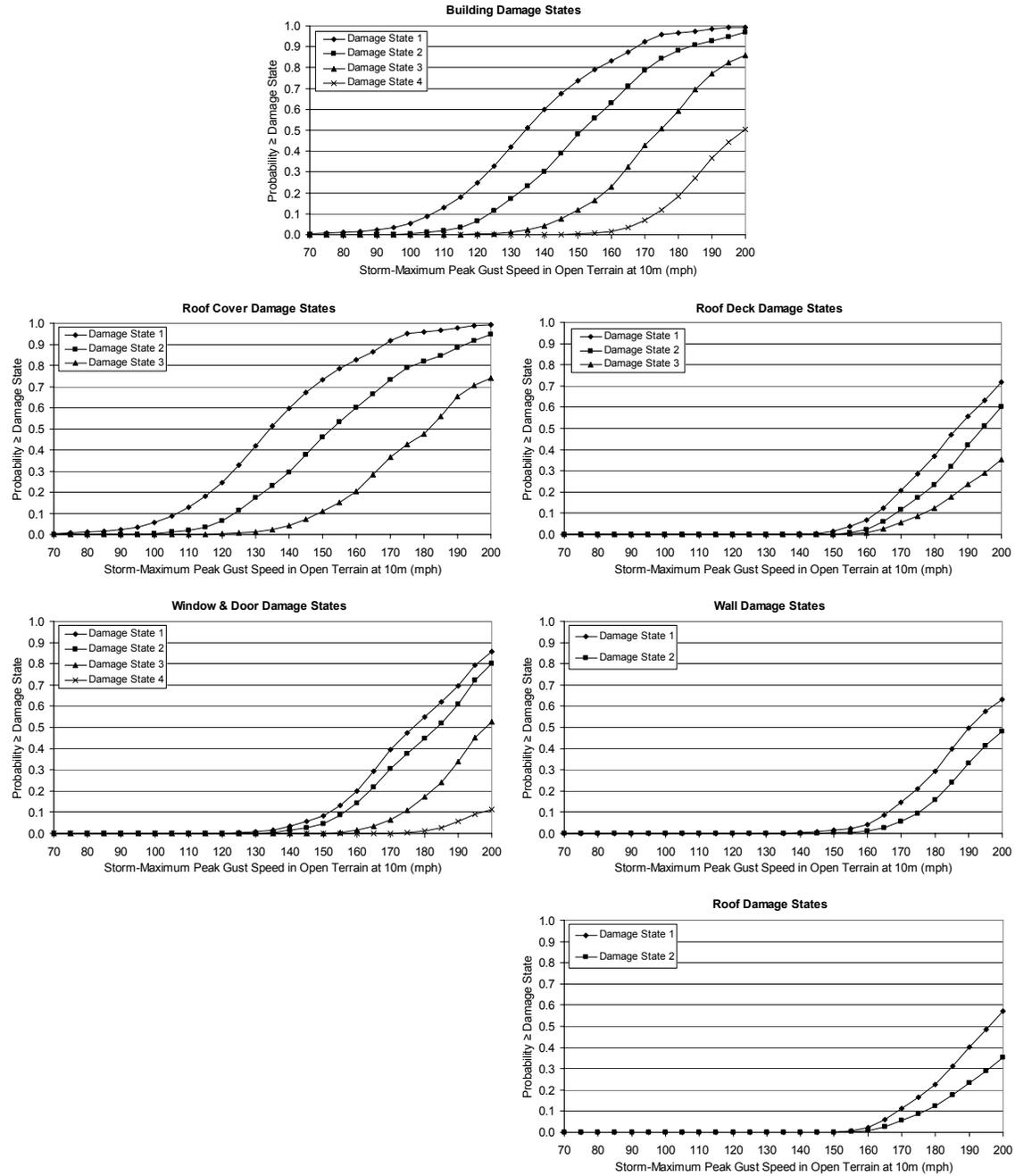
**Figure D.10. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



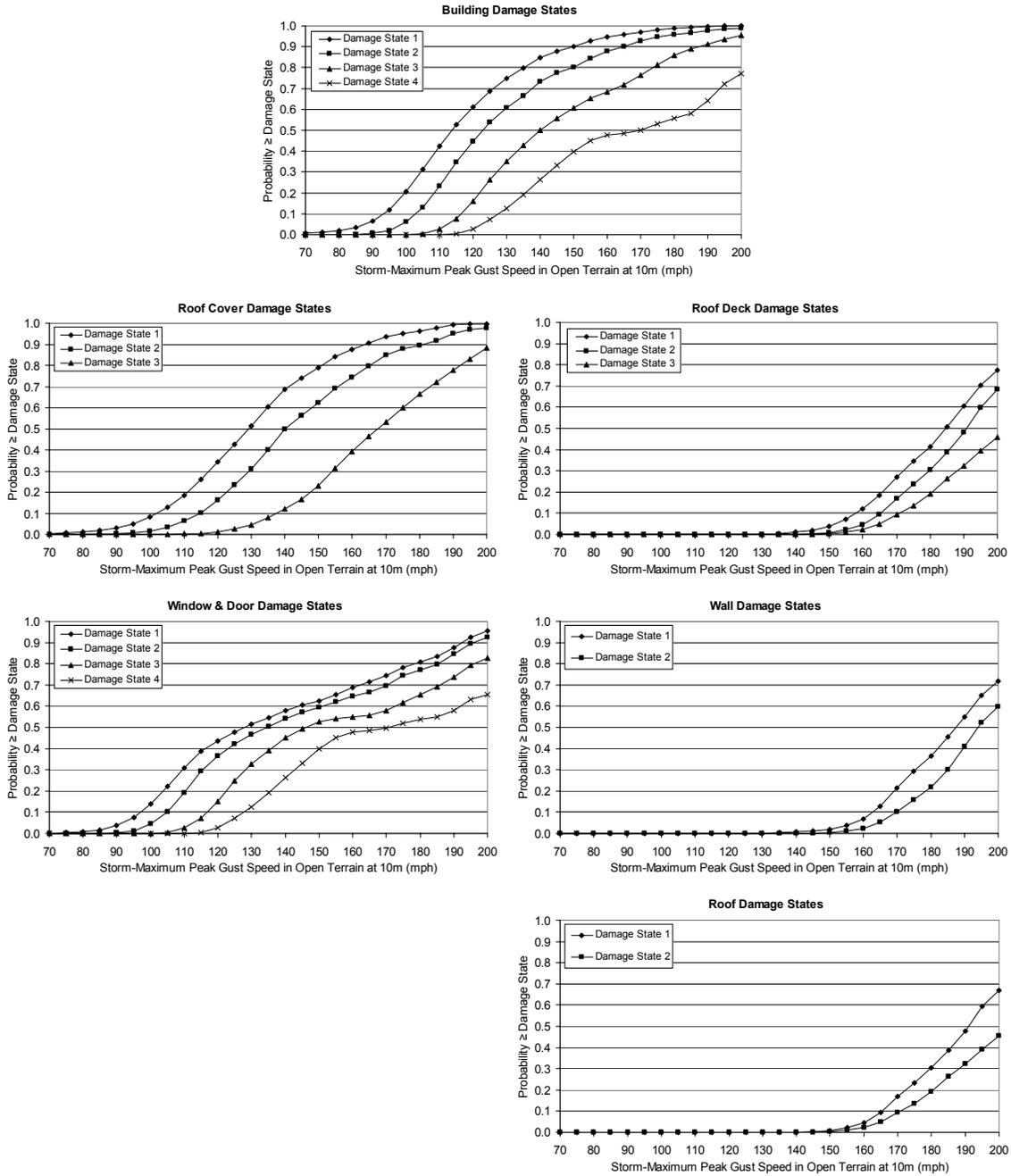
**Figure D.11. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B,  $z_0=0.35$  m.**



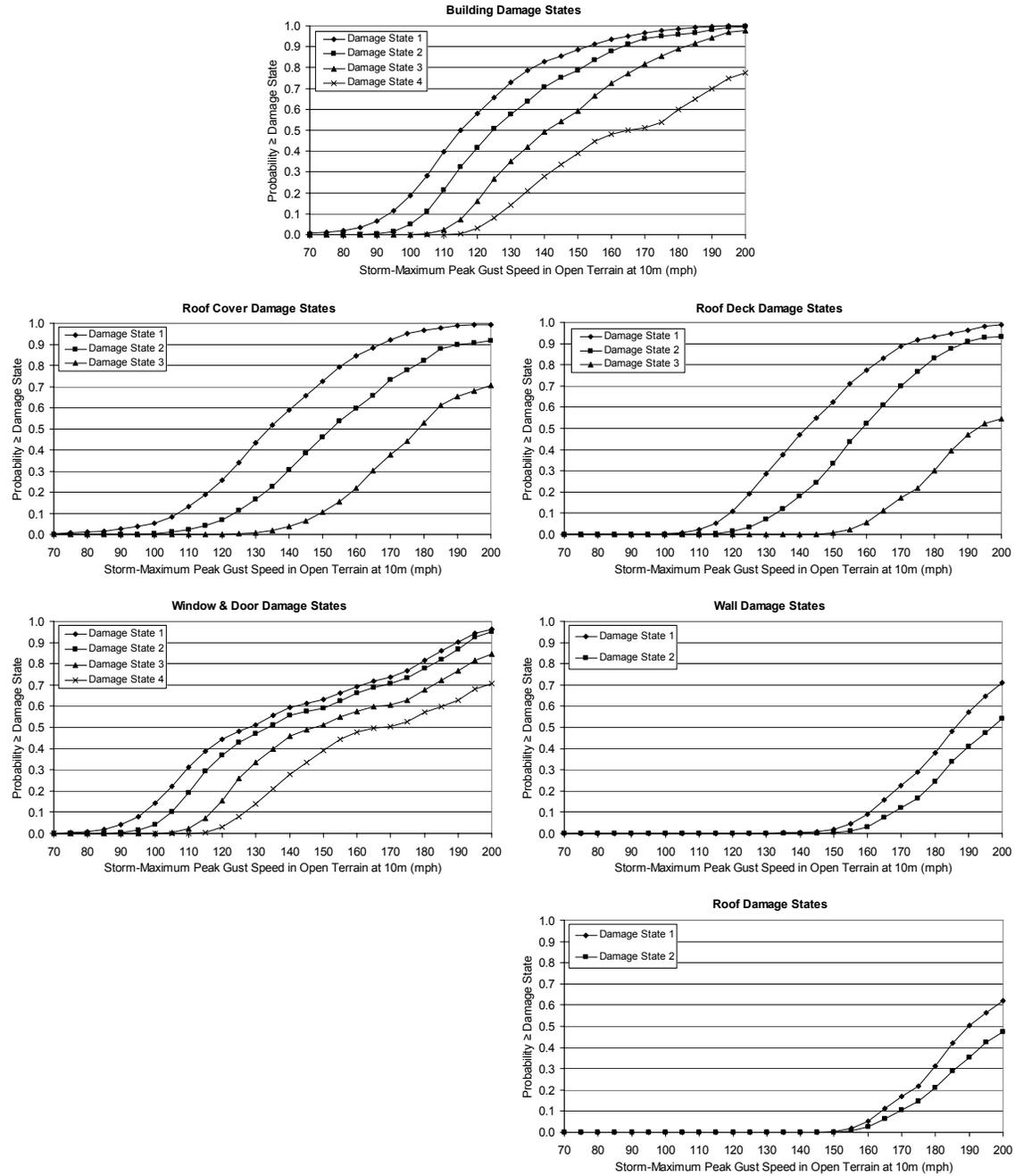
**Figure D.12. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C,  $z_0=0.35$  m.**



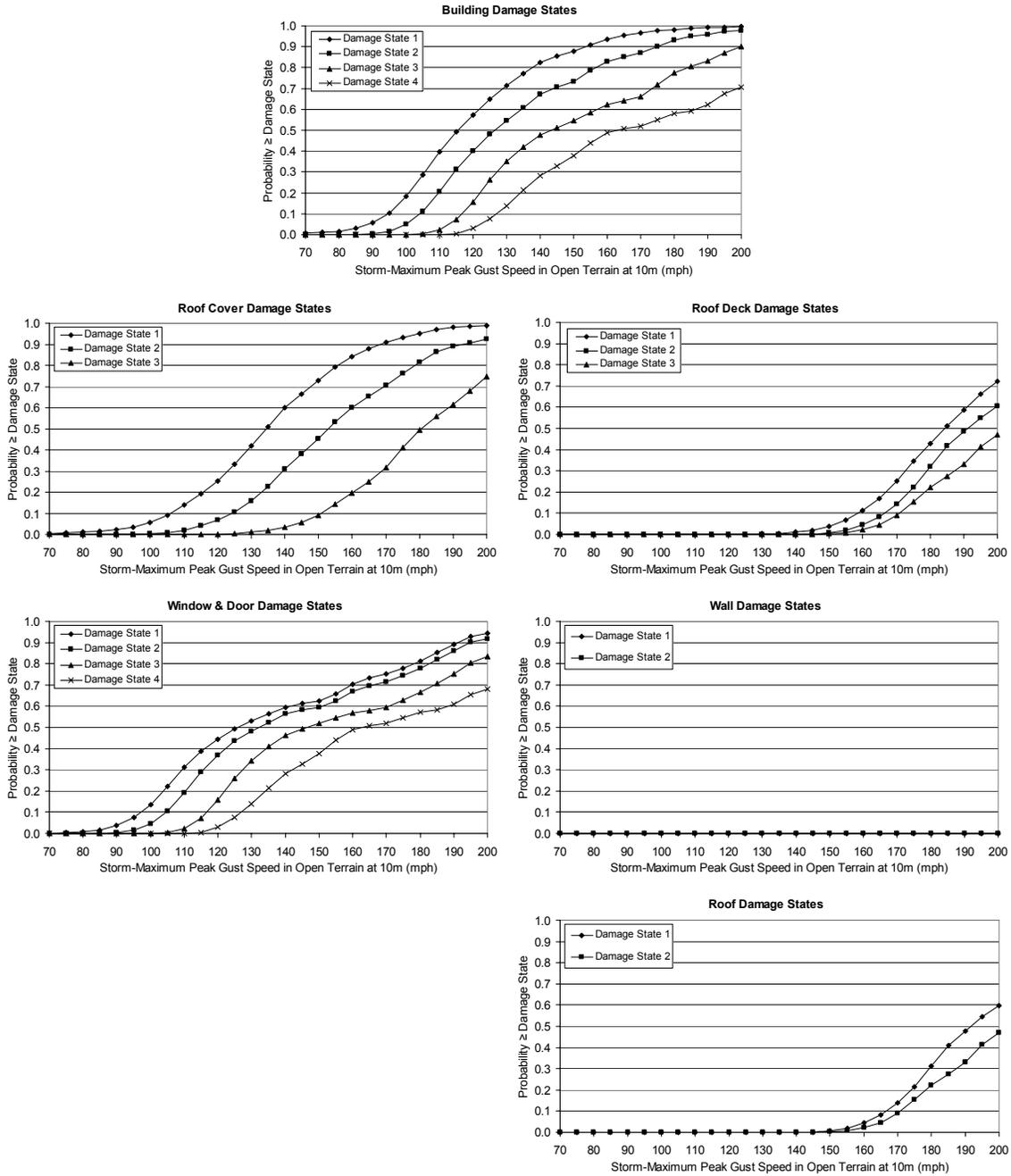
**Figure D.13. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D,  $z_0=0.35$  m.**



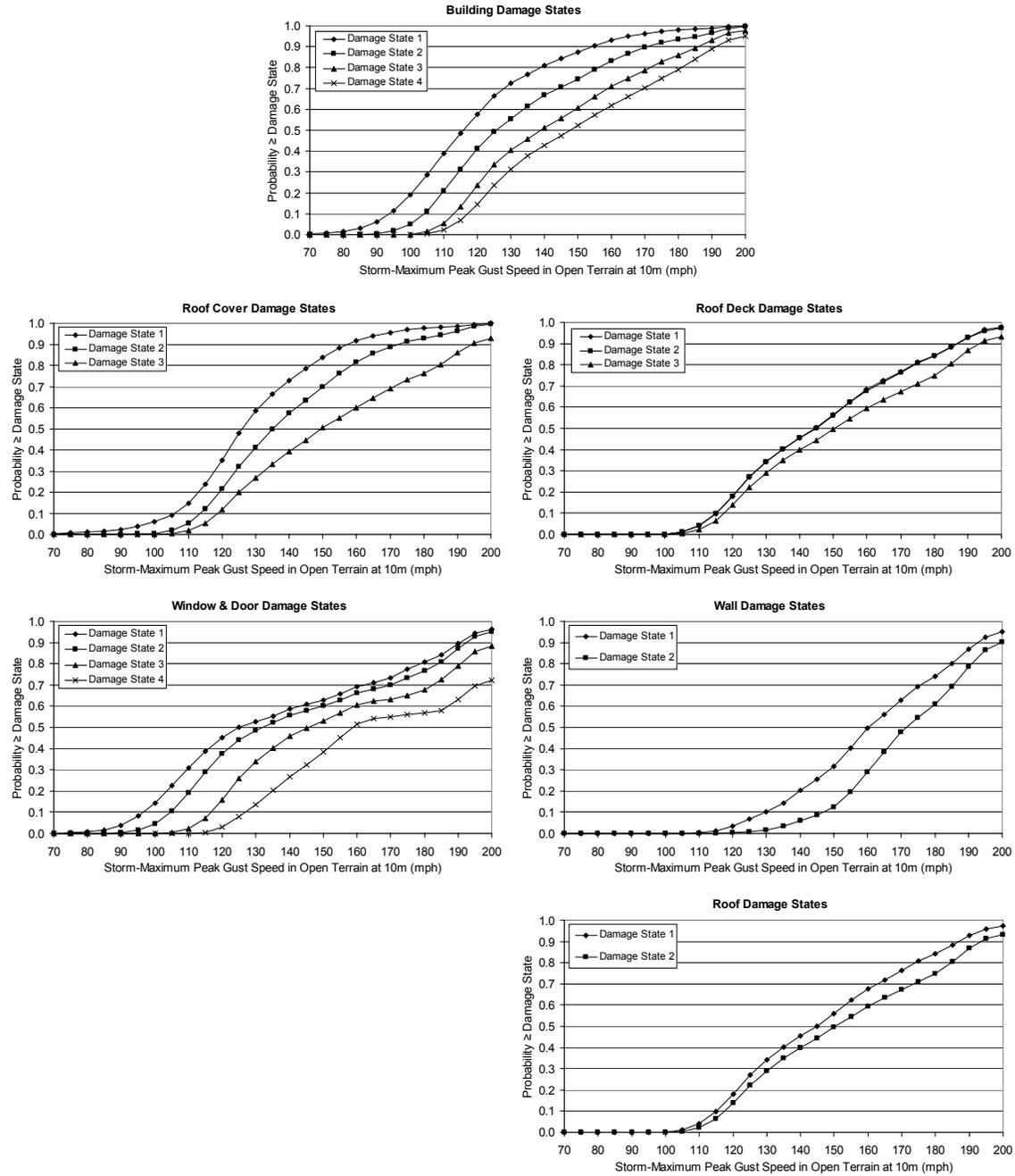
**Figure D.14. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



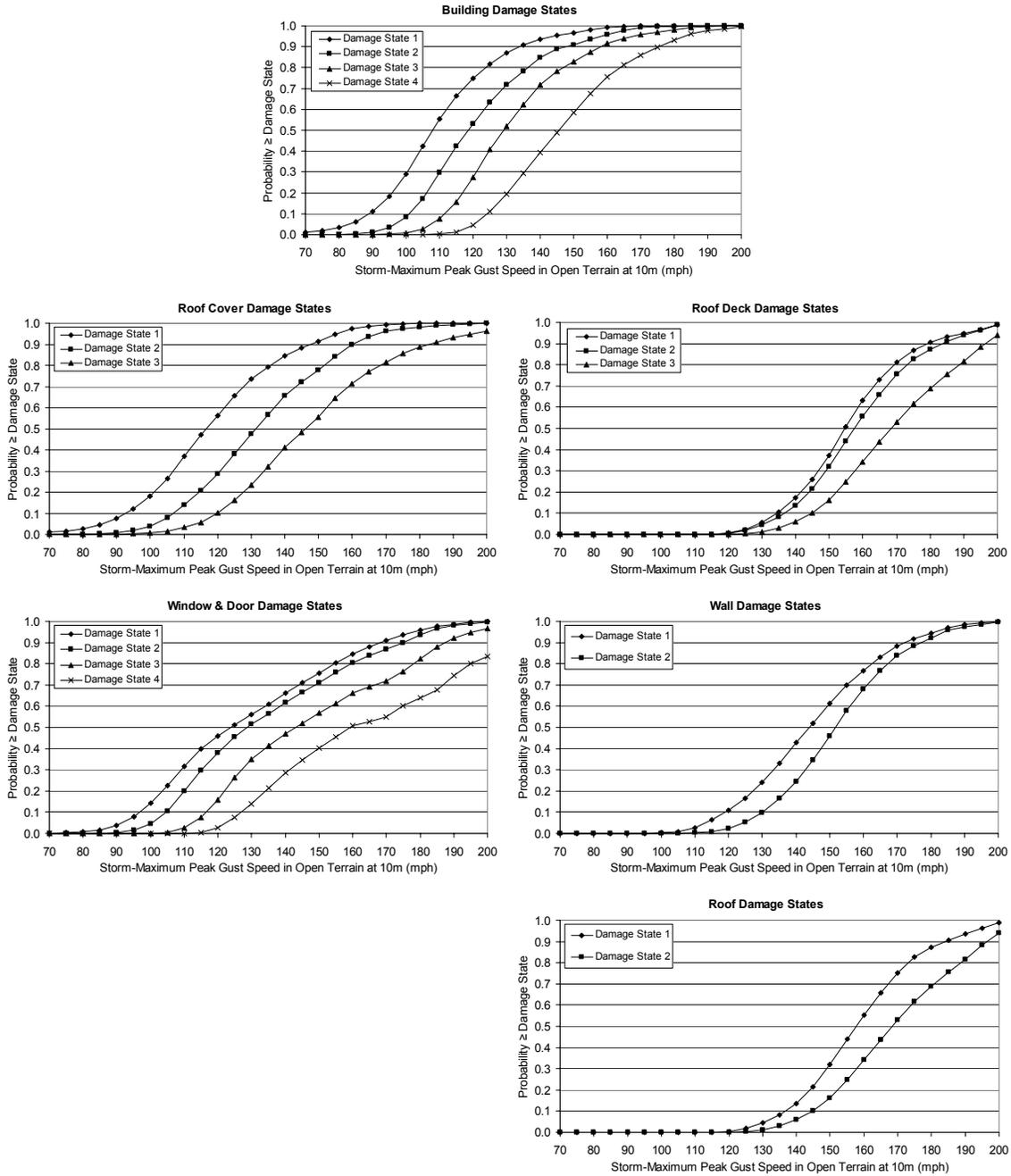
**Figure D.15. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 6d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



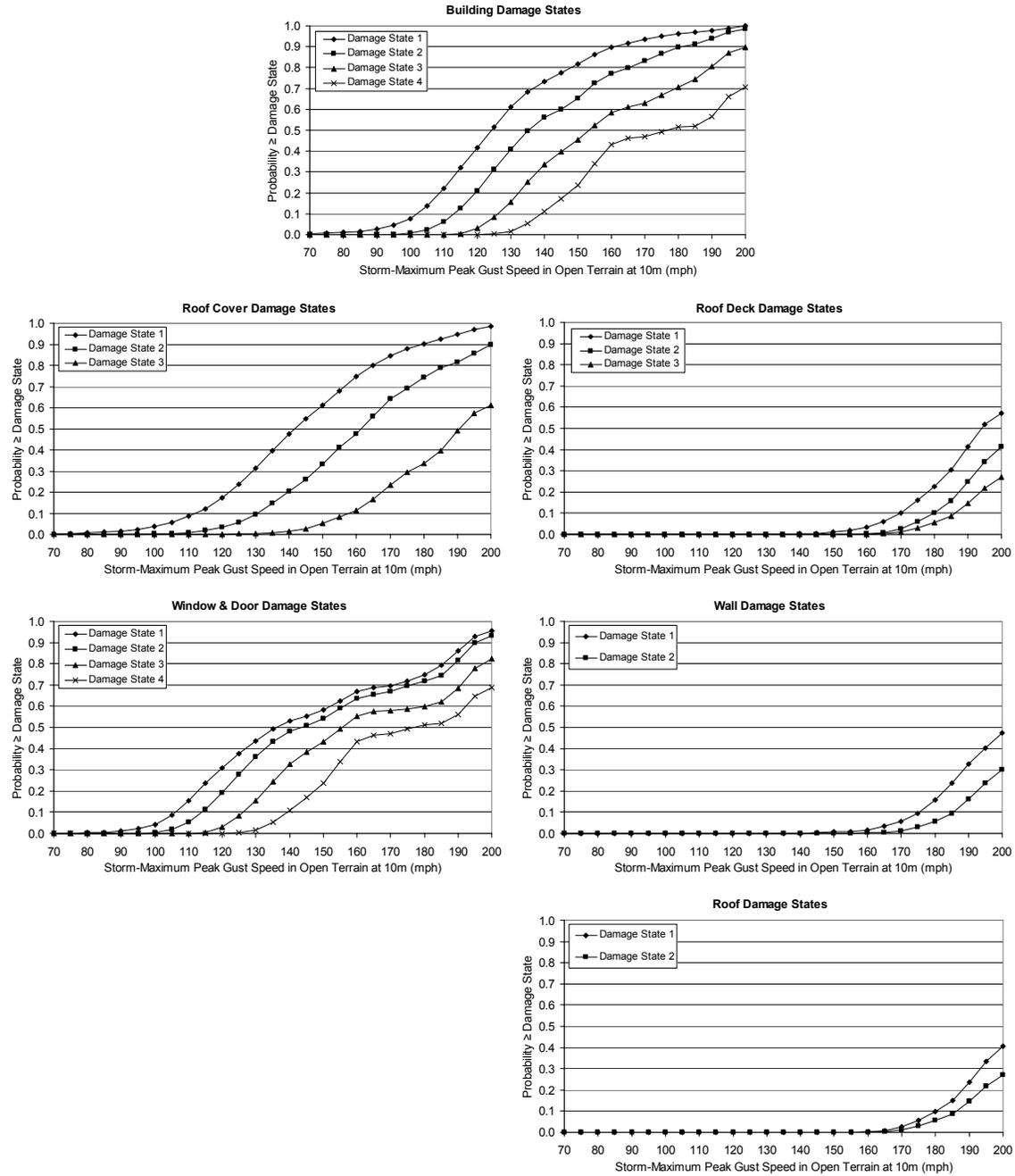
**Figure D.16. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



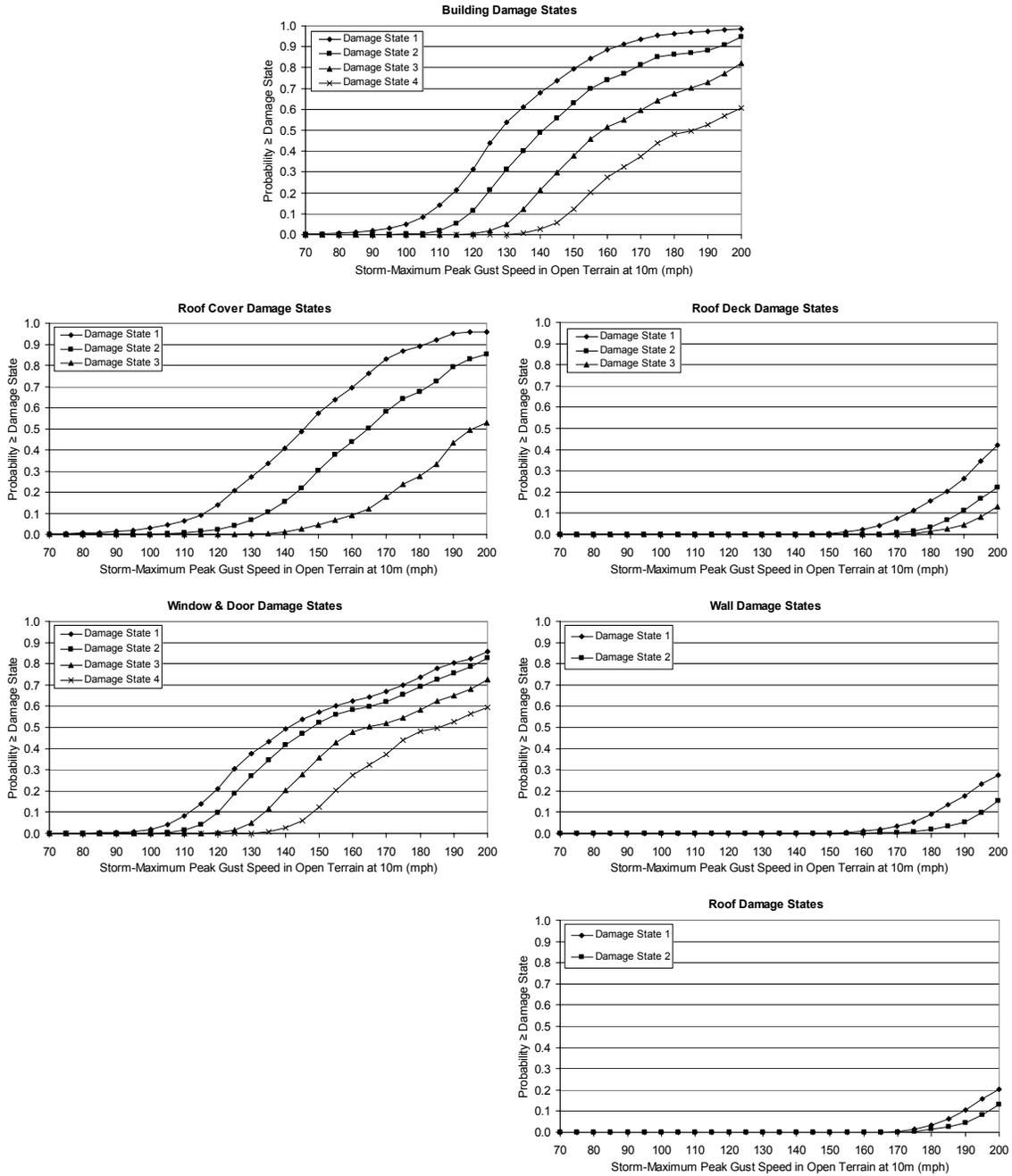
**Figure D.17. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Toe-Nailed Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



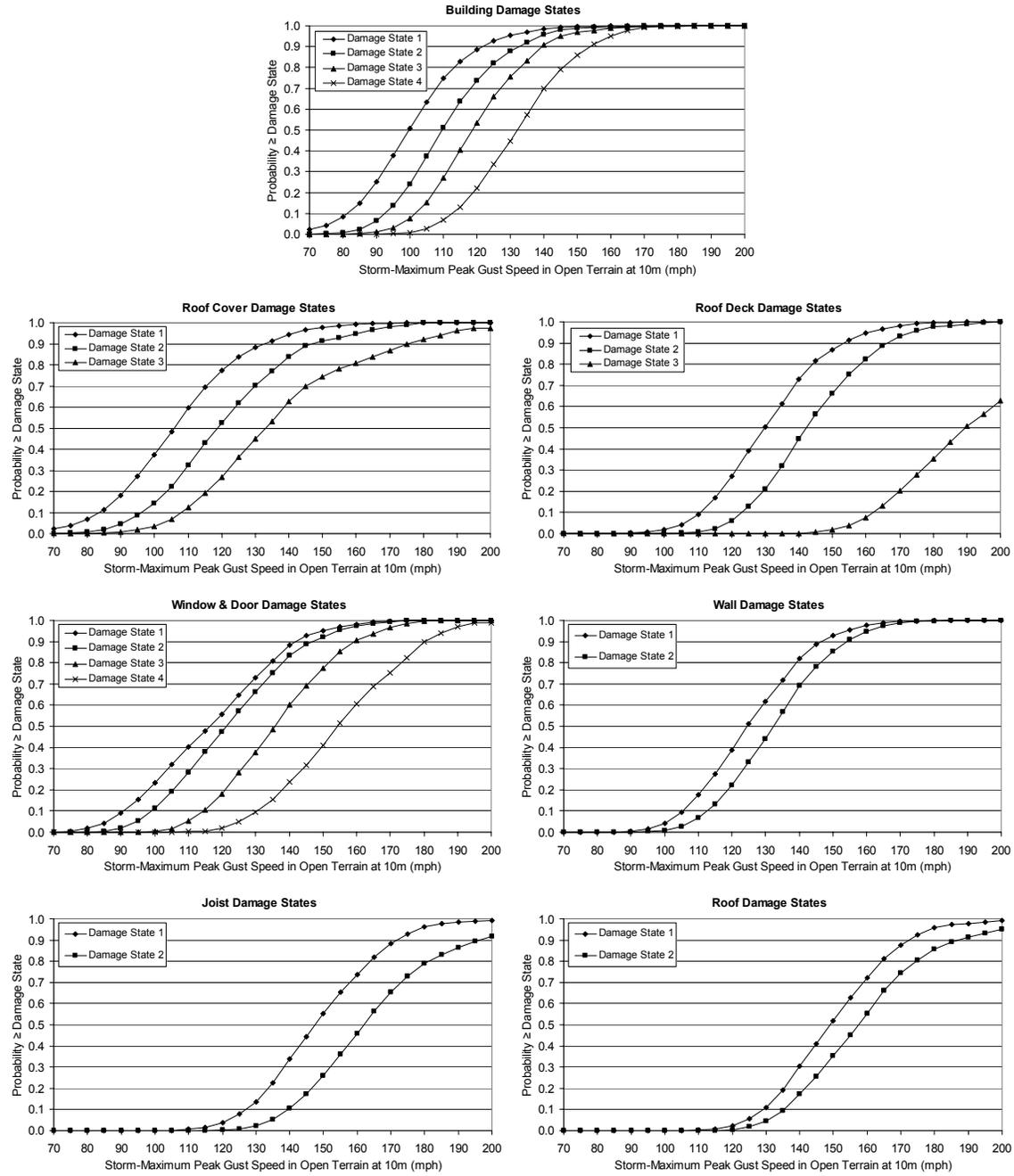
**Figure D.18. Damage States vs. Peak Gust Wind Speed – Strip Mall Building B – Height=20', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



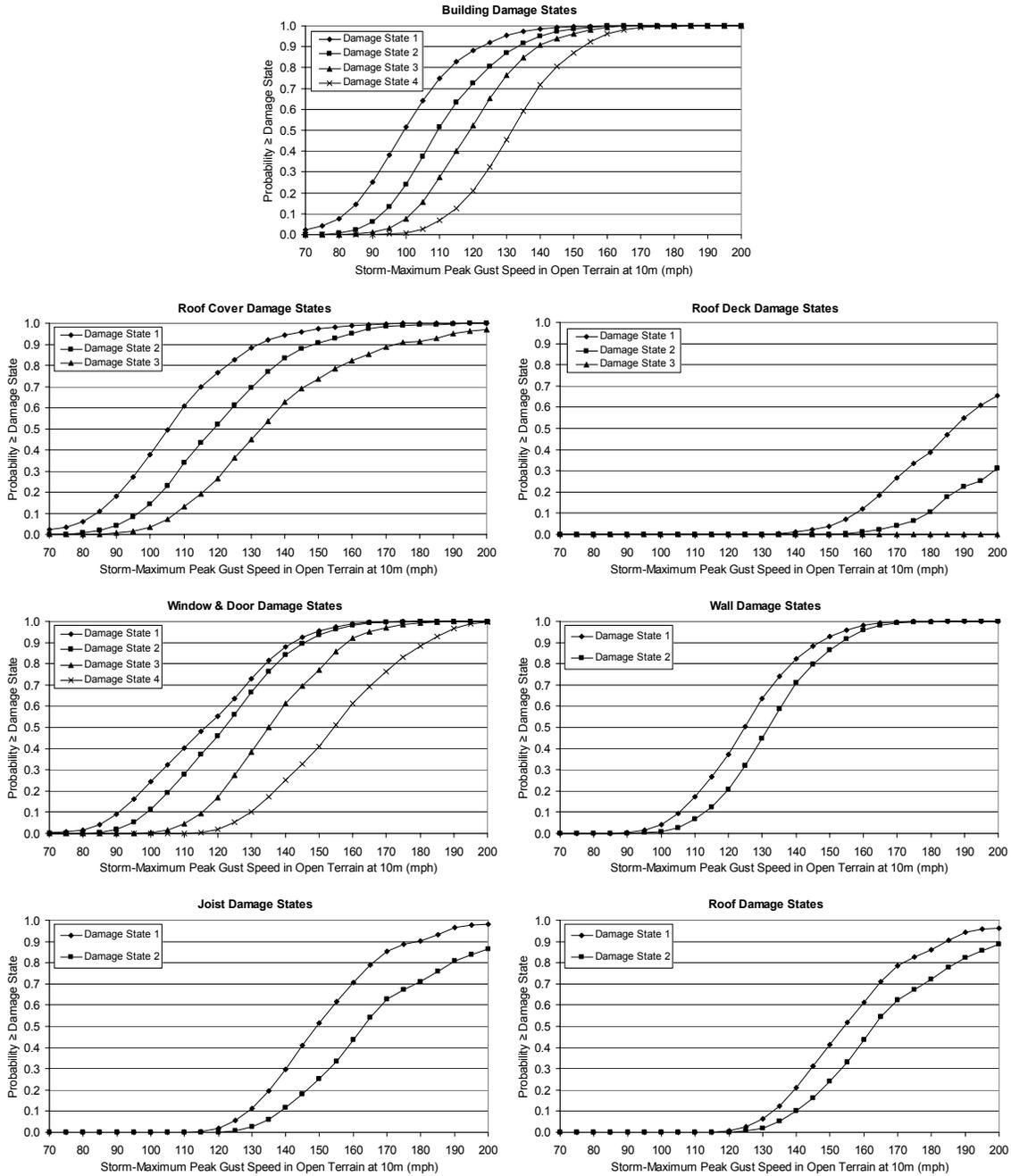
**Figure D.19. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.70$  m.**



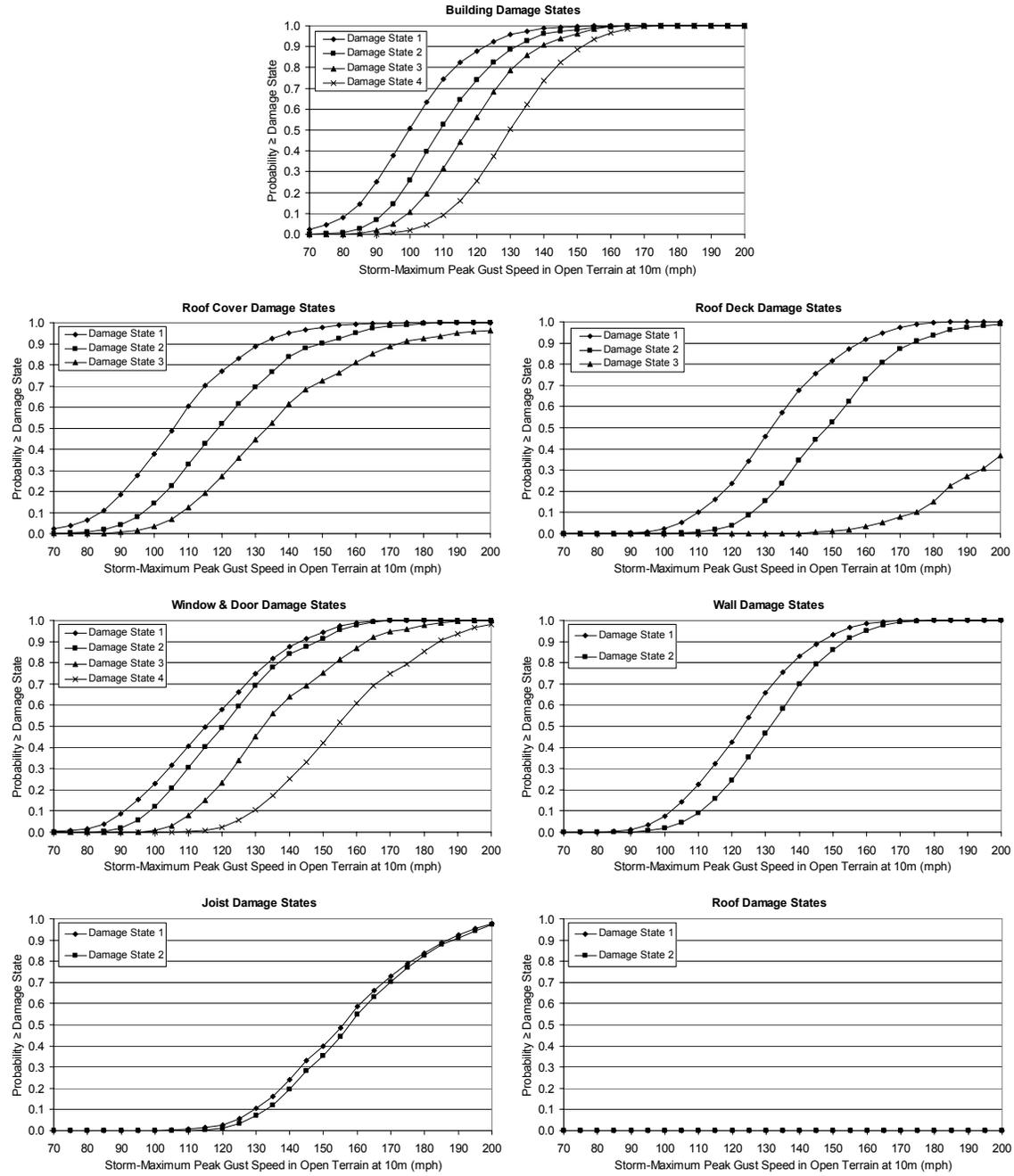
**Figure D.20. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=1.0$  m.**



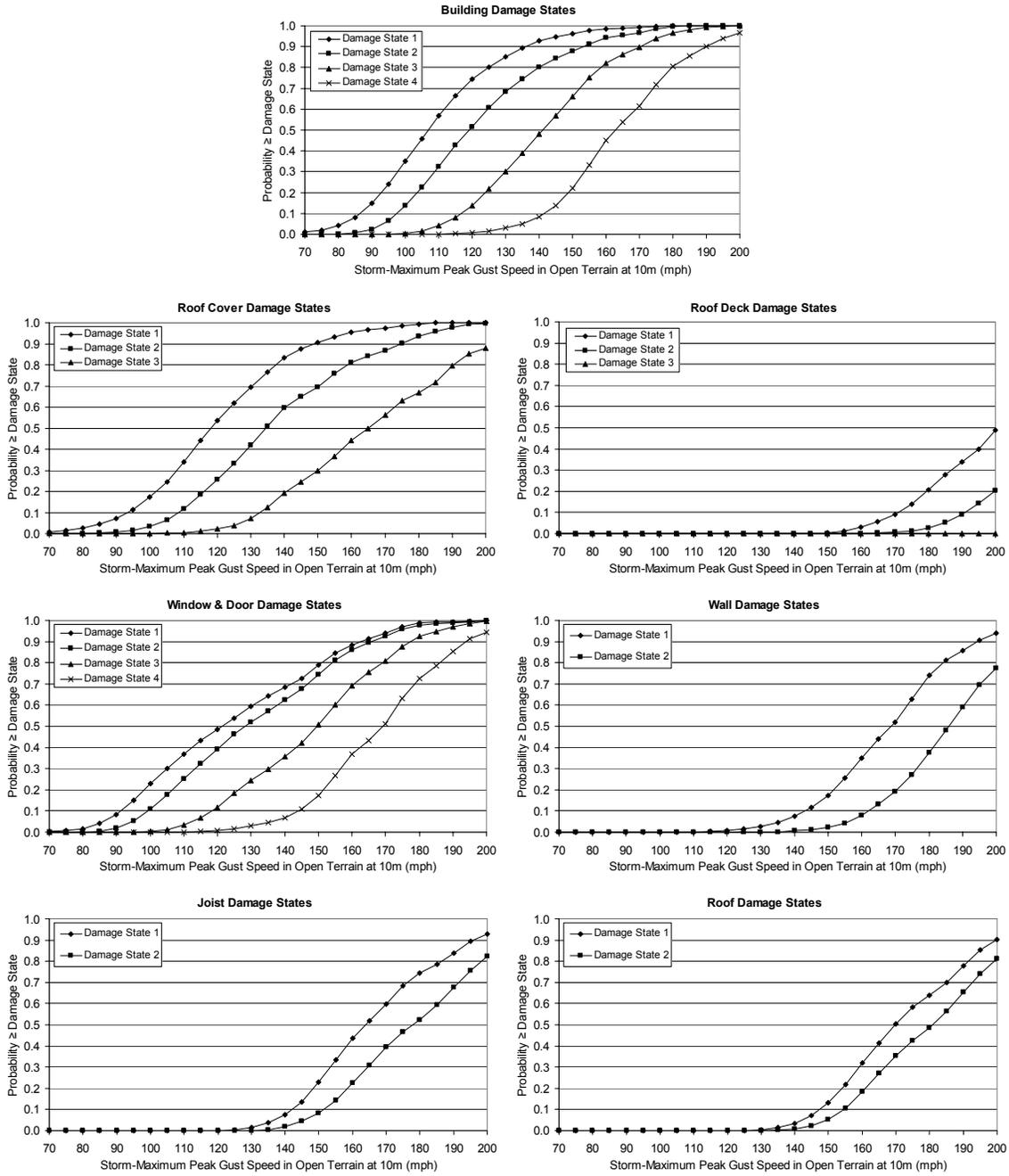
**Figure D.21. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



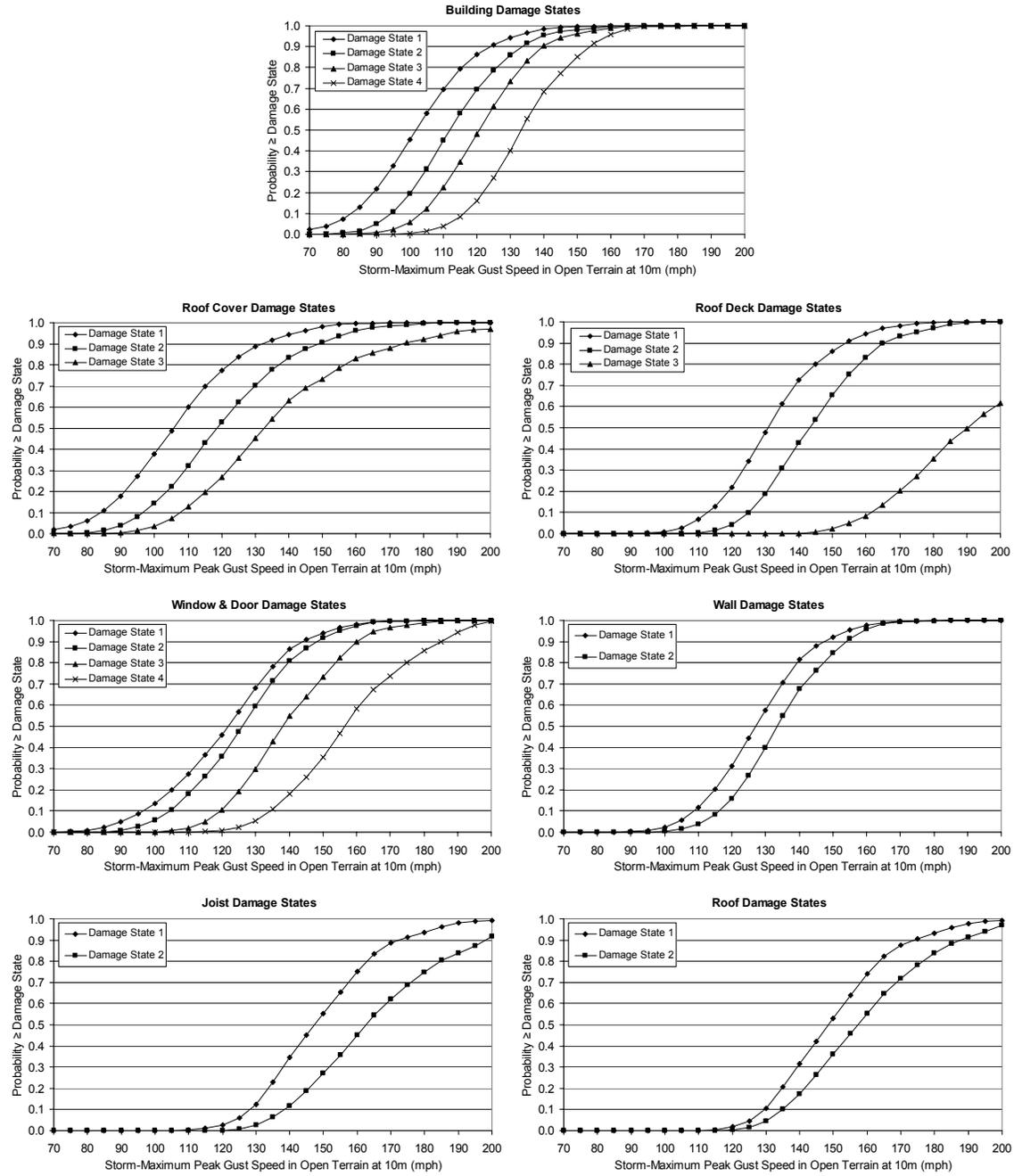
**Figure D.22. Damage States vs. Peak Gust Wind Speed – Strip Mall Building B – Height=20', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



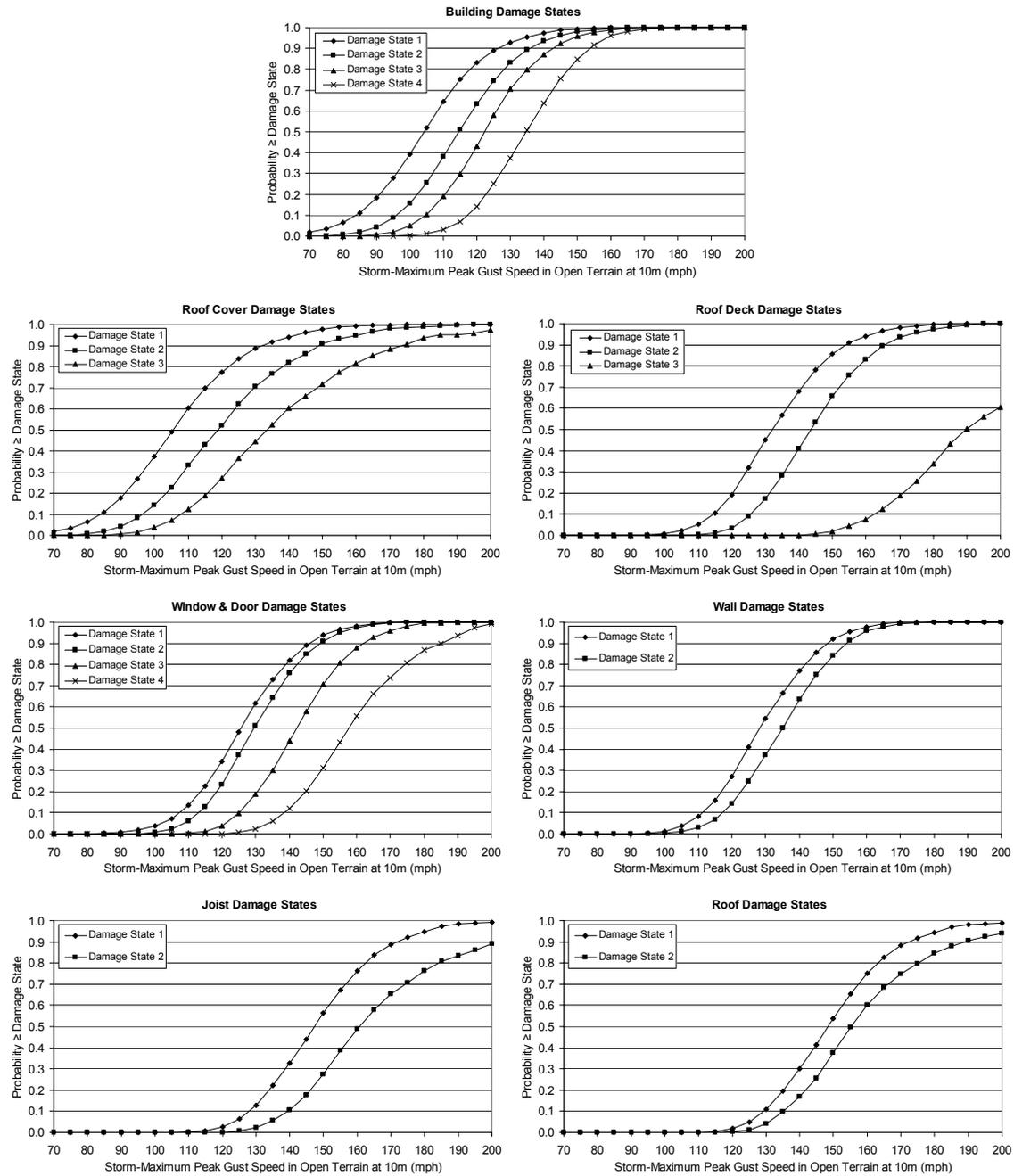
**Figure D.23. Damage States vs. Peak Gust Wind Speed – Strip Mall Building D – Height=20', No. of Units=1, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



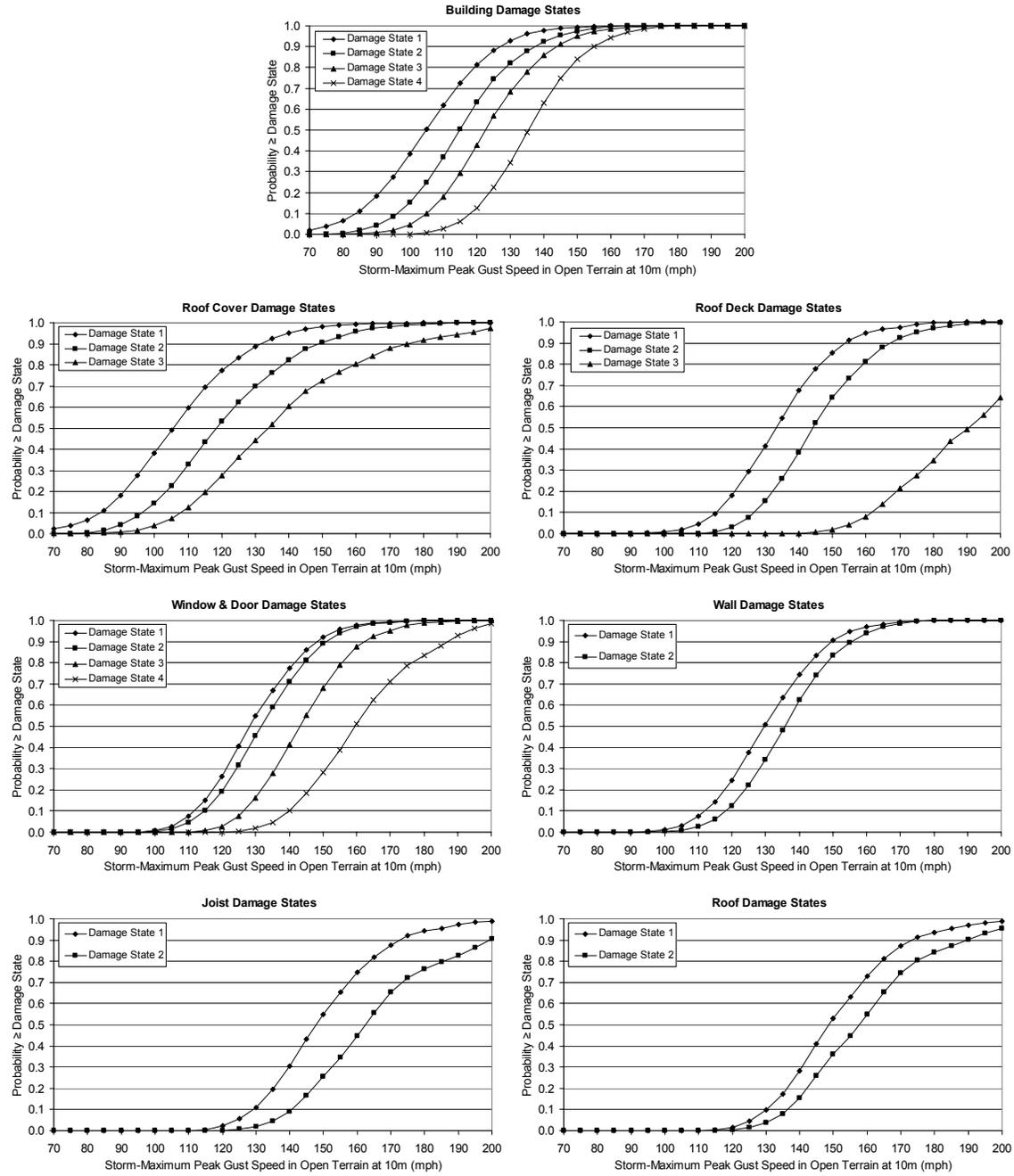
**Figure D.24. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



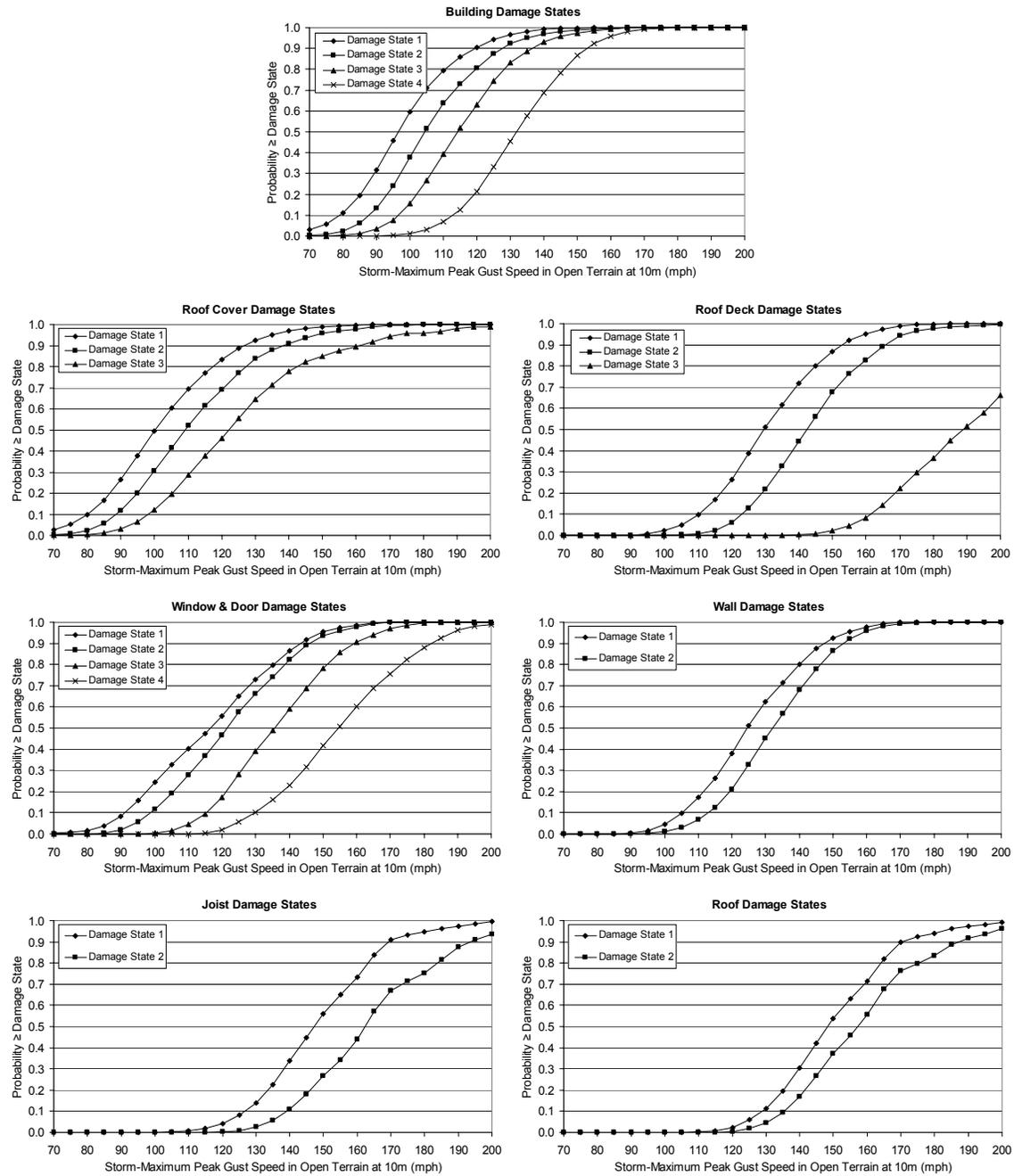
**Figure D.25. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B,  $z_0=0.03$  m.**



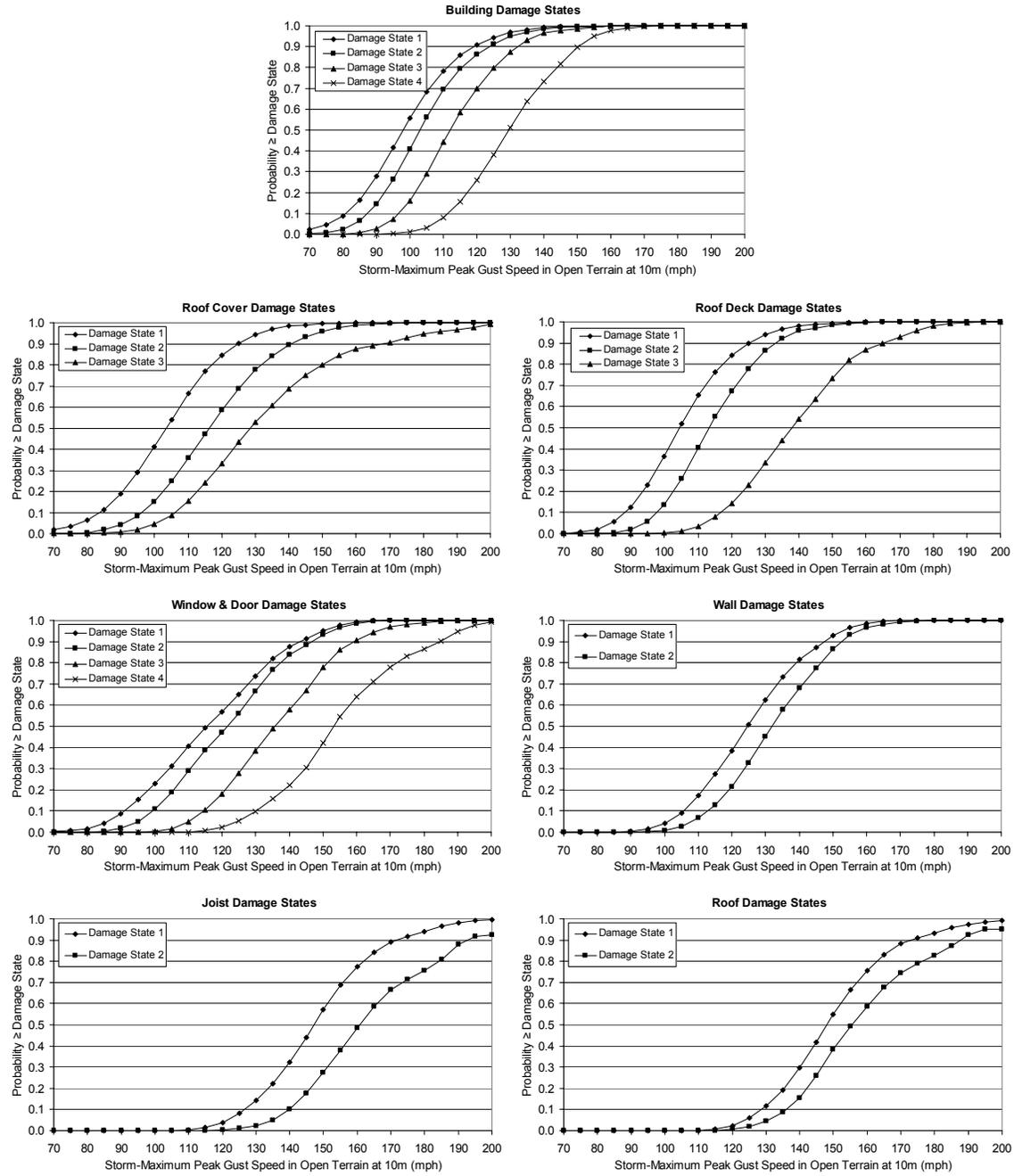
**Figure D.26. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C,  $z_0=0.03$  m.**



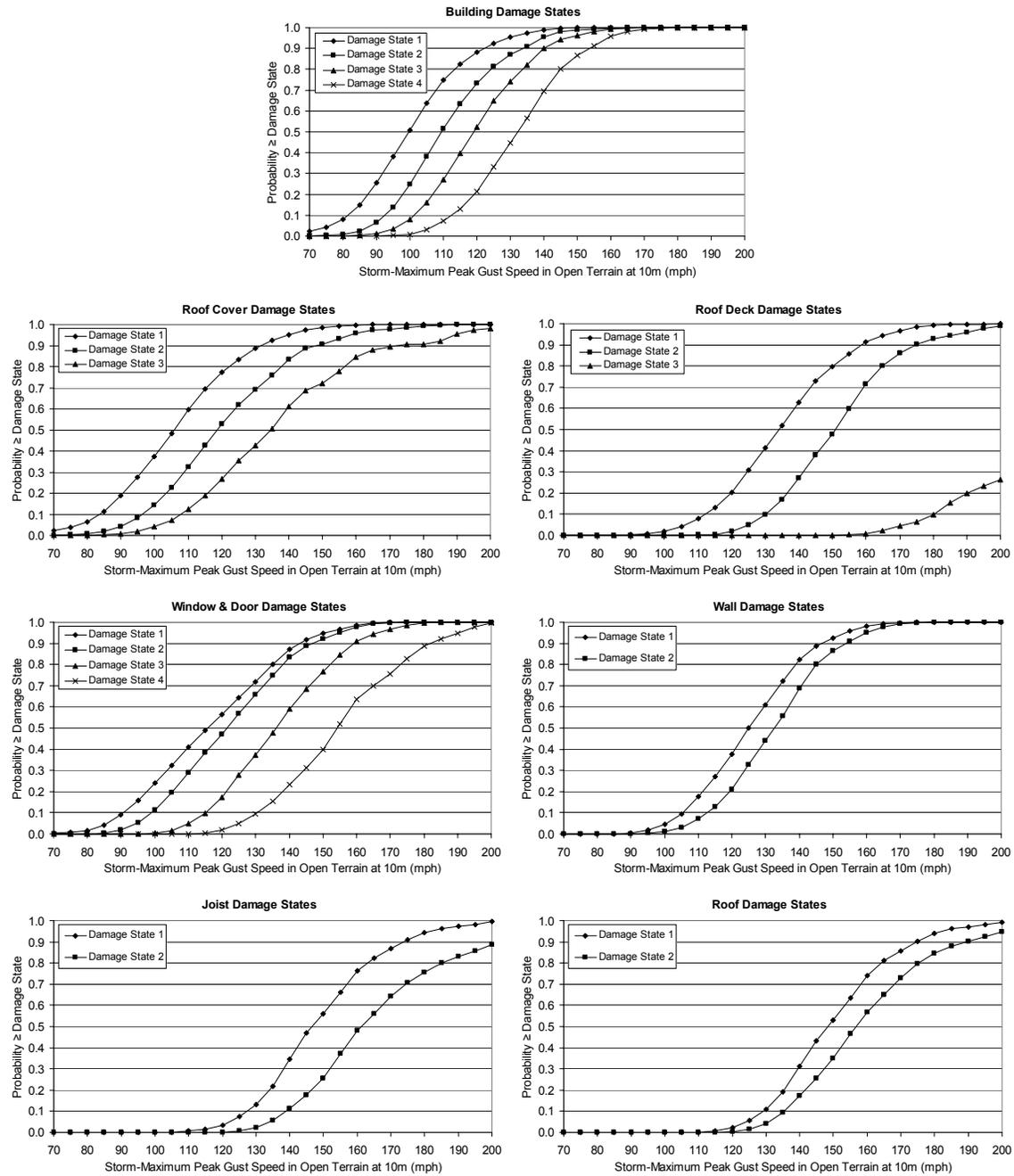
**Figure D.27. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D,  $z_0=0.03$  m.**



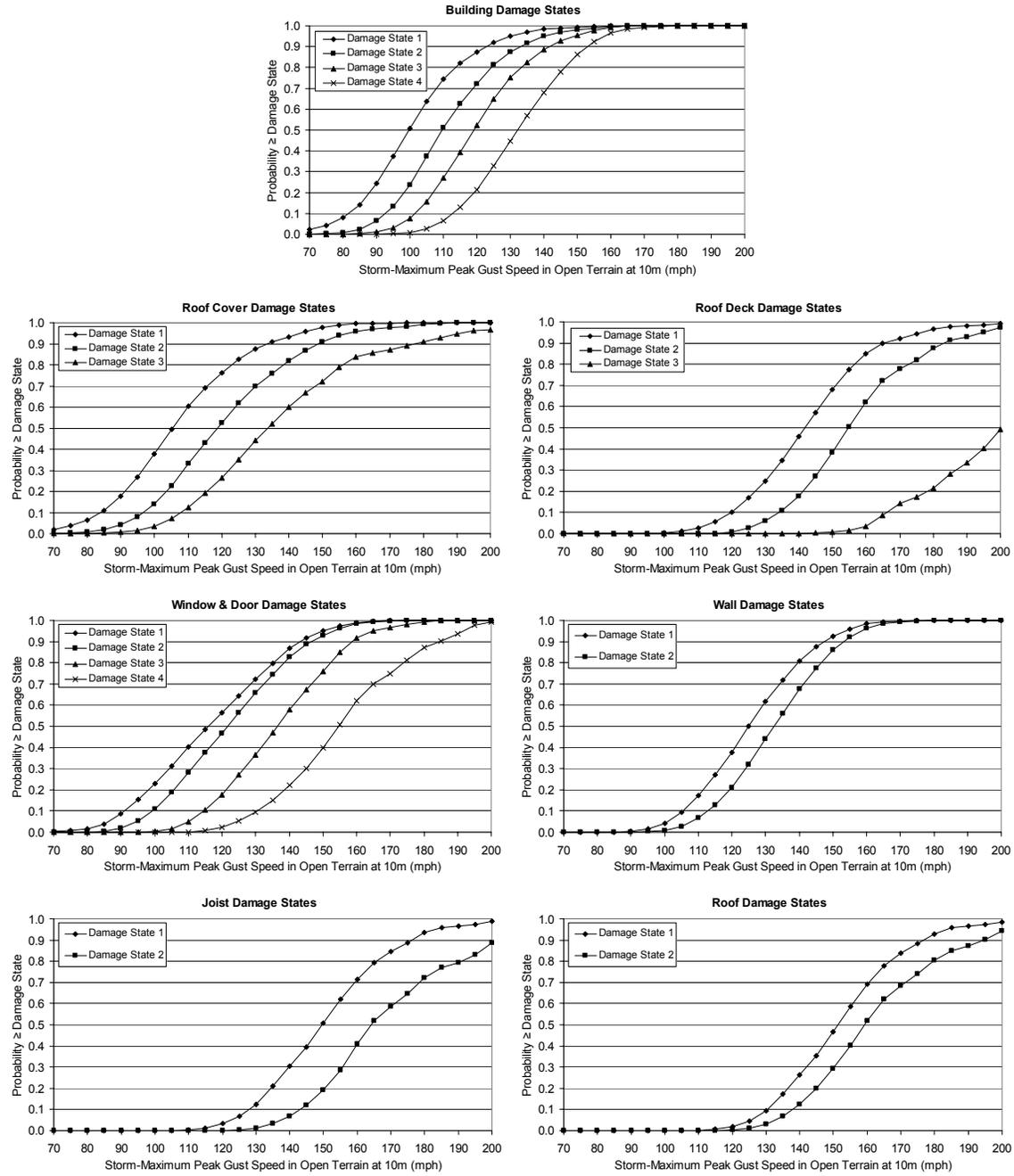
**Figure D.28. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



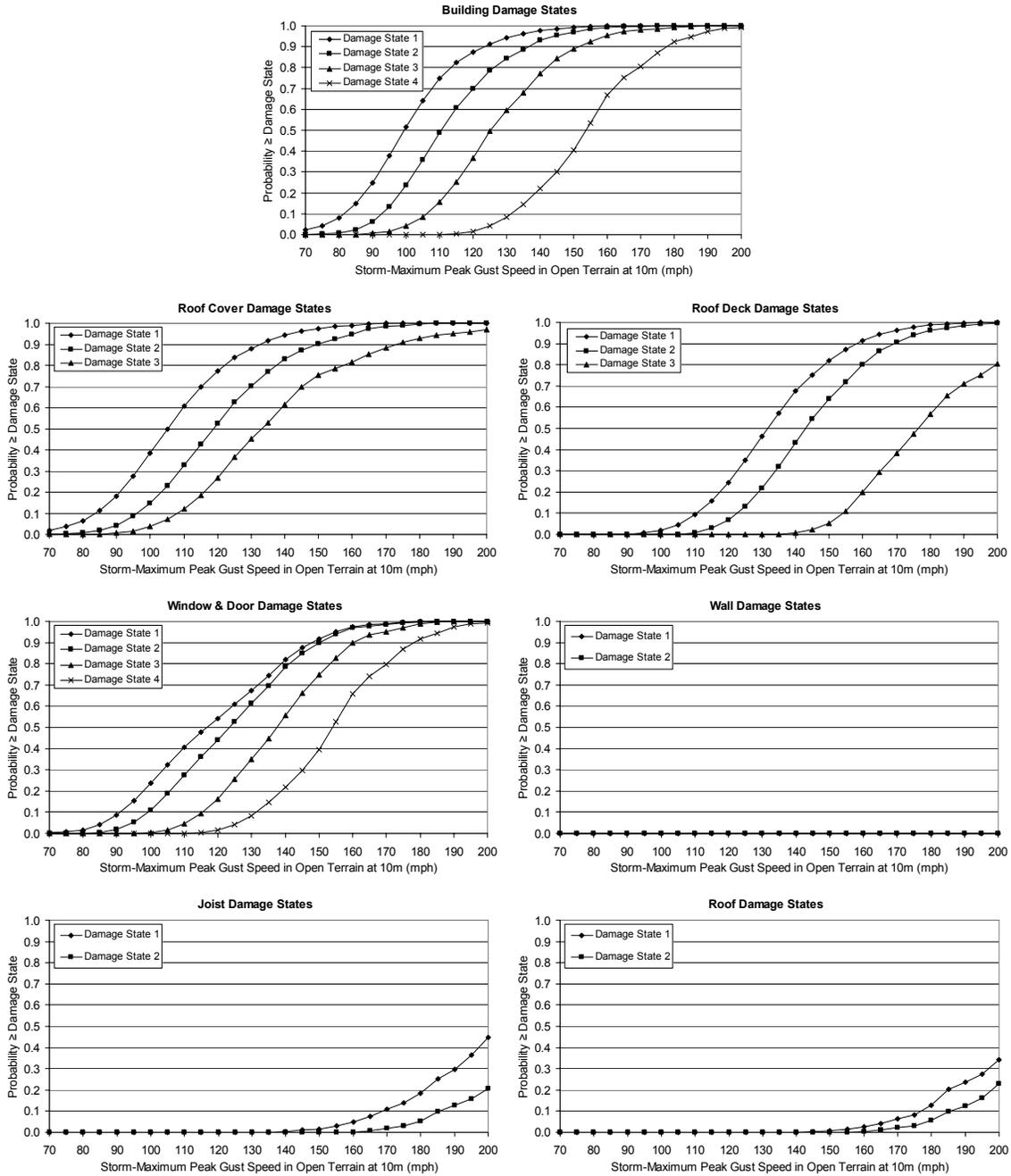
**Figure D.29. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists with 50% Reduction in Resistance, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



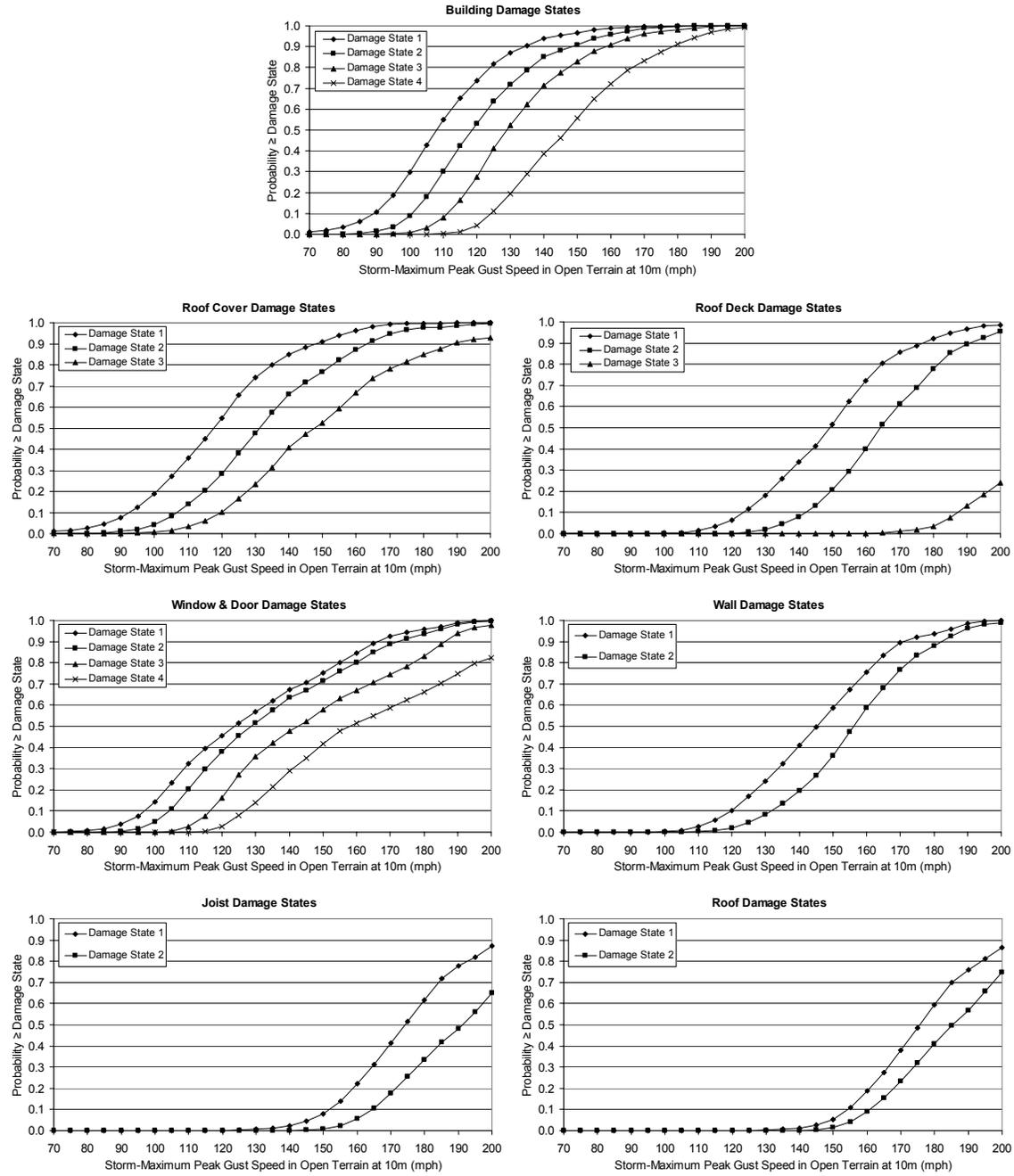
**Figure D.30. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Screwed to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



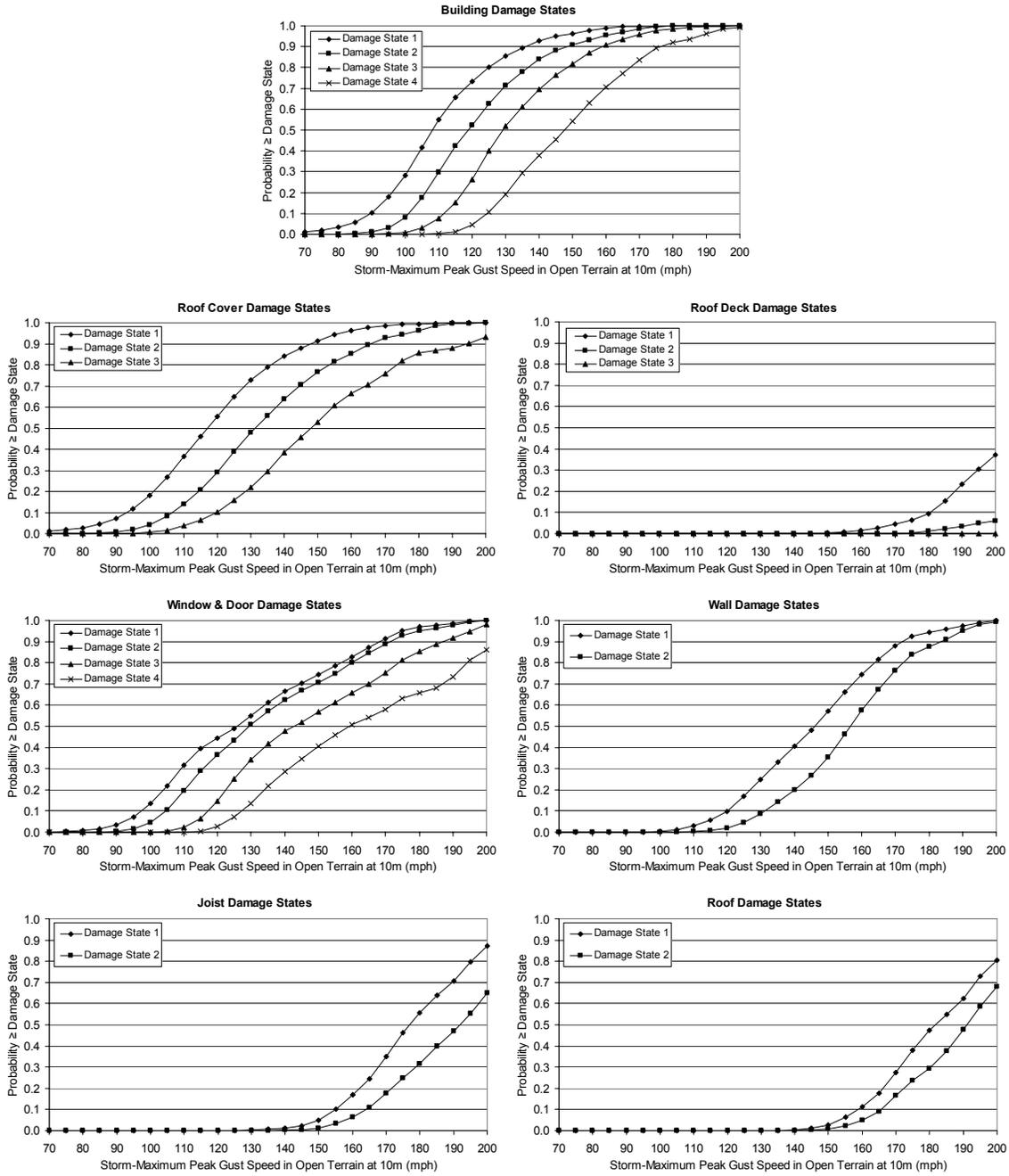
**Figure D.31. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, ASCE 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



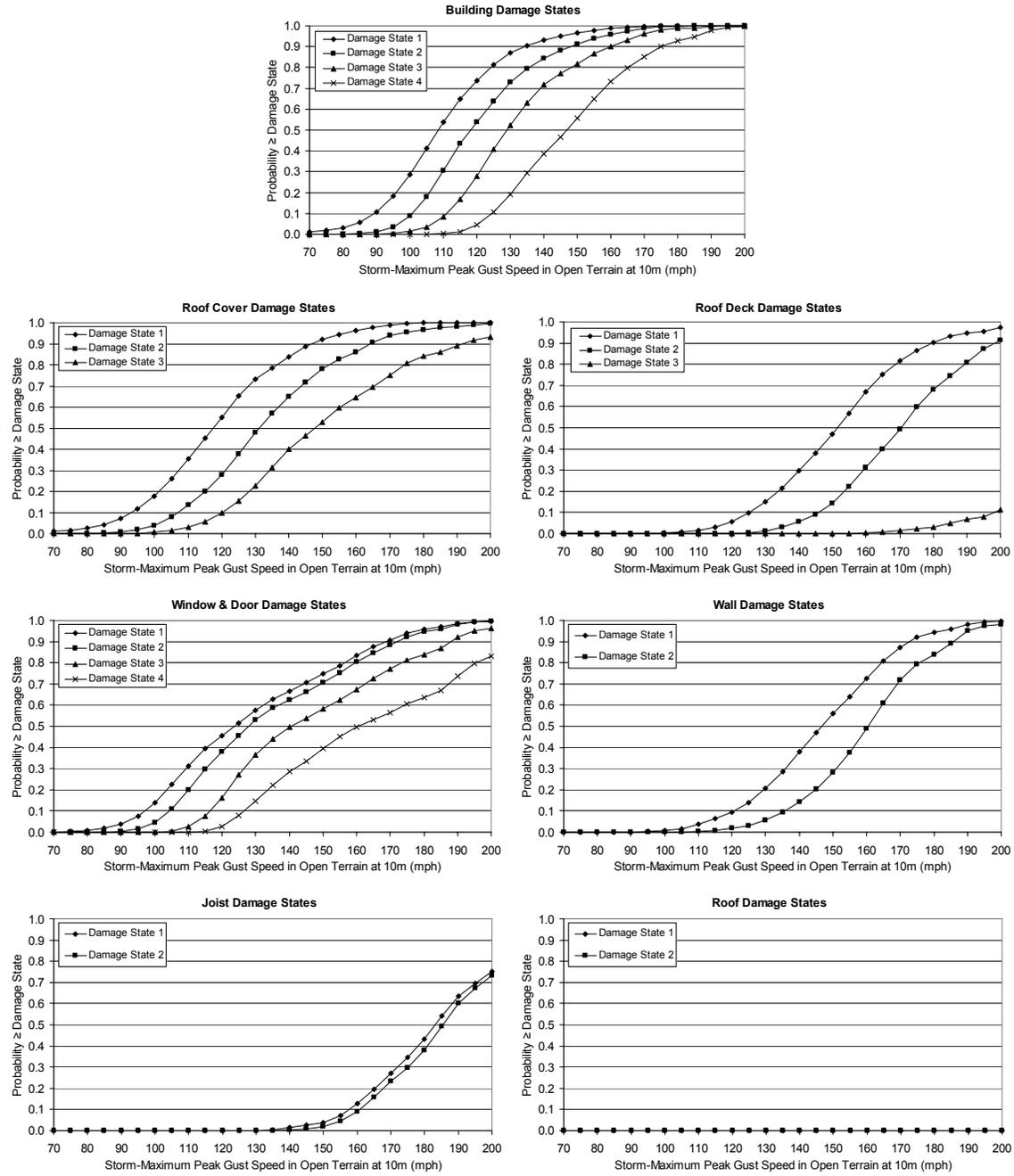
**Figure D.32. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



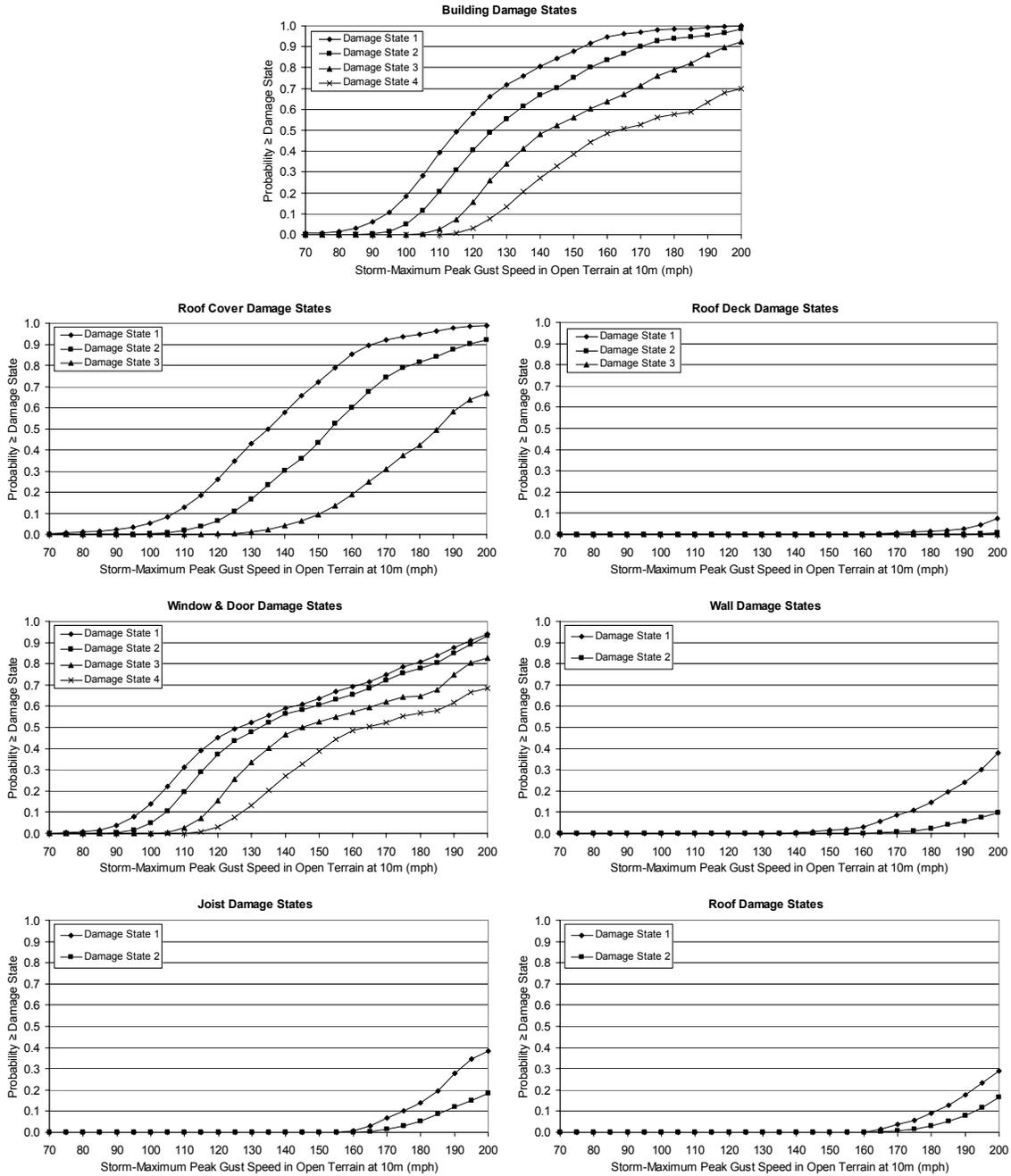
**Figure D.33. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



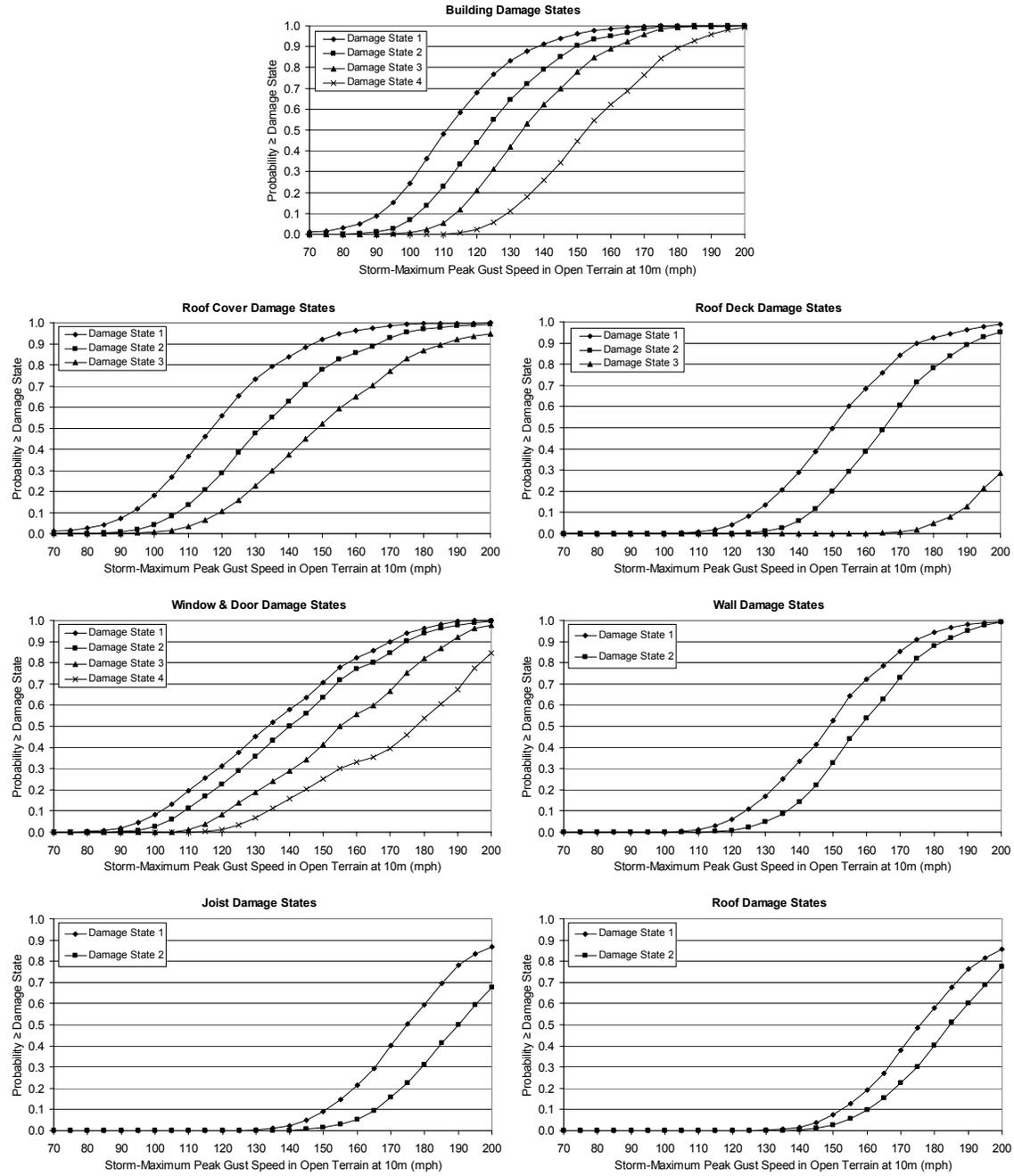
**Figure D.34. Damage States vs. Peak Gust Wind Speed – Strip Mall Building B – Height=20', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



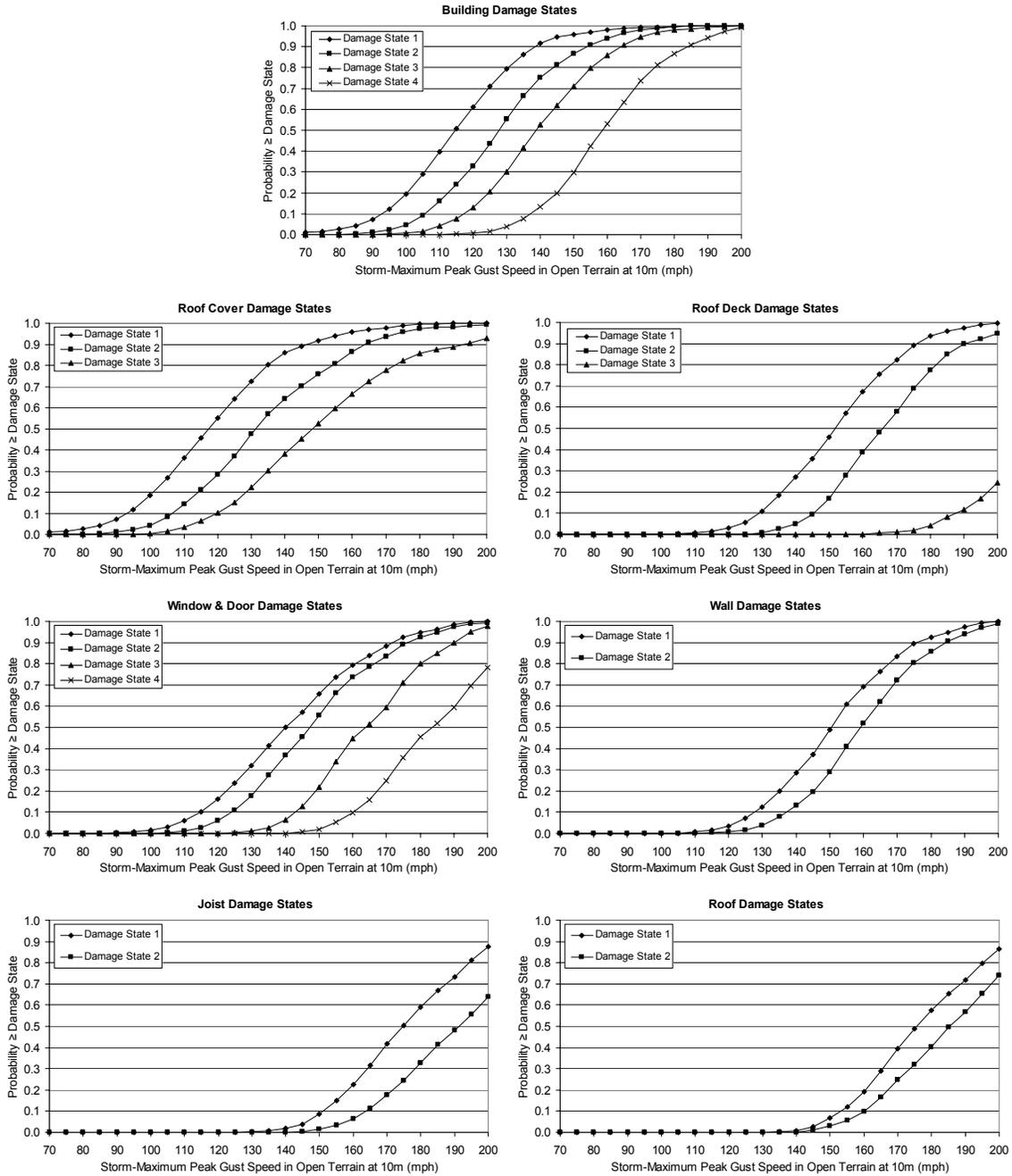
**Figure D.35. Damage States vs. Peak Gust Wind Speed – Strip Mall Building D – Height=20', No. of Units=1, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



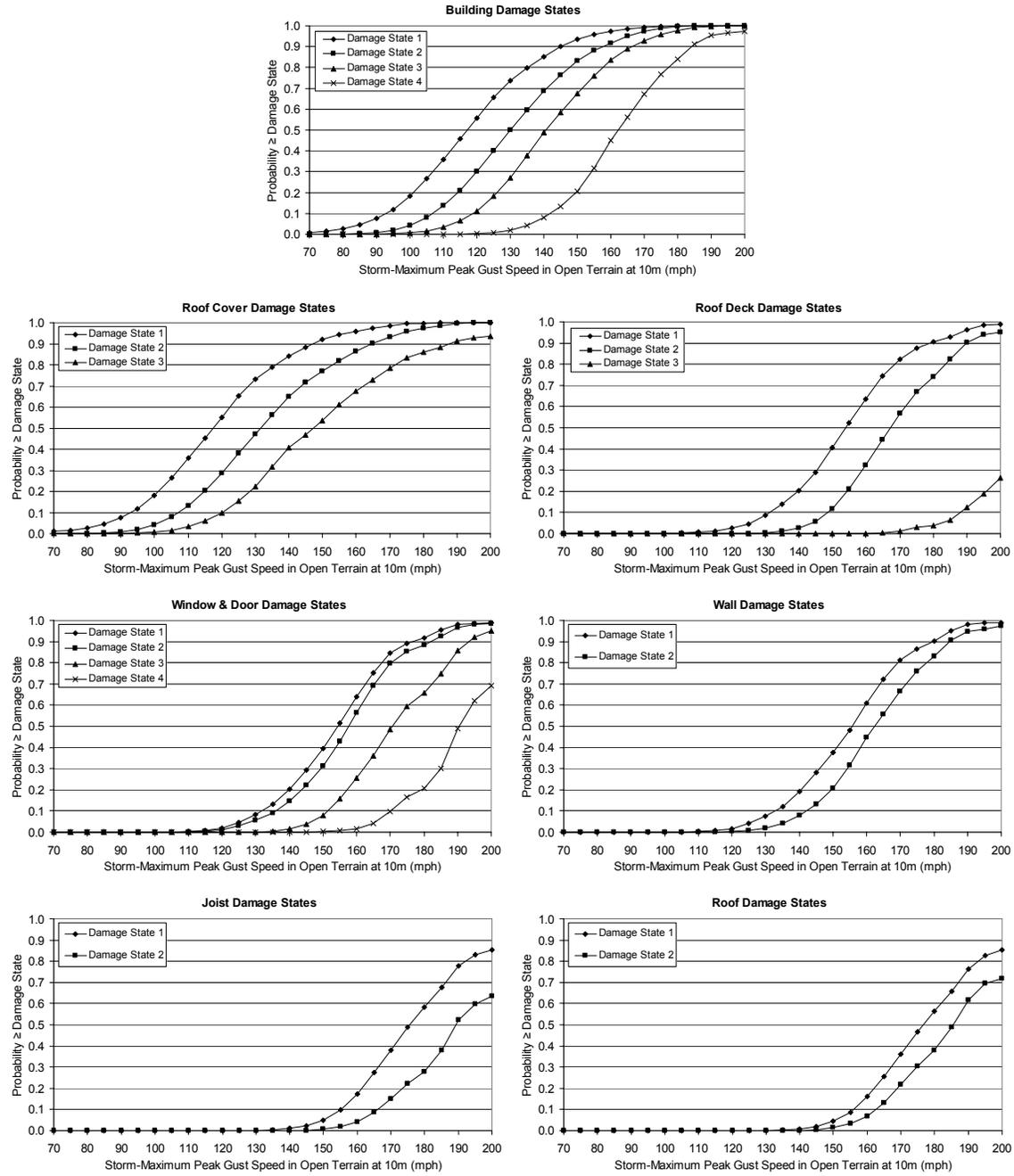
**Figure D.36. Damage States vs. Peak Gust Wind Speed – Strip Mall Building A – Height=12', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



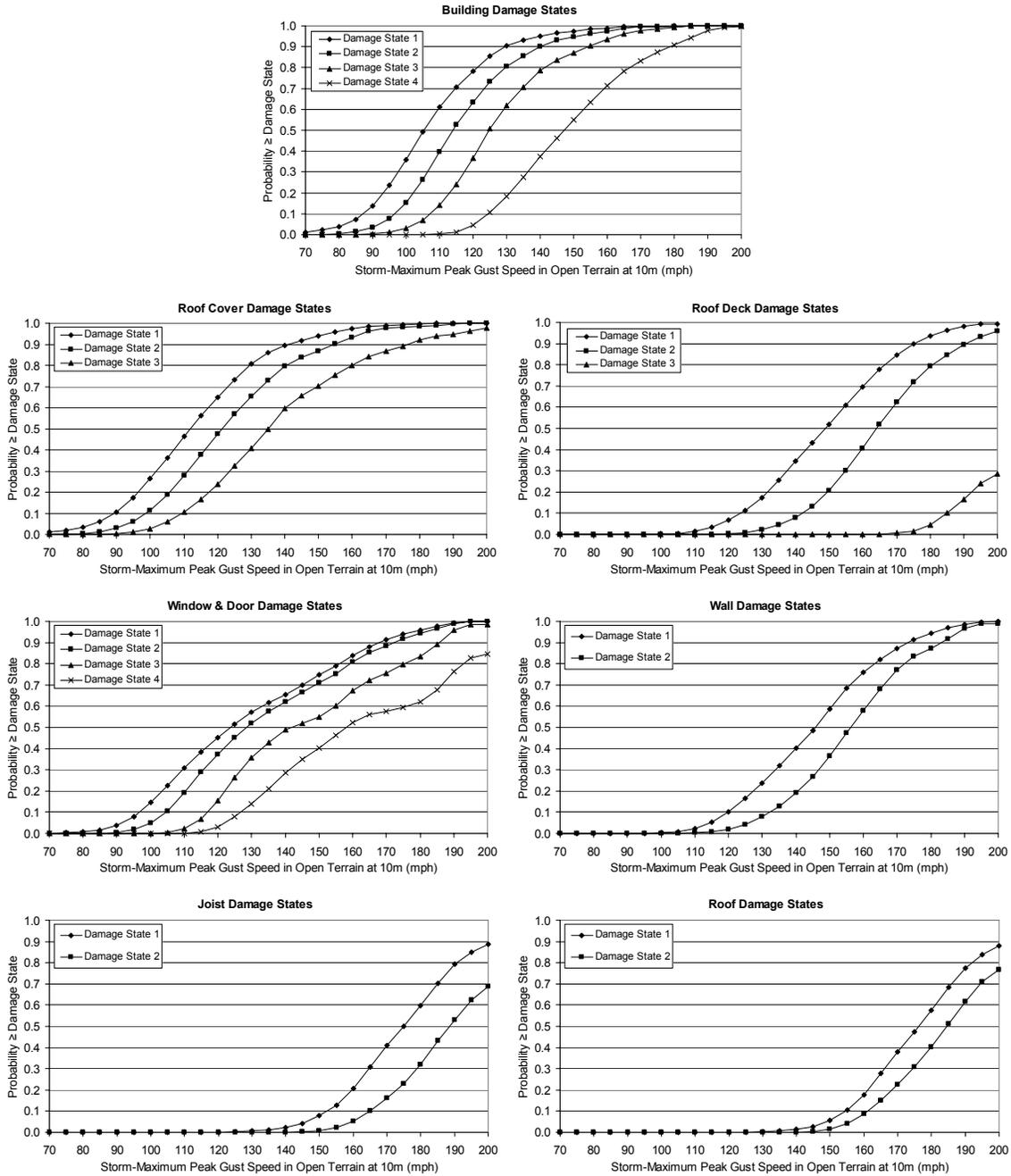
**Figure D.37. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B,  $z_0=0.35$  m.**



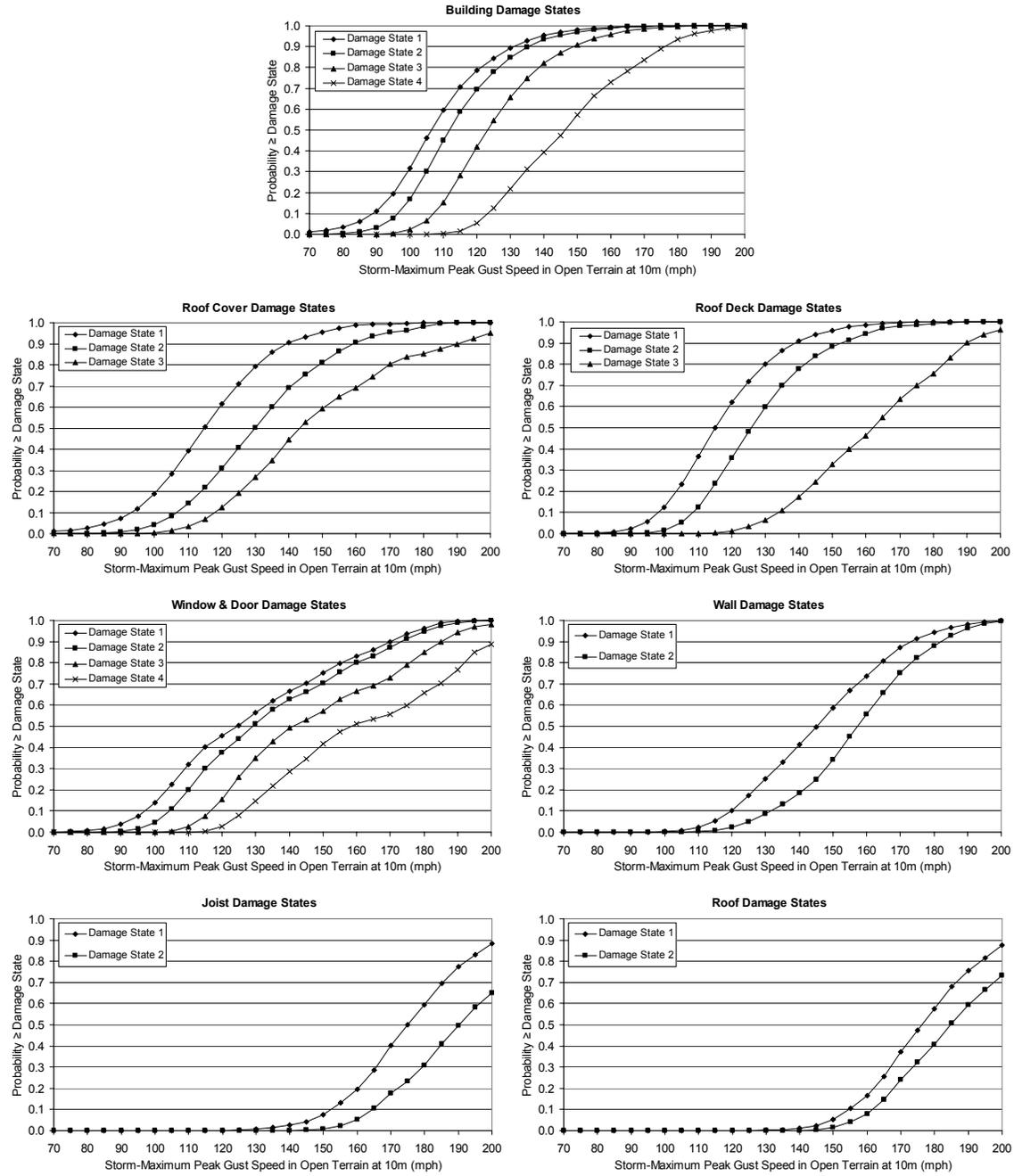
**Figure D.38. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C,  $z_0=0.35$  m.**



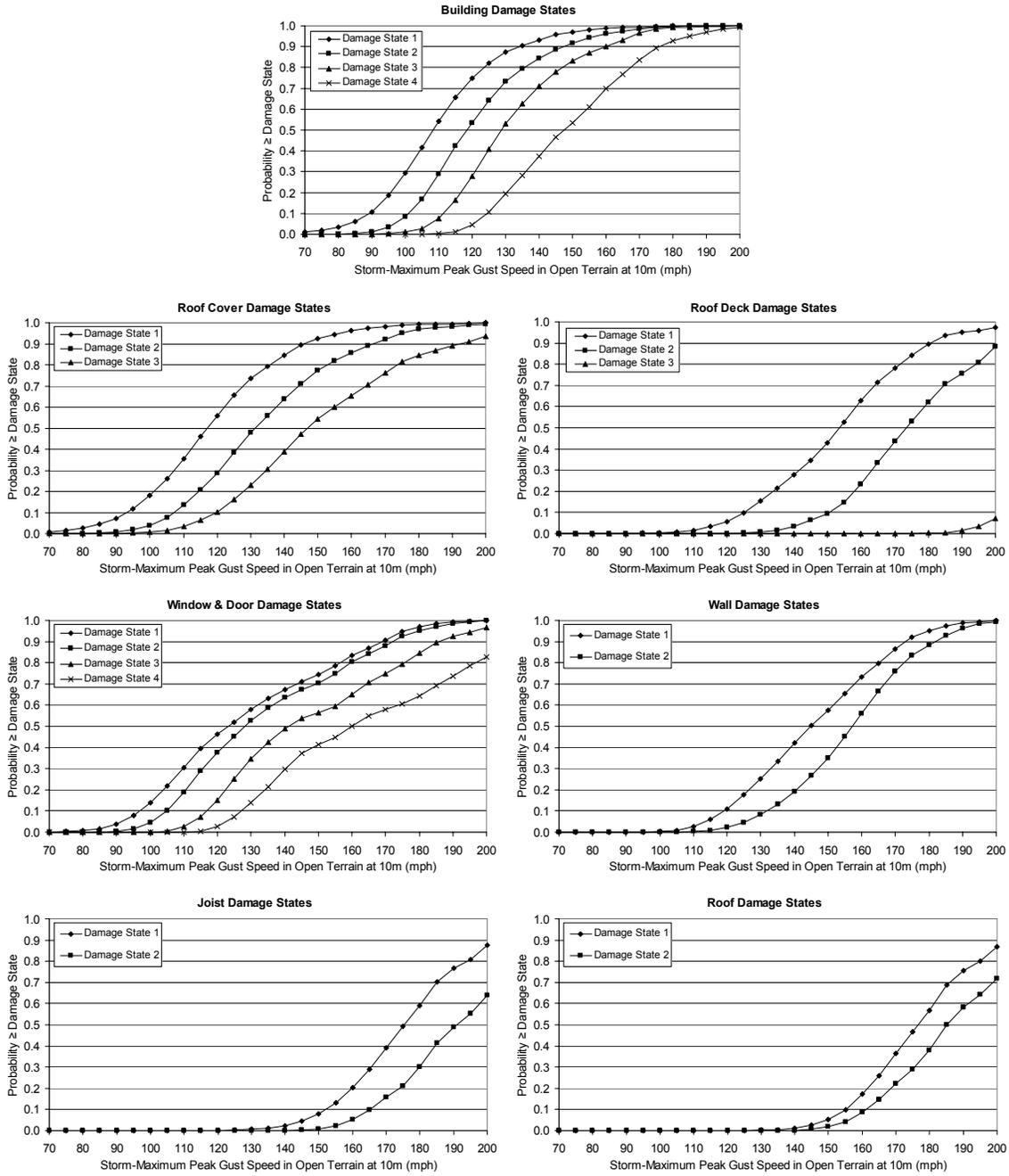
**Figure D.39. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D,  $z_0=0.35$  m.**



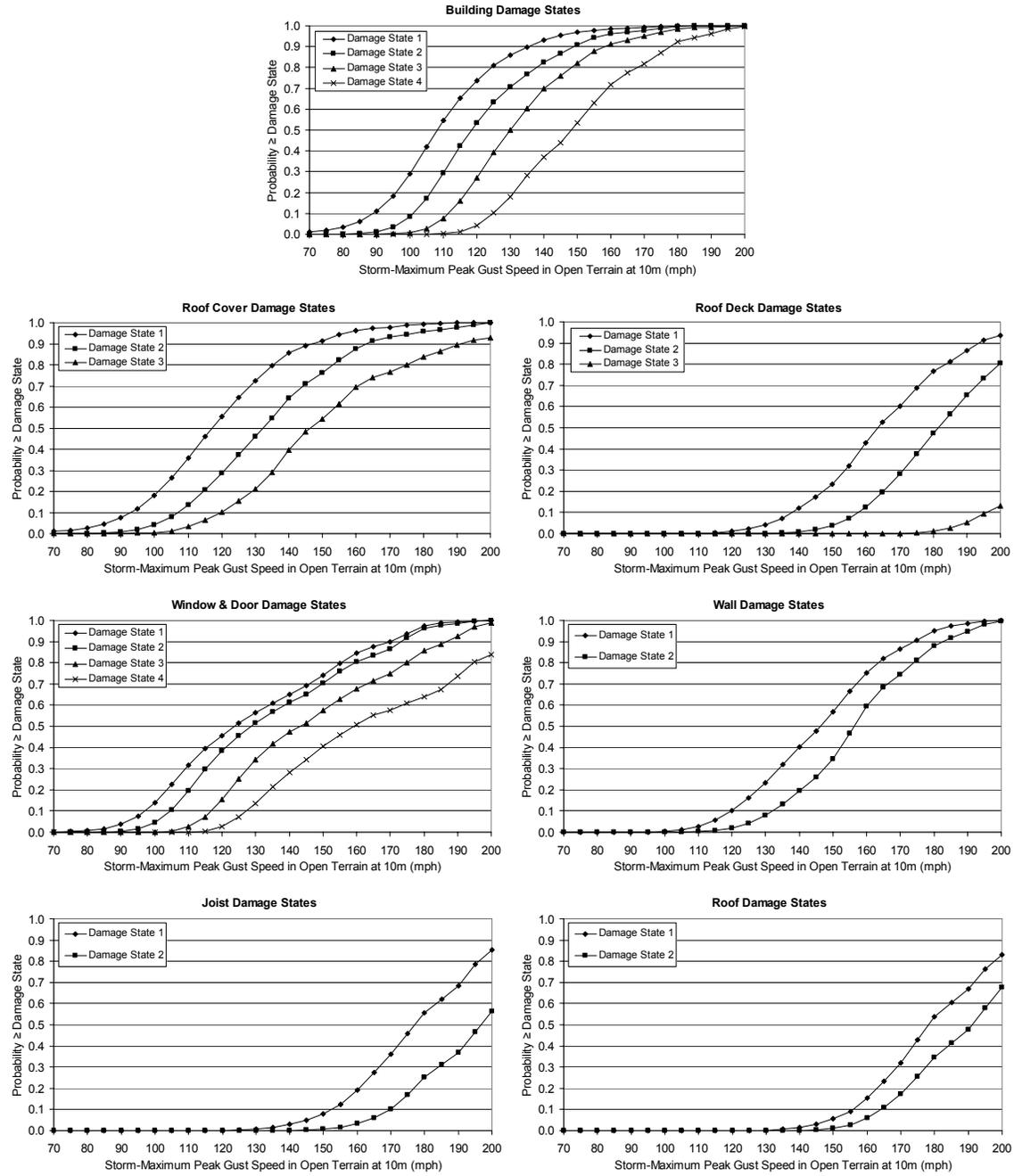
**Figure D.40. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



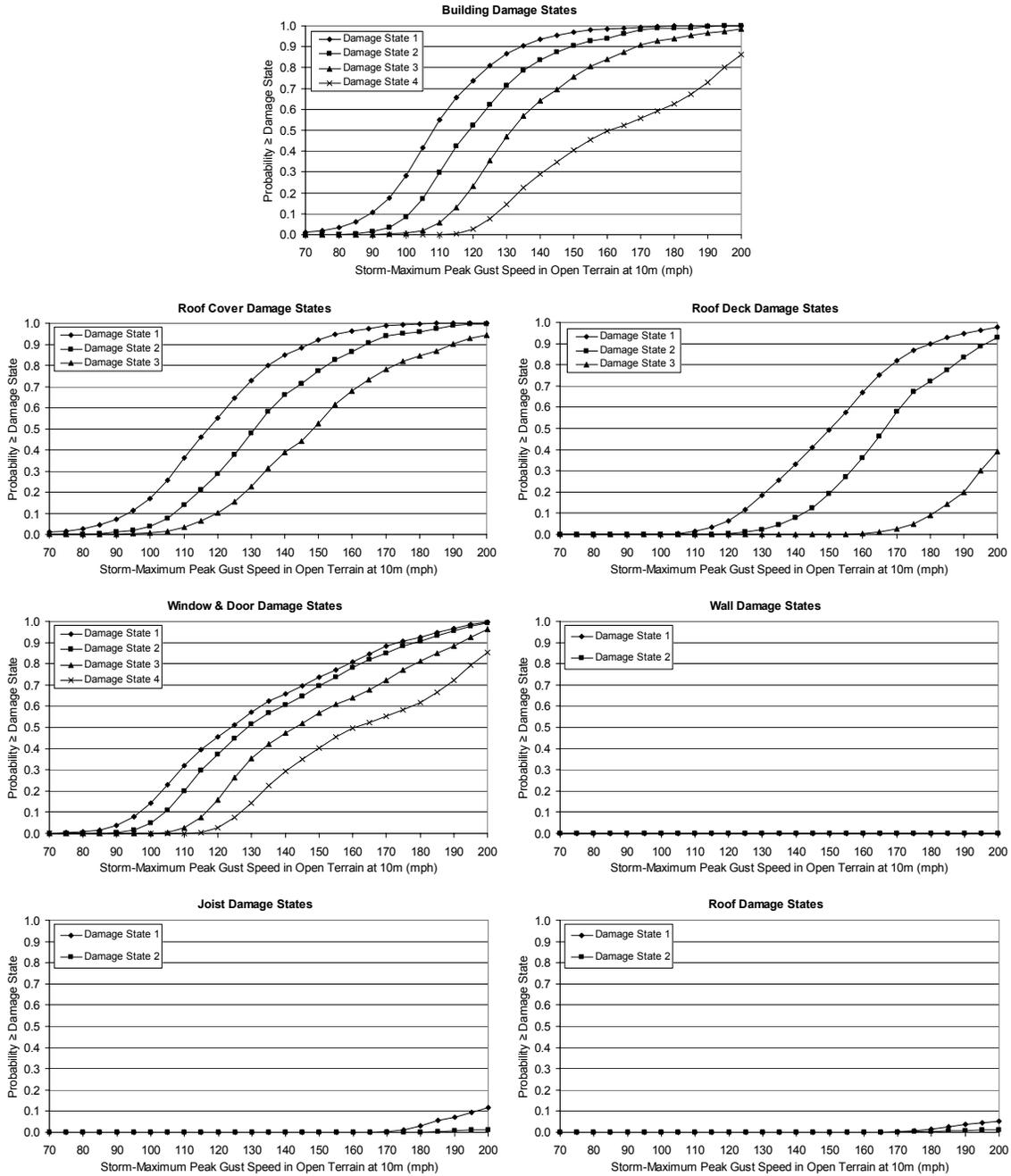
**Figure D.41. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists with 50% Reduction in Resistance, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



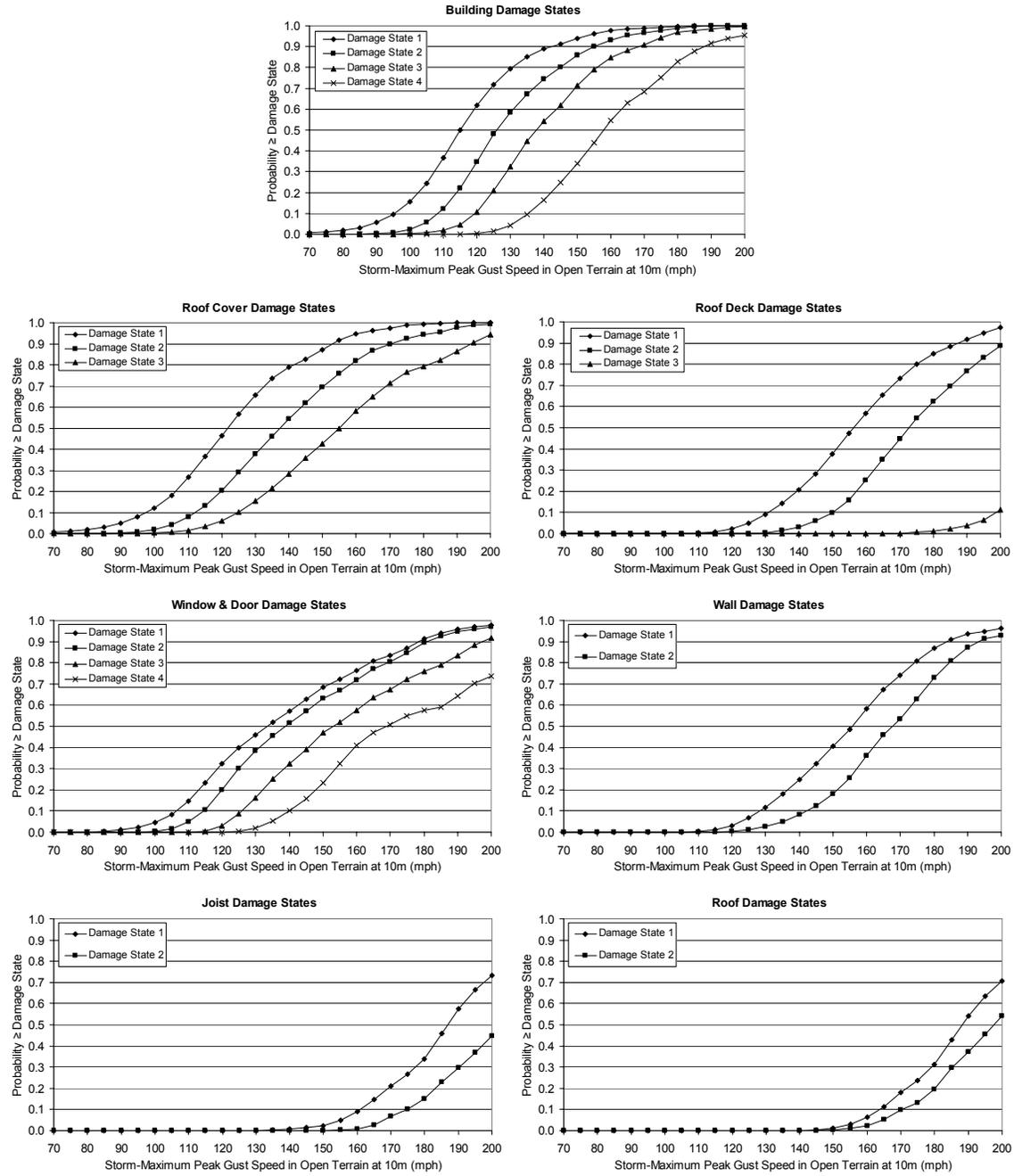
**Figure D.42. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Screwed to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



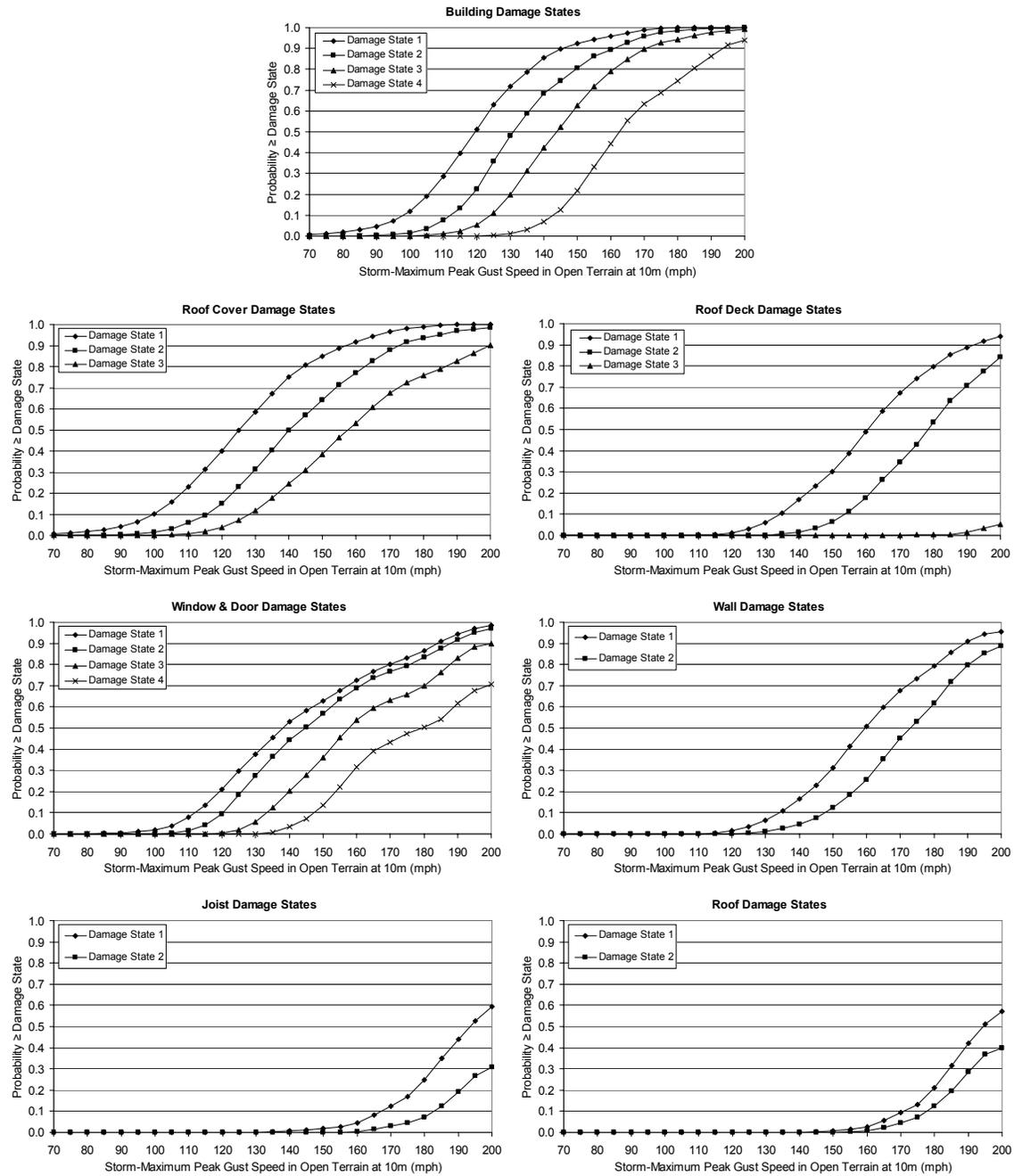
**Figure D.43. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, ASCE 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



**Figure D.44. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



**Figure D.45. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.70$  m.**



**Figure D.46. Damage States vs. Peak Gust Wind Speed – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A,  $z_0=1.0$  m.**



**Appendix E.**  
**Damage State Functions for Pre-Engineered Metal**  
**Buildings**

## Appendix E

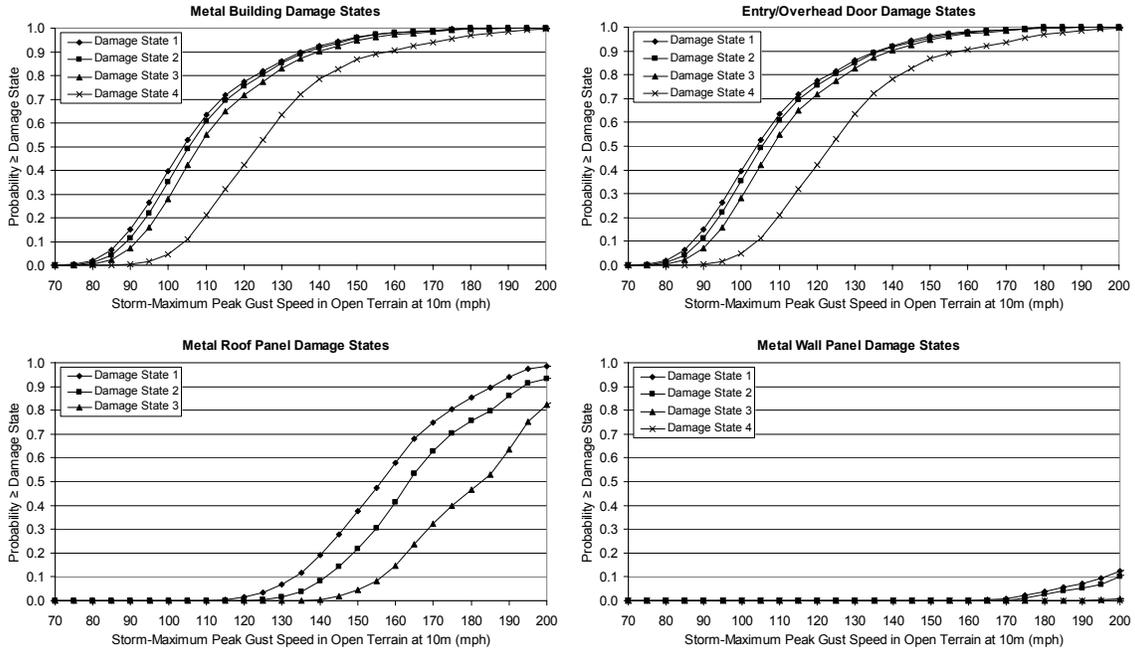
### Damage State Functions for Pre-Engineered Metal Buildings

This appendix presents damage state curves for pre-engineered metal buildings. The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.11-1 for damage state definitions).

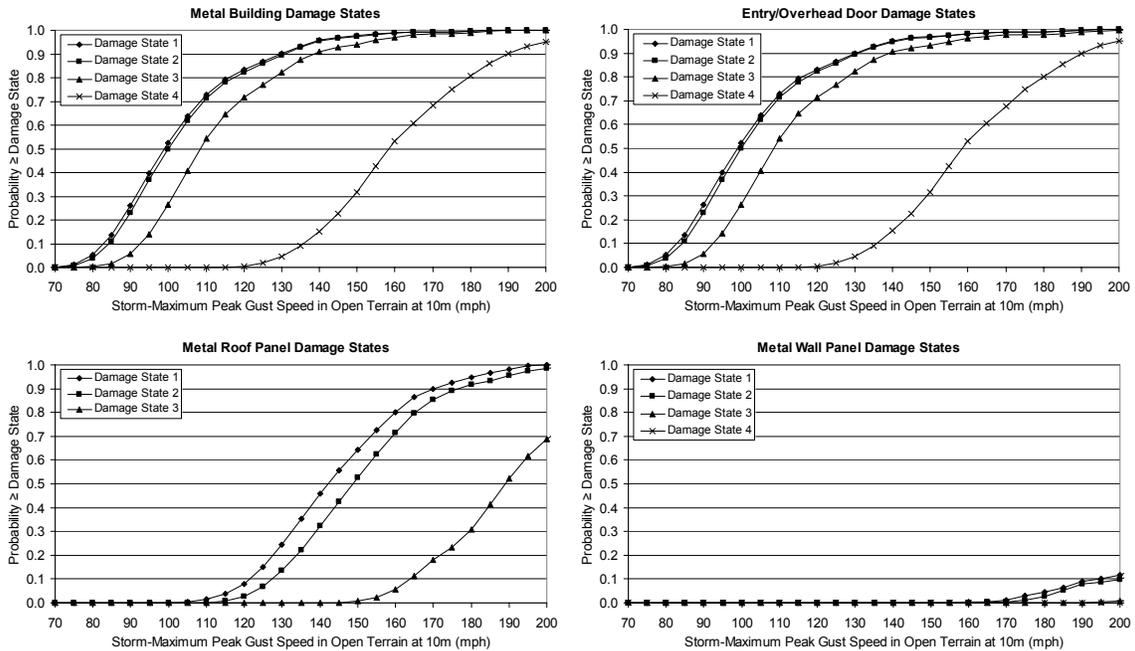
As shown in Table E.1, two sets of five figures are given for the metal buildings. The first set of five figures (Figures E.1 through E.5) is for buildings located in an open terrain ( $z_0=0.03$  m) and the second set (Figures E.6 through E.10) is for buildings situated in a typical suburban environment ( $z_0=0.35$  m). The first figure in each set of five shows damage state results for the small metal building designed using a 100 mph design speed and with no reduction in the metal roof panel capacity. The remaining four plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). Figures E.11 and E.12 show results of the reference building situated in two additional terrain environments (i.e.,  $z_0=0.70$  m and 1.0 m).

**Table E.1. Damage State Functions for Pre-Engineered Metal Buildings**

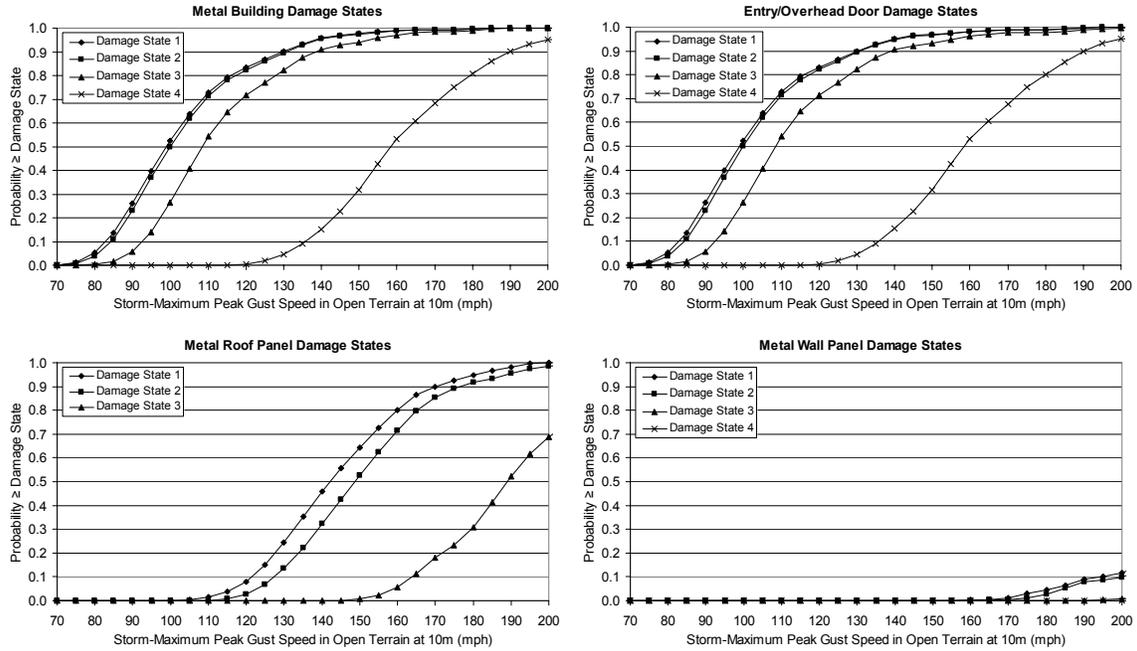
Figure	Model Building	Design Wind Speed	Metal Panel Capacity	Terrain
E.1	Small	100 mph	Full	0.03
E.2	<b>Medium</b>	100 mph	Full	0.03
E.3	<b>Large</b>	100 mph	Full	0.03
E.4	Small	<b>90 mph</b>	Full	0.03
E.5	Small	100 mph	<b>50%</b>	0.03
E.6	Small	100 mph	Full	<b>0.35</b>
E.7	<b>Medium</b>	100 mph	Full	0.35
E.8	<b>Large</b>	100 mph	Full	0.35
E.9	Small	<b>90 mph</b>	Full	0.35
E.10	Small	100 mph	<b>50%</b>	0.35
E.11	Small	100 mph	Full	<b>0.70</b>
E.12	Small	100 mph	Full	<b>1.00</b>



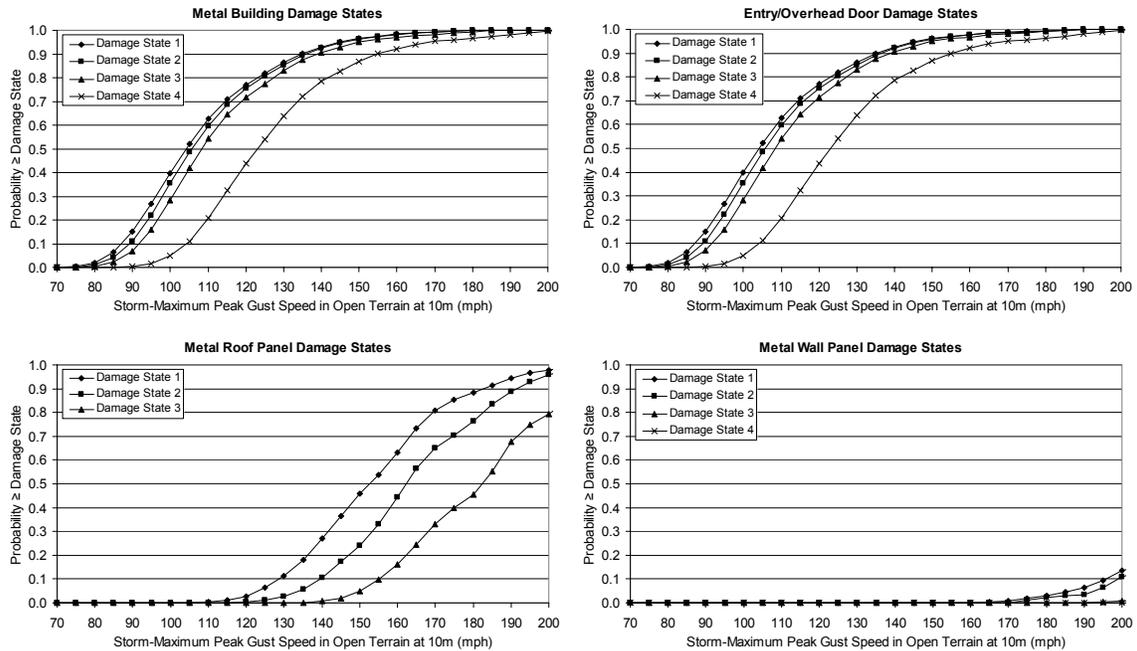
**Figure E.1. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=0.03$  m, No Reduction in Metal Panel Capacity.**



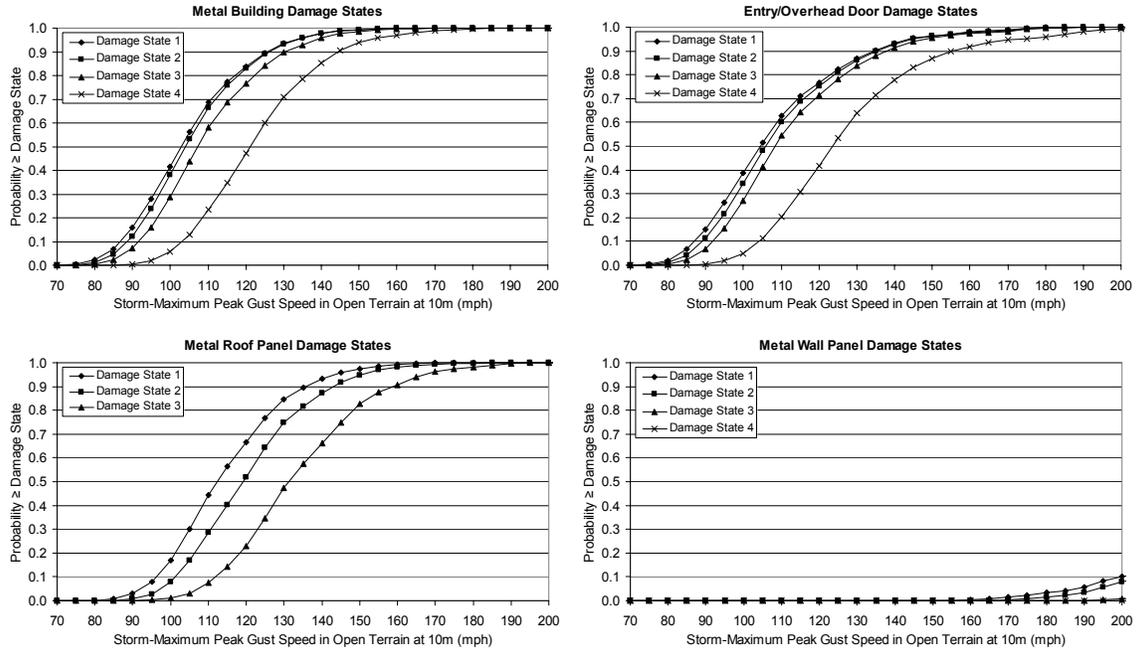
**Figure E.2. Damage States vs. Peak Gust Wind Speed – Medium-Sized Metal Building, 100 mph Design Speed,  $z_0=0.03$  m, No Reduction in Metal Panel Capacity..**



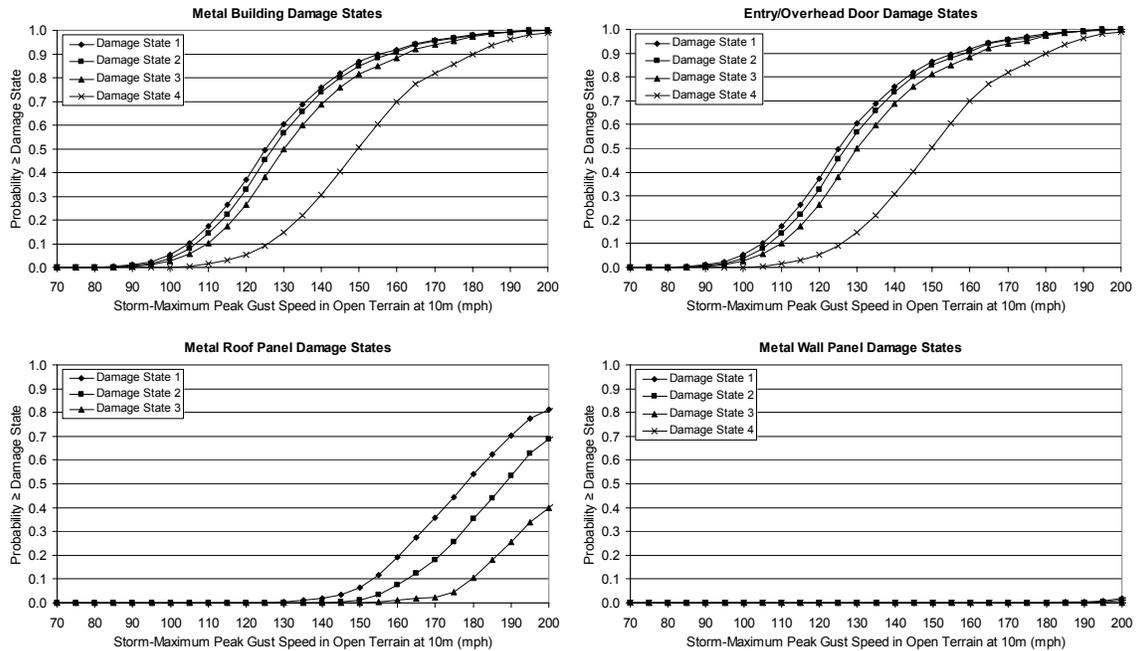
**Figure E.3. Damage States vs. Peak Gust Wind Speed – Large Metal Building, 100 mph Design Speed,  $z_0=0.03$  m, No Reduction in Metal Panel Capacity.**



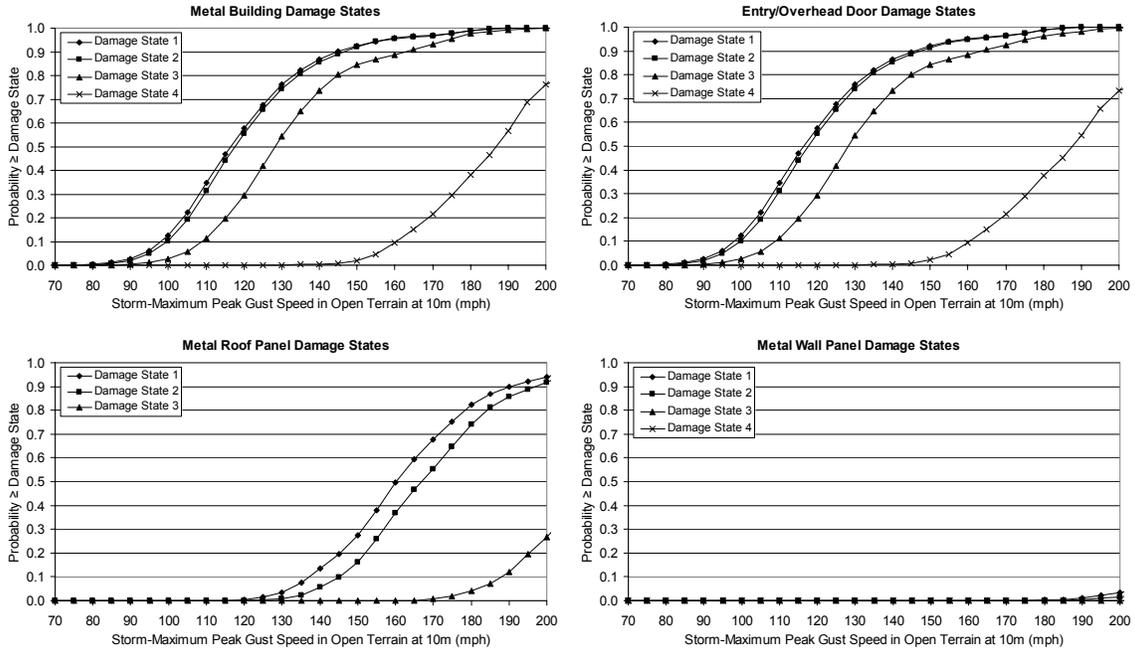
**Figure E.4. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 90 mph Design Speed,  $z_0=0.03$  m, No Reduction in Metal Panel Capacity.**



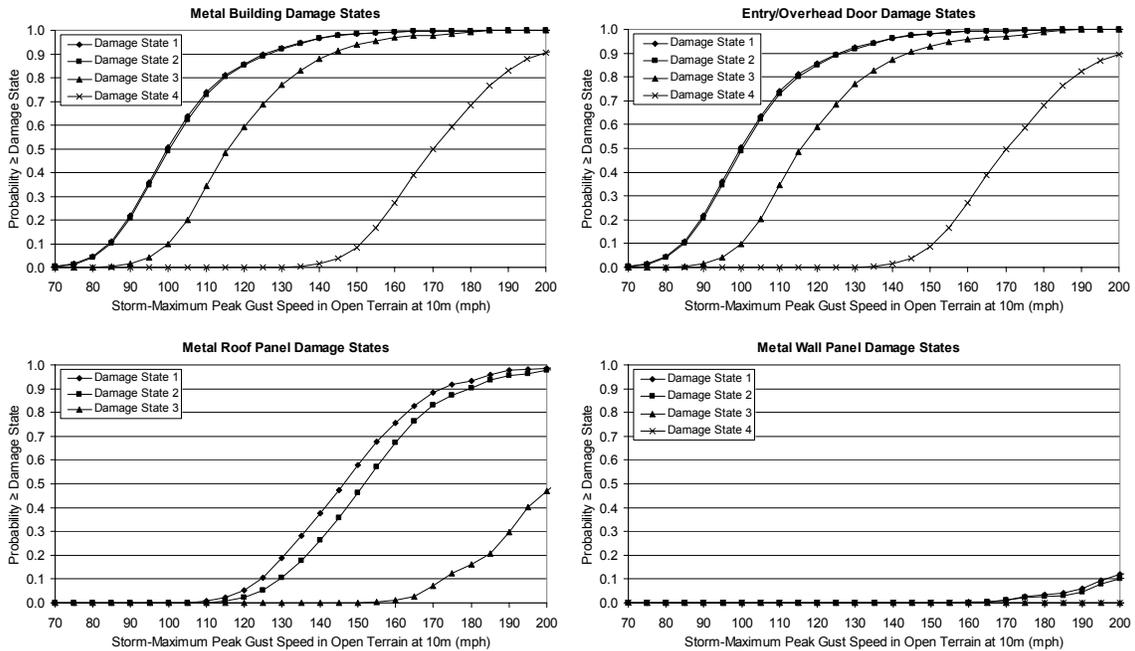
**Figure E.5. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=0.03$  m, 50% Reduction in Metal Panel Capacity.**



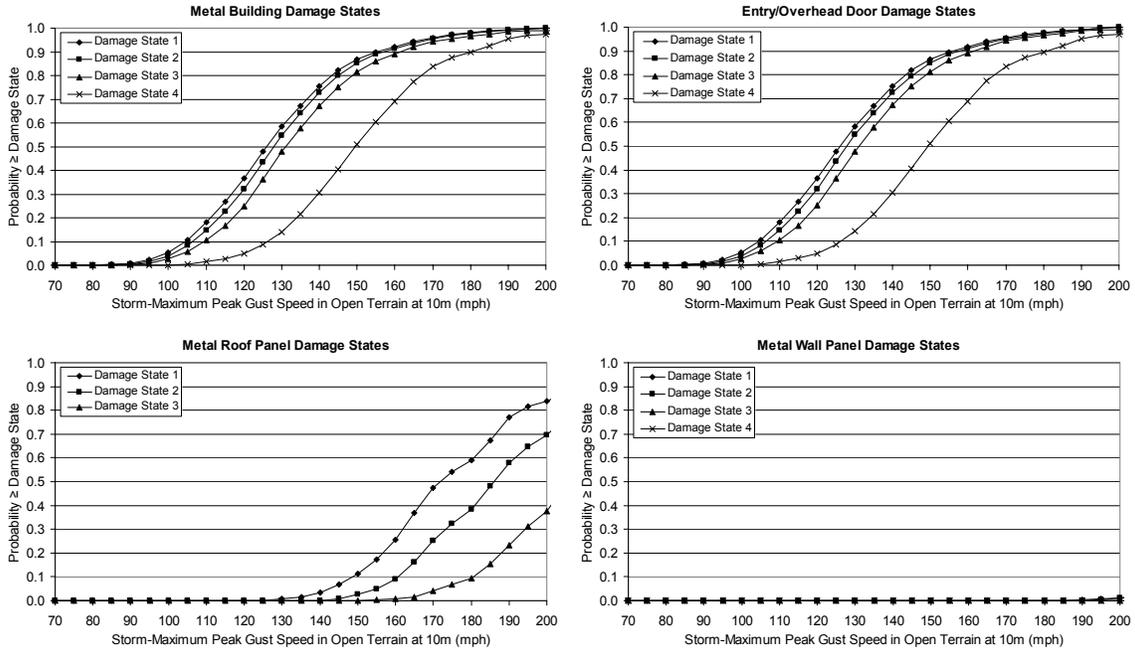
**Figure E.6. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=0.35$  m, No Reduction in Metal Panel Capacity.**



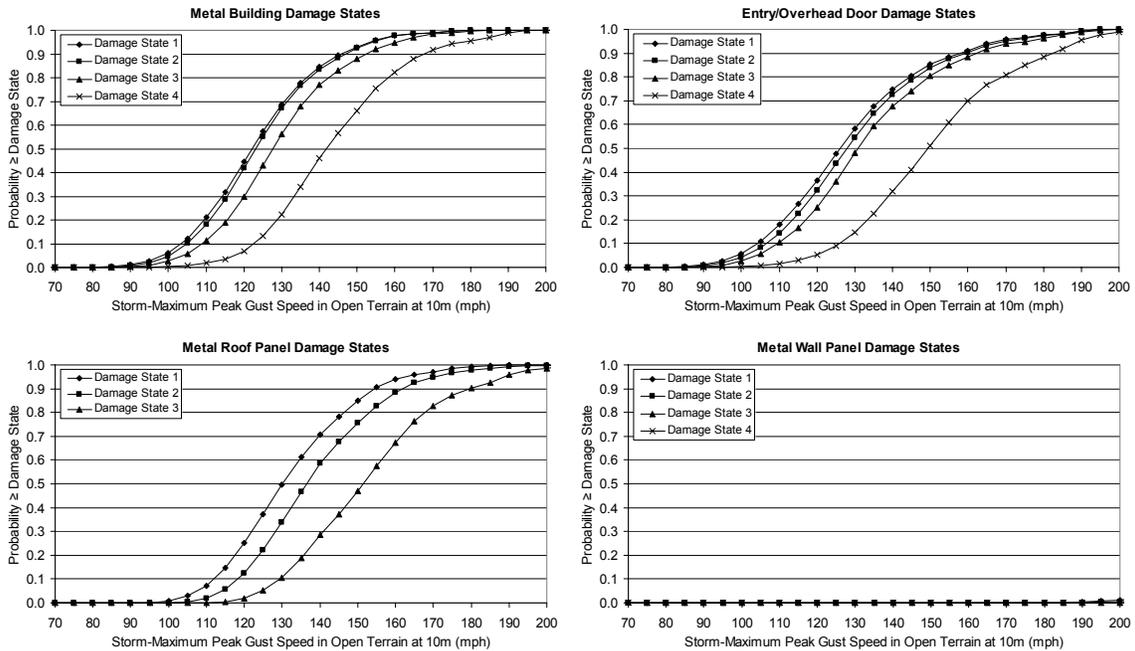
**Figure E.7. Damage States vs. Peak Gust Wind Speed – Medium-Sized Metal Building, 100 mph Design Speed,  $z_0=0.35$  m, No Reduction in Metal Panel Capacity.**



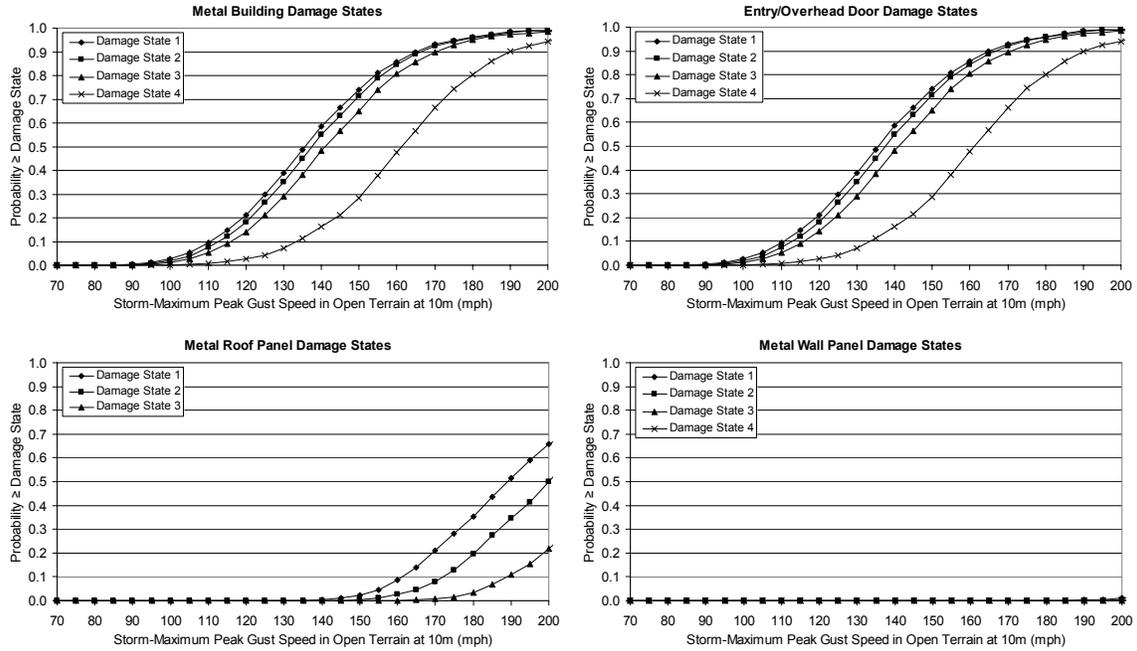
**Figure E.8. Damage States vs. Peak Gust Wind Speed – Large Metal Building, 100 mph Design Speed,  $z_0=0.35$  m, No Reduction in Metal Panel Capacity.**



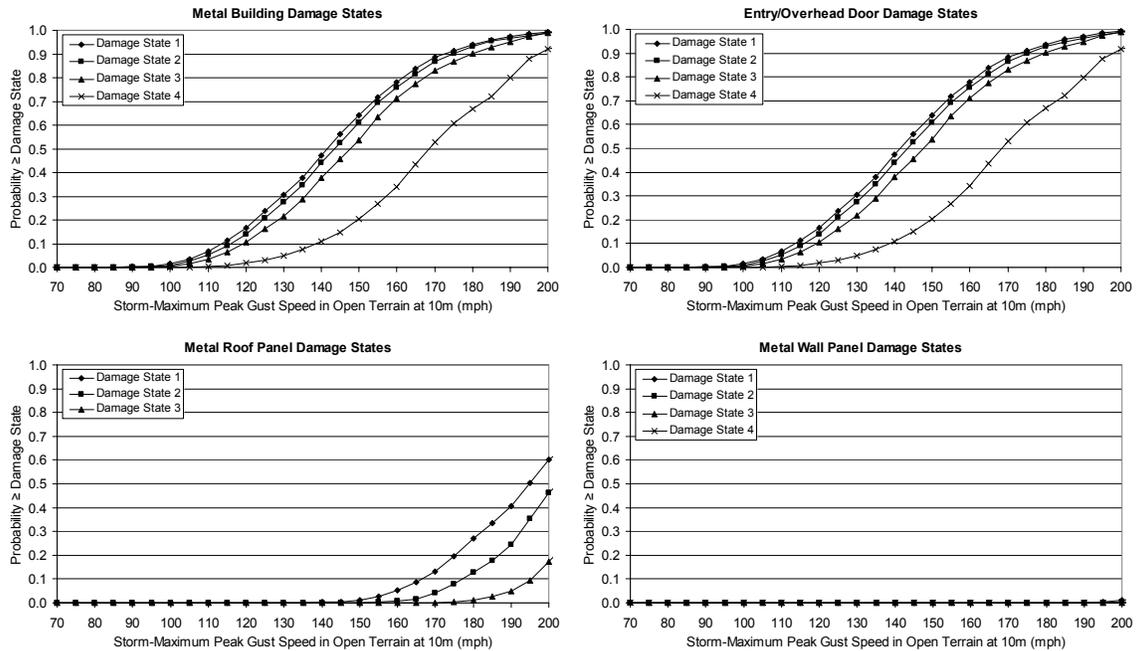
**Figure E.9. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 90 mph Design Speed,  $z_0=0.35$  m, No Reduction in Metal Panel Capacity.**



**Figure E.10. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=0.35$  m, 50% Reduction in Metal Panel Capacity.**



**Figure E.11. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=0.70$  m, No Reduction in Metal Panel Capacity.**



**Figure E.12. Damage States vs. Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed,  $z_0=1.0$  m, No Reduction in Metal Panel Capacity.**

**Appendix F.**  
**Damage State Functions for Engineered Residential  
and Commercial Buildings**

## Appendix F. Damage State Functions for Engineered Residential and Commercial Buildings

This appendix presents damage state curves for engineered residential and commercial buildings. The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.12-1 for damage state definitions).

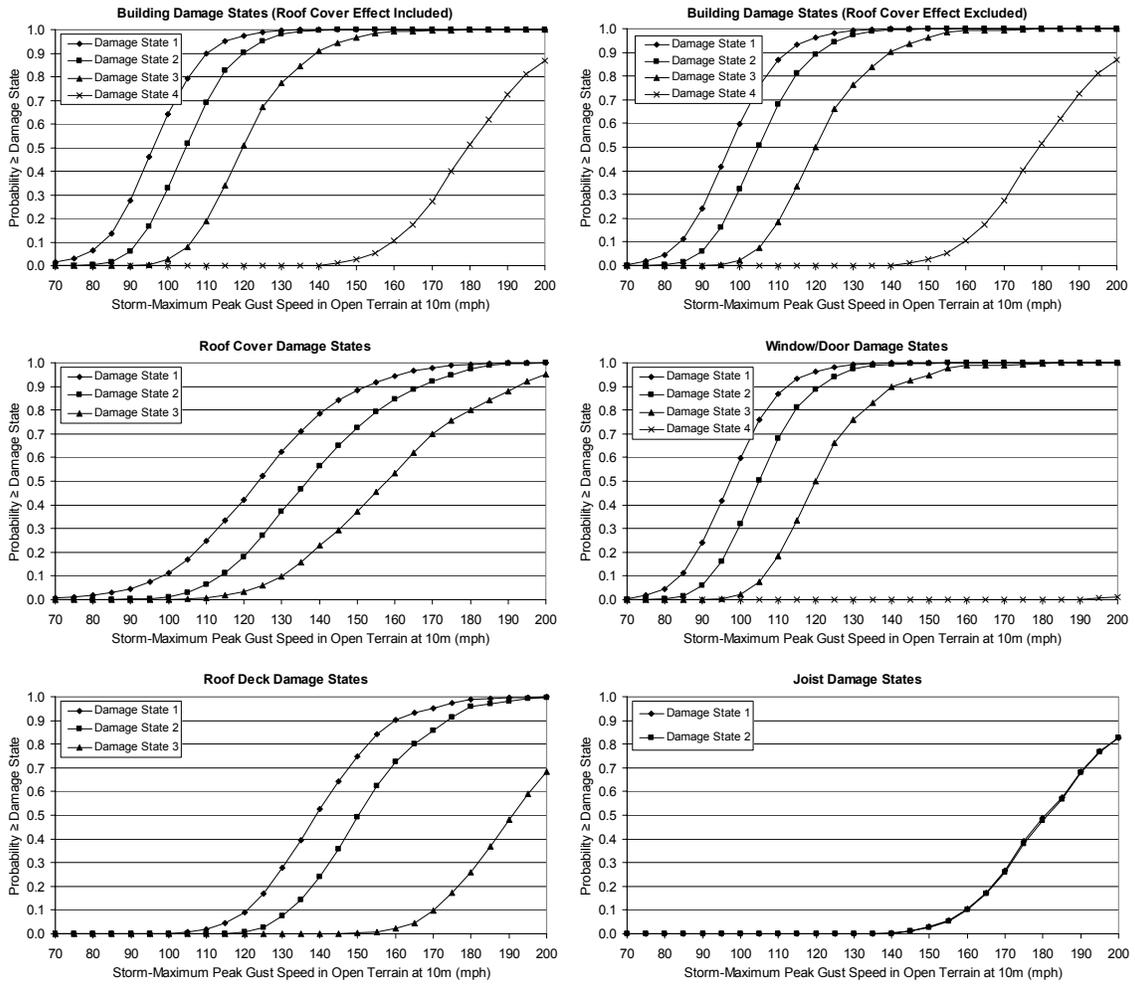
Table F.1 lists the figures provided in this appendix. Damage state plots for the two-, five- and eight-story buildings are given in Figures F.1 through F.18, F.19 through F.36 and F.37 through F.54, respectively. Two sets of eight figures are given for each of the two-, five- and eight-story engineered buildings. The first set of eight figures are for buildings located in an open terrain ( $z_0=0.03$  m) and the second set are for buildings situated in a typical suburban environment ( $z_0=0.35$  m). The first figure in each set of eight shows damage state results for the engineered residential building having 33% glazing coverage, a built-up roof cover and situated in Missile Environment A. The remaining seven plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). The last two figures associated with the two-, five- and eight-story engineered buildings show results of the reference building situated in two additional terrain environments (i.e.,  $z_0=0.70$  m and 1.0 m).

**Table F.1. Sample Damage State Functions for Engineered Residential and Commercial Buildings**

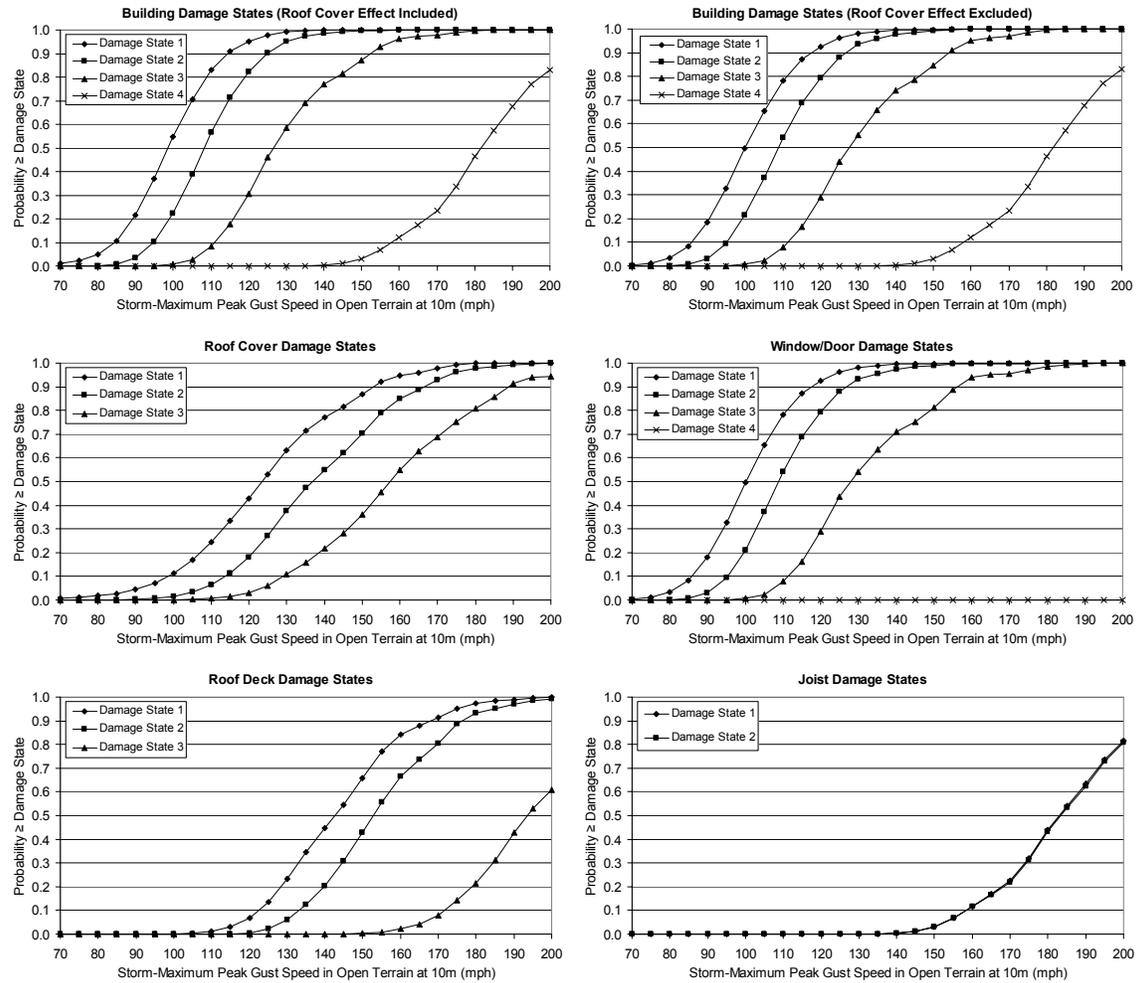
Figure	Stories	Occupancy	Roof Cover	Glazing	Missile Environ.	Terrain
F.1	2	Residential	BUR	33%	A	0.03
F.2	2	Residential	BUR	<b>20%</b>	A	0.03
F.3	2	Residential	BUR	<b>50%</b>	A	0.03
F.4	2	Residential	<b>SPM</b>	33%	A	0.03
F.5	2	Residential	BUR	33%	<b>B</b>	0.03
F.6	2	Residential	BUR	33%	<b>C</b>	0.03
F.7	2	Residential	BUR	33%	<b>D</b>	0.03
F.8	2	<b>Commercial</b>	BUR	33%	A	0.03
F.9	2	Residential	BUR	33%	A	<b>0.35</b>
F.10	2	Residential	BUR	<b>20%</b>	A	0.35
F.11	2	Residential	BUR	<b>50%</b>	A	0.35
F.12	2	Residential	<b>SPM</b>	33%	A	0.35
F.13	2	Residential	BUR	33%	<b>B</b>	0.35
F.14	2	Residential	BUR	33%	<b>C</b>	0.35
F.15	2	Residential	BUR	33%	<b>D</b>	0.35
F.16	2	<b>Commercial</b>	BUR	33%	A	0.35
F.17	2	Residential	BUR	33%	A	<b>0.70</b>

**Table F.1. Sample Damage State Functions for Engineered Residential and Commercial Buildings (concluded)**

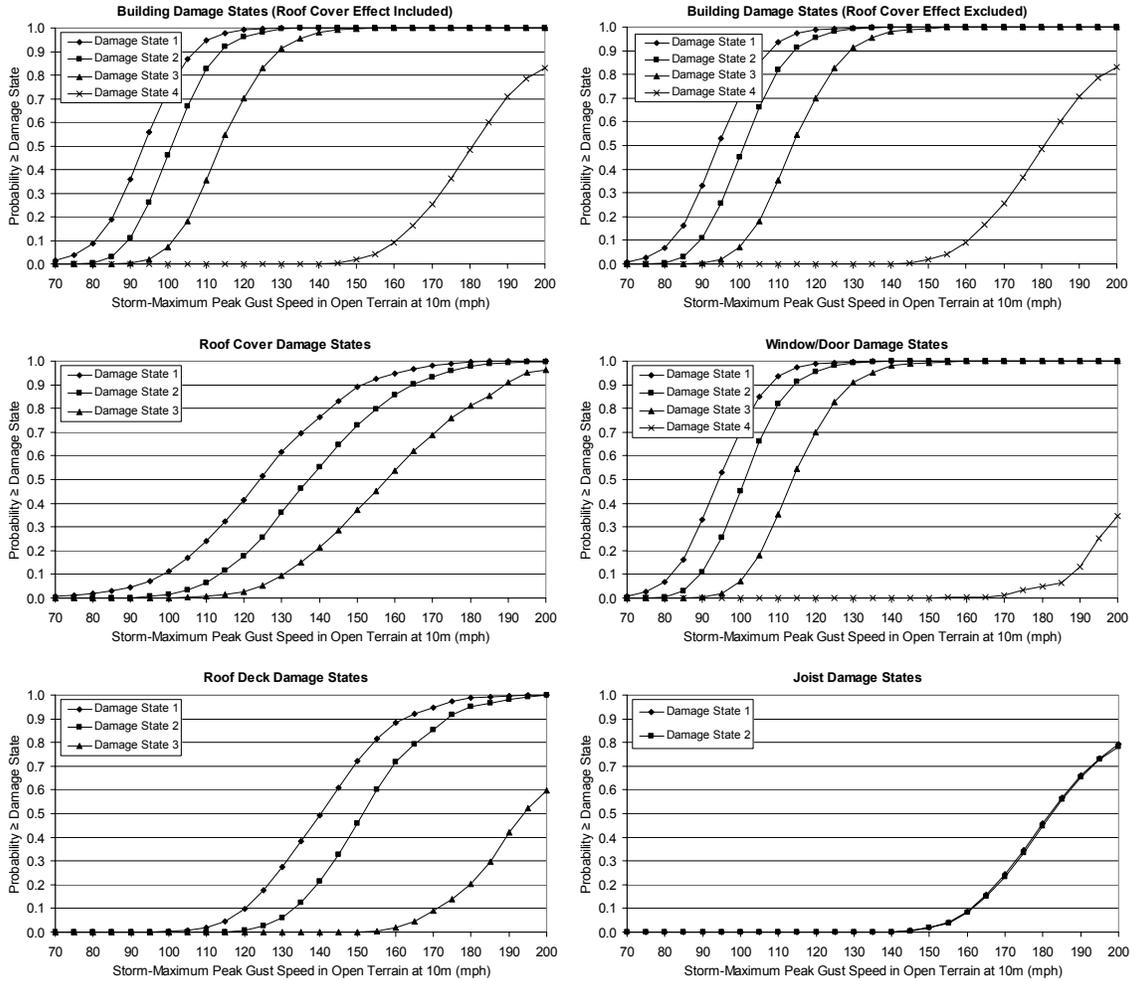
Figure	Stories	Occupancy	Roof Cover	Glazing	Missile Environ.	Terrain
F.18	2	Residential	BUR	33%	A	<b>1.00</b>
F.19	<b>5</b>	Residential	BUR	33%	A	0.03
F.20	5	Residential	BUR	<b>20%</b>	A	0.03
F.21	5	Residential	BUR	<b>50%</b>	A	0.03
F.22	5	Residential	<b>SPM</b>	33%	A	0.03
F.23	5	Residential	BUR	33%	<b>B</b>	0.03
F.24	5	Residential	BUR	33%	<b>C</b>	0.03
F.25	5	Residential	BUR	33%	<b>D</b>	0.03
F.26	5	<b>Commercial</b>	BUR	33%	A	0.03
F.27	5	Residential	BUR	33%	A	<b>0.35</b>
F.28	5	Residential	BUR	<b>20%</b>	A	0.35
F.29	5	Residential	BUR	<b>50%</b>	A	0.35
F.30	5	Residential	<b>SPM</b>	33%	A	0.35
F.31	5	Residential	BUR	33%	<b>B</b>	0.35
F.32	5	Residential	BUR	33%	<b>C</b>	0.35
F.33	5	Residential	BUR	33%	<b>D</b>	0.35
F.34	5	<b>Commercial</b>	BUR	33%	A	0.35
F.35	5	Residential	BUR	33%	A	<b>0.70</b>
F.36	5	Residential	BUR	33%	A	<b>1.00</b>
F.37	<b>8</b>	Residential	BUR	33%	A	0.03
F.38	8	Residential	BUR	<b>20%</b>	A	0.03
F.39	8	Residential	BUR	<b>50%</b>	A	0.03
F.40	8	Residential	<b>SPM</b>	33%	A	0.03
F.41	8	Residential	BUR	33%	<b>B</b>	0.03
F.42	8	Residential	BUR	33%	<b>C</b>	0.03
F.43	8	Residential	BUR	33%	<b>D</b>	0.03
F.44	8	<b>Commercial</b>	BUR	33%	A	0.03
F.45	8	Residential	BUR	33%	A	<b>0.35</b>
F.46	8	Residential	BUR	<b>20%</b>	A	0.35
F.47	8	Residential	BUR	<b>50%</b>	A	0.35
F.48	8	Residential	<b>SPM</b>	33%	A	0.35
F.49	8	Residential	BUR	33%	<b>B</b>	0.35
F.50	8	Residential	BUR	33%	<b>C</b>	0.35
F.51	8	Residential	BUR	33%	<b>D</b>	0.35
F.52	8	<b>Commercial</b>	BUR	33%	A	0.35
F.53	8	Residential	BUR	33%	A	<b>0.70</b>
F.54	8	Residential	BUR	33%	A	<b>1.00</b>



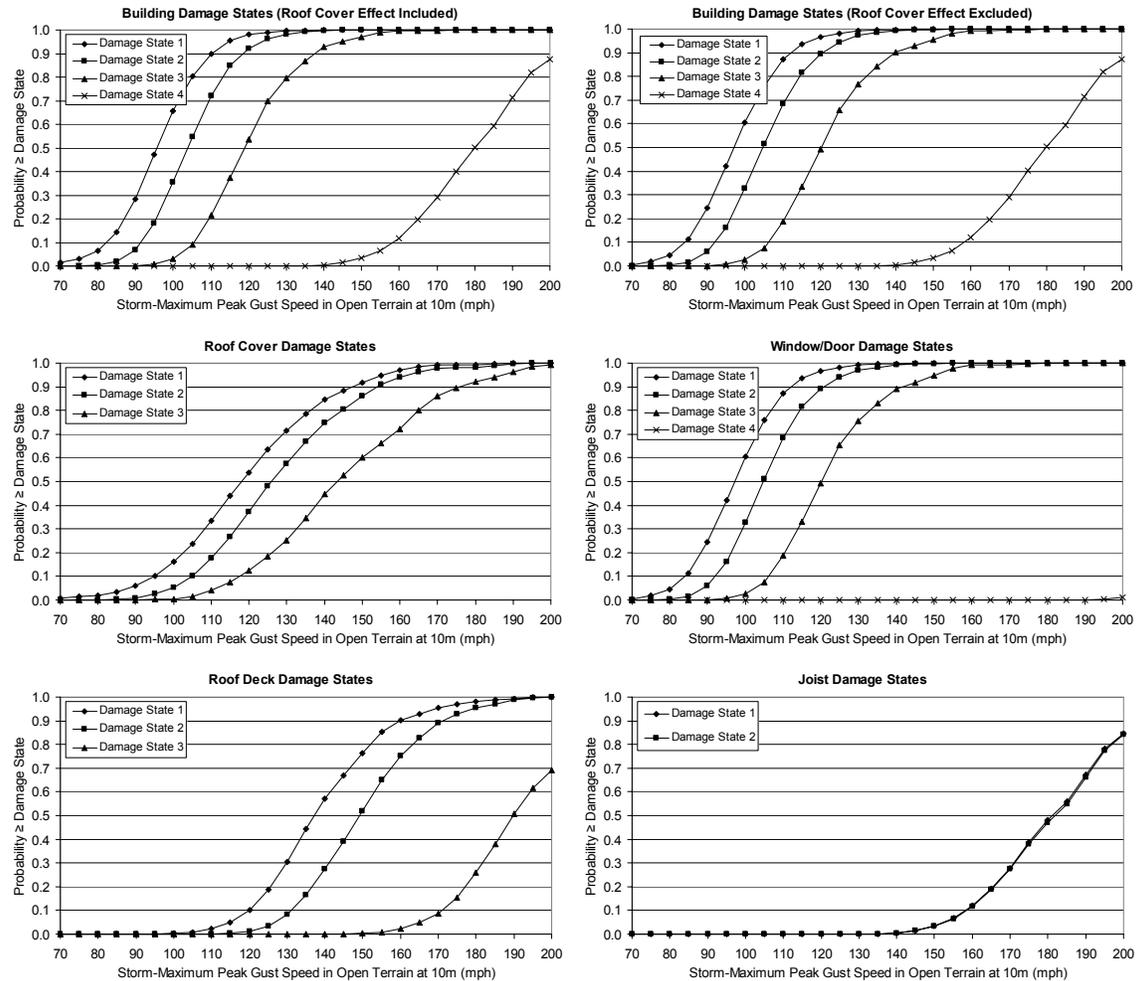
**Figure F.1. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_{\theta}=0.03$  m.**



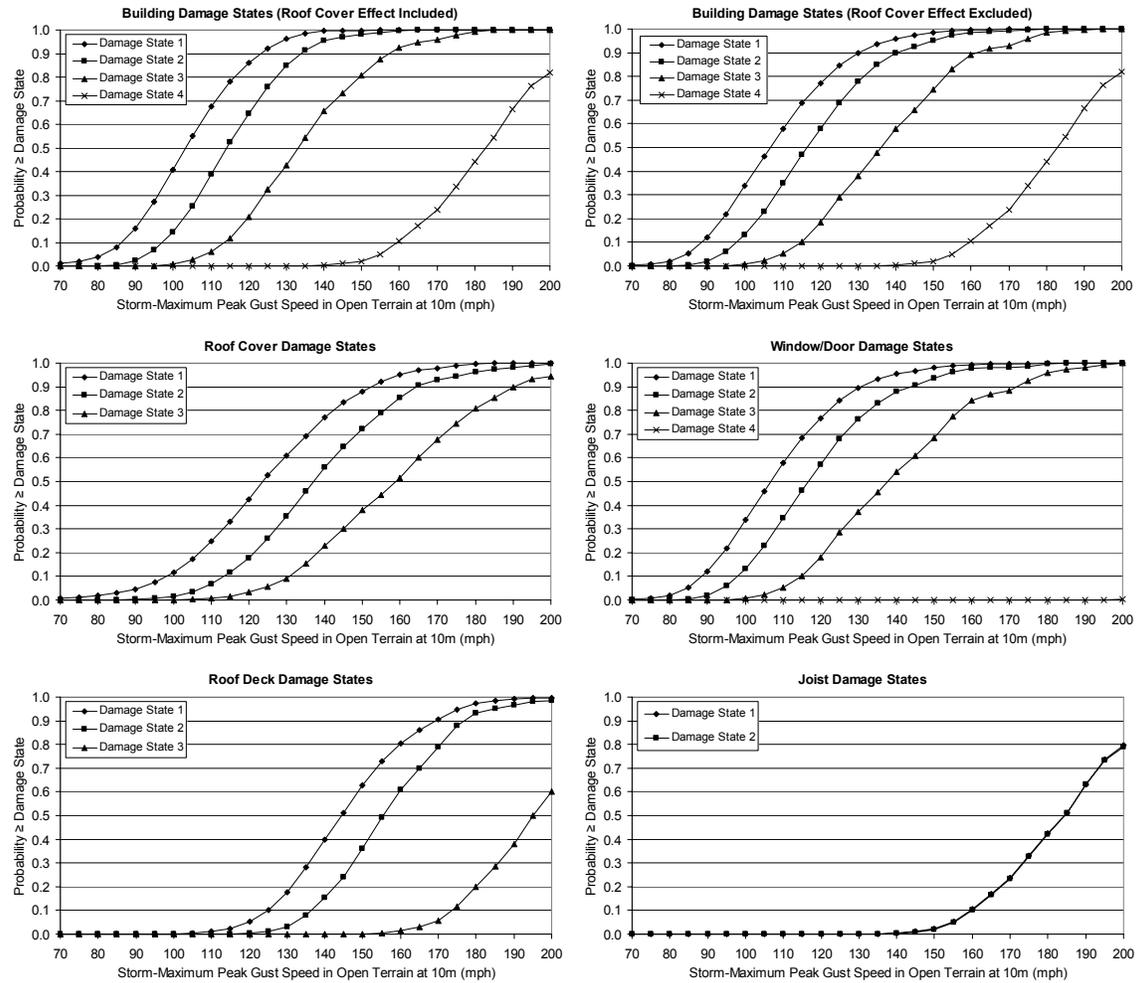
**Figure F.2. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



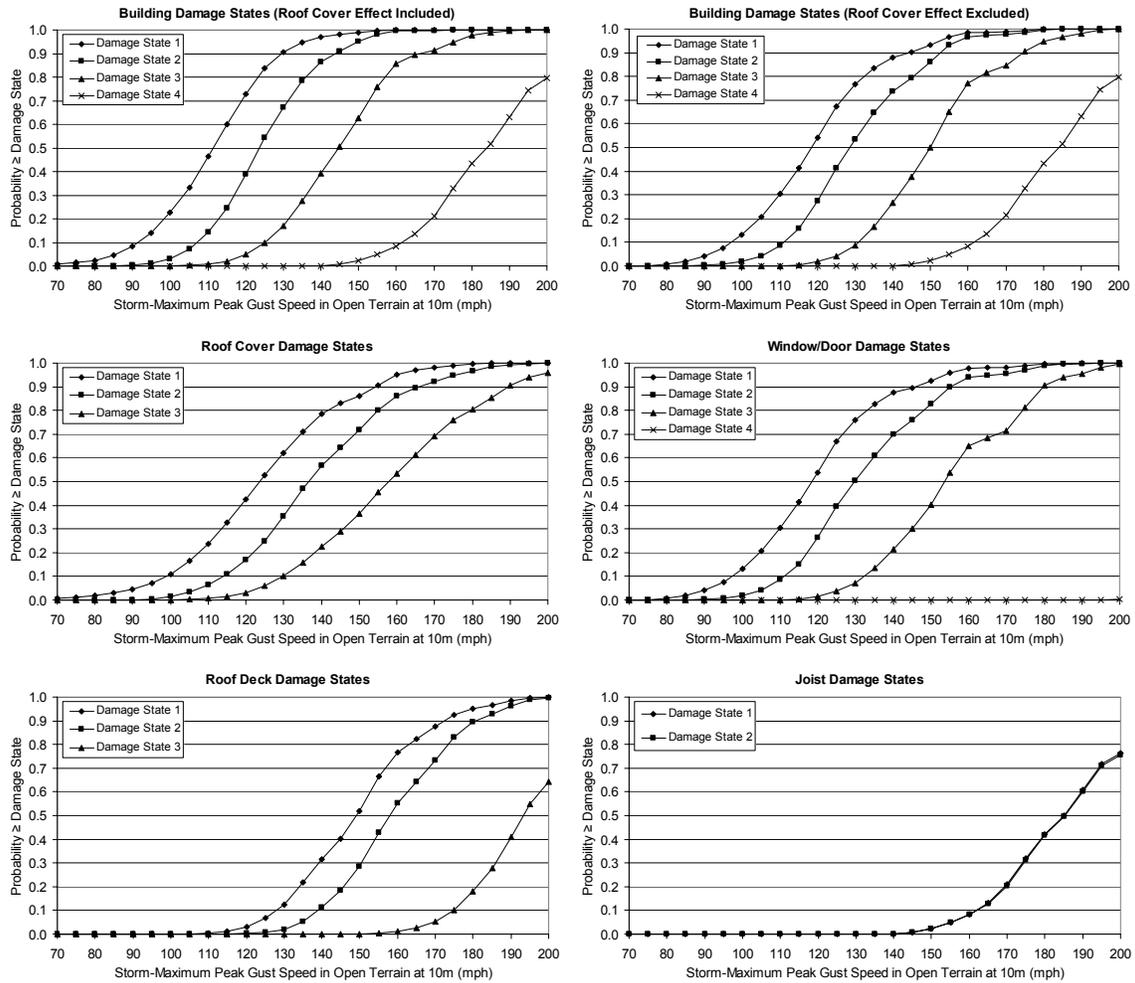
**Figure F.3. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



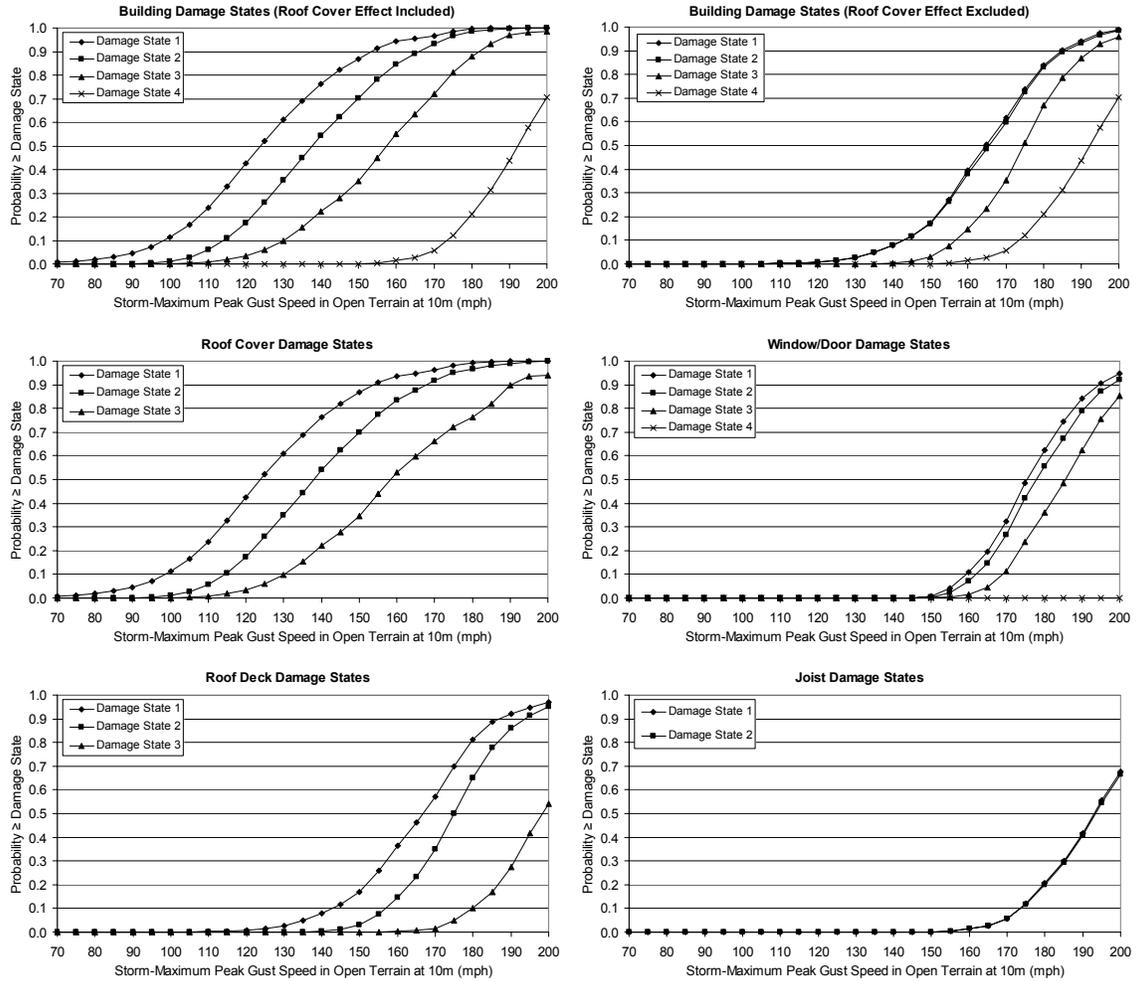
**Figure F.4. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



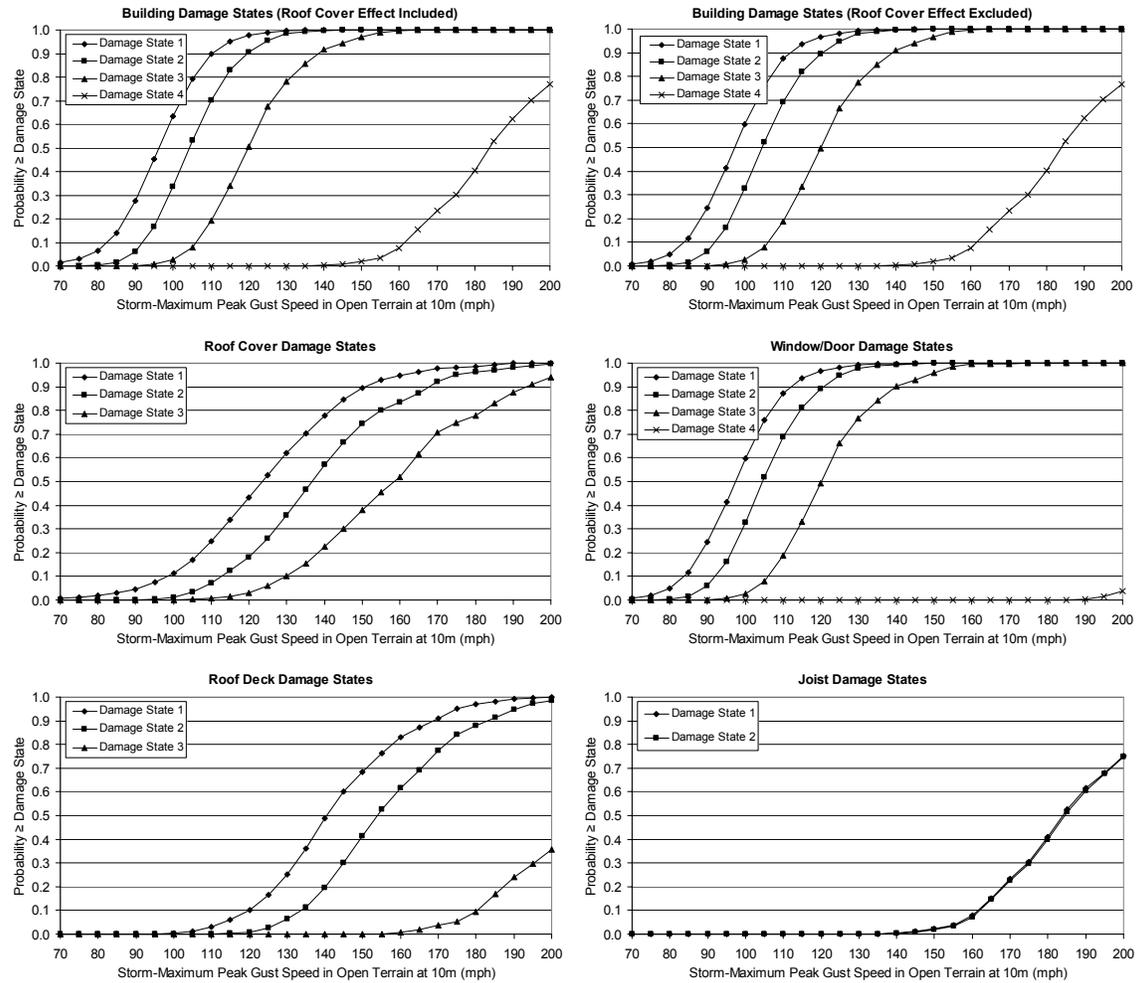
**Figure F.5. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.03$  m.**



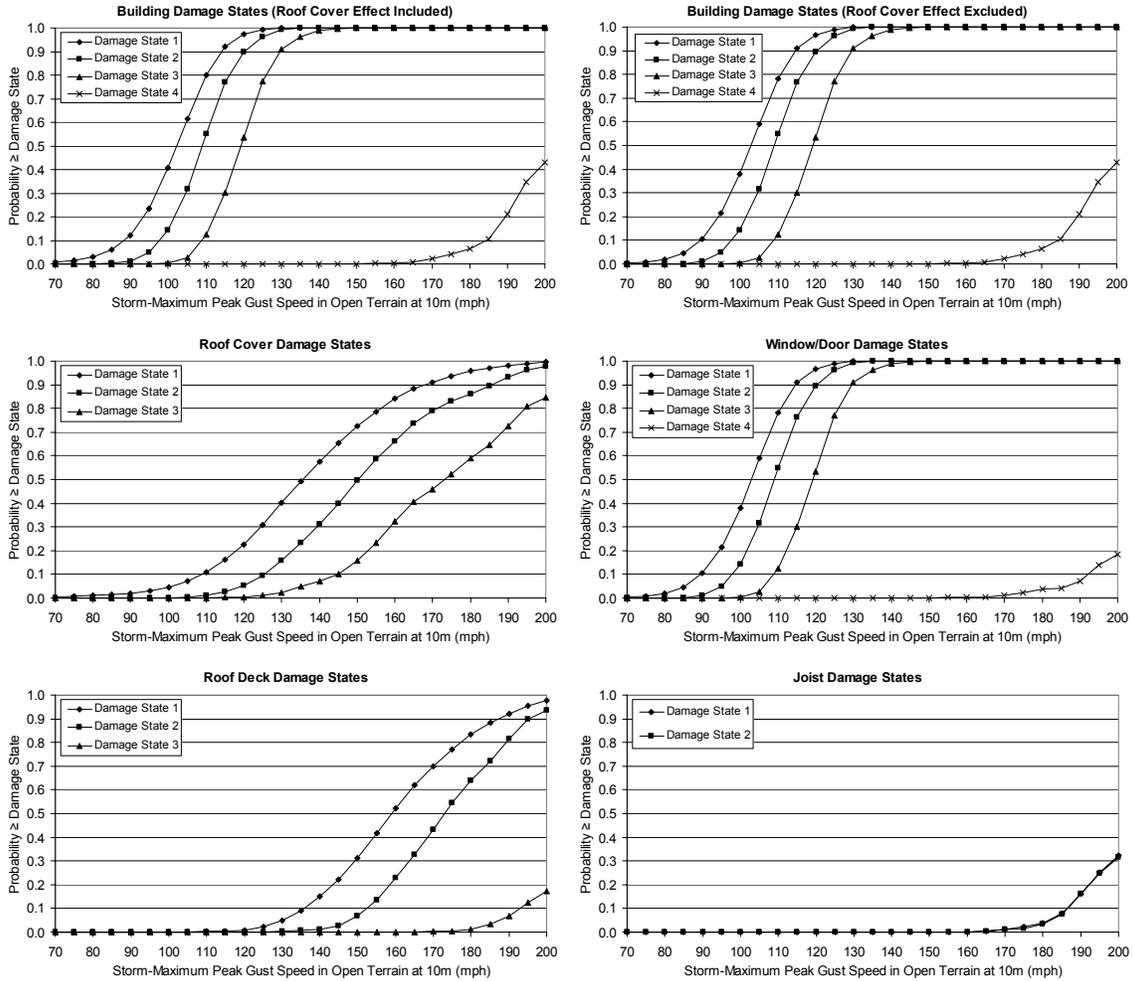
**Figure F.6. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_0=0.03$  m.**



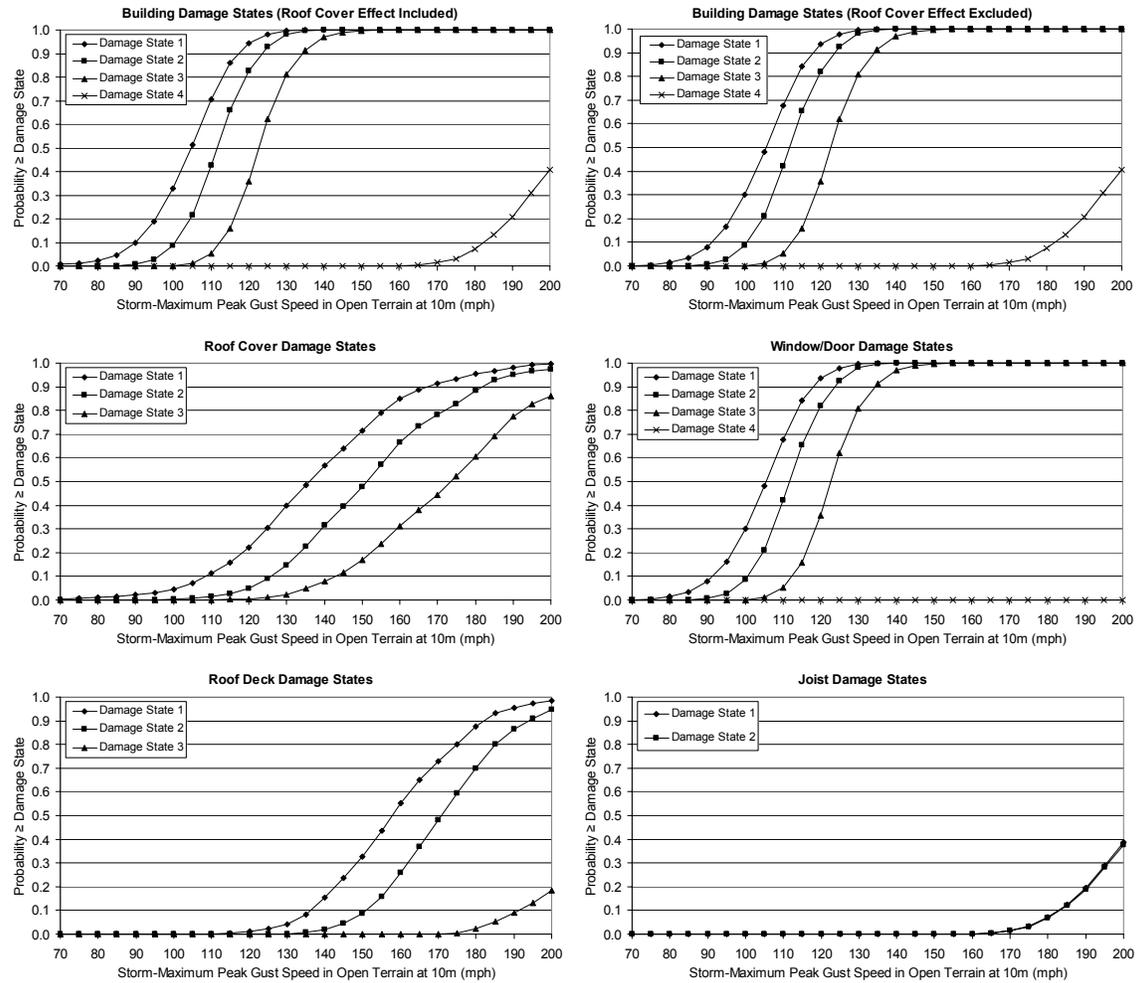
**Figure F.7. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_0=0.03$  m.**



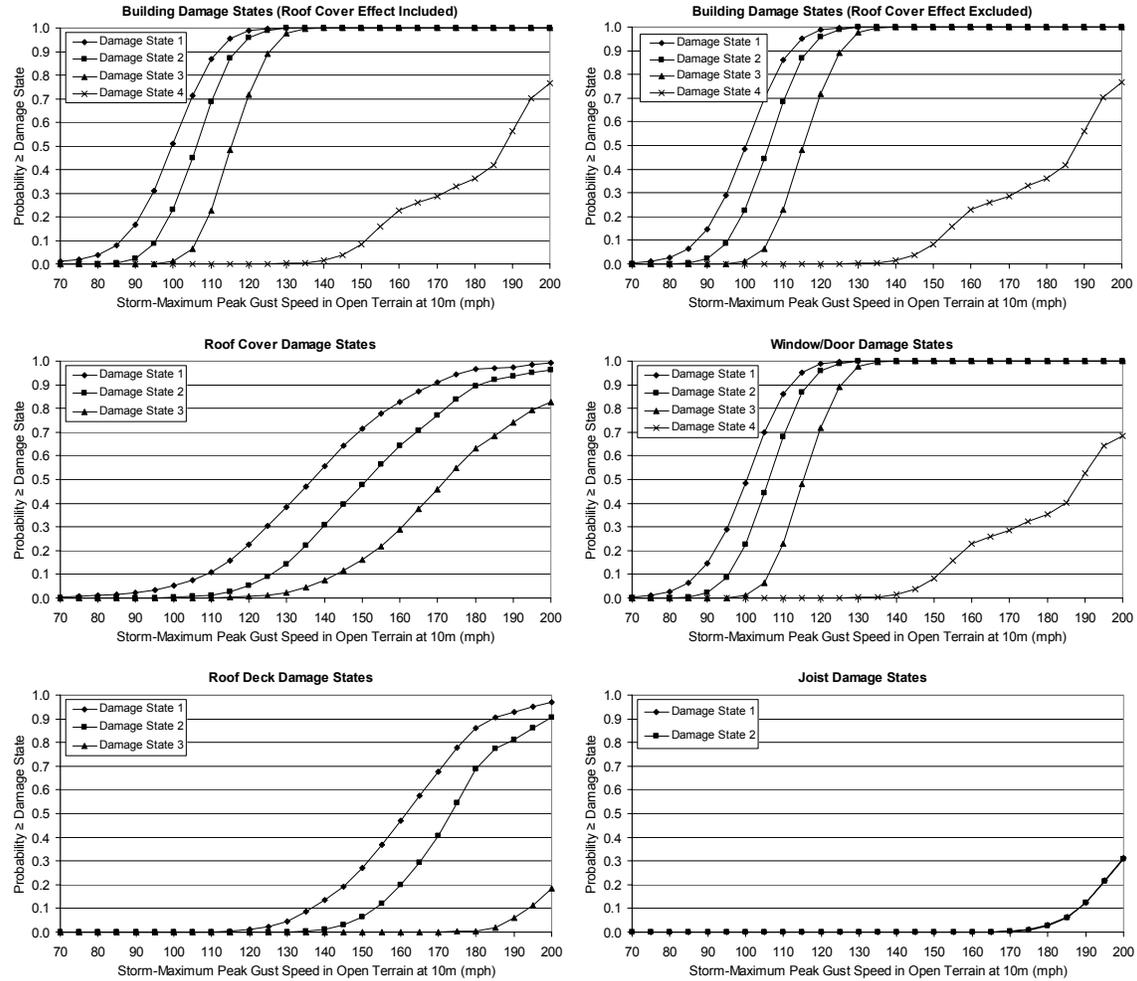
**Figure F.8. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



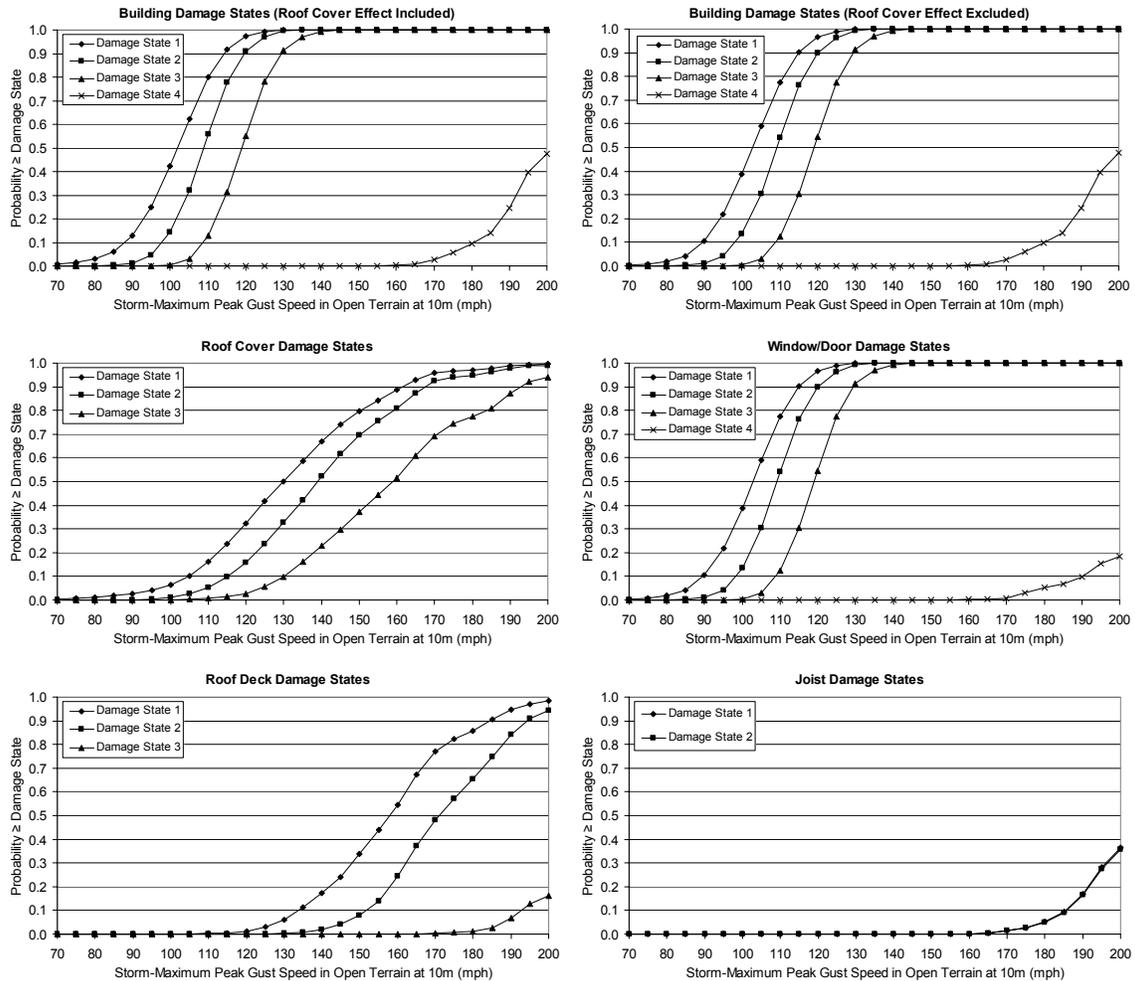
**Figure F.9. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



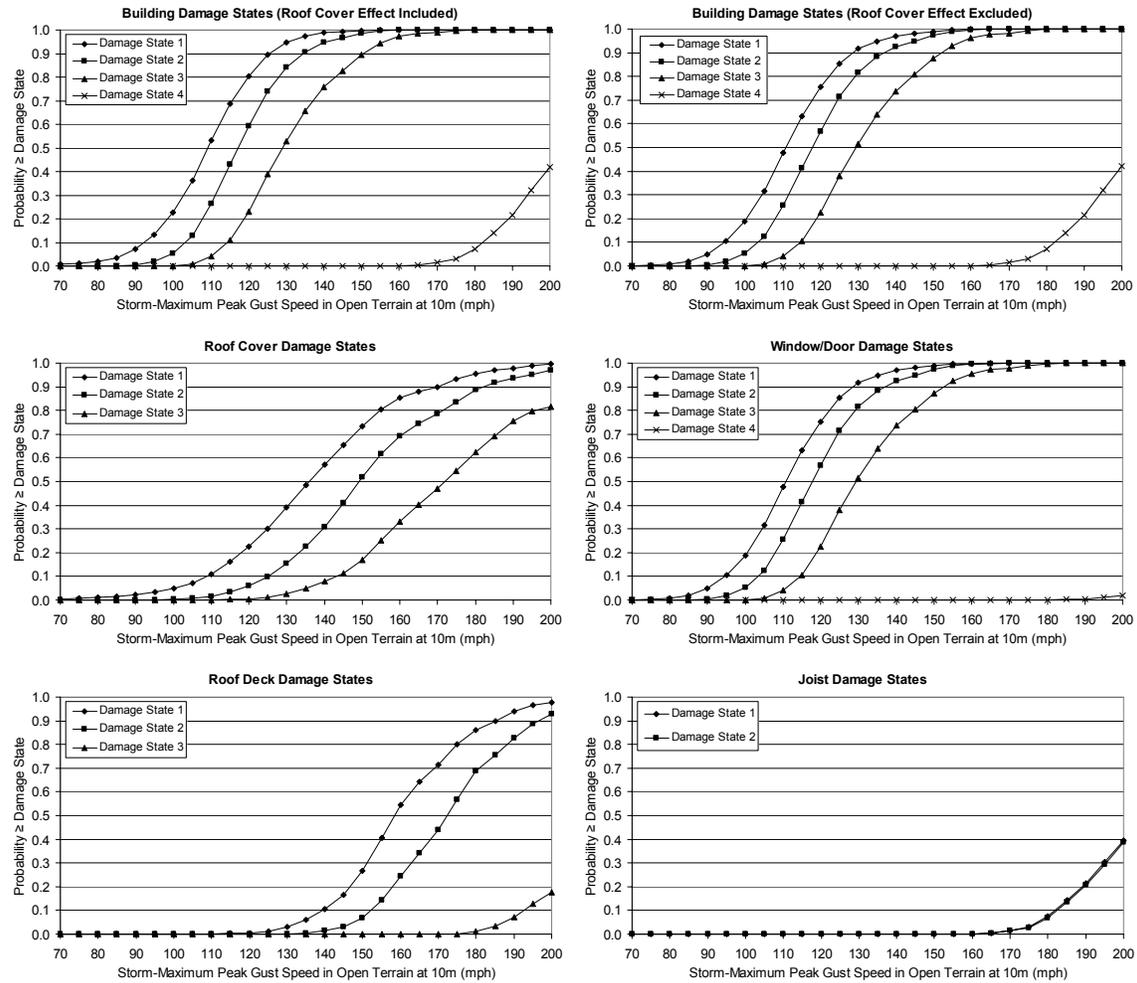
**Figure F.10. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



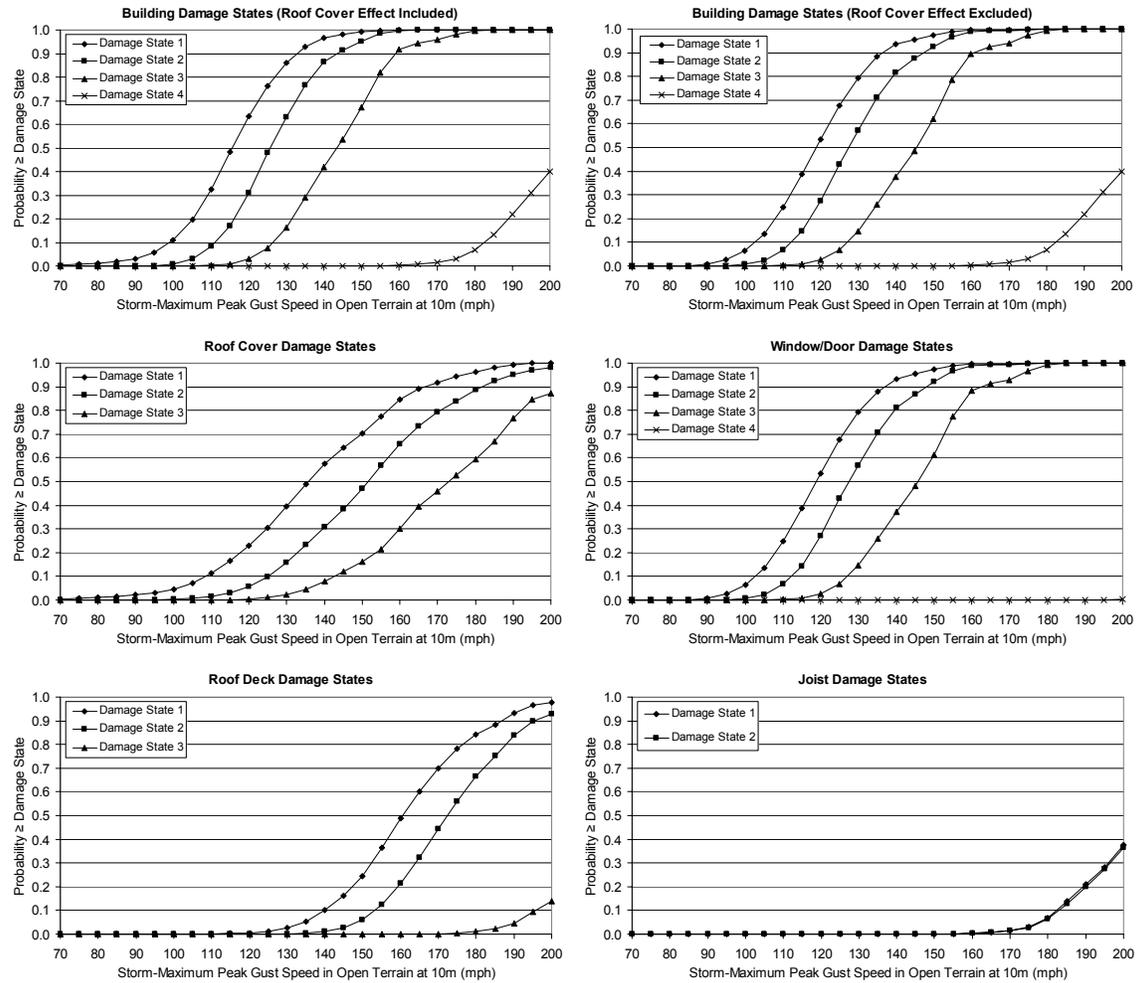
**Figure F.11. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



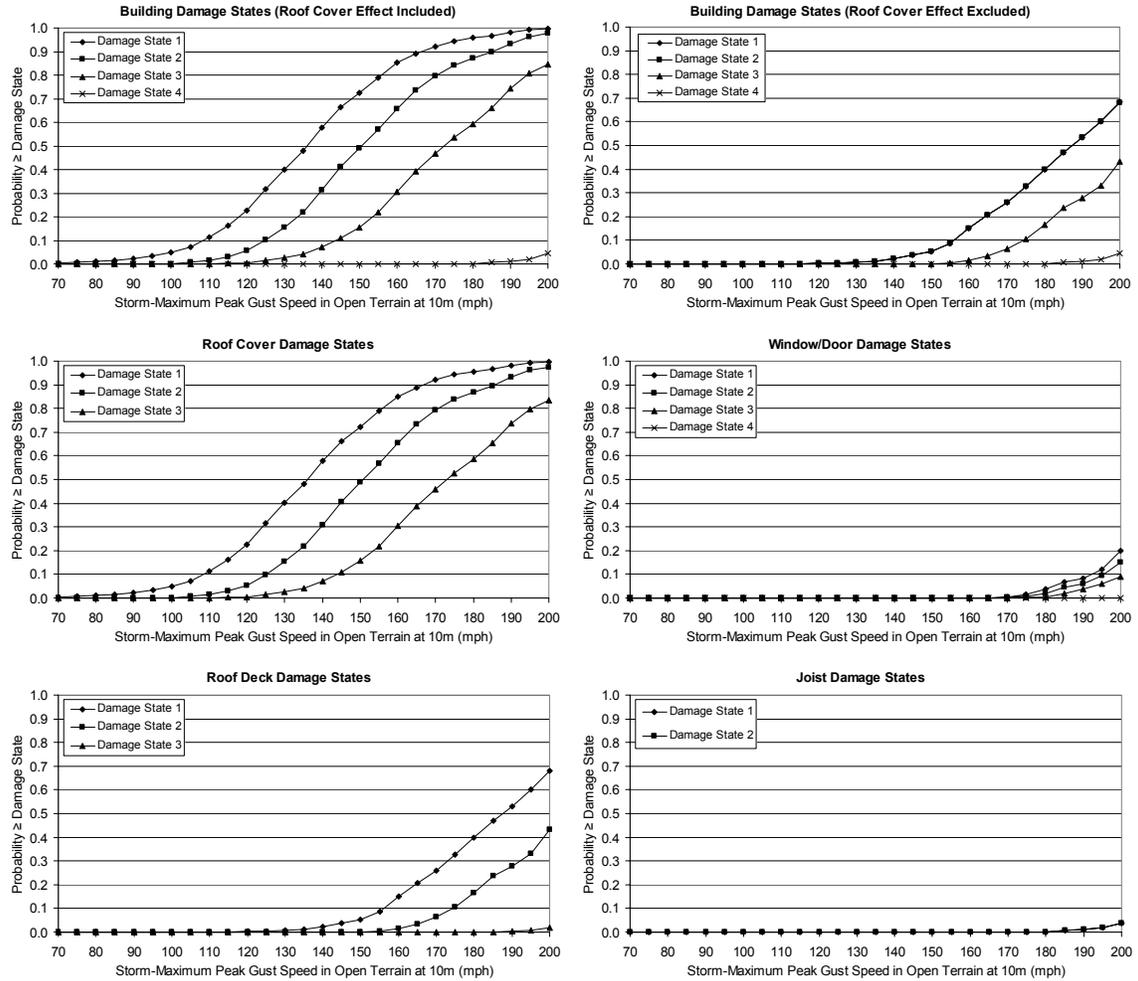
**Figure F.12. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



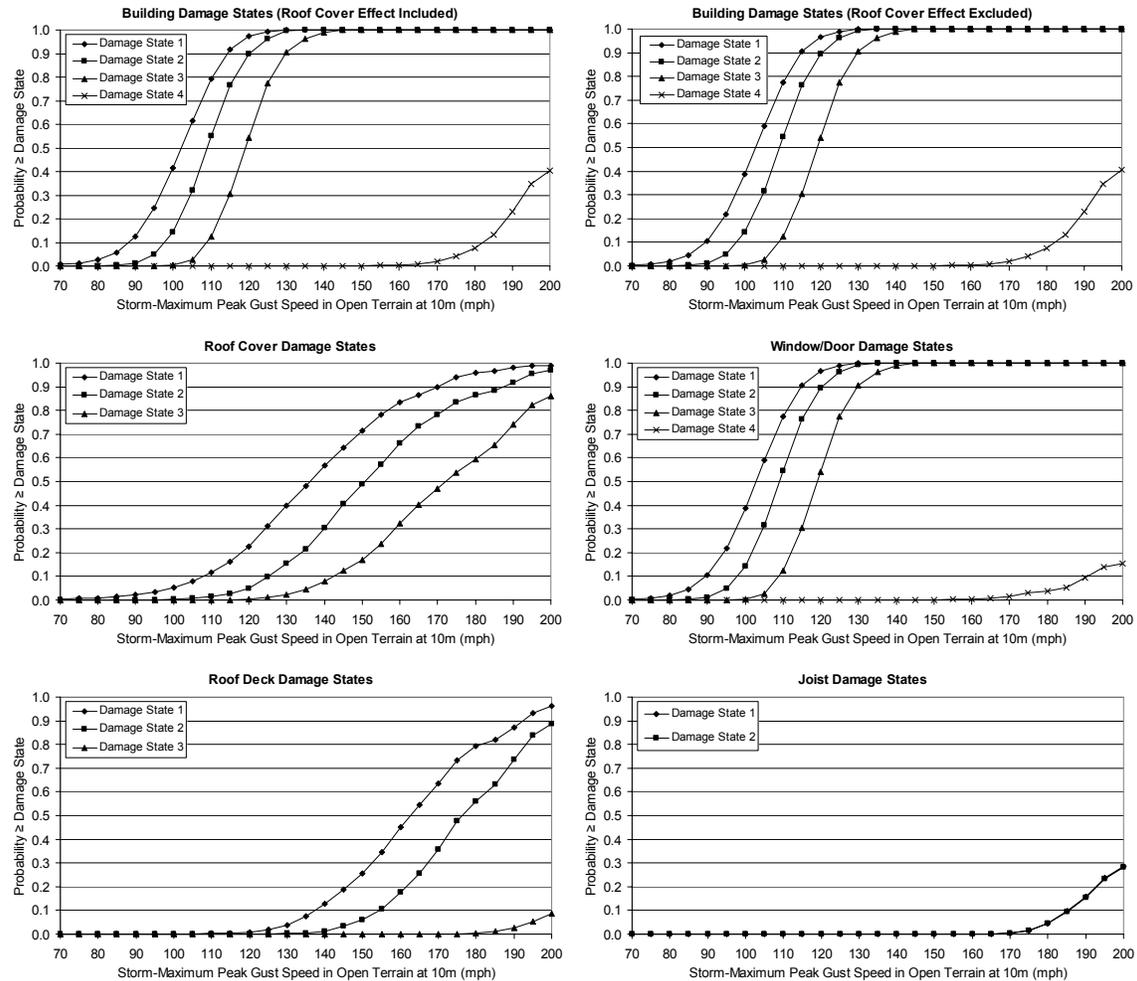
**Figure F.13. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.35$  m.**



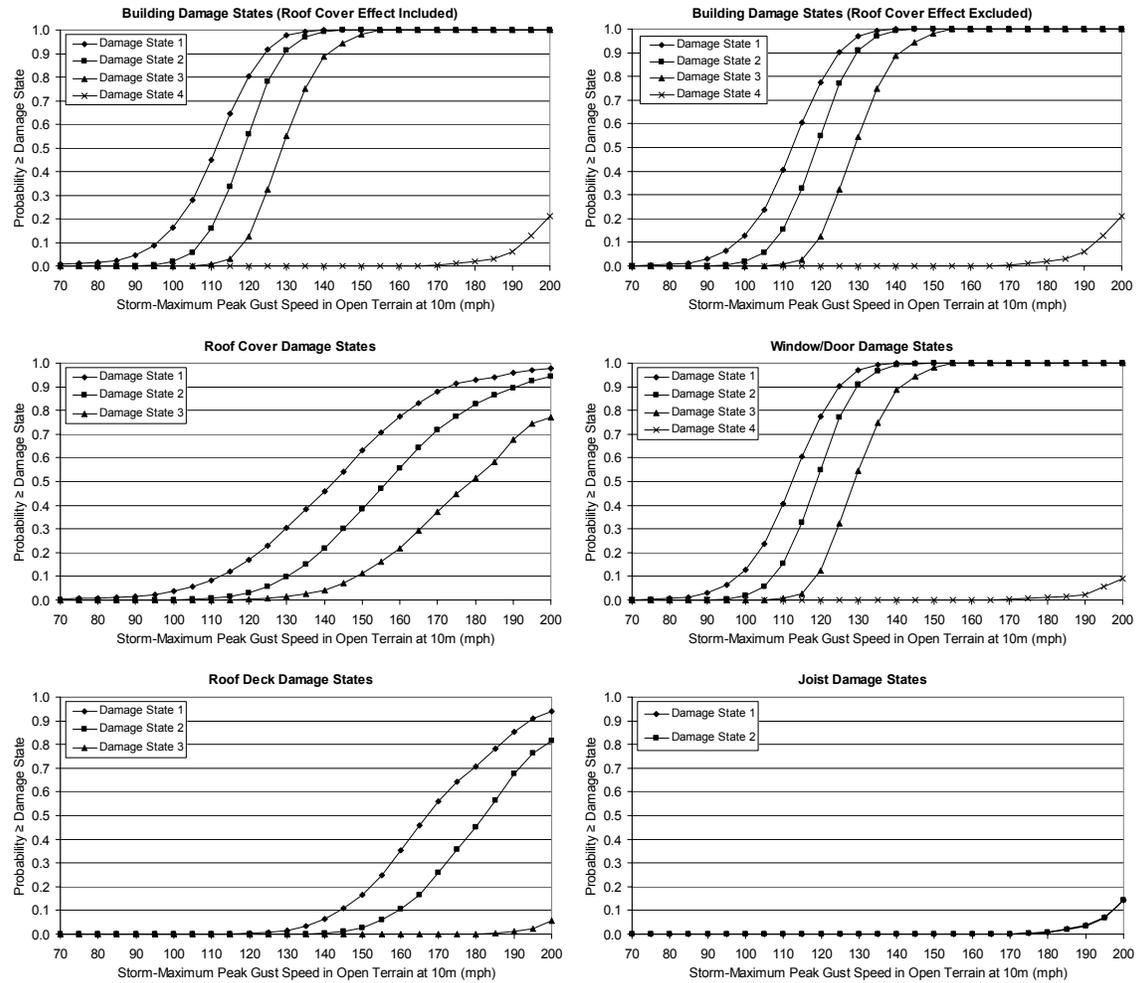
**Figure F.14. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_{\theta}=0.35$  m.**



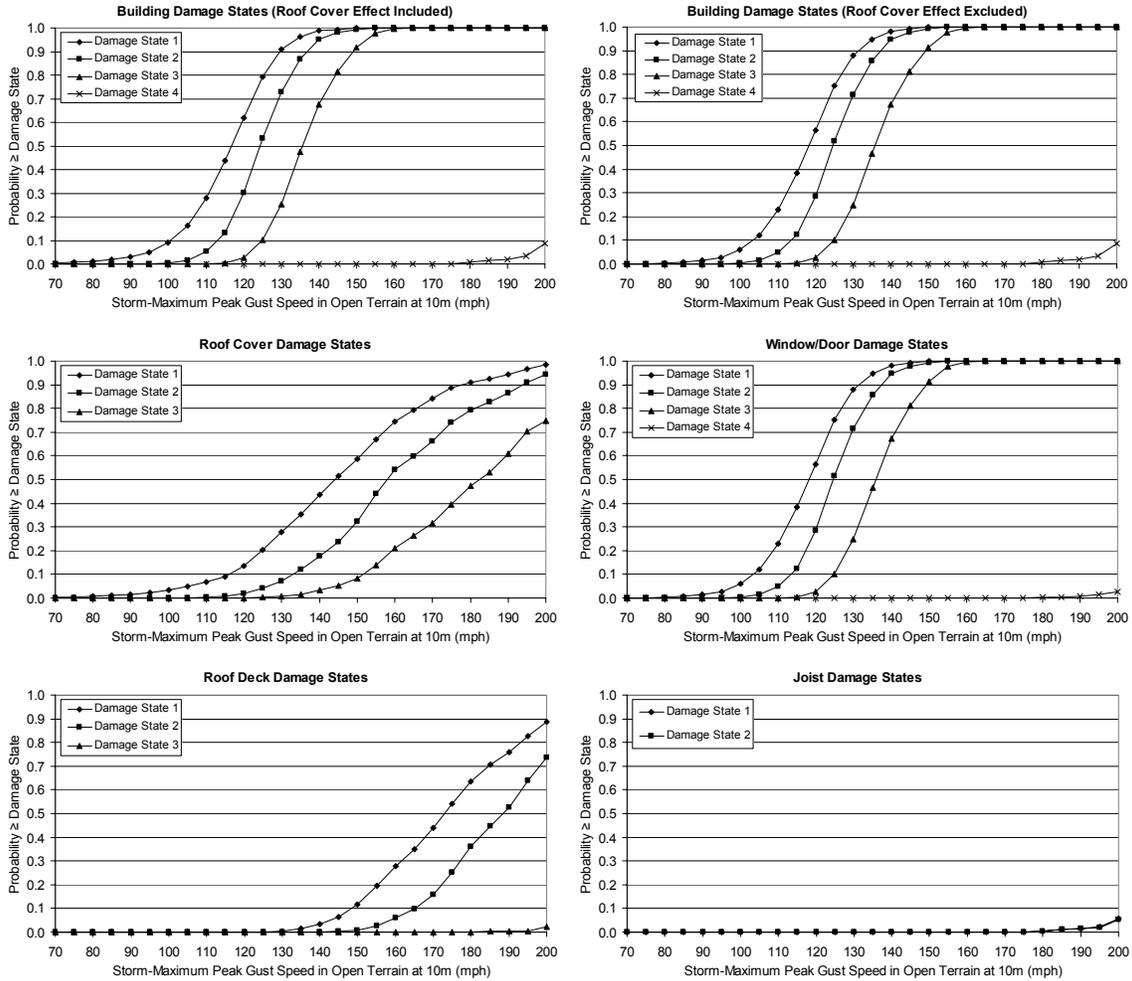
**Figure F.15. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_{\theta}=0.35$  m.**



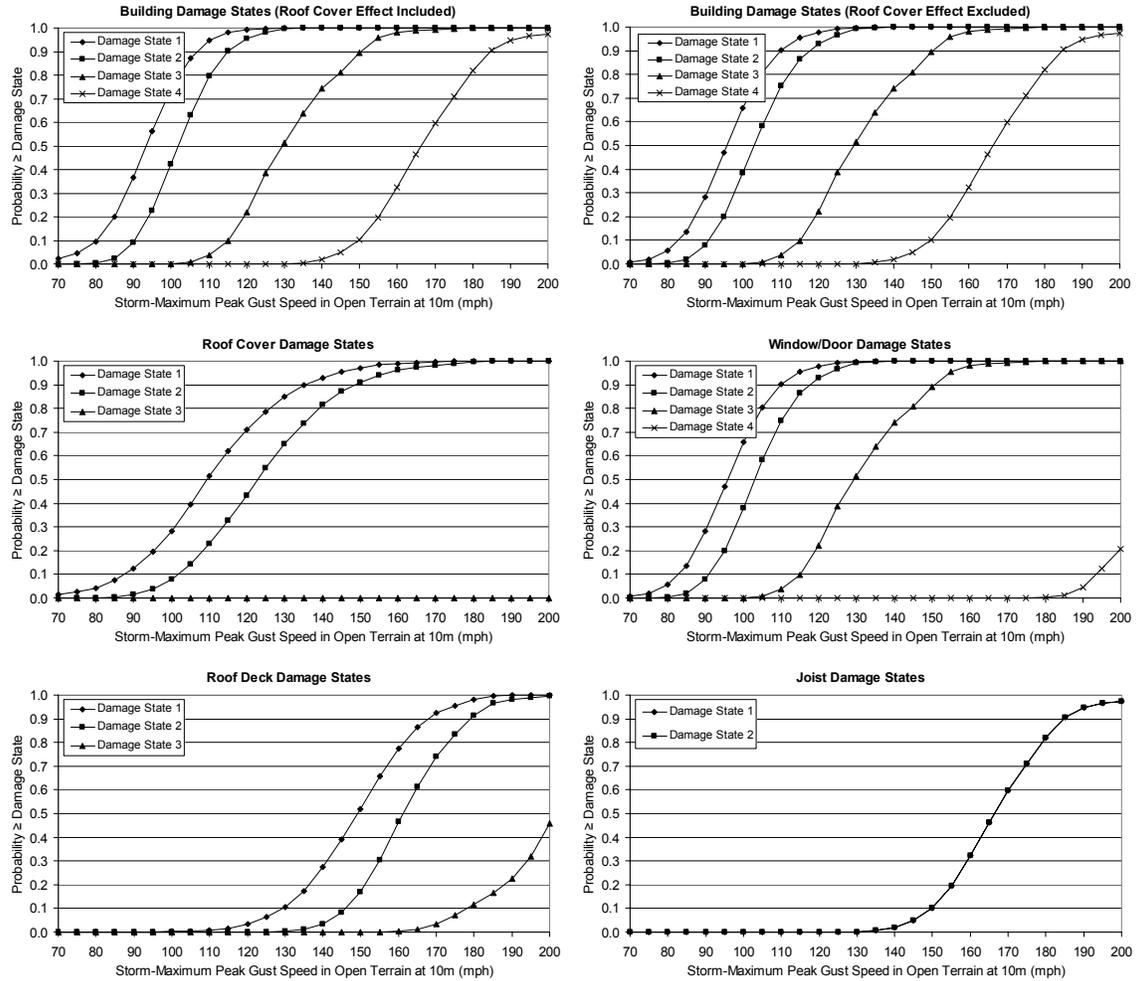
**Figure F.16. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



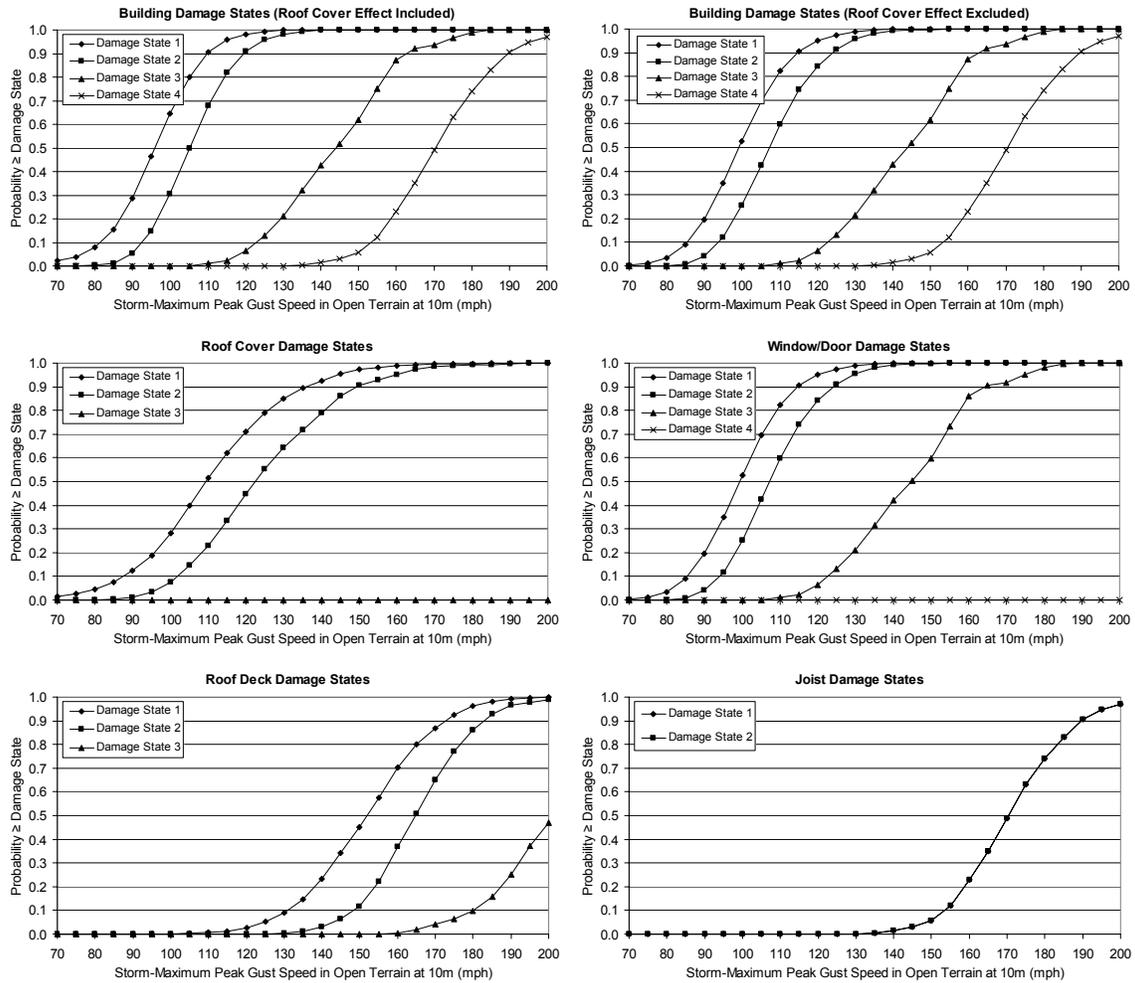
**Figure F.17. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.70$  m.**



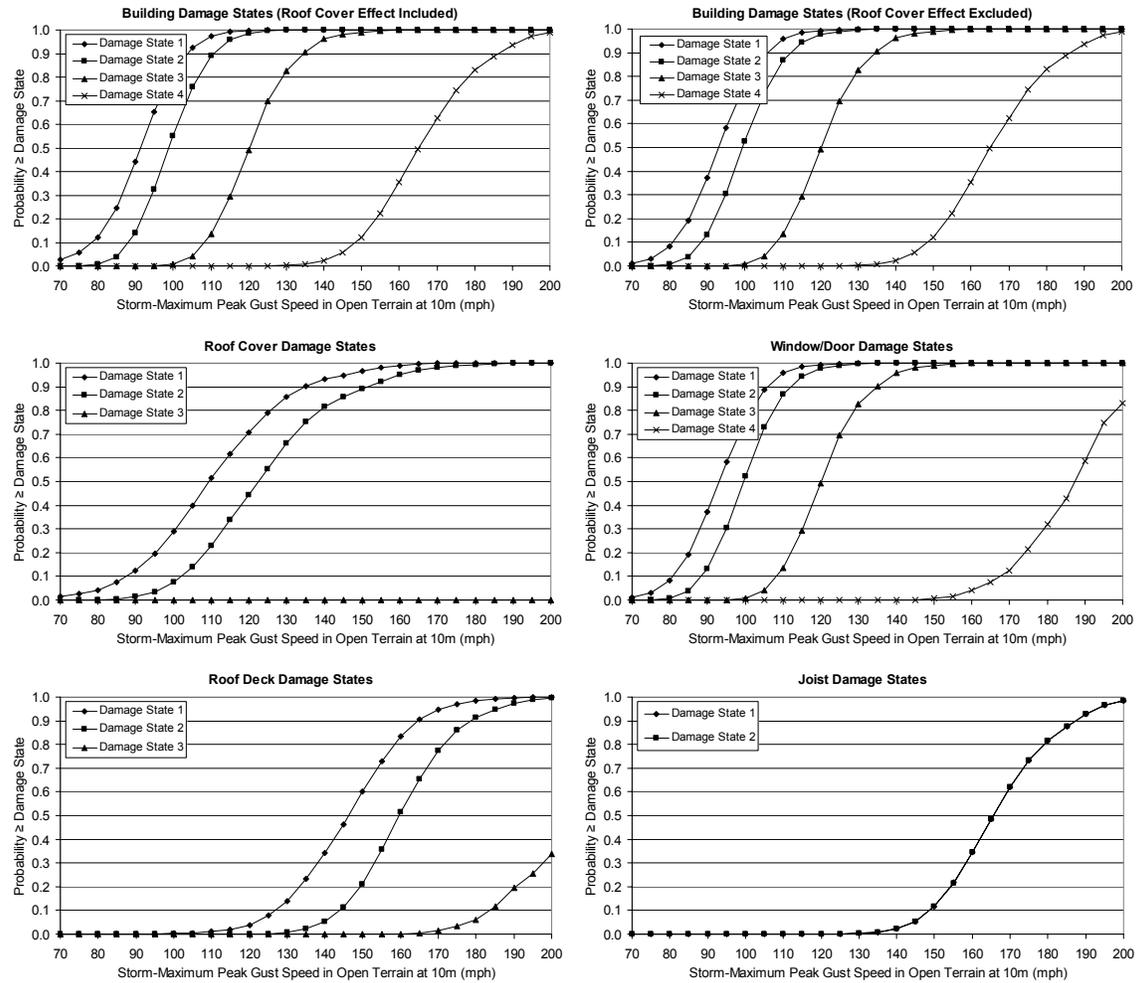
**Figure F.18. Damage States vs. Peak Gust Wind Speed – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=1.0$  m.**



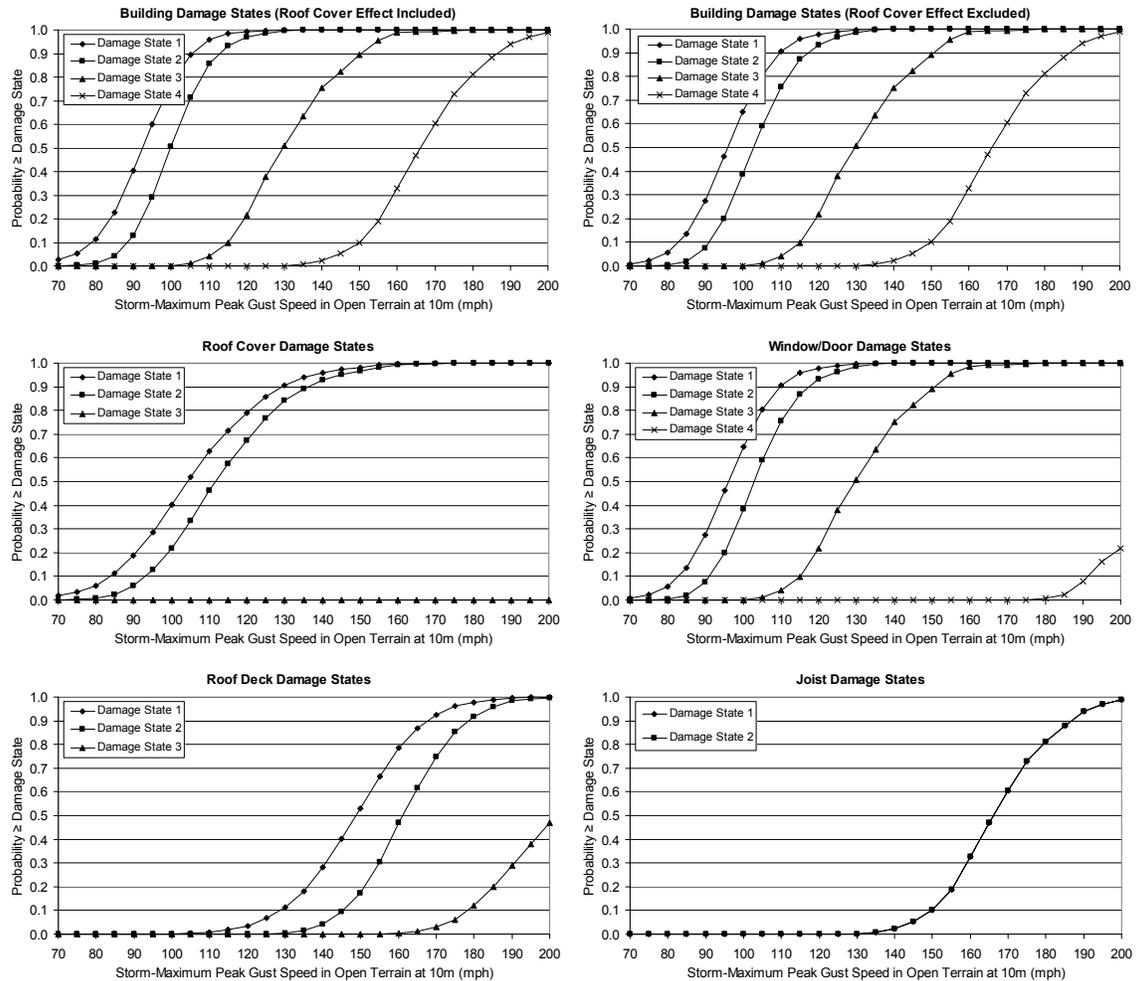
**Figure F.19. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



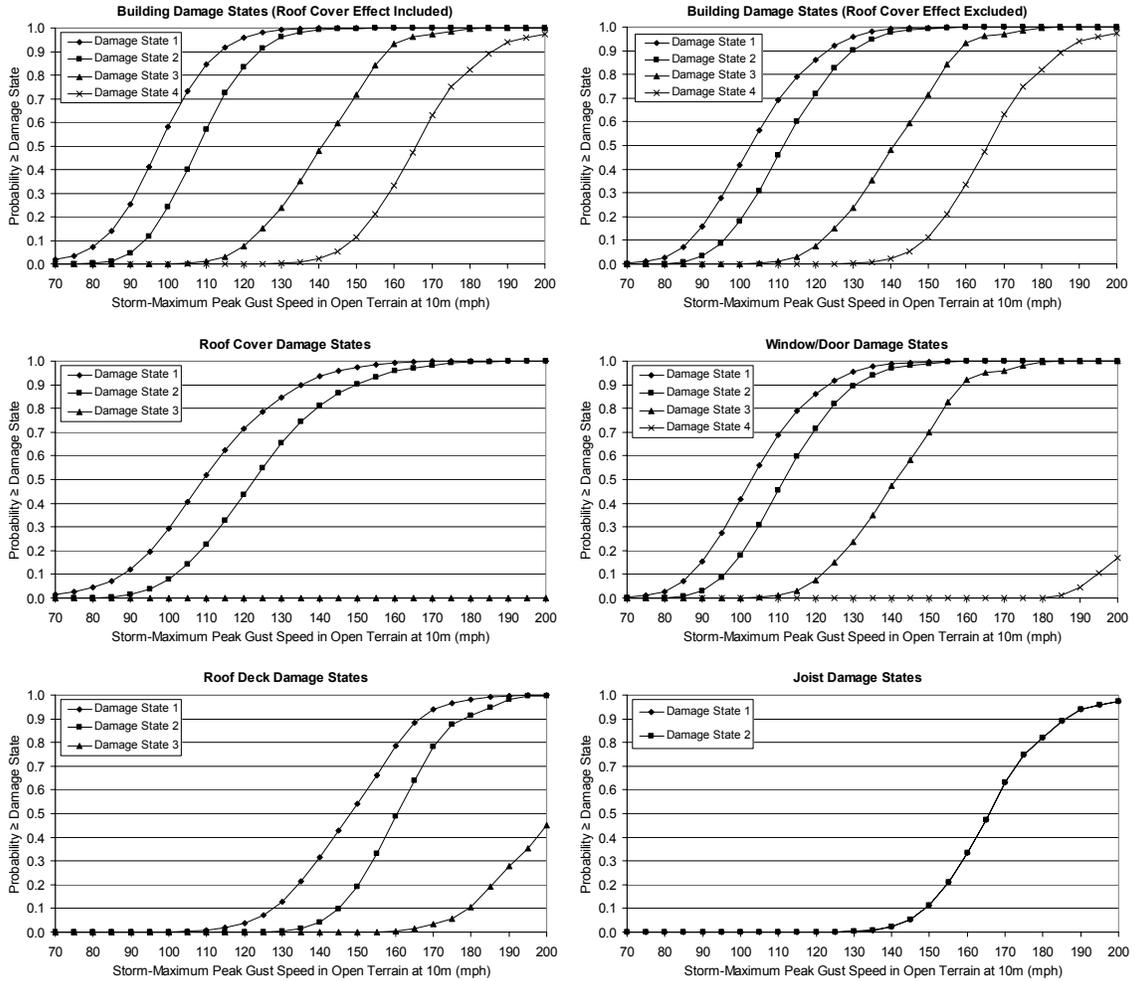
**Figure F.20. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



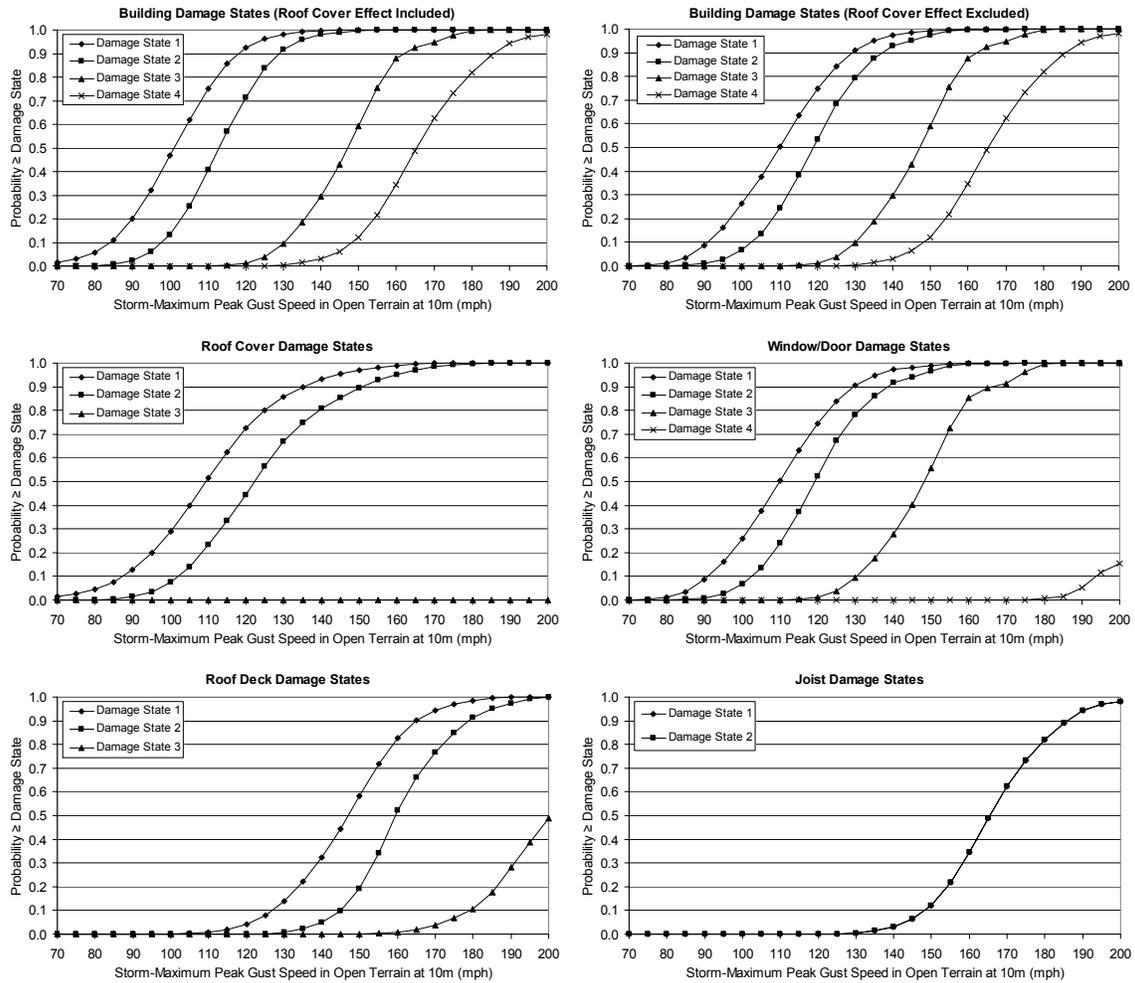
**Figure F.21. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



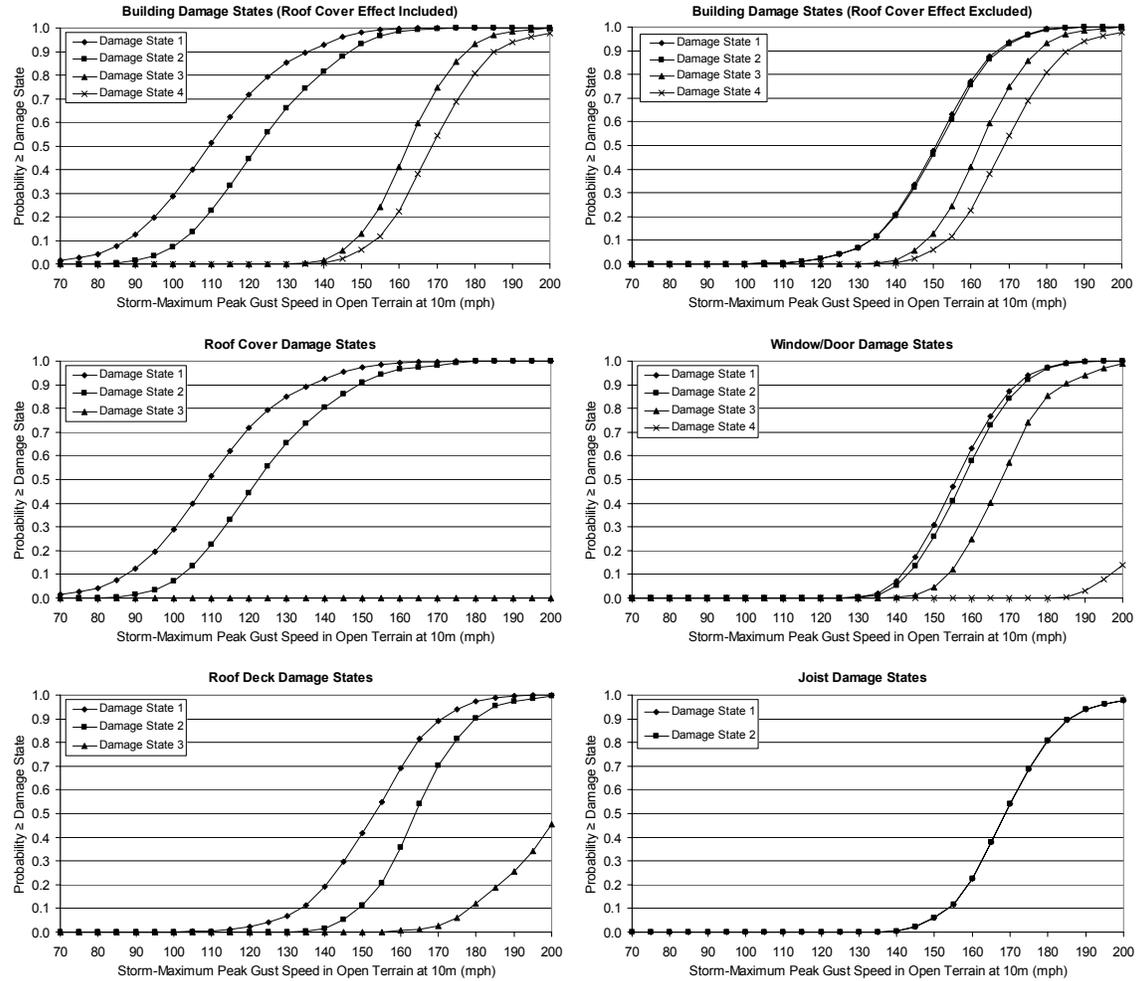
**Figure F.22. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



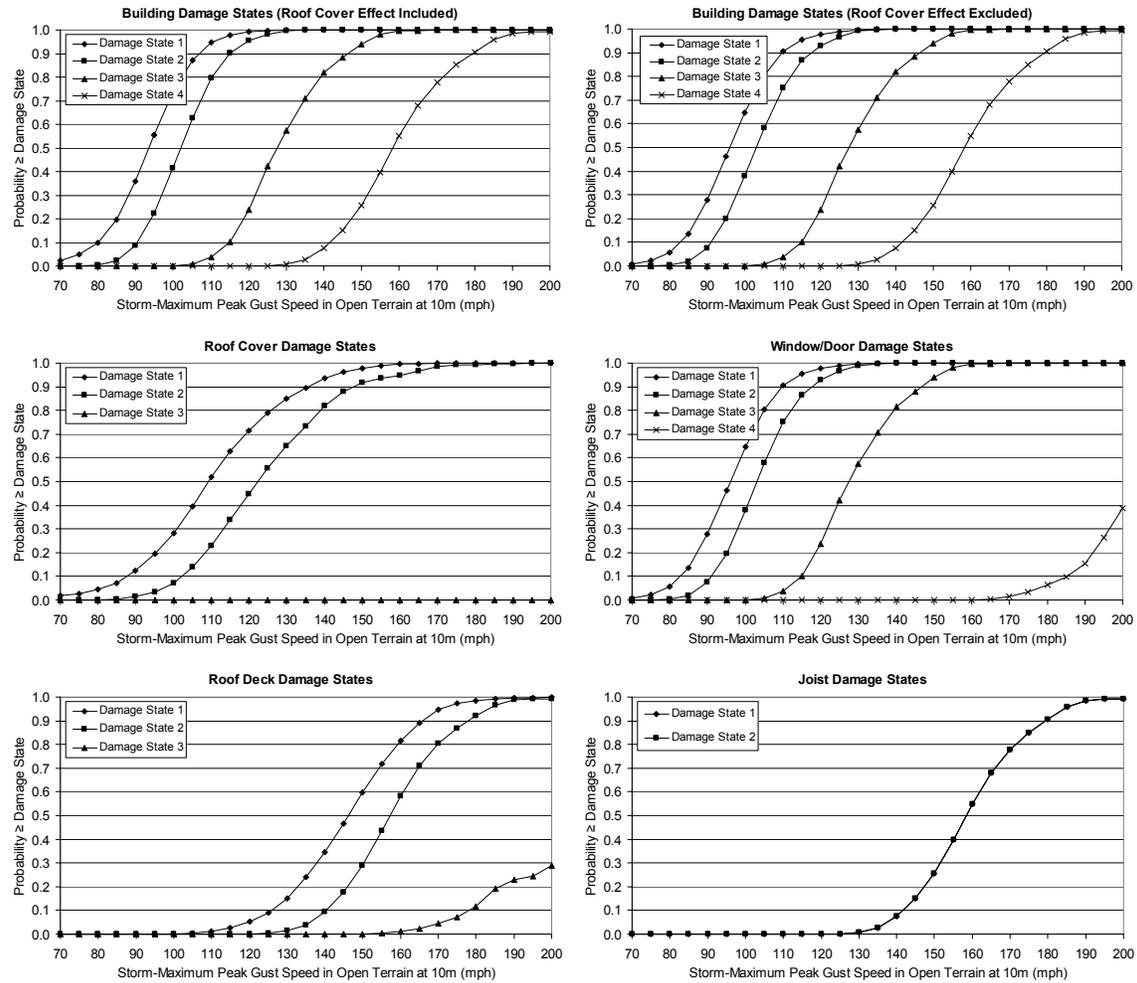
**Figure F.23. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.03$  m.**



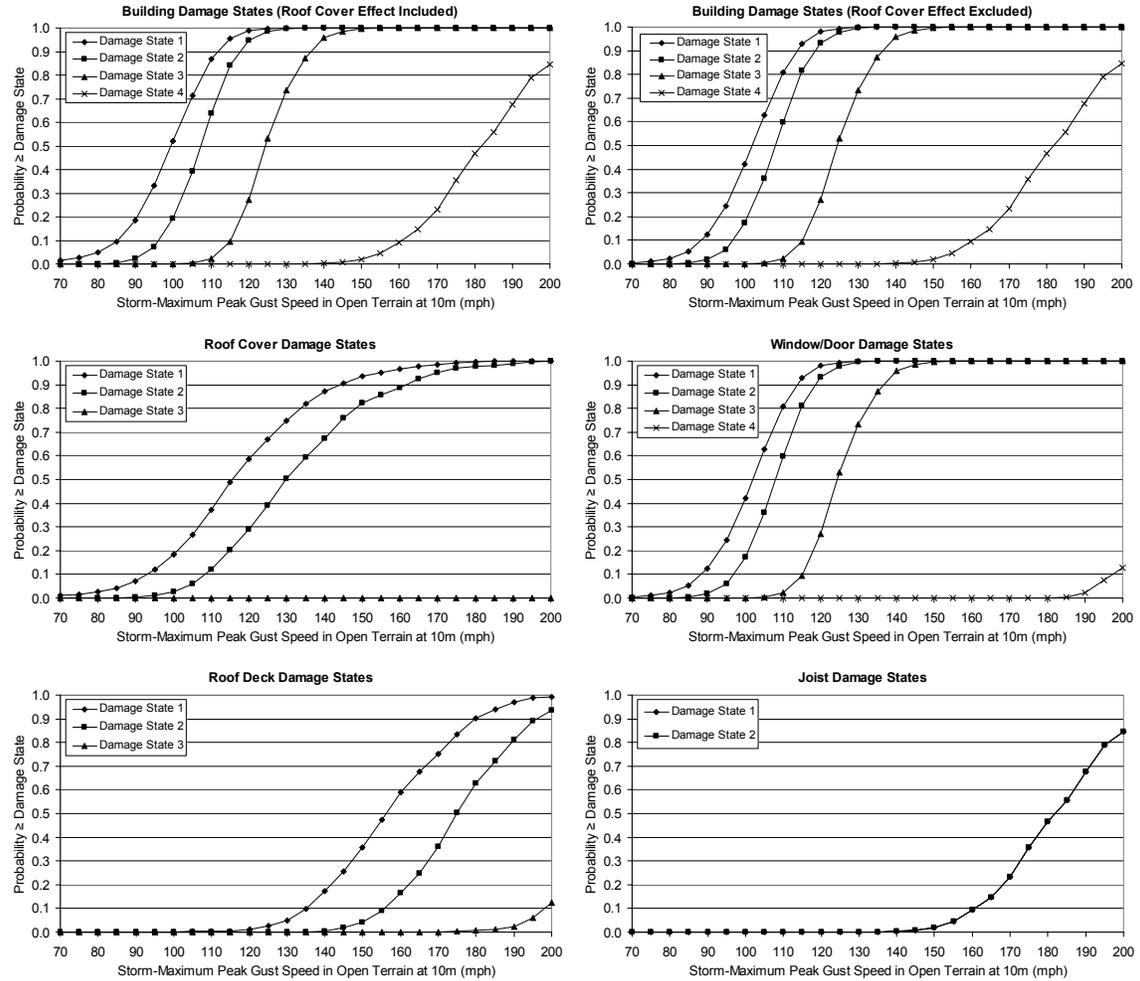
**Figure F.24. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_{\theta}=0.03$  m.**



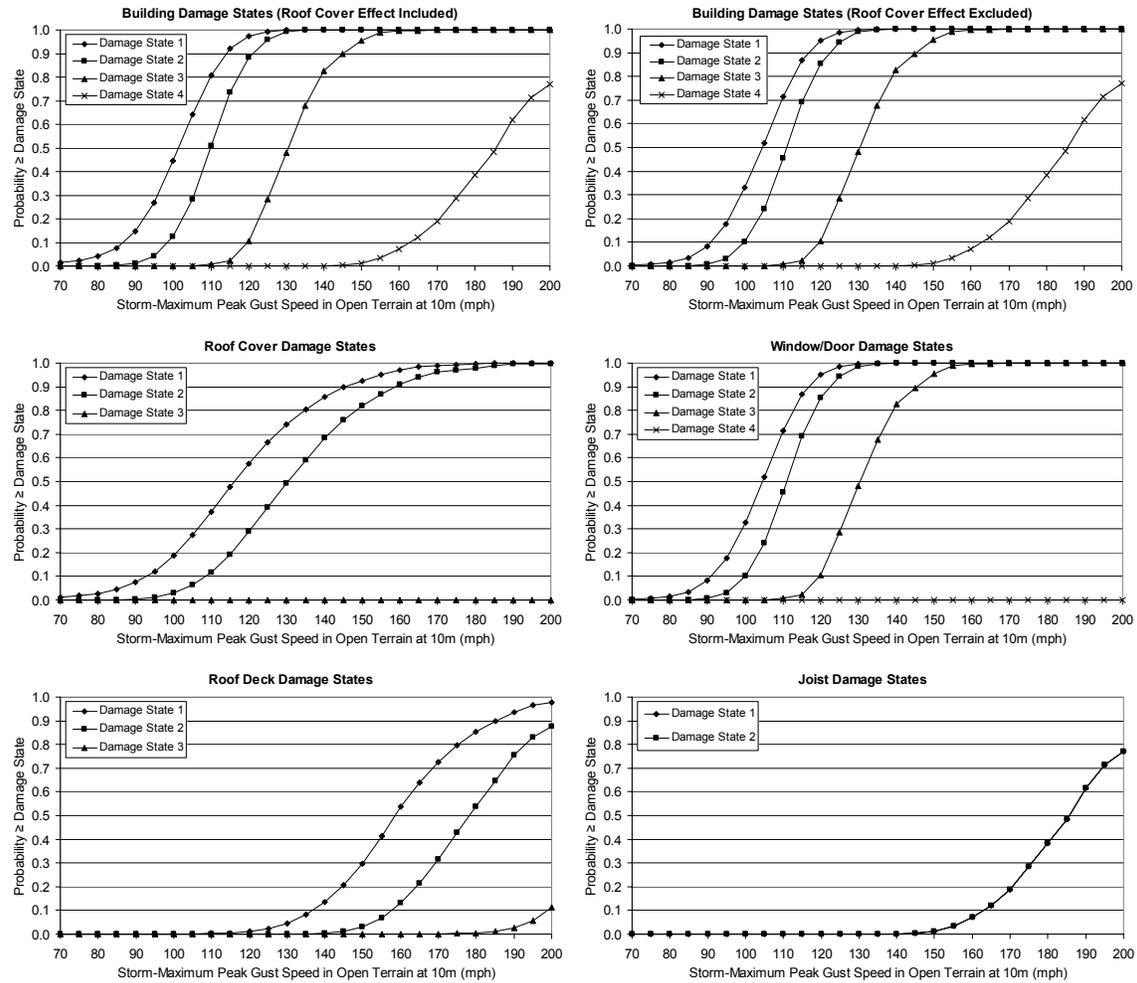
**Figure F.25. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_{\theta}=0.03$  m.**



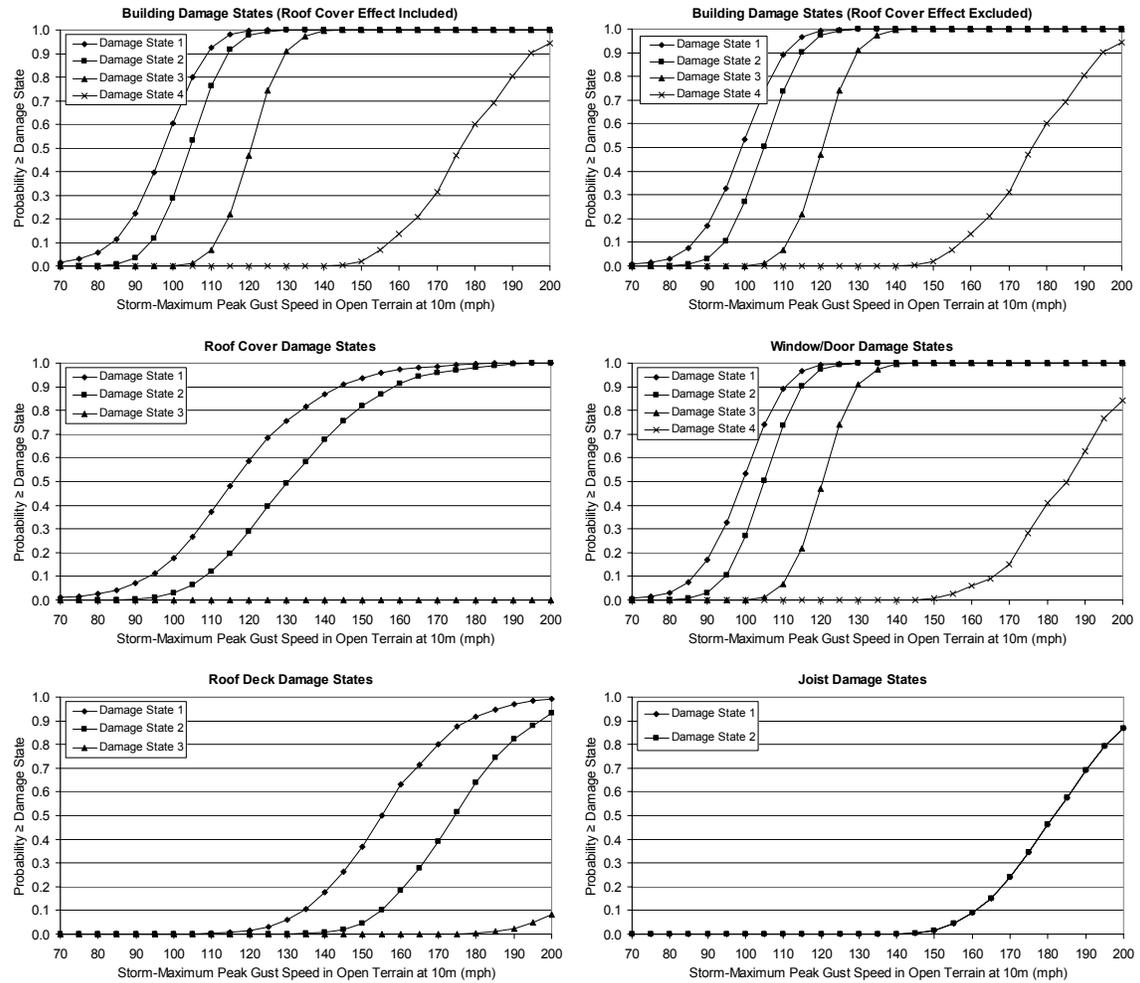
**Figure F.26. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



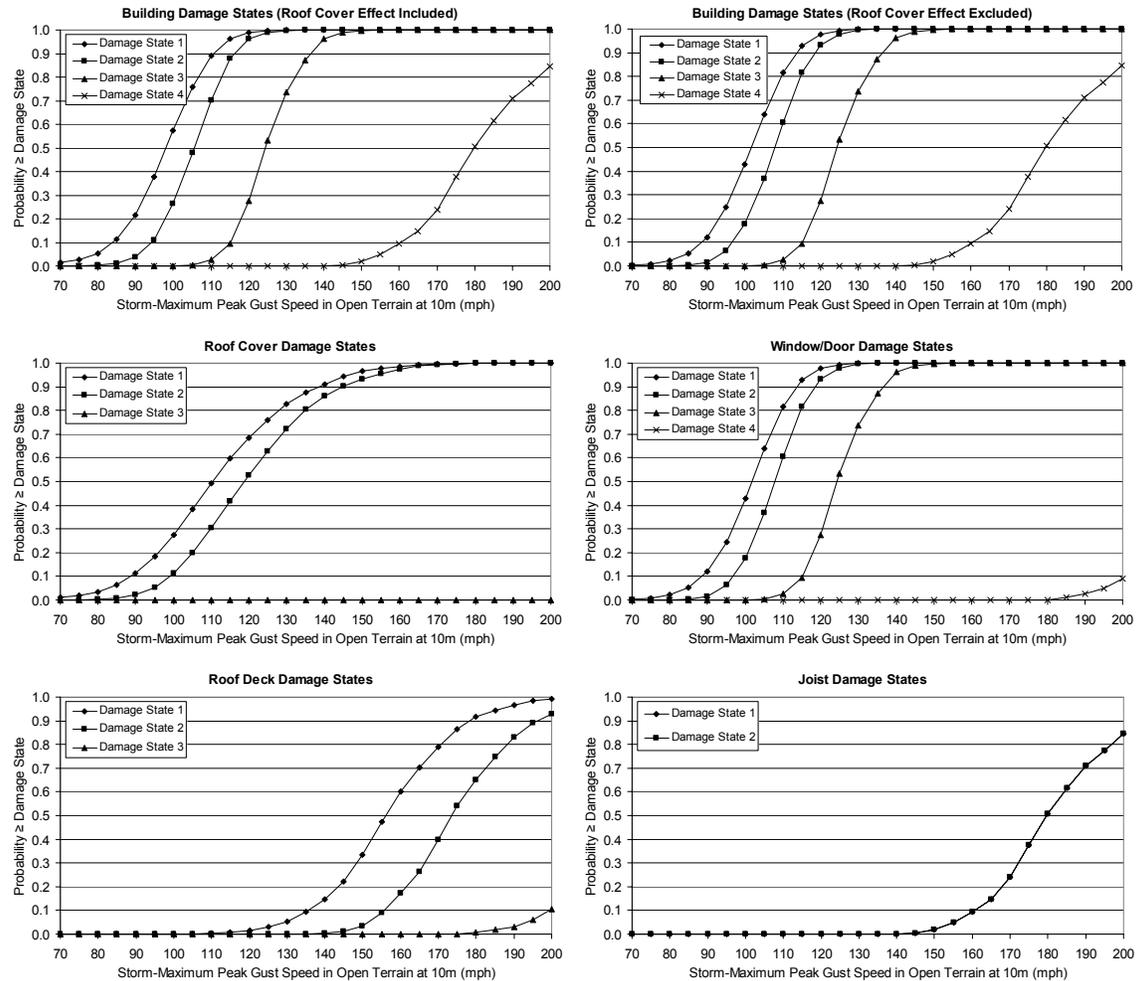
**Figure F.27. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



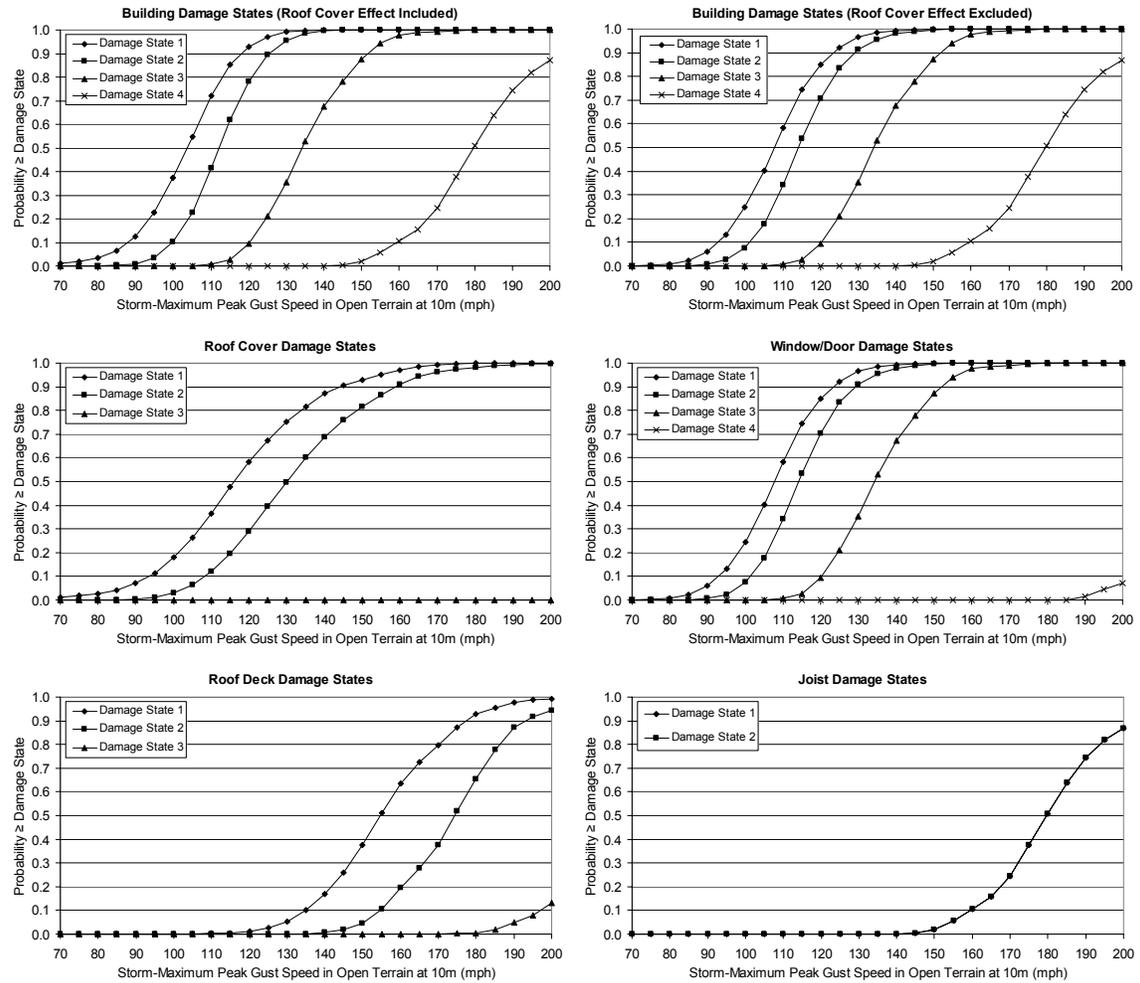
**Figure F.28. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



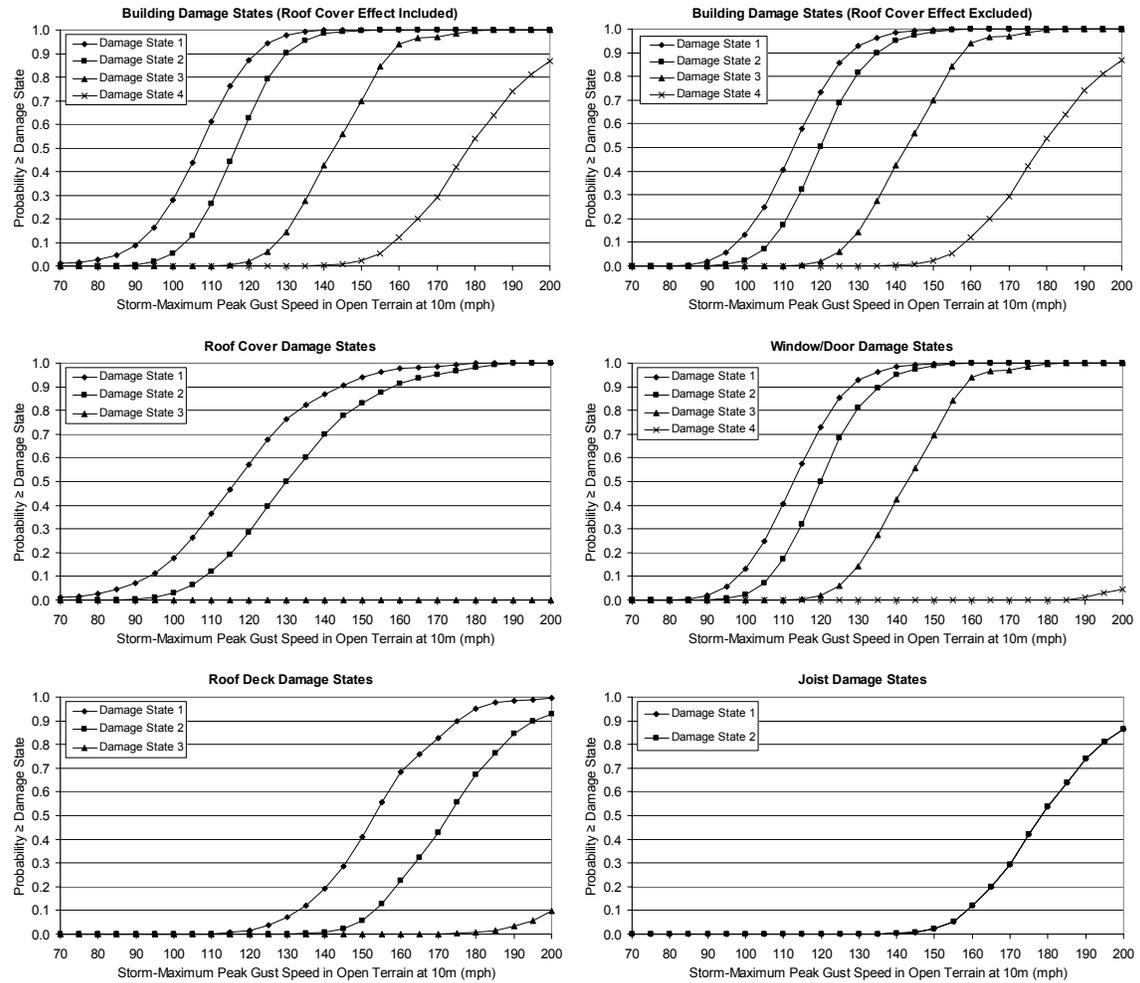
**Figure F.29. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



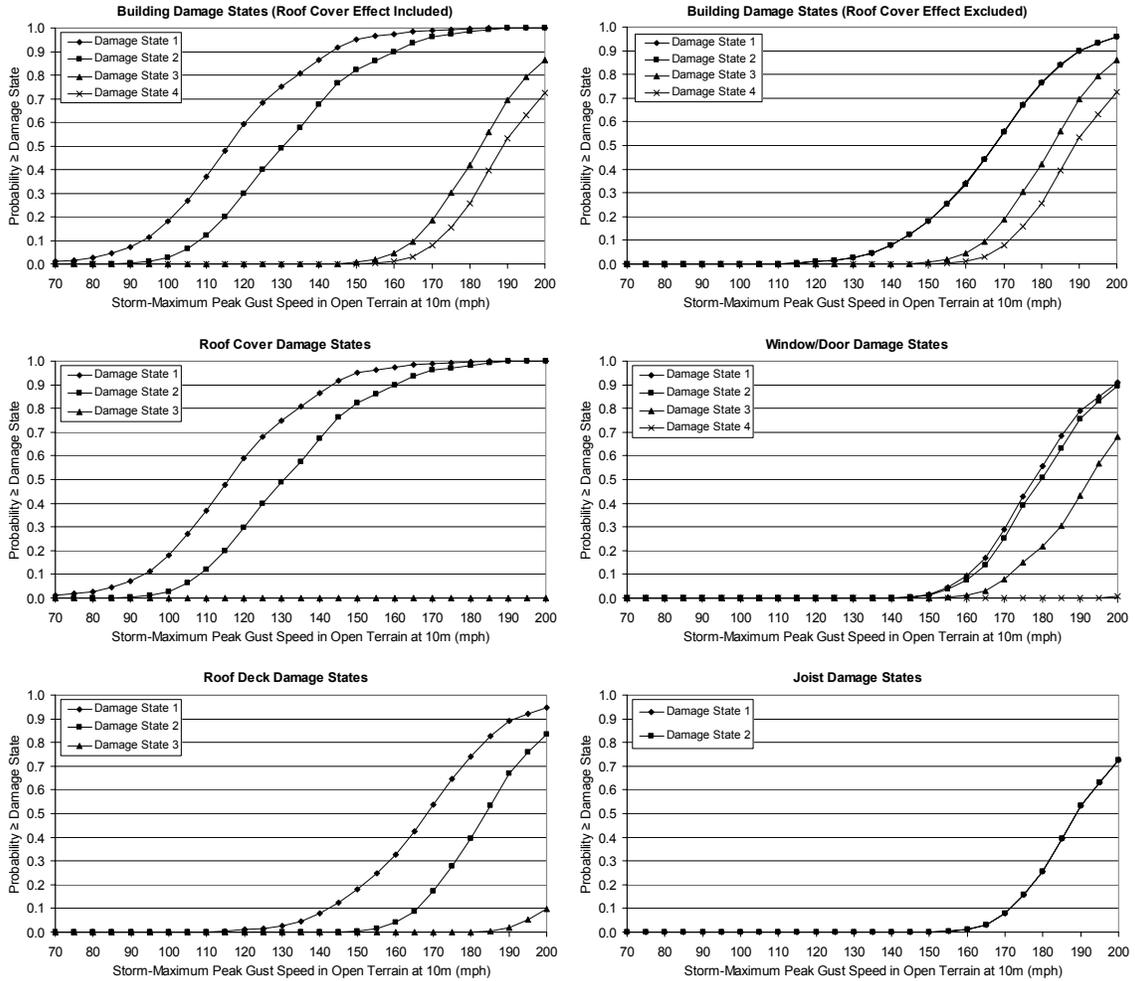
**Figure F.30. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



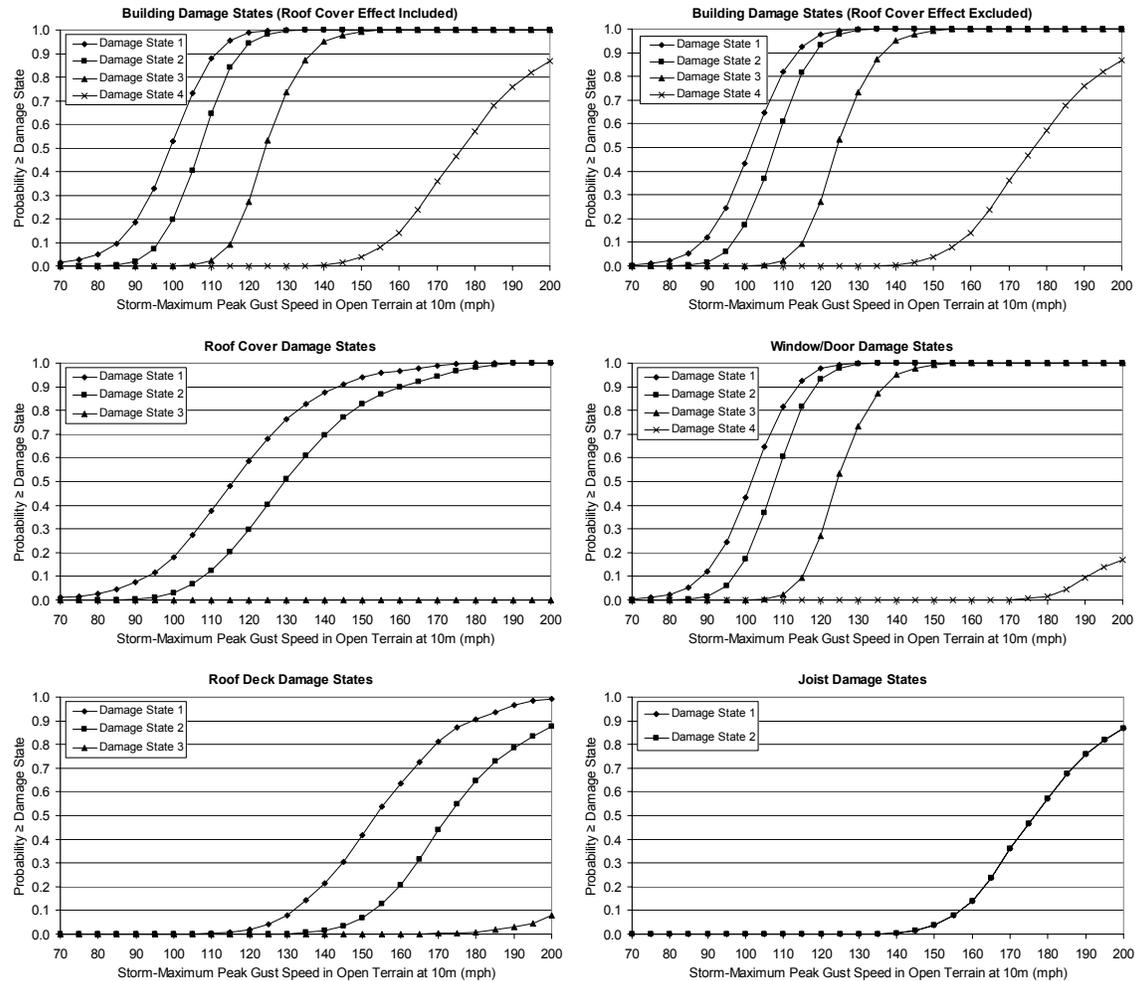
**Figure F.31. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.35$  m.**



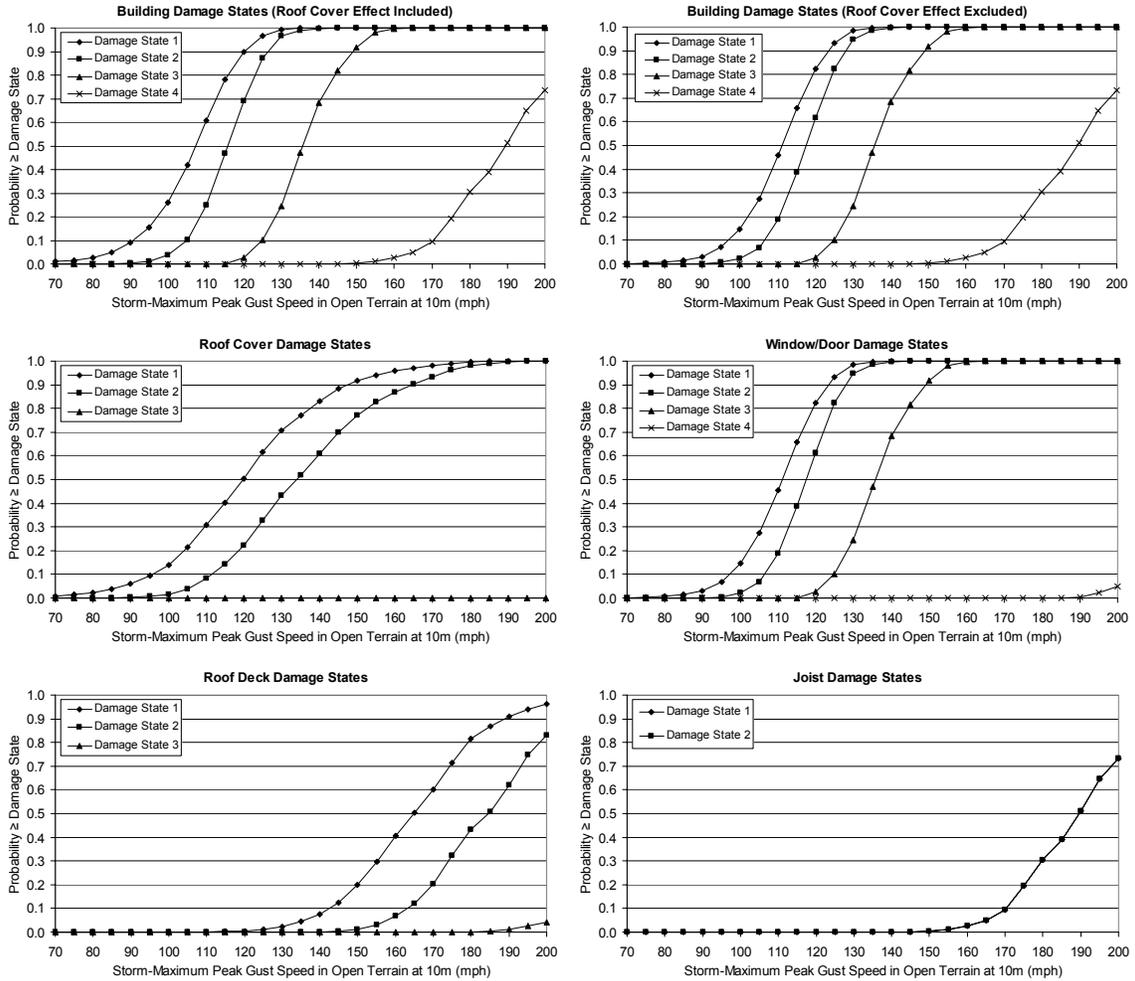
**Figure F.32. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_{\theta}=0.35$  m.**



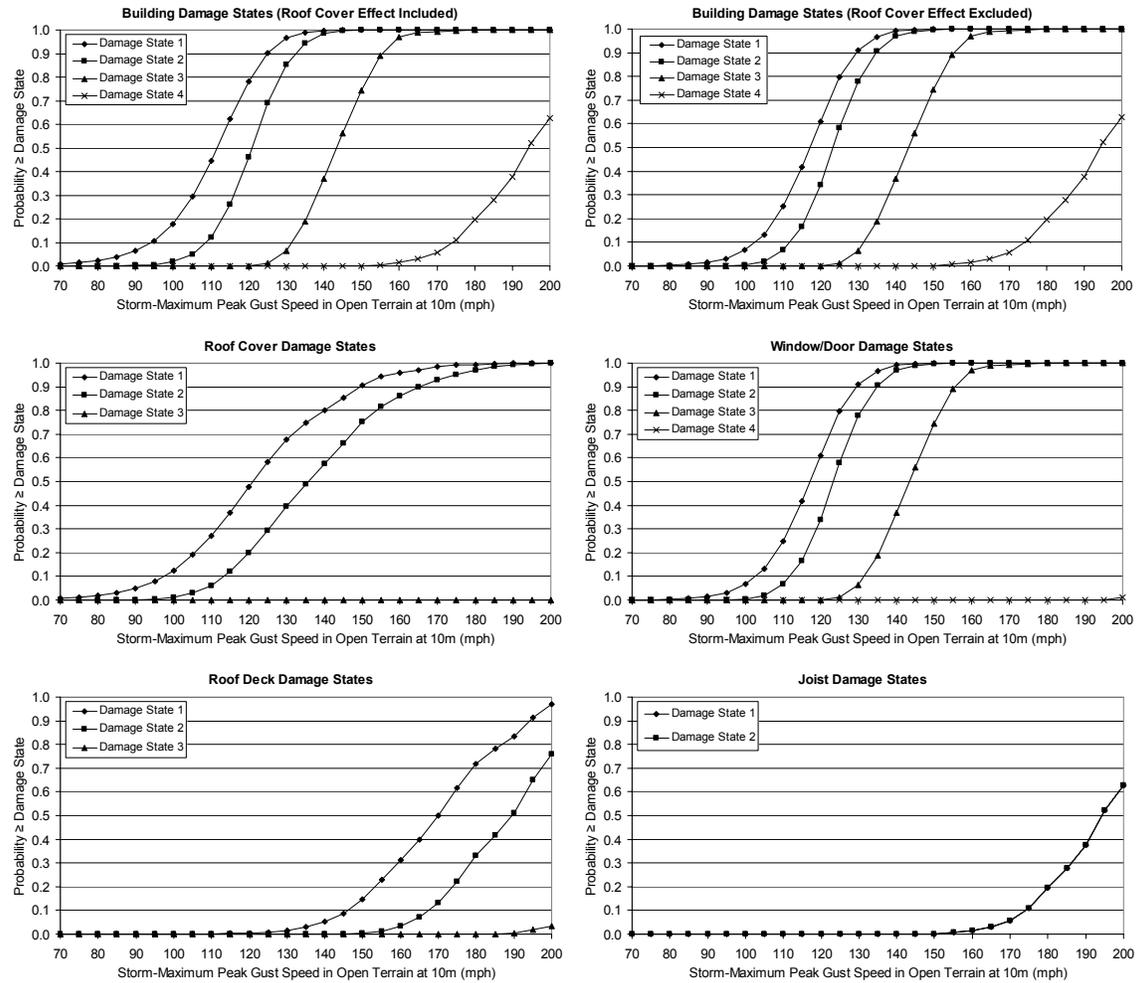
**Figure F.33. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_{\theta}=0.35$  m.**



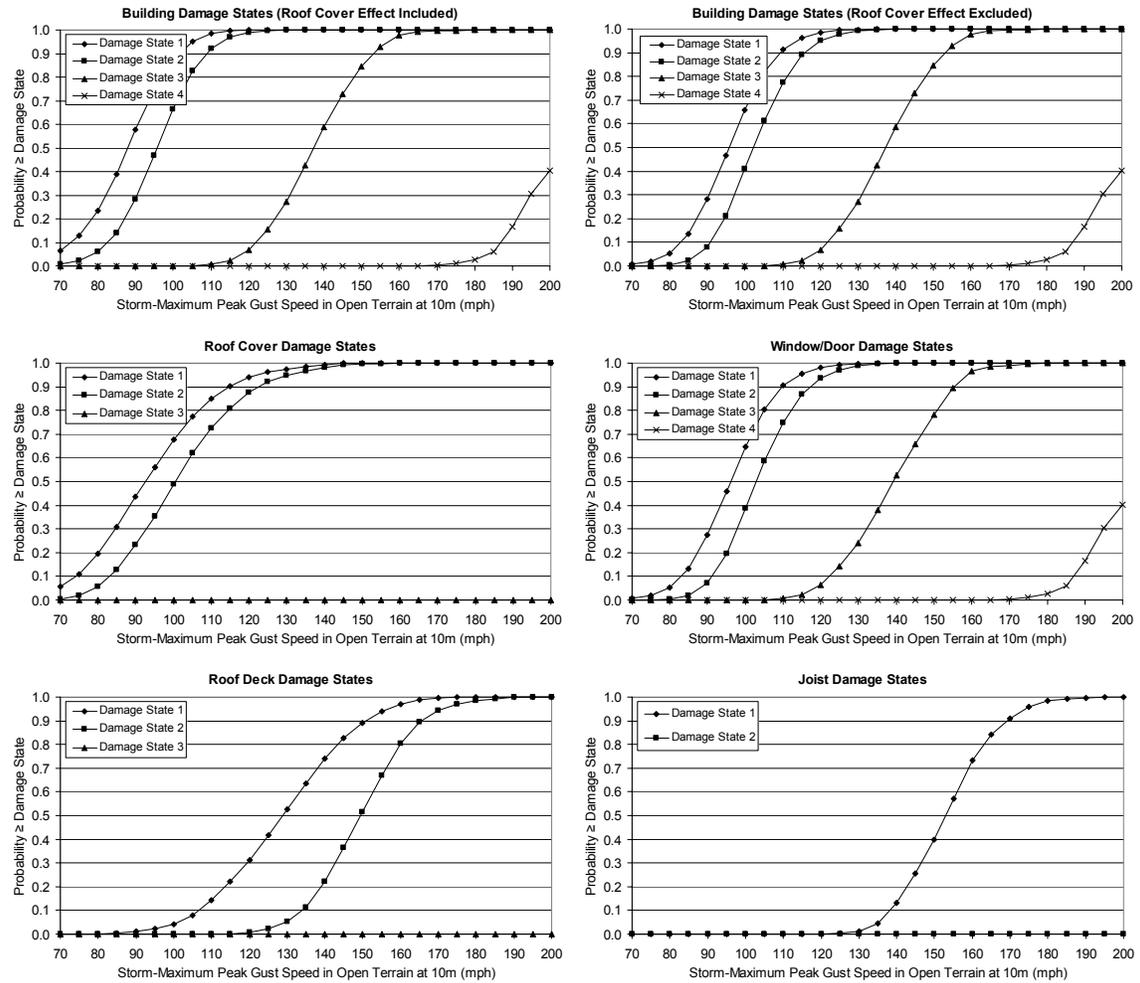
**Figure F.34. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



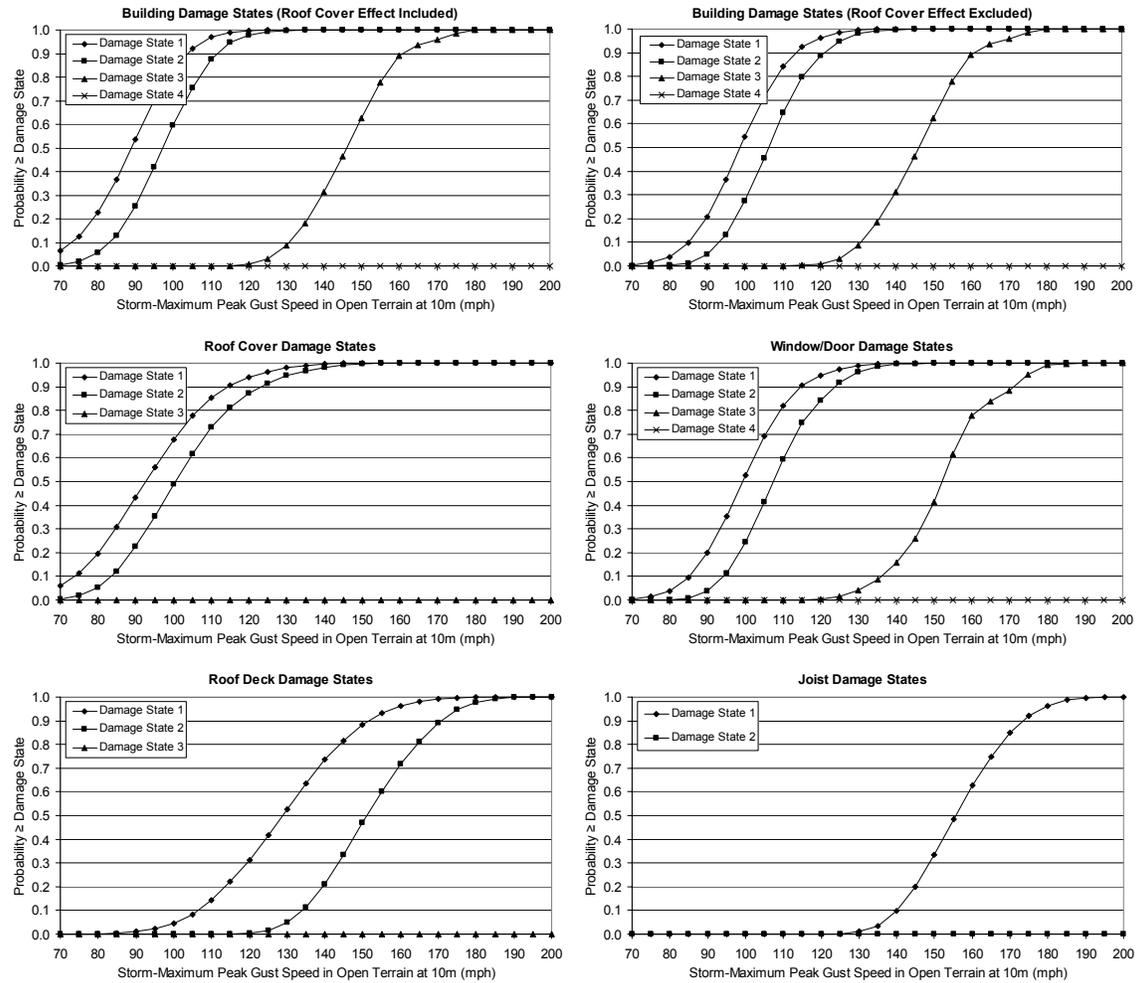
**Figure F.35. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.70$  m.**



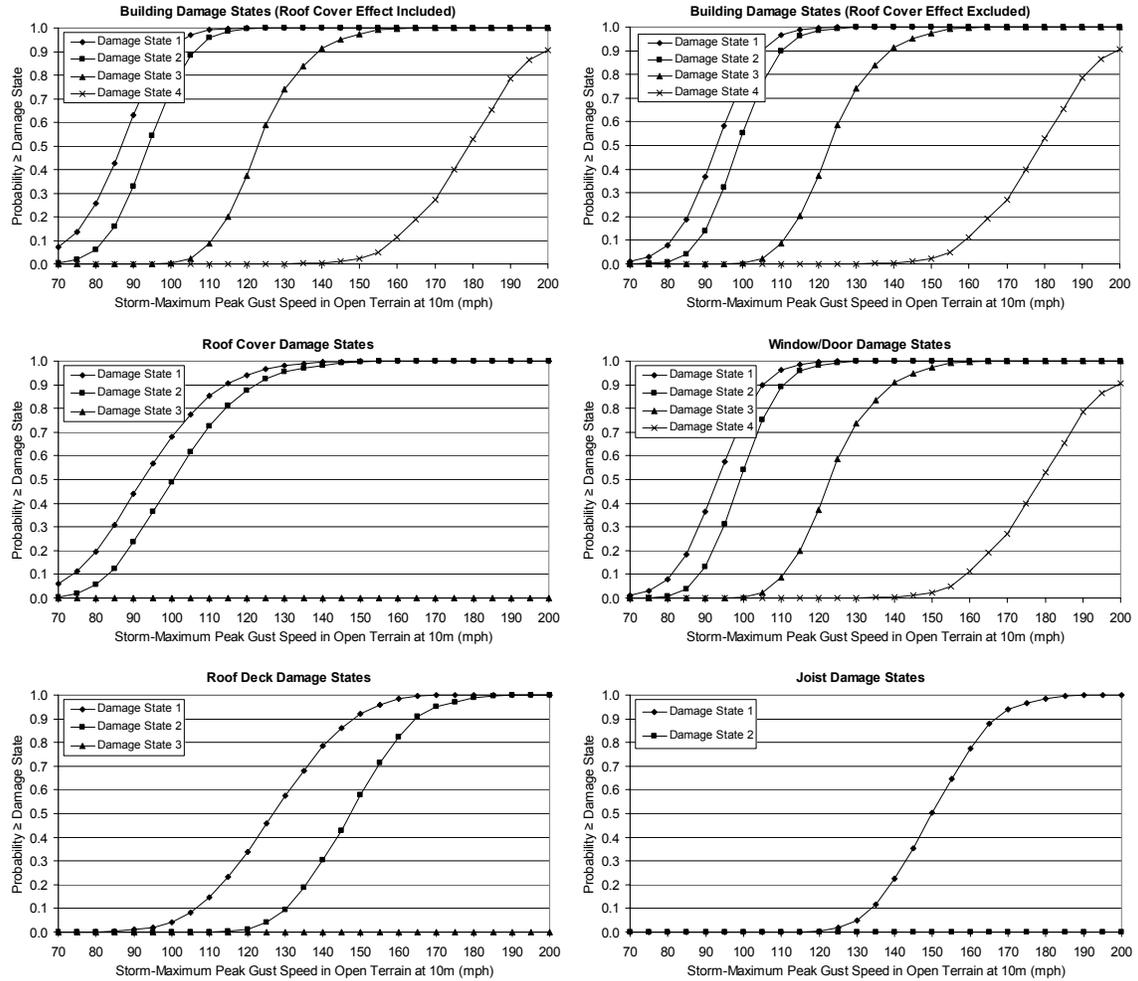
**Figure F.36. Damage States vs. Peak Gust Wind Speed – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=1.0$  m.**



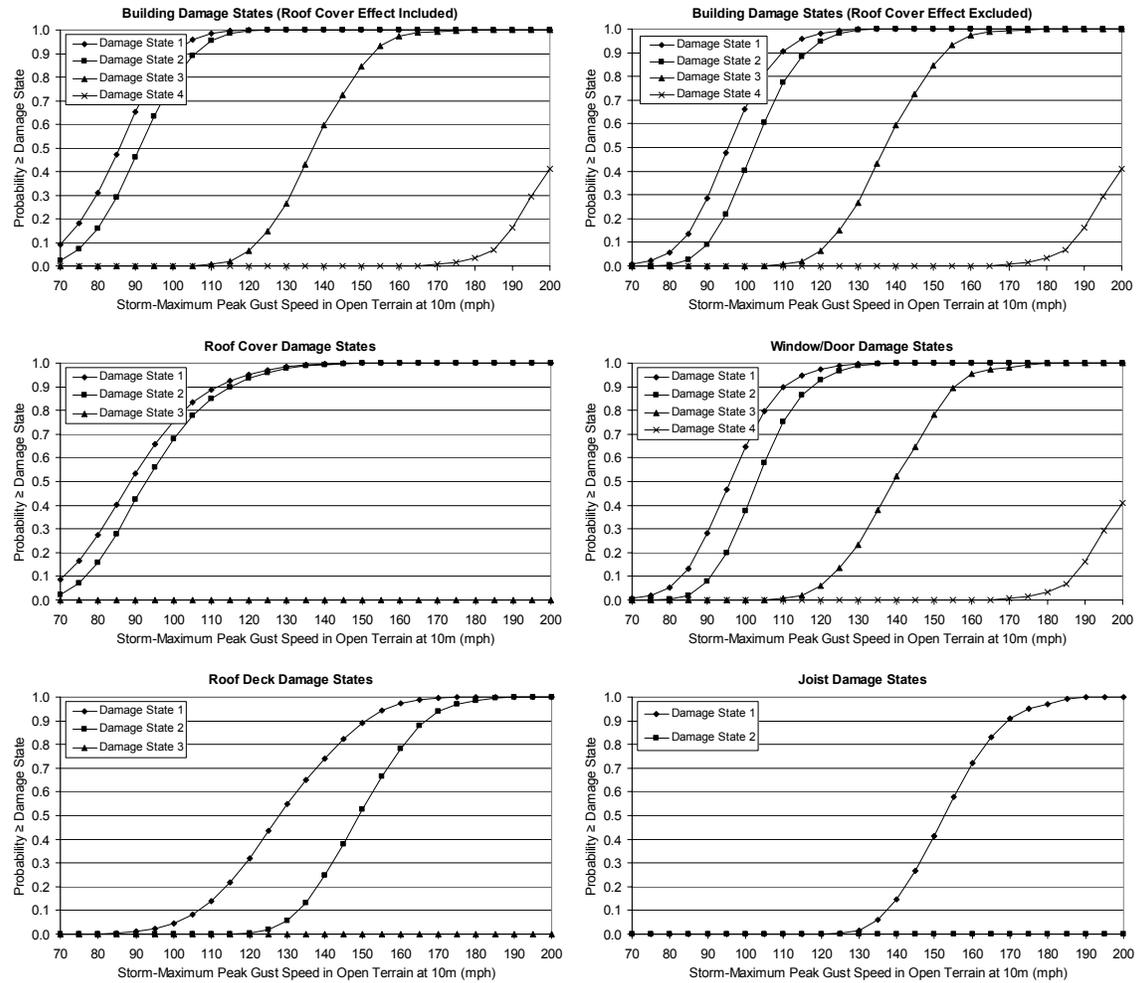
**Figure F.37. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



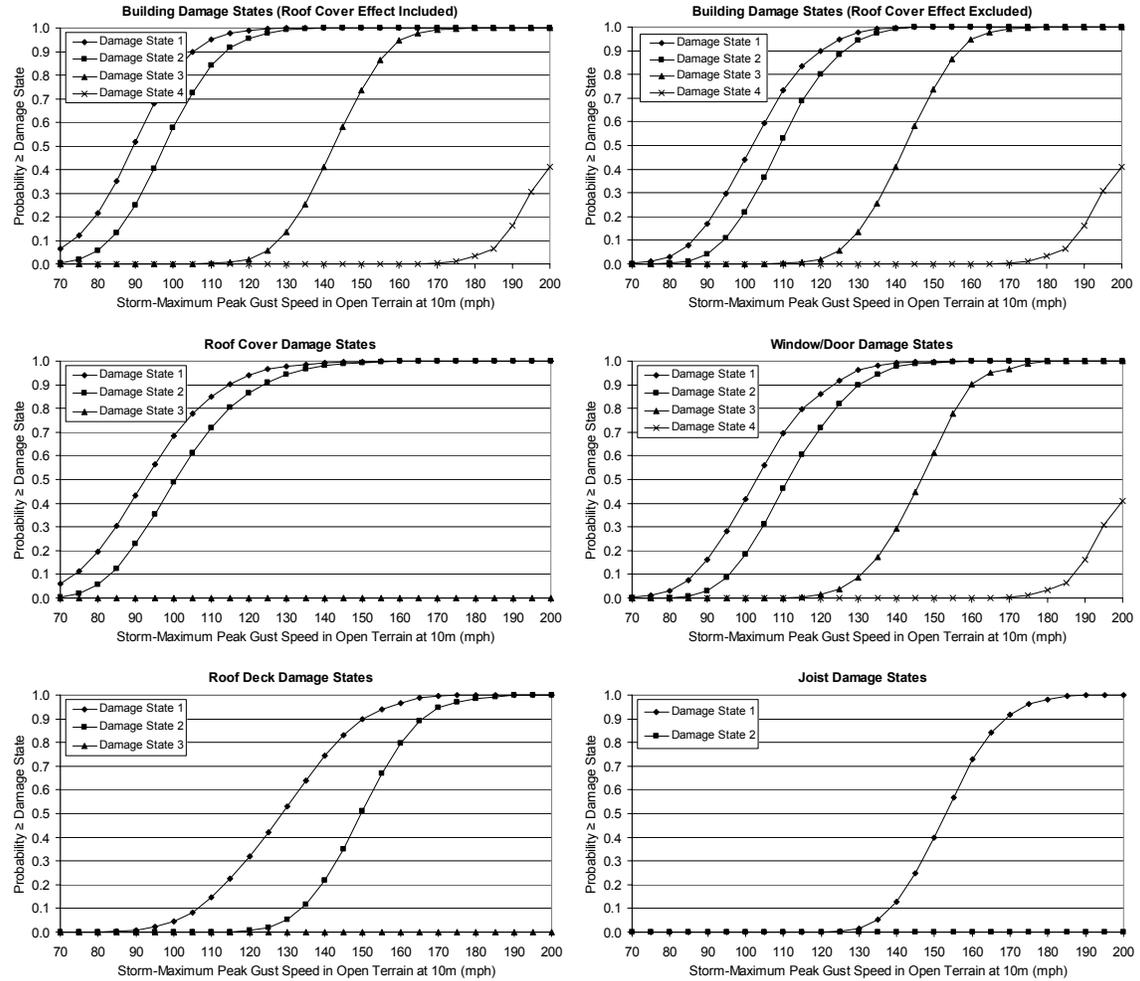
**Figure F.38. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



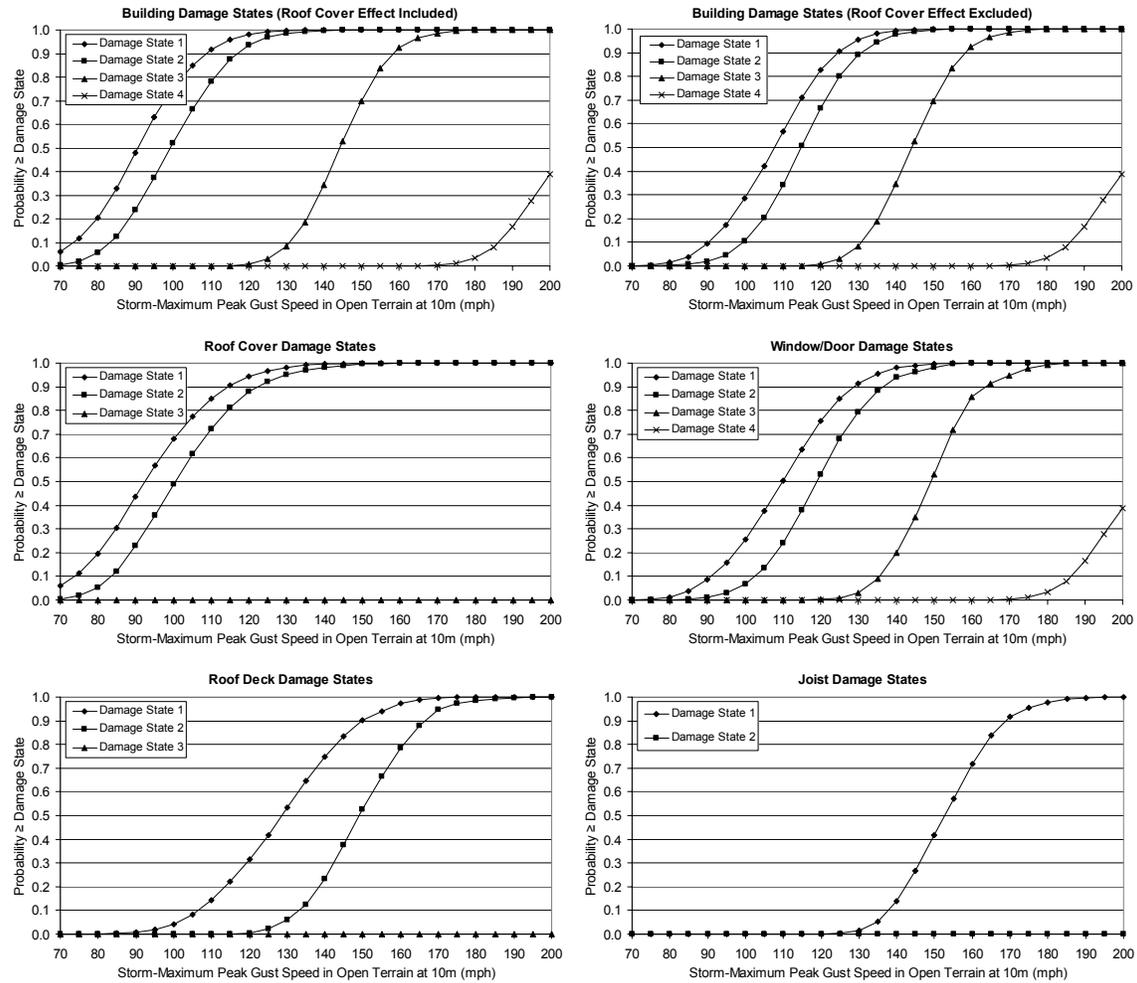
**Figure F.39. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_{\theta}=0.03$  m.**



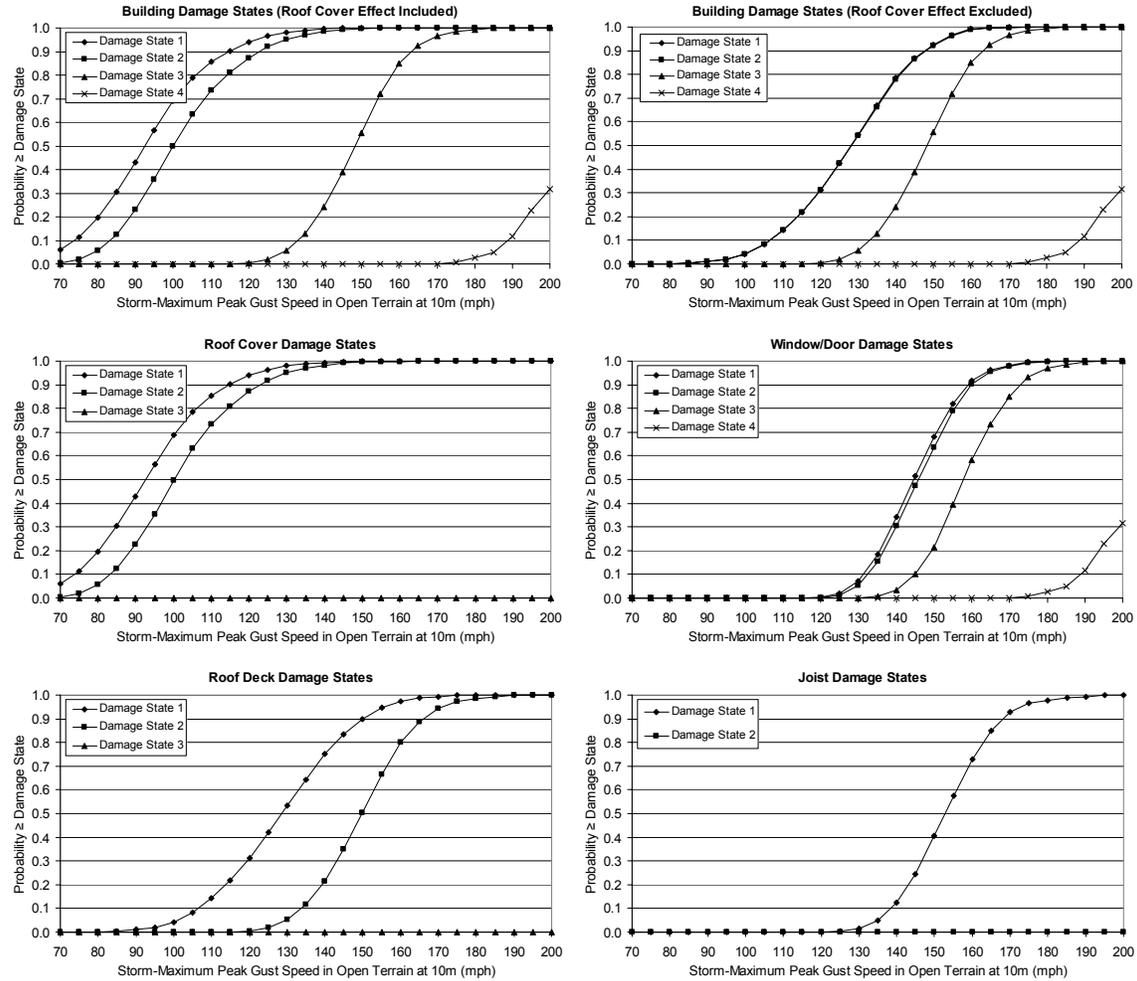
**Figure F.40. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



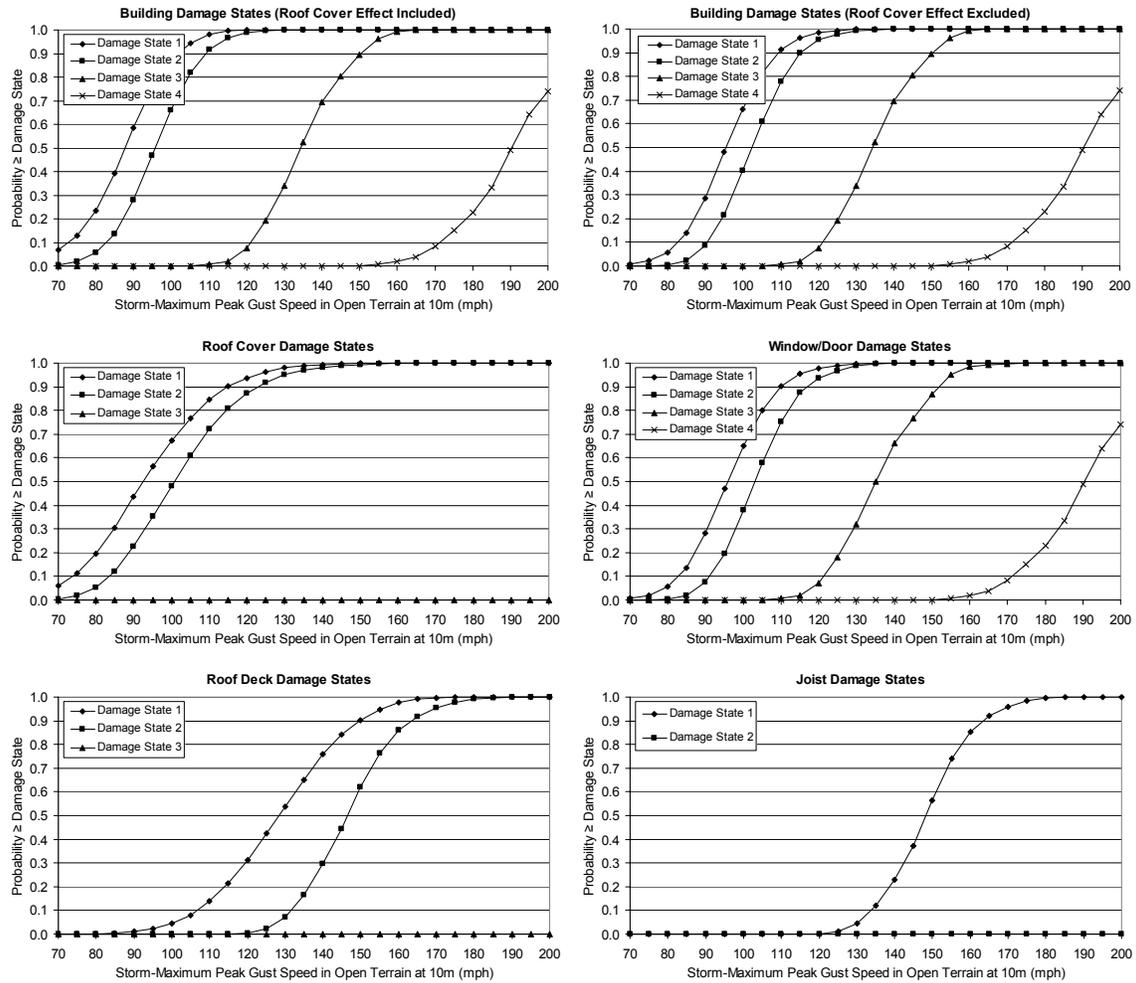
**Figure F.41. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.03$  m.**



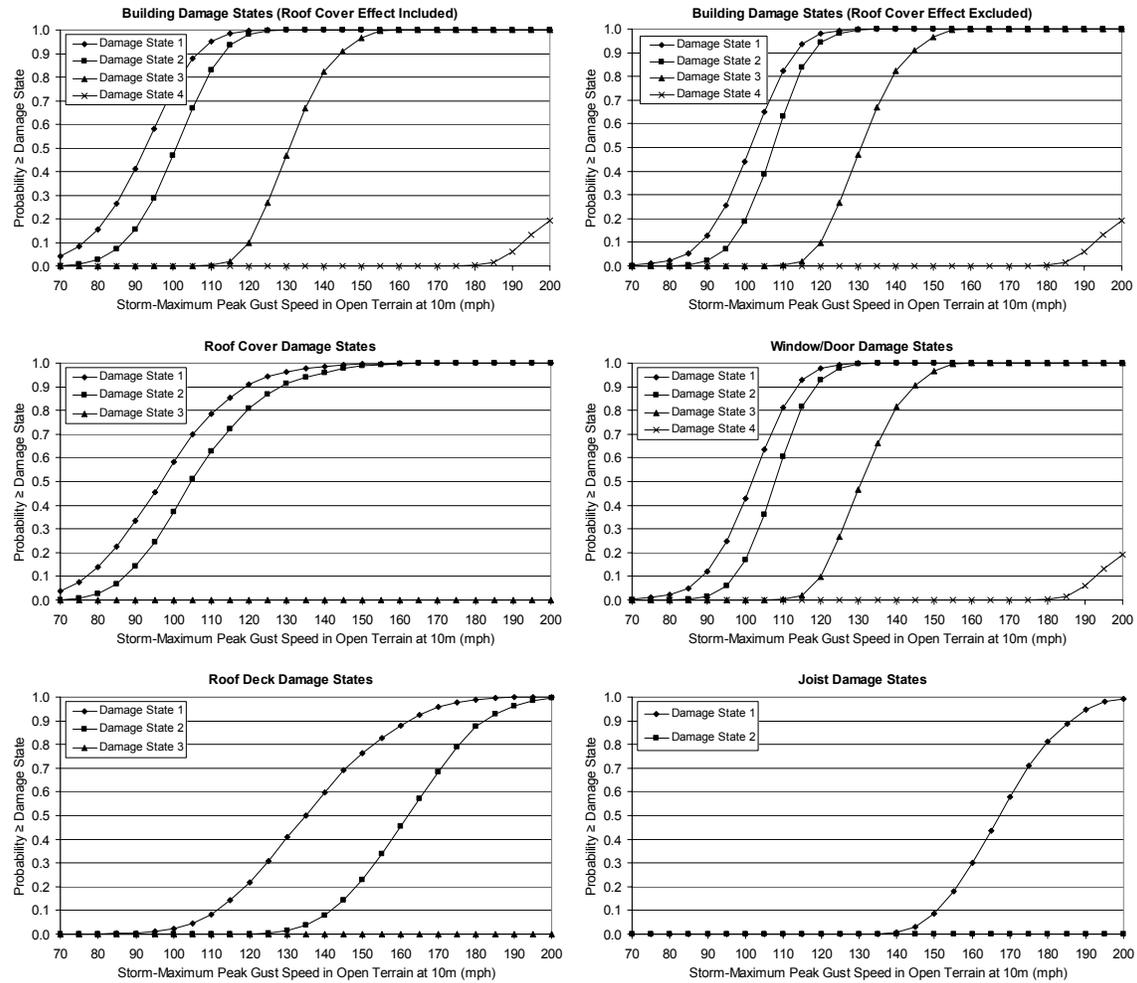
**Figure F.42. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_0=0.03$  m.**



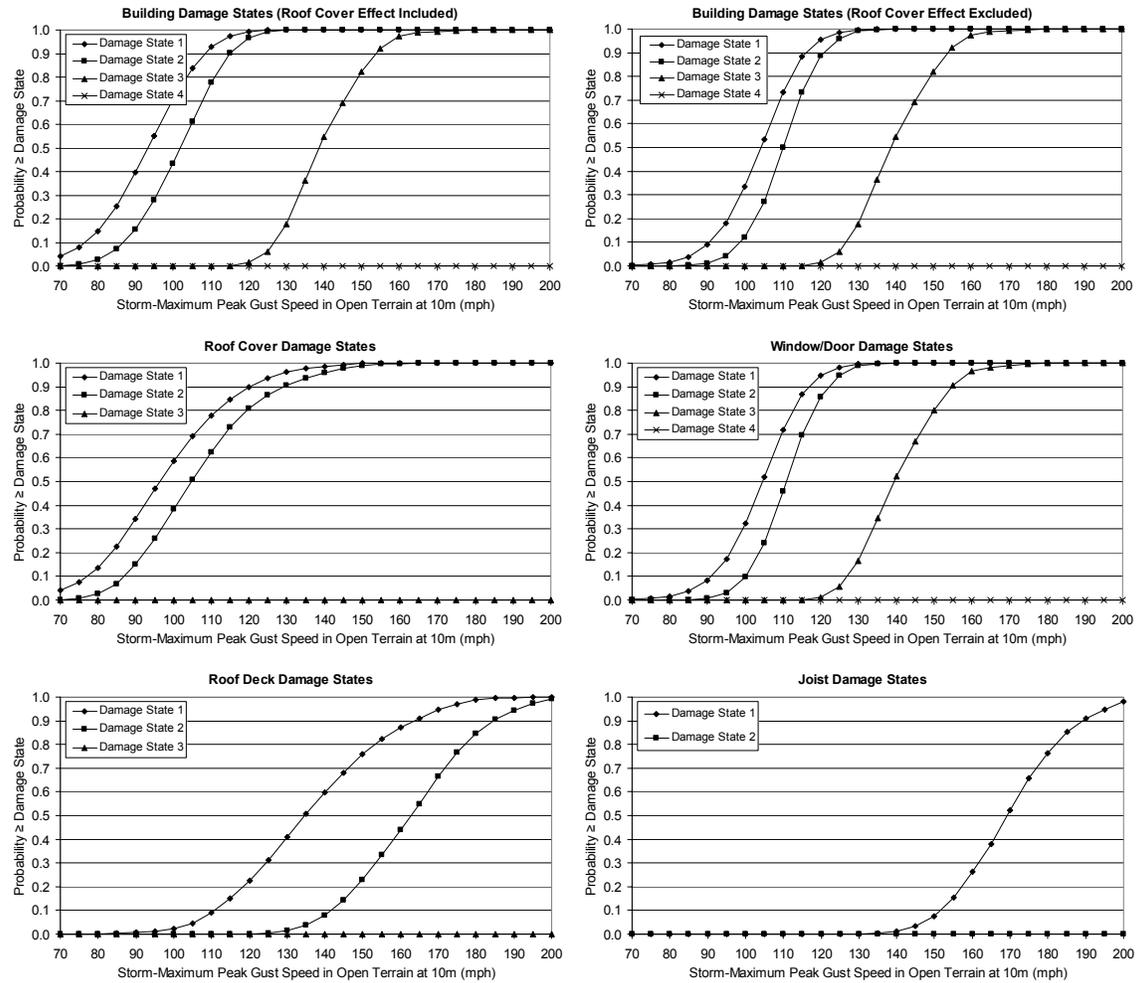
**Figure F.43. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_{\theta}=0.03$  m.**



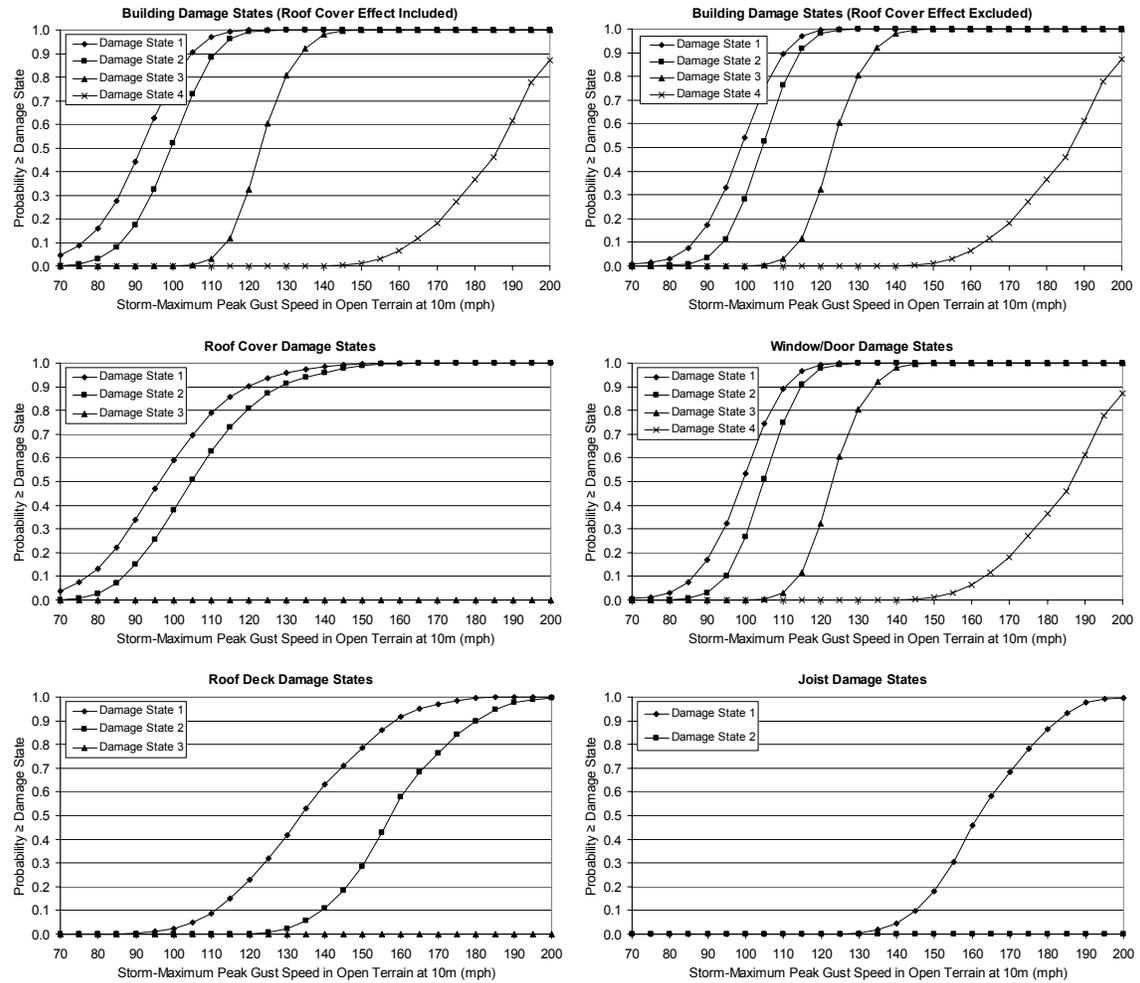
**Figure F.44. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.03$  m.**



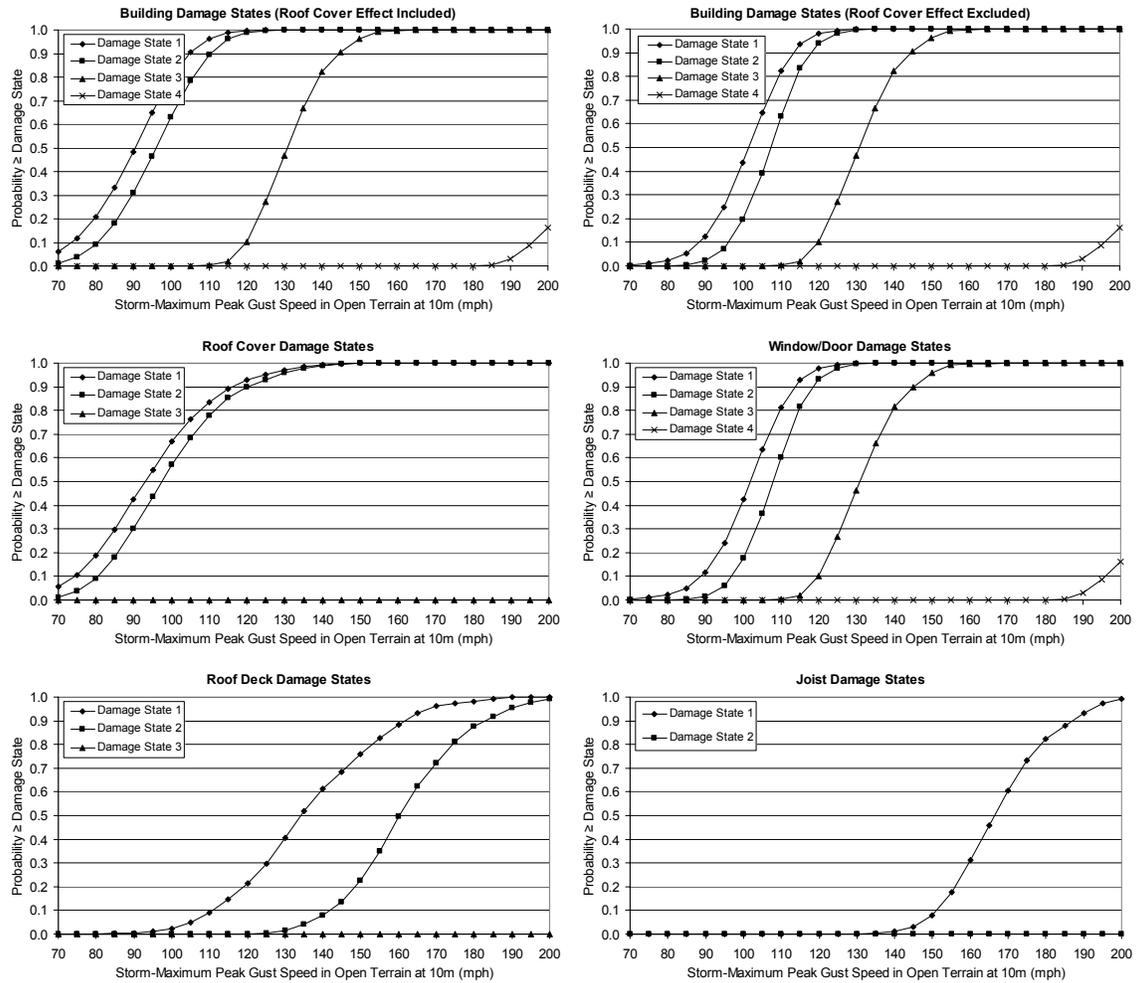
**Figure F.45. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



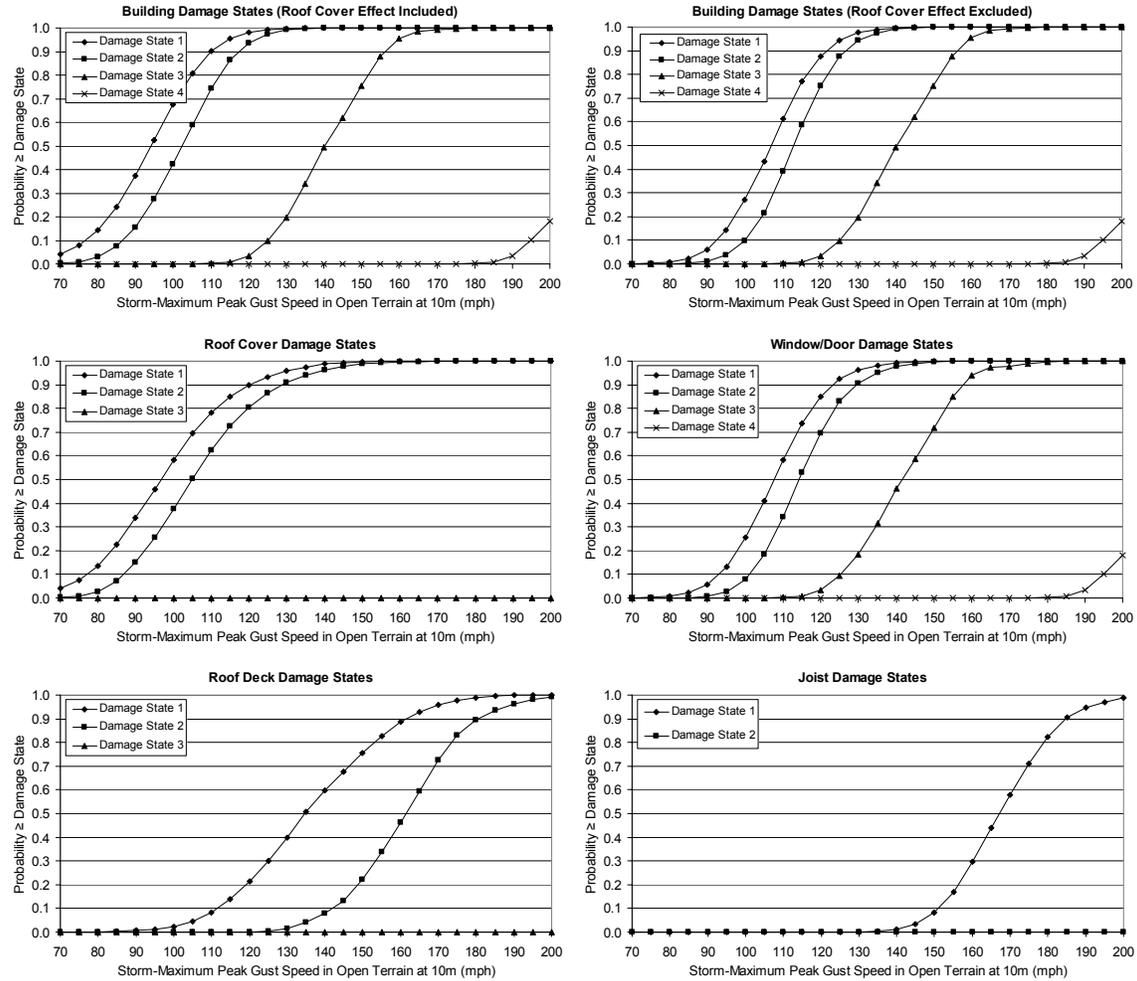
**Figure F.46. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Missile Environment A,  $z_{\theta}=0.35$  m.**



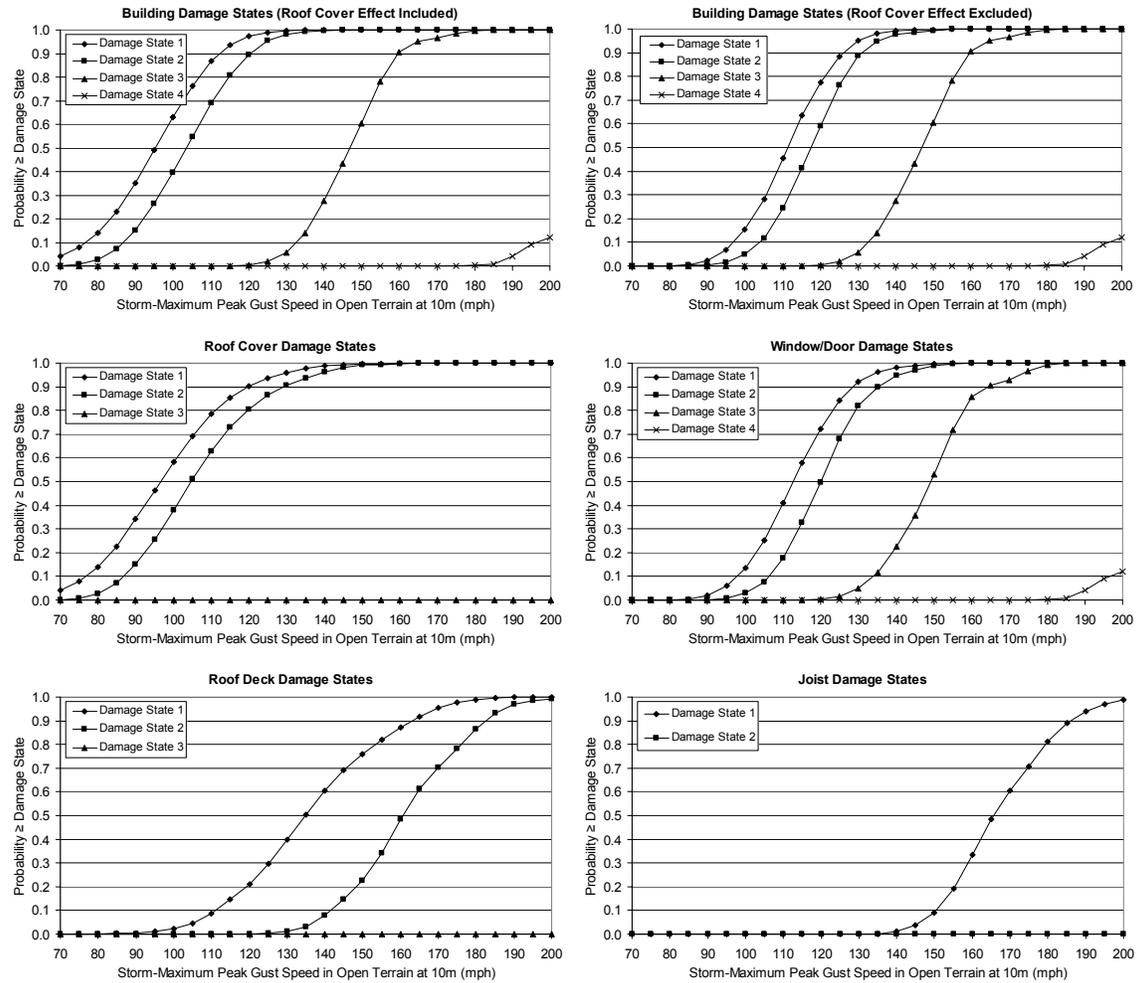
**Figure F.47. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Missile Environment A,  $z_{\theta}=0.35$  m.**



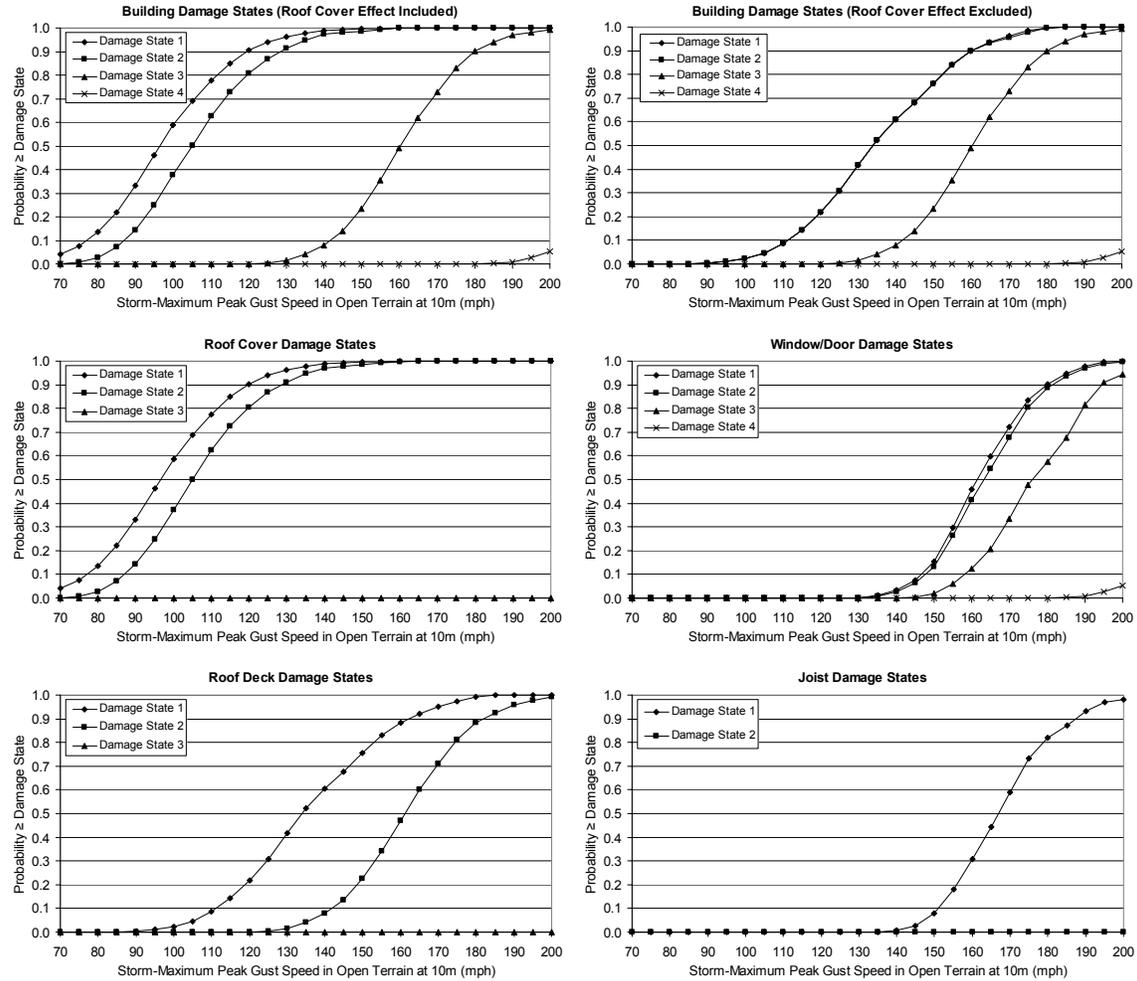
**Figure F.48. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



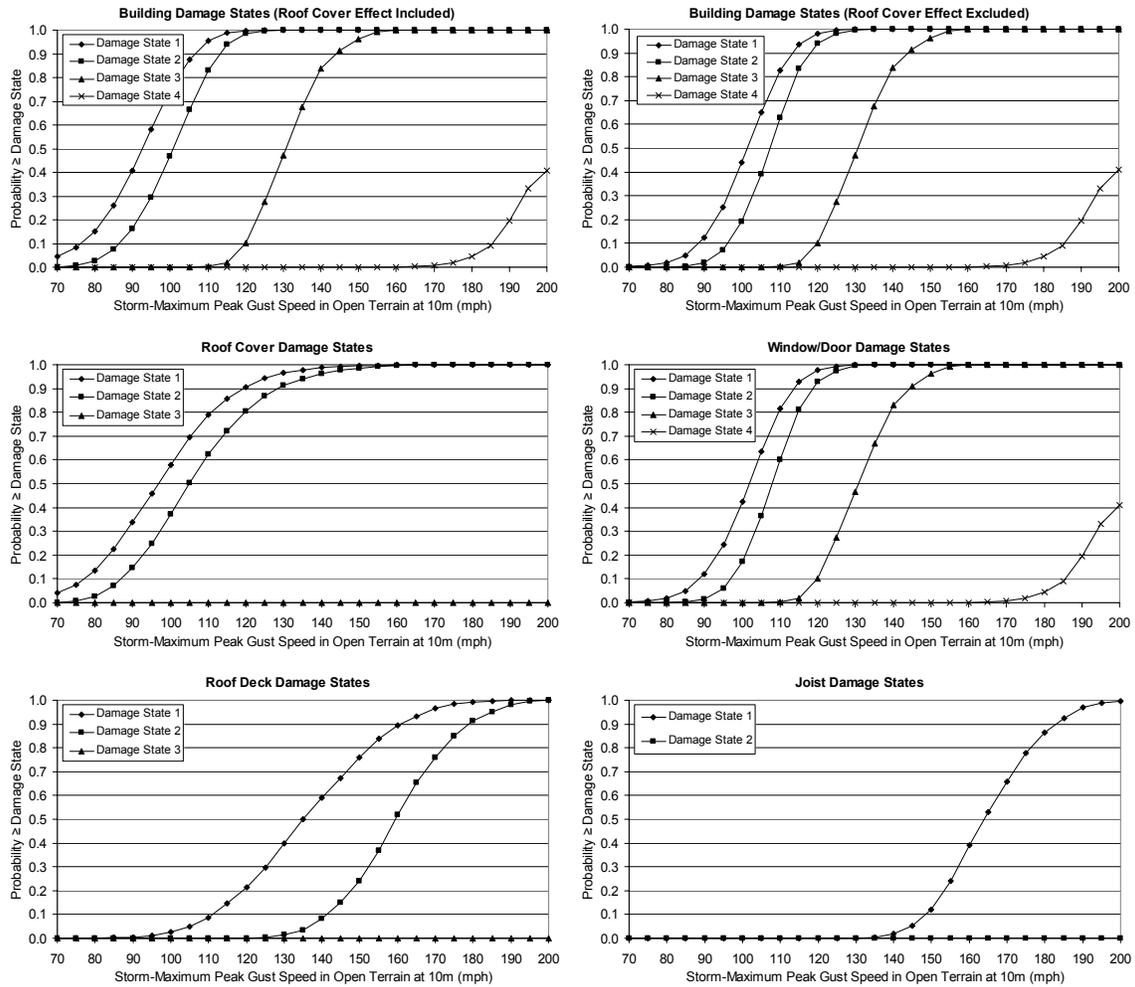
**Figure F.49. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment B,  $z_{\theta}=0.35$  m.**



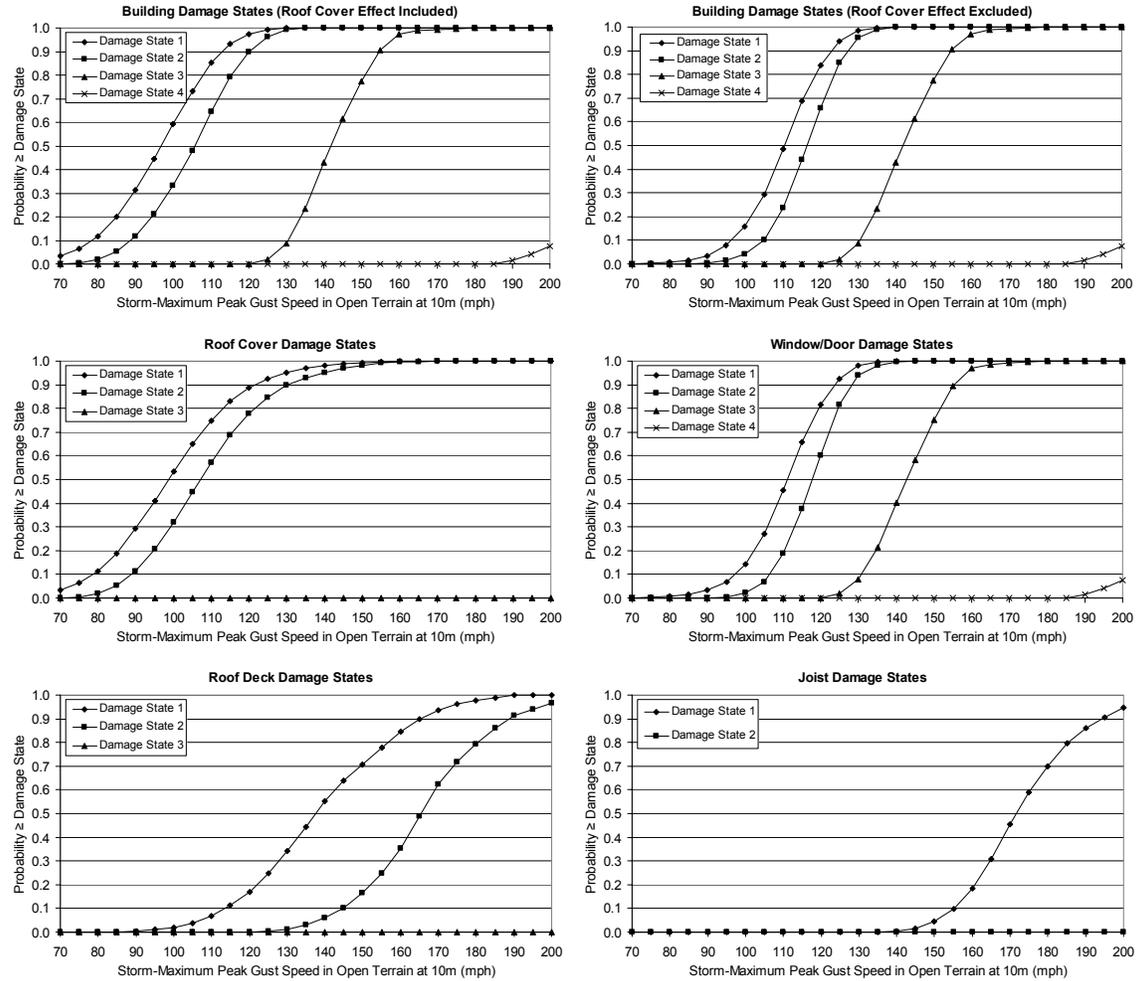
**Figure F.50. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment C,  $z_{\theta}=0.35$  m.**



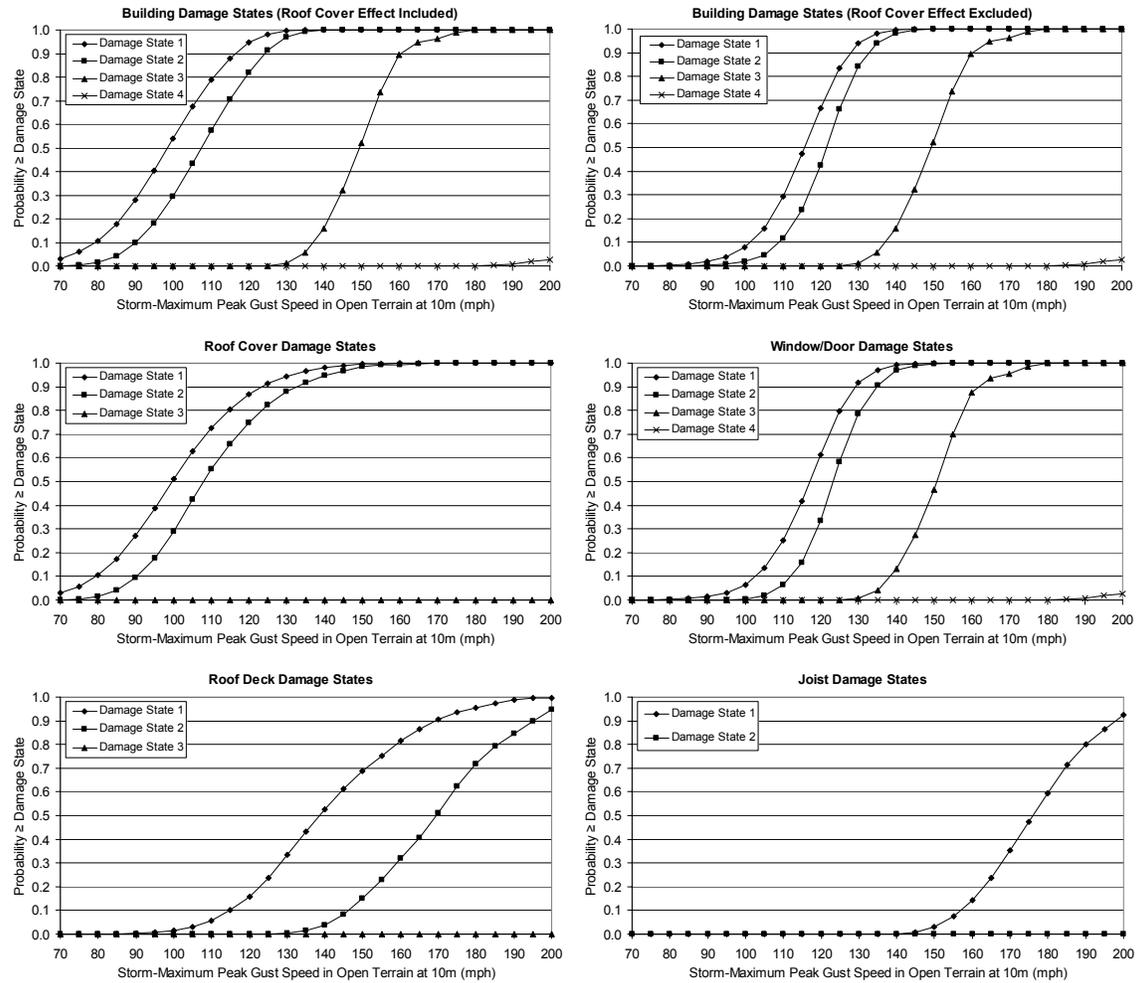
**Figure F.51. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment D,  $z_{\theta}=0.35$  m.**



**Figure F.52. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.35$  m.**



**Figure F.53. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=0.70$  m.**



**Figure F.54. Damage States vs. Peak Gust Wind Speed – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Missile Environment A,  $z_0=1.0$  m.**



**Appendix G.**  
**Damage State Functions for Industrial Buildings**

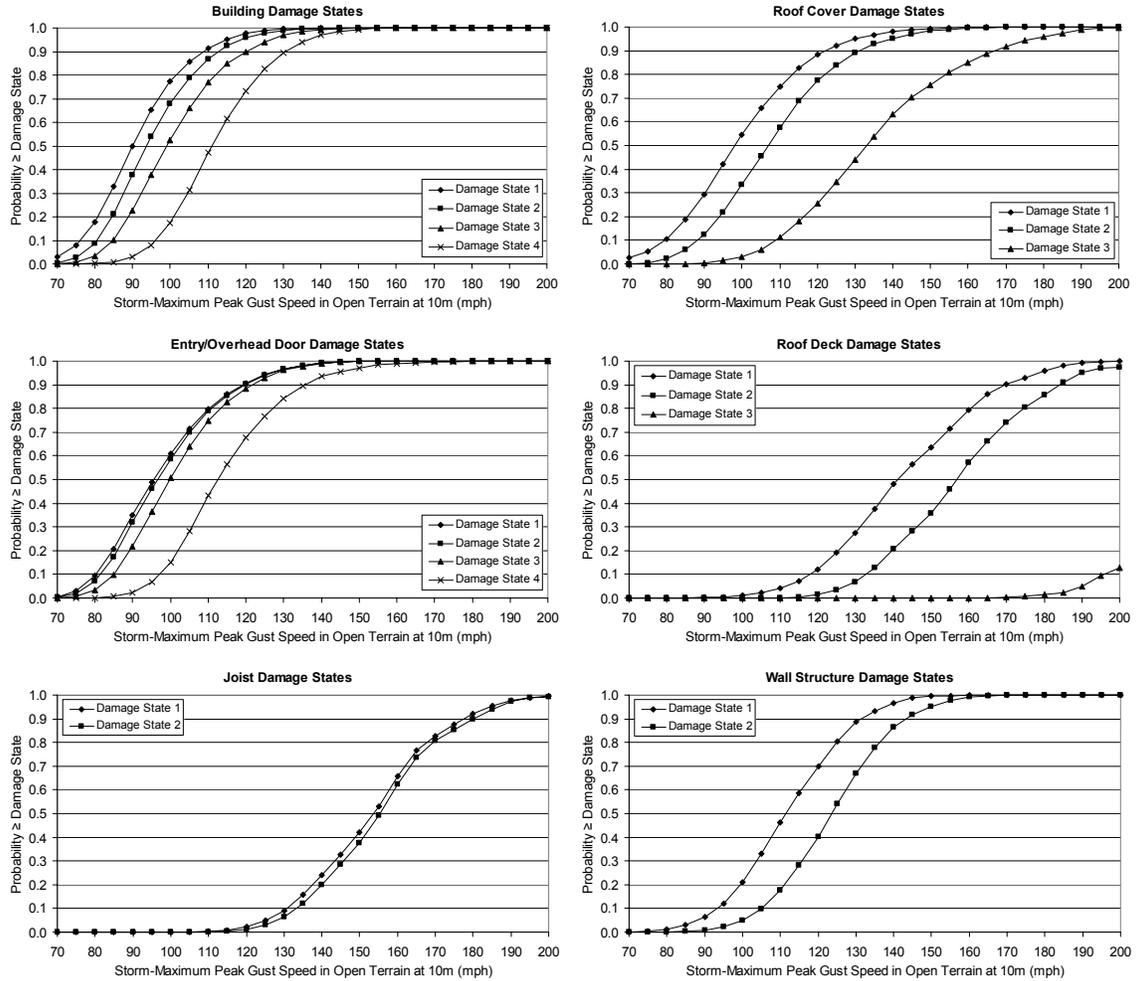
## Appendix G. Damage State Functions for Industrial Buildings

This appendix presents damage state curves for industrial buildings. The damage state curves show the probability of achieving a certain damage state versus storm-maximum peak gust speed (open terrain at 10m above ground). Plots are presented for the overall building damage states and for the individual building component damage states (refer to Table 6.13-1 for damage state definitions).

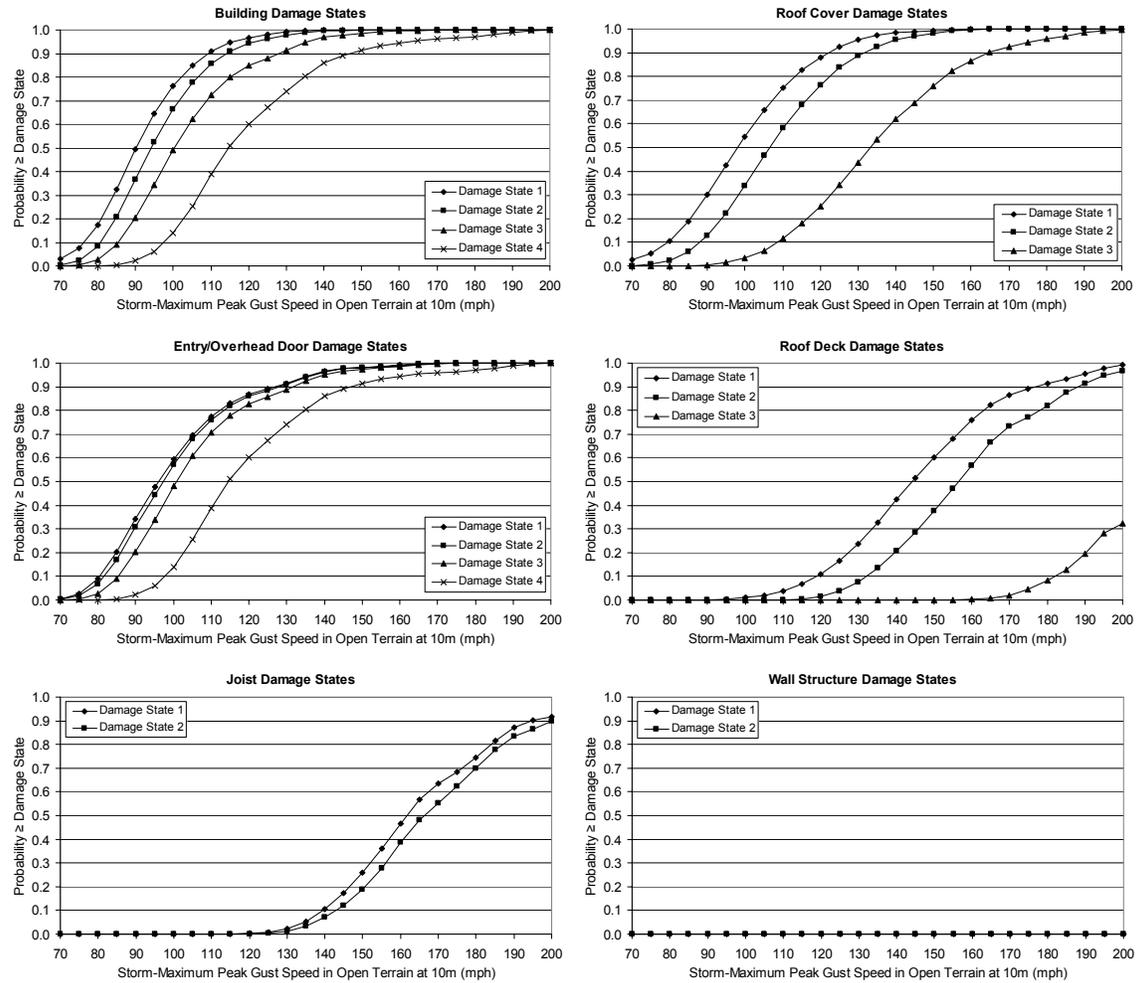
Table G.1 lists the figures provided in this appendix. Two sets of three figures are given for the metal buildings. The first set of three figures (Figures G.1 through G.3) are for buildings located in an open terrain ( $z_0=0.03$  m) and the second set (Figures G.4 through G.6) are for buildings situated in a typical suburban environment ( $z_0=0.35$  m). The first figure in each set of three shows damage state results for the industrial building constructed with unreinforced masonry walls, having no reduction in the metal roof deck capacity and situated in Missile Environment A. The remaining two plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles). Figures G.7 and G.8 show results of the reference building situated in two additional terrain environments (i.e.,  $z_0=0.70$  m and 1.0 m).

**Table G.1. Sample Damage State Functions for Industrial Buildings**

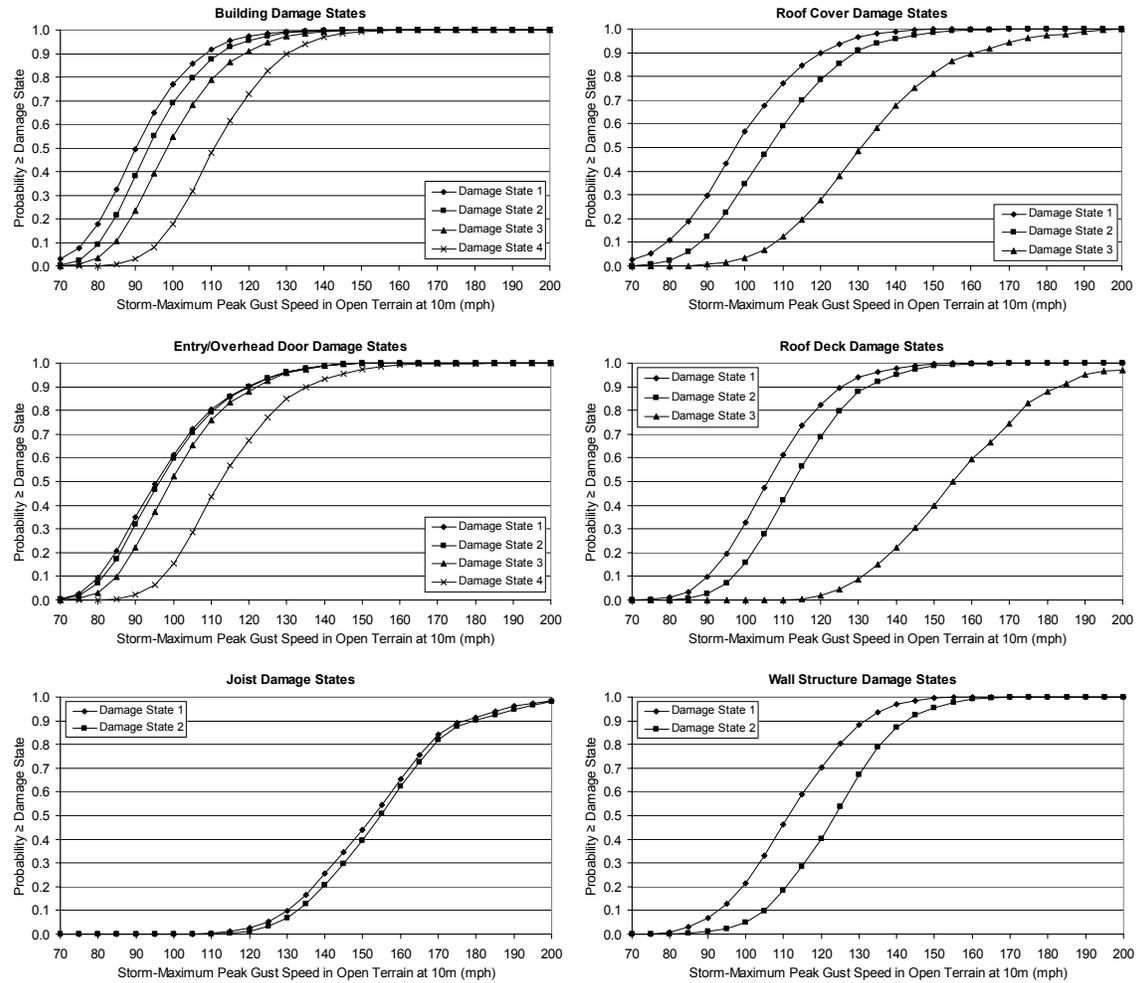
Figure	Walls	Metal Deck Capacity	Missile Environ.	Terrain
G.1	URM	Full	A	0.03
G.2	<b>RM</b>	Full	A	0.03
G.3	URM	<b>50%</b>	A	0.03
G.4	URM	Full	A	<b>0.35</b>
G.5	<b>RM</b>	Full	A	0.35
G.6	URM	<b>50%</b>	A	0.35
G.7	URM	Full	A	<b>0.70</b>
G.8	URM	Full	A	<b>1.00</b>



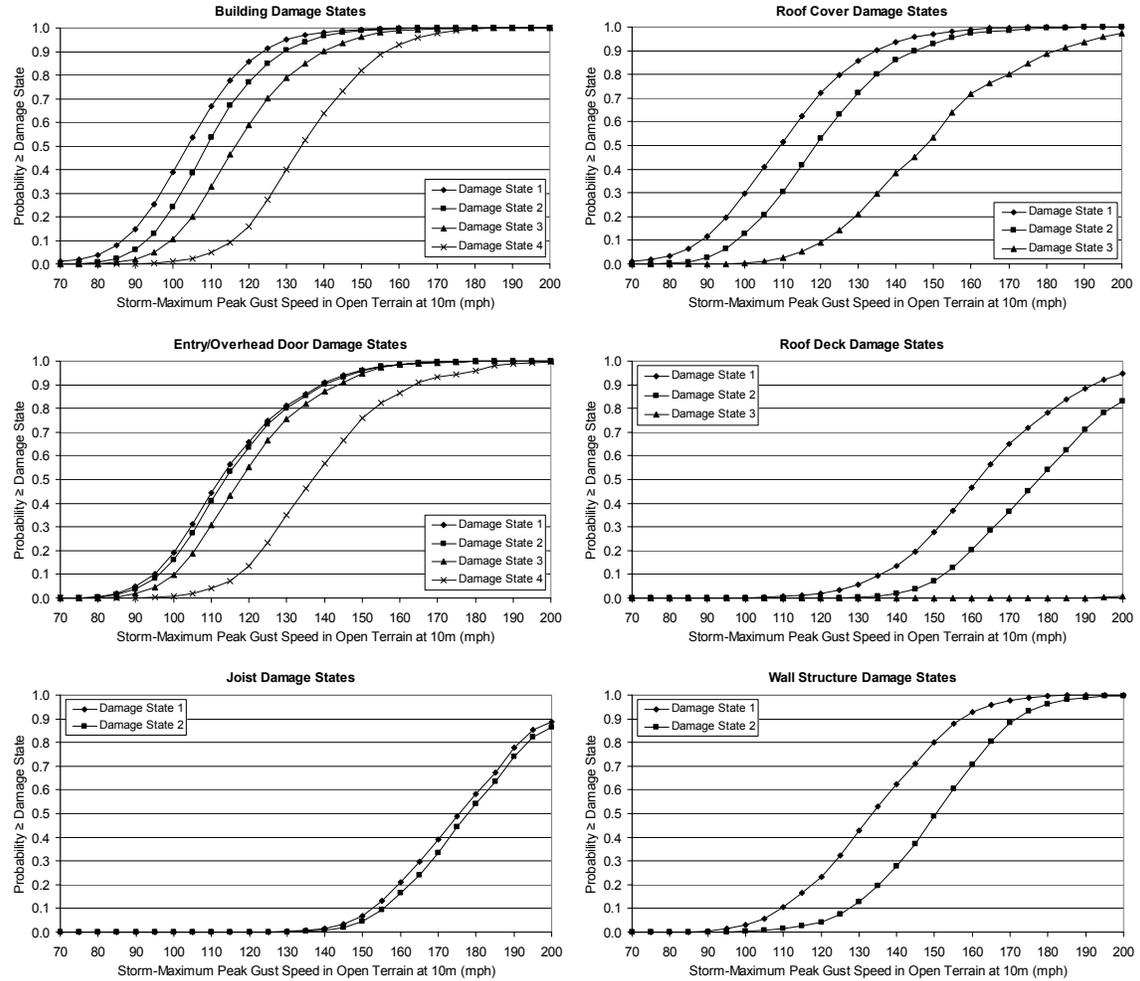
**Figure G.1. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



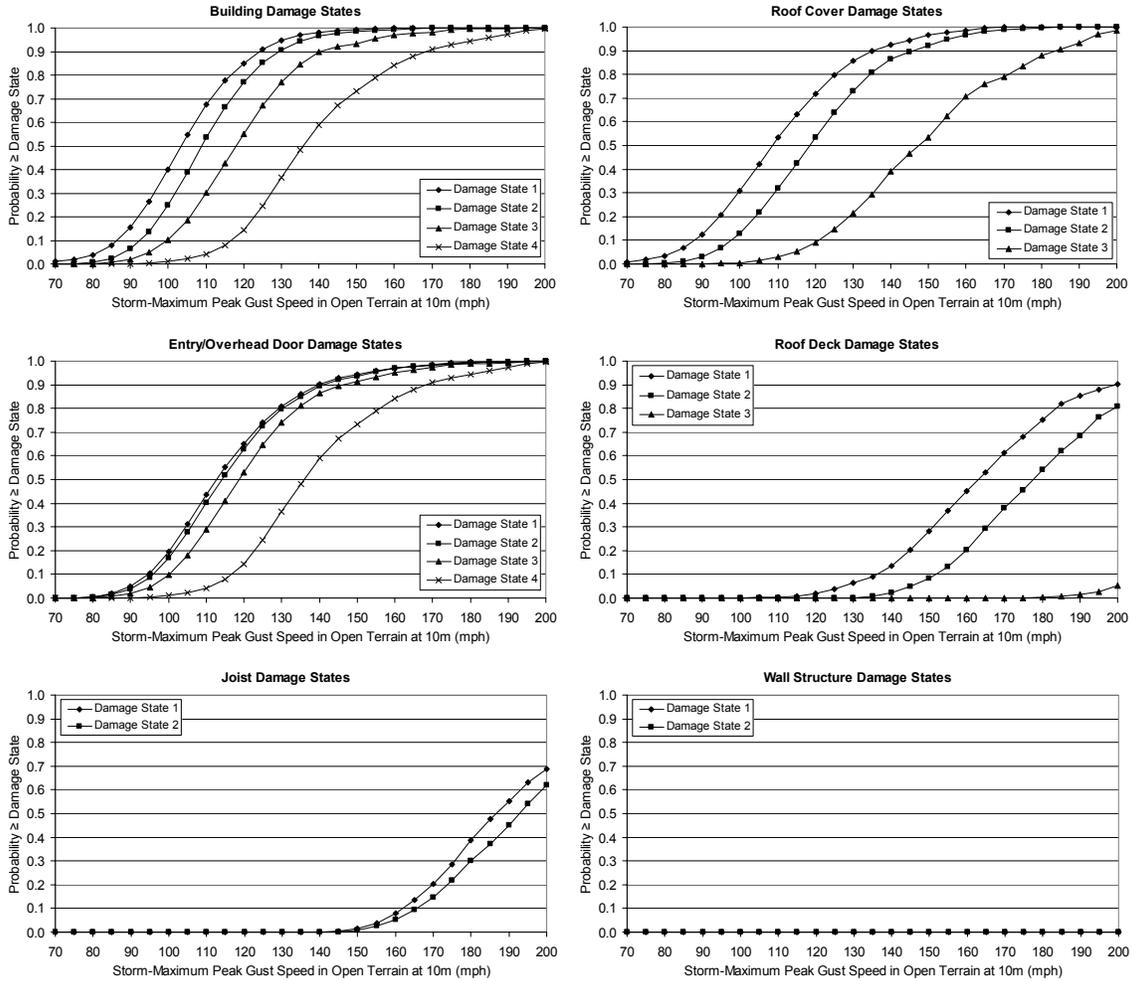
**Figure G.2. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



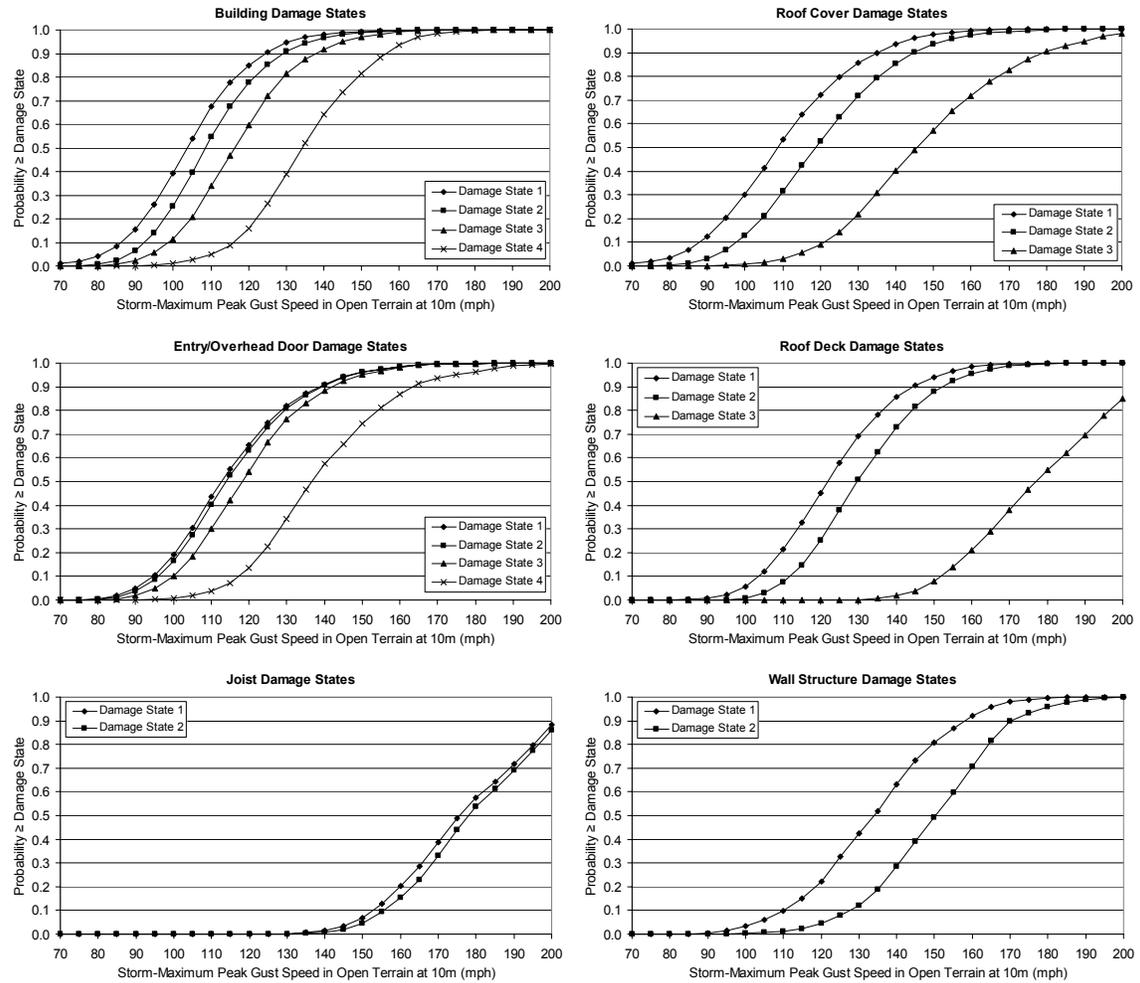
**Figure G.3. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – 50% Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.03$  m.**



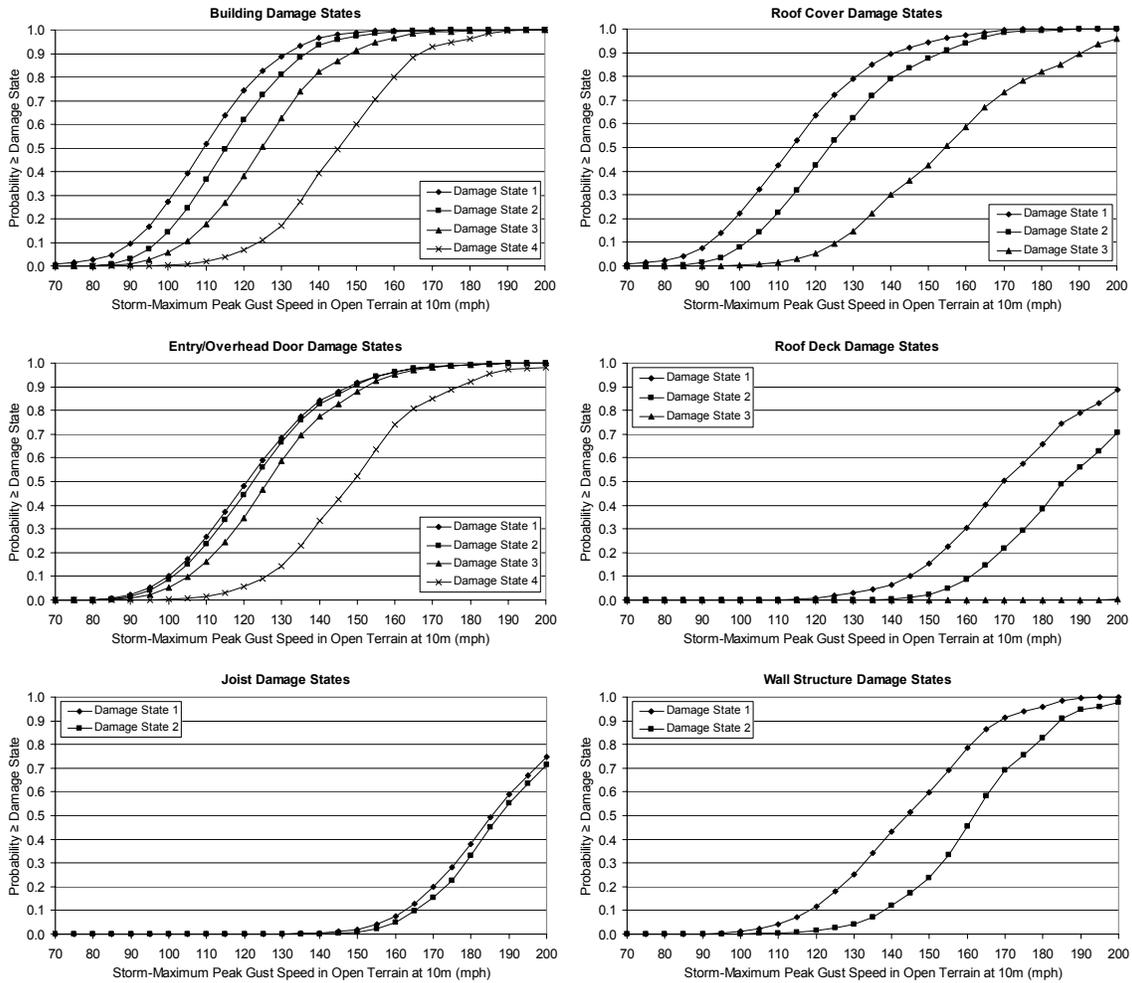
**Figure G.4. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_{\theta}=0.35$  m.**



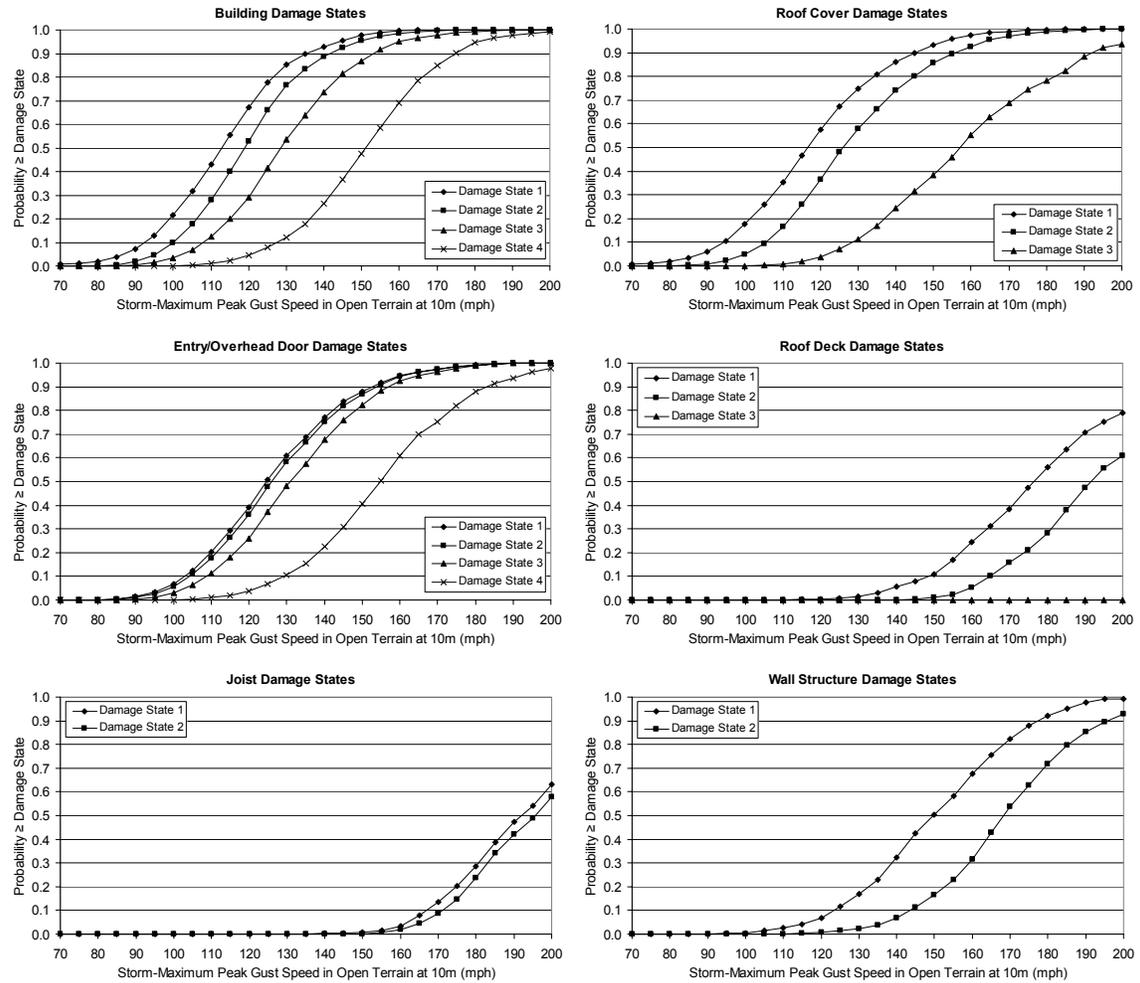
**Figure G.5. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Reinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



**Figure G.6. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – 50% Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.35$  m.**



**Figure G.7. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_0=0.7$  m.**



**Figure G.8. Damage States vs. Maximum Peak Gust Wind Speed – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A,  $z_{\theta}=1.0$  m.**

**Appendix H.**  
**Loss Functions for Residential Buildings**

## **Appendix H. Loss Functions for Residential Buildings**

This appendix presents loss functions for residential buildings (see Section 7.7). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

Table H.1 lists the figures provided in this appendix. In each set of sixteen plots, the building parameters varied are: roof deck nails (6d or 8d), roof/wall connections (to E.nail or strap), number of stories (one or two), and roof shape (gable or hip). Plots are presented for the buildings constructed with wood frame walls and for the buildings having no garage.

**Table H.1. Sample Loss Functions for Residential Buildings**

Figure	Loss Type	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/Wall	Shutters	Upgraded Roof	Secondary Water Resistance
H.1	Building	WFR	1	No	Gable	6d	Toe-Nail	No	No	No
H.2	Building	WFR	1	No	Gable	6d	Strap	No	No	No
H.3	Building	WFR	1	No	Gable	8d	Toe-Nail	No	No	No
H.4	Building	WFR	1	No	Gable	8d	Strap	No	No	No
H.5	Building	WFR	1	No	Hip	6d	Toe-Nail	No	No	No
H.6	Building	WFR	1	No	Hip	6d	Strap	No	No	No
H.7	Building	WFR	1	No	Hip	8d	Toe-Nail	No	No	No
H.8	Building	WFR	1	No	Hip	8d	Strap	No	No	No
H.9	Building	WFR	2	No	Gable	6d	Toe-Nail	No	No	No
H.10	Building	WFR	2	No	Gable	6d	Strap	No	No	No
H.11	Building	WFR	2	No	Gable	8d	Toe-Nail	No	No	No
H.12	Building	WFR	2	No	Gable	8d	Strap	No	No	No
H.13	Building	WFR	2	No	Hip	6d	Toe-Nail	No	No	No
H.14	Building	WFR	2	No	Hip	6d	Strap	No	No	No
H.15	Building	WFR	2	No	Hip	8d	Toe-Nail	No	No	No
H.16	Building	WFR	2	No	Hip	8d	Strap	No	No	No
H.17	Content	WFR	1	No	Gable	6d	Toe-Nail	No	No	No
H.18	Content	WFR	1	No	Gable	6d	Strap	No	No	No
H.19	Content	WFR	1	No	Gable	8d	Toe-Nail	No	No	No
H.20	Content	WFR	1	No	Gable	8d	Strap	No	No	No
H.21	Content	WFR	1	No	Hip	6d	Toe-Nail	No	No	No

**Table H.1. Sample Loss Functions for Residential Buildings (continued)**

Figure	Loss Type	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Secondary Water Resistance
H.22	Content	WFR	1	No	Hip	6d	Strap	No	No	No
H.23	Content	WFR	1	No	Hip	8d	Toe-Nail	No	No	No
H.24	Content	WFR	1	No	Hip	8d	Strap	No	No	No
H.25	Content	WFR	2	No	Gable	6d	Toe-Nail	No	No	No
H.26	Content	WFR	2	No	Gable	6d	Strap	No	No	No
H.27	Content	WFR	2	No	Gable	8d	Toe-Nail	No	No	No
H.28	Content	WFR	2	No	Gable	8d	Strap	No	No	No
H.29	Content	WFR	2	No	Hip	6d	Toe-Nail	No	No	No
H.30	Content	WFR	2	No	Hip	6d	Strap	No	No	No
H.31	Content	WFR	2	No	Hip	8d	Toe-Nail	No	No	No
H.32	Content	WFR	2	No	Hip	8d	Strap	No	No	No
H.33	Building	WFR	1	No	Gable	6d	Toe-Nail	Yes	No	No
H.34	Building	WFR	1	No	Gable	6d	Strap	Yes	No	No
H.35	Building	WFR	1	No	Gable	8d	Toe-Nail	Yes	No	No
H.36	Building	WFR	1	No	Gable	8d	Strap	Yes	No	No
H.37	Building	WFR	1	No	Hip	6d	Toe-Nail	Yes	No	No
H.38	Building	WFR	1	No	Hip	6d	Strap	Yes	No	No
H.39	Building	WFR	1	No	Hip	8d	Toe-Nail	Yes	No	No
H.40	Building	WFR	1	No	Hip	8d	Strap	Yes	No	No
H.41	Building	WFR	2	No	Gable	6d	Toe-Nail	Yes	No	No
H.42	Building	WFR	2	No	Gable	6d	Strap	Yes	No	No
H.43	Building	WFR	2	No	Gable	8d	Toe-Nail	Yes	No	No
H.44	Building	WFR	2	No	Gable	8d	Strap	Yes	No	No
H.45	Building	WFR	2	No	Hip	6d	Toe-Nail	Yes	No	No
H.46	Building	WFR	2	No	Hip	6d	Strap	Yes	No	No
H.47	Building	WFR	2	No	Hip	8d	Toe-Nail	Yes	No	No
H.48	Building	WFR	2	No	Hip	8d	Strap	Yes	No	No
H.49	Content	WFR	1	No	Gable	6d	Toe-Nail	Yes	No	No
H.50	Content	WFR	1	No	Gable	6d	Strap	Yes	No	No
H.51	Content	WFR	1	No	Gable	8d	Toe-Nail	Yes	No	No
H.52	Content	WFR	1	No	Gable	8d	Strap	Yes	No	No
H.53	Content	WFR	1	No	Hip	6d	Toe-Nail	Yes	No	No
H.54	Content	WFR	1	No	Hip	6d	Strap	Yes	No	No
H.55	Content	WFR	1	No	Hip	8d	Toe-Nail	Yes	No	No
H.56	Content	WFR	1	No	Hip	8d	Strap	Yes	No	No
H.57	Content	WFR	2	No	Gable	6d	Toe-Nail	Yes	No	No
H.58	Content	WFR	2	No	Gable	6d	Strap	Yes	No	No
H.59	Content	WFR	2	No	Gable	8d	Toe-Nail	Yes	No	No
H.60	Content	WFR	2	No	Gable	8d	Strap	Yes	No	No
H.61	Content	WFR	2	No	Hip	6d	Toe-Nail	Yes	No	No
H.62	Content	WFR	2	No	Hip	6d	Strap	Yes	No	No
H.63	Content	WFR	2	No	Hip	8d	Toe-Nail	Yes	No	No
H.64	Content	WFR	2	No	Hip	8d	Strap	Yes	No	No

**Table H.1. Sample Loss Functions for Residential Buildings (continued)**

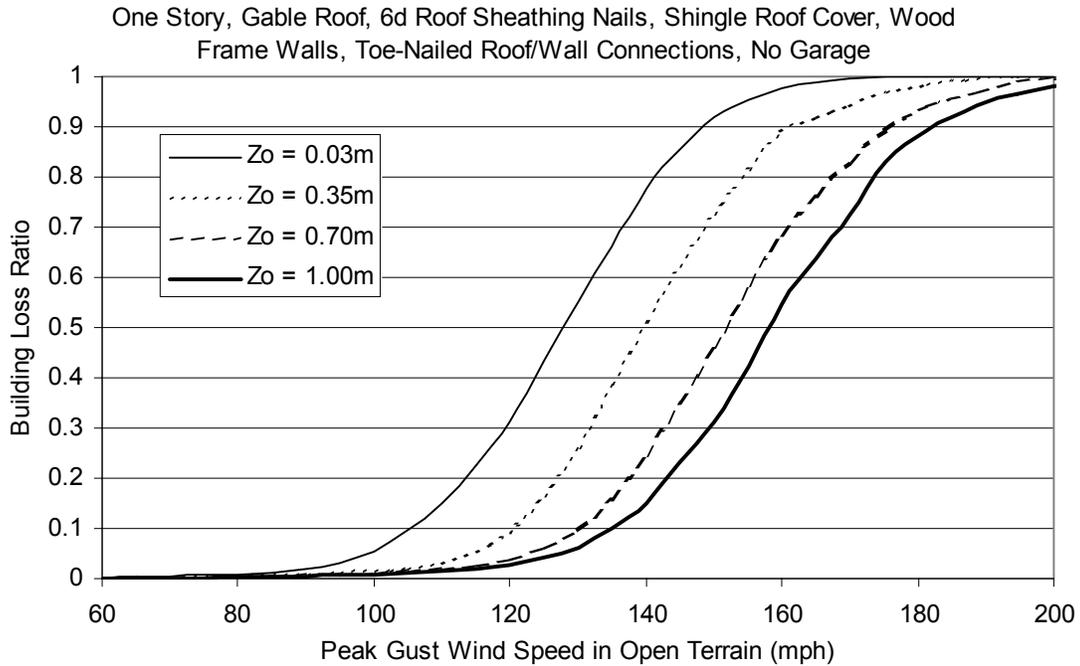
Figure	Loss Type	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Secondary Water Resistance
H.65	Building	WFR	1	No	Gable	6d	Toe-Nail	No	Yes	No
H.66	Building	WFR	1	No	Gable	6d	Strap	No	Yes	No
H.67	Building	WFR	1	No	Gable	8d	Toe-Nail	No	Yes	No
H.68	Building	WFR	1	No	Gable	8d	Strap	No	Yes	No
H.69	Building	WFR	1	No	Hip	6d	Toe-Nail	No	Yes	No
H.70	Building	WFR	1	No	Hip	6d	Strap	No	Yes	No
H.71	Building	WFR	1	No	Hip	8d	Toe-Nail	No	Yes	No
H.72	Building	WFR	1	No	Hip	8d	Strap	No	Yes	No
H.73	Building	WFR	2	No	Gable	6d	Toe-Nail	No	Yes	No
H.74	Building	WFR	2	No	Gable	6d	Strap	No	Yes	No
H.75	Building	WFR	2	No	Gable	8d	Toe-Nail	No	Yes	No
H.76	Building	WFR	2	No	Gable	8d	Strap	No	Yes	No
H.77	Building	WFR	2	No	Hip	6d	Toe-Nail	No	Yes	No
H.78	Building	WFR	2	No	Hip	6d	Strap	No	Yes	No
H.79	Building	WFR	2	No	Hip	8d	Toe-Nail	No	Yes	No
H.80	Building	WFR	2	No	Hip	8d	Strap	No	Yes	No
H.81	Content	WFR	1	No	Gable	6d	Toe-Nail	No	Yes	No
H.82	Content	WFR	1	No	Gable	6d	Strap	No	Yes	No
H.83	Content	WFR	1	No	Gable	8d	Toe-Nail	No	Yes	No
H.84	Content	WFR	1	No	Gable	8d	Strap	No	Yes	No
H.85	Content	WFR	1	No	Hip	6d	Toe-Nail	No	Yes	No
H.86	Content	WFR	1	No	Hip	6d	Strap	No	Yes	No
H.87	Content	WFR	1	No	Hip	8d	Toe-Nail	No	Yes	No
H.88	Content	WFR	1	No	Hip	8d	Strap	No	Yes	No
H.89	Content	WFR	2	No	Gable	6d	Toe-Nail	No	Yes	No
H.90	Content	WFR	2	No	Gable	6d	Strap	No	Yes	No
H.91	Content	WFR	2	No	Gable	8d	Toe-Nail	No	Yes	No
H.92	Content	WFR	2	No	Gable	8d	Strap	No	Yes	No
H.93	Content	WFR	2	No	Hip	6d	Toe-Nail	No	Yes	No
H.94	Content	WFR	2	No	Hip	6d	Strap	No	Yes	No
H.95	Content	WFR	2	No	Hip	8d	Toe-Nail	No	Yes	No
H.96	Content	WFR	2	No	Hip	8d	Strap	No	Yes	No
H.97	Building	WFR	1	No	Gable	6d	Toe-Nail	No	Yes	Yes
H.98	Building	WFR	1	No	Gable	6d	Strap	No	Yes	Yes
H.99	Building	WFR	1	No	Gable	8d	Toe-Nail	No	Yes	Yes
H.100	Building	WFR	1	No	Gable	8d	Strap	No	Yes	Yes
H.101	Building	WFR	1	No	Hip	6d	Toe-Nail	No	Yes	Yes
H.102	Building	WFR	1	No	Hip	6d	Strap	No	Yes	Yes
H.103	Building	WFR	1	No	Hip	8d	Toe-Nail	No	Yes	Yes
H.104	Building	WFR	1	No	Hip	8d	Strap	No	Yes	Yes
H.105	Building	WFR	2	No	Gable	6d	Toe-Nail	No	Yes	Yes
H.106	Building	WFR	2	No	Gable	6d	Strap	No	Yes	Yes
H.107	Building	WFR	2	No	Gable	8d	Toe-Nail	No	Yes	Yes

**Table H.1. Sample Loss Functions for Residential Buildings (continued)**

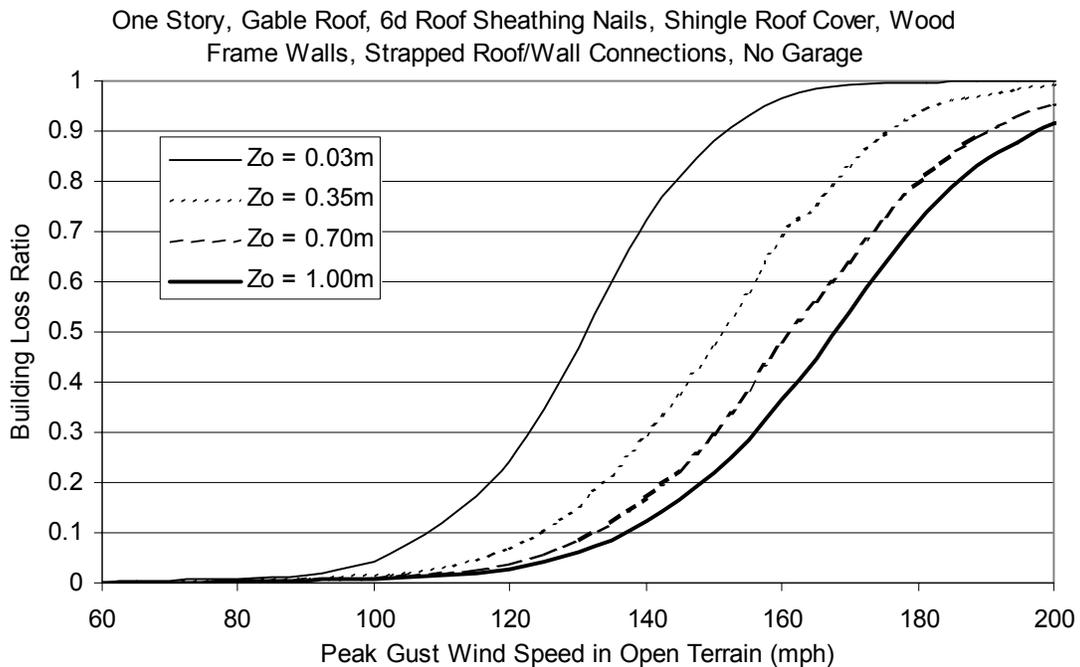
Figure	Loss Type	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Secondary Water Resistance
H.108	Building	WFR	2	No	Gable	8d	Strap	No	Yes	Yes
H.109	Building	WFR	2	No	Hip	6d	Toe-Nail	No	Yes	Yes
H.110	Building	WFR	2	No	Hip	6d	Strap	No	Yes	Yes
H.111	Building	WFR	2	No	Hip	8d	Toe-Nail	No	Yes	Yes
H.112	Building	WFR	2	No	Hip	8d	Strap	No	Yes	Yes
H.113	Content	WFR	1	No	Gable	6d	Toe-Nail	No	Yes	Yes
H.114	Content	WFR	1	No	Gable	6d	Strap	No	Yes	Yes
H.115	Content	WFR	1	No	Gable	8d	Toe-Nail	No	Yes	Yes
H.116	Content	WFR	1	No	Gable	8d	Strap	No	Yes	Yes
H.117	Content	WFR	1	No	Hip	6d	Toe-Nail	No	Yes	Yes
H.118	Content	WFR	1	No	Hip	6d	Strap	No	Yes	Yes
H.119	Content	WFR	1	No	Hip	8d	Toe-Nail	No	Yes	Yes
H.120	Content	WFR	1	No	Hip	8d	Strap	No	Yes	Yes
H.121	Content	WFR	2	No	Gable	6d	Toe-Nail	No	Yes	Yes
H.122	Content	WFR	2	No	Gable	6d	Strap	No	Yes	Yes
H.123	Content	WFR	2	No	Gable	8d	Toe-Nail	No	Yes	Yes
H.124	Content	WFR	2	No	Gable	8d	Strap	No	Yes	Yes
H.125	Content	WFR	2	No	Hip	6d	Toe-Nail	No	Yes	Yes
H.126	Content	WFR	2	No	Hip	6d	Strap	No	Yes	Yes
H.127	Content	WFR	2	No	Hip	8d	Toe-Nail	No	Yes	Yes
H.128	Content	WFR	2	No	Hip	8d	Strap	No	Yes	Yes
H.129	Building	WFR	1	No	Gable	6d	Toe-Nail	Yes	Yes	No
H.130	Building	WFR	1	No	Gable	6d	Strap	Yes	Yes	No
H.131	Building	WFR	1	No	Gable	8d	Toe-Nail	Yes	Yes	No
H.132	Building	WFR	1	No	Gable	8d	Strap	Yes	Yes	No
H.133	Building	WFR	1	No	Hip	6d	Toe-Nail	Yes	Yes	No
H.134	Building	WFR	1	No	Hip	6d	Strap	Yes	Yes	No
H.135	Building	WFR	1	No	Hip	8d	Toe-Nail	Yes	Yes	No
H.136	Building	WFR	1	No	Hip	8d	Strap	Yes	Yes	No
H.137	Building	WFR	2	No	Gable	6d	Toe-Nail	Yes	Yes	No
H.138	Building	WFR	2	No	Gable	6d	Strap	Yes	Yes	No
H.139	Building	WFR	2	No	Gable	8d	Toe-Nail	Yes	Yes	No
H.140	Building	WFR	2	No	Gable	8d	Strap	Yes	Yes	No
H.141	Building	WFR	2	No	Hip	6d	Toe-Nail	Yes	Yes	No
H.142	Building	WFR	2	No	Hip	6d	Strap	Yes	Yes	No
H.143	Building	WFR	2	No	Hip	8d	Toe-Nail	Yes	Yes	No
H.144	Building	WFR	2	No	Hip	8d	Strap	Yes	Yes	No
H.145	Content	WFR	1	No	Gable	6d	Toe-Nail	Yes	Yes	No
H.146	Content	WFR	1	No	Gable	6d	Strap	Yes	Yes	No
H.147	Content	WFR	1	No	Gable	8d	Toe-Nail	Yes	Yes	No
H.148	Content	WFR	1	No	Gable	8d	Strap	Yes	Yes	No
H.149	Content	WFR	1	No	Hip	6d	Toe-Nail	Yes	Yes	No
H.150	Content	WFR	1	No	Hip	6d	Strap	Yes	Yes	No

**Table H.1. Sample Loss Functions for Residential Buildings (concluded)**

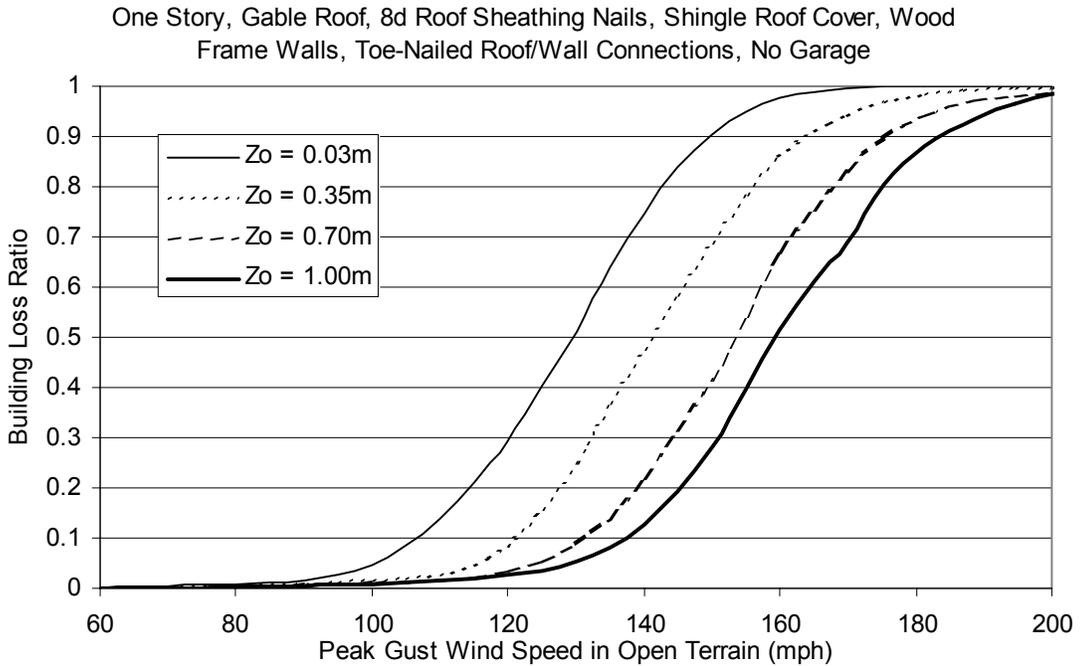
Figure	Loss Type	Walls	Stories	Garage	Roof Shape	Sheathing	Roof/ Wall	Shutters	Upgraded Roof	Secondary Water Resistance
H.151	Content	WFR	1	No	Hip	8d	Toe-Nail	Yes	Yes	No
H.152	Content	WFR	1	No	Hip	8d	Strap	Yes	Yes	No
H.153	Content	WFR	2	No	Gable	6d	Toe-Nail	Yes	Yes	No
H.154	Content	WFR	2	No	Gable	6d	Strap	Yes	Yes	No
H.155	Content	WFR	2	No	Gable	8d	Toe-Nail	Yes	Yes	No
H.156	Content	WFR	2	No	Gable	8d	Strap	Yes	Yes	No
H.157	Content	WFR	2	No	Hip	6d	Toe-Nail	Yes	Yes	No
H.158	Content	WFR	2	No	Hip	6d	Strap	Yes	Yes	No
H.159	Content	WFR	2	No	Hip	8d	Toe-Nail	Yes	Yes	No
H.160	Content	WFR	2	No	Hip	8d	Strap	Yes	Yes	No
H.161	Building	WFR	1	No	Gable	6d	Toe-Nail	Yes	Yes	Yes
H.162	Building	WFR	1	No	Gable	6d	Strap	Yes	Yes	Yes
H.163	Building	WFR	1	No	Gable	8d	Toe-Nail	Yes	Yes	Yes
H.164	Building	WFR	1	No	Gable	8d	Strap	Yes	Yes	Yes
H.165	Building	WFR	1	No	Hip	6d	Toe-Nail	Yes	Yes	Yes
H.166	Building	WFR	1	No	Hip	6d	Strap	Yes	Yes	Yes
H.167	Building	WFR	1	No	Hip	8d	Toe-Nail	Yes	Yes	Yes
H.168	Building	WFR	1	No	Hip	8d	Strap	Yes	Yes	Yes
H.169	Building	WFR	2	No	Gable	6d	Toe-Nail	Yes	Yes	Yes
H.170	Building	WFR	2	No	Gable	6d	Strap	Yes	Yes	Yes
H.171	Building	WFR	2	No	Gable	8d	Toe-Nail	Yes	Yes	Yes
H.172	Building	WFR	2	No	Gable	8d	Strap	Yes	Yes	Yes
H.173	Building	WFR	2	No	Hip	6d	Toe-Nail	Yes	Yes	Yes
H.174	Building	WFR	2	No	Hip	6d	Strap	Yes	Yes	Yes
H.175	Building	WFR	2	No	Hip	8d	Toe-Nail	Yes	Yes	Yes
H.176	Building	WFR	2	No	Hip	8d	Strap	Yes	Yes	Yes
H.177	Content	WFR	1	No	Gable	6d	Toe-Nail	Yes	Yes	Yes
H.178	Content	WFR	1	No	Gable	6d	Strap	Yes	Yes	Yes
H.179	Content	WFR	1	No	Gable	8d	Toe-Nail	Yes	Yes	Yes
H.180	Content	WFR	1	No	Gable	8d	Strap	Yes	Yes	Yes
H.181	Content	WFR	1	No	Hip	6d	Toe-Nail	Yes	Yes	Yes
H.182	Content	WFR	1	No	Hip	6d	Strap	Yes	Yes	Yes
H.183	Content	WFR	1	No	Hip	8d	Toe-Nail	Yes	Yes	Yes
H.184	Content	WFR	1	No	Hip	8d	Strap	Yes	Yes	Yes
H.185	Content	WFR	2	No	Gable	6d	Toe-Nail	Yes	Yes	Yes
H.186	Content	WFR	2	No	Gable	6d	Strap	Yes	Yes	Yes
H.187	Content	WFR	2	No	Gable	8d	Toe-Nail	Yes	Yes	Yes
H.188	Content	WFR	2	No	Gable	8d	Strap	Yes	Yes	Yes
H.189	Content	WFR	2	No	Hip	6d	Toe-Nail	Yes	Yes	Yes
H.190	Content	WFR	2	No	Hip	6d	Strap	Yes	Yes	Yes
H.191	Content	WFR	2	No	Hip	8d	Toe-Nail	Yes	Yes	Yes
H.192	Content	WFR	2	No	Hip	8d	Strap	Yes	Yes	Yes



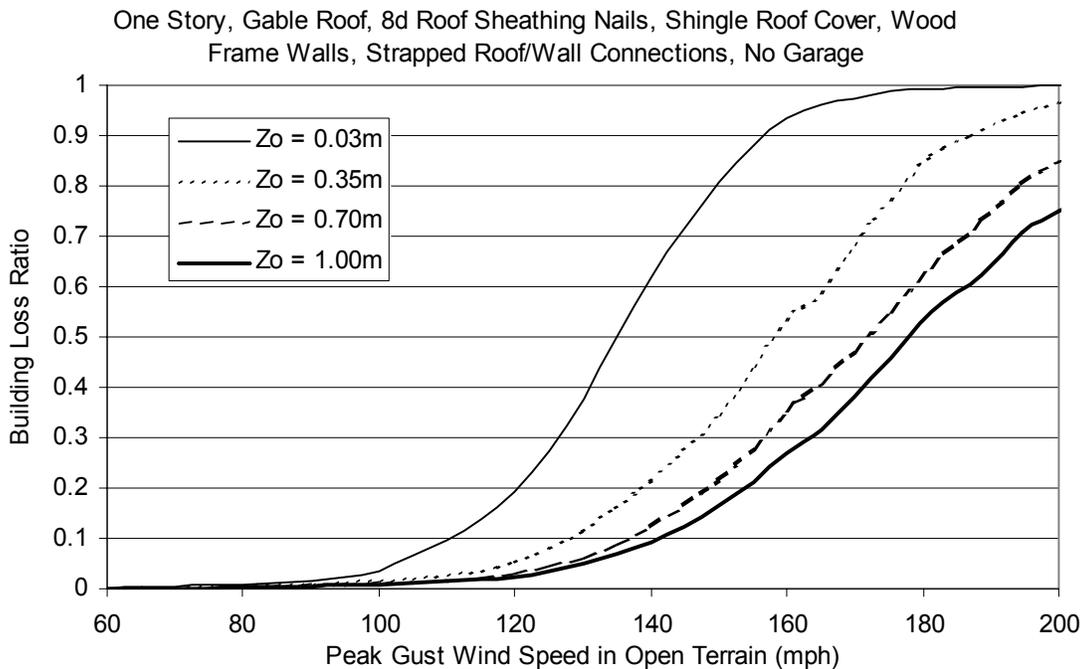
**Figure H.1. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



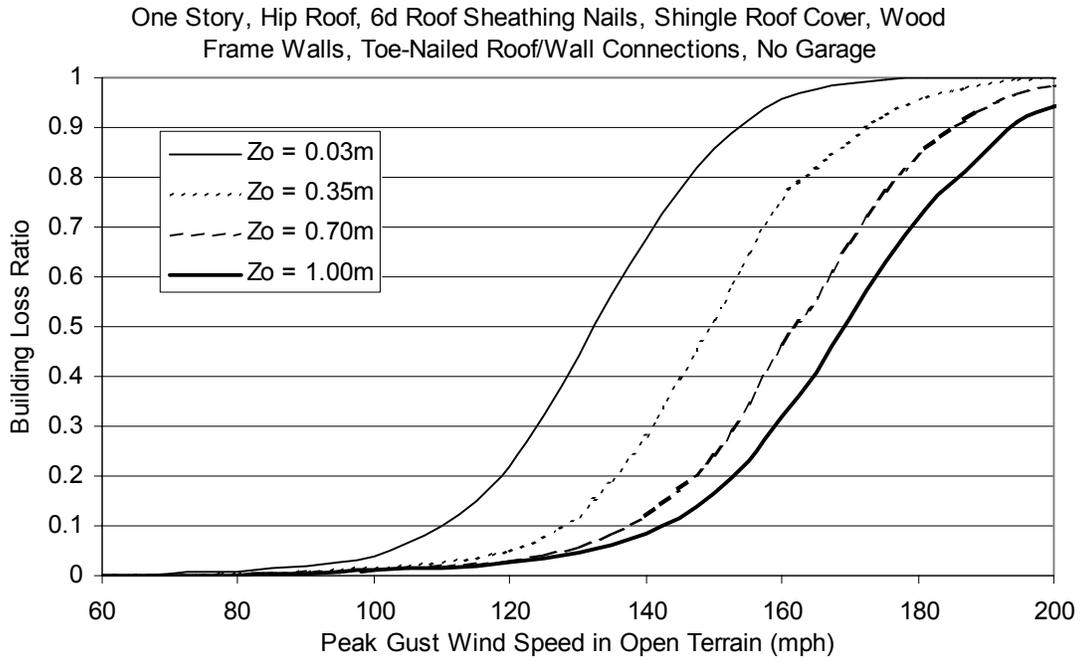
**Figure H.2. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



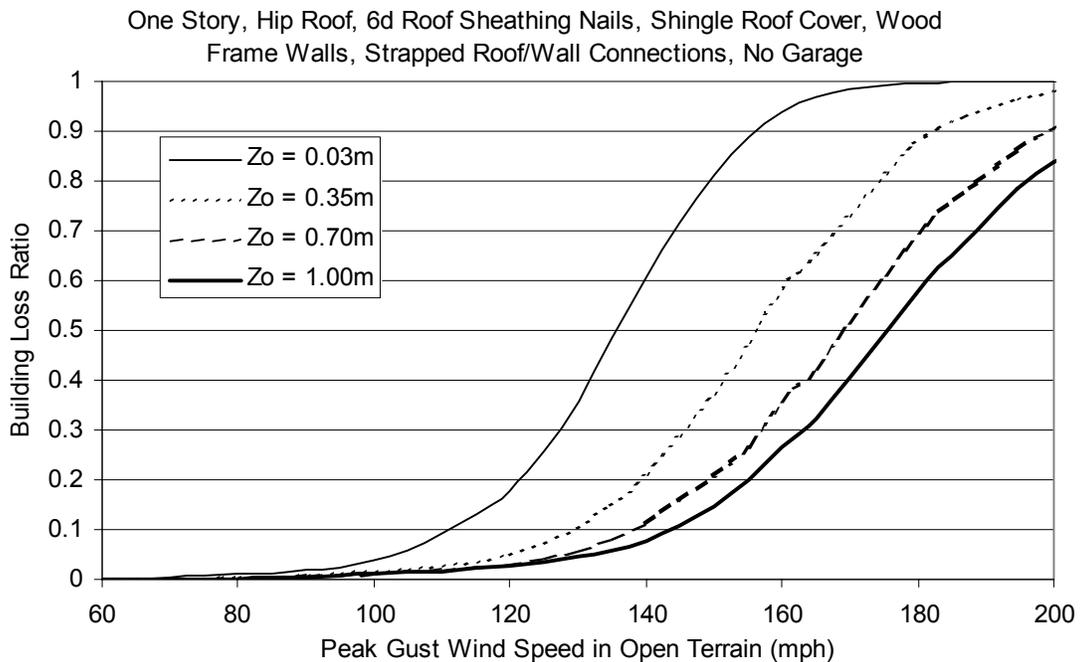
**Figure H.3. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



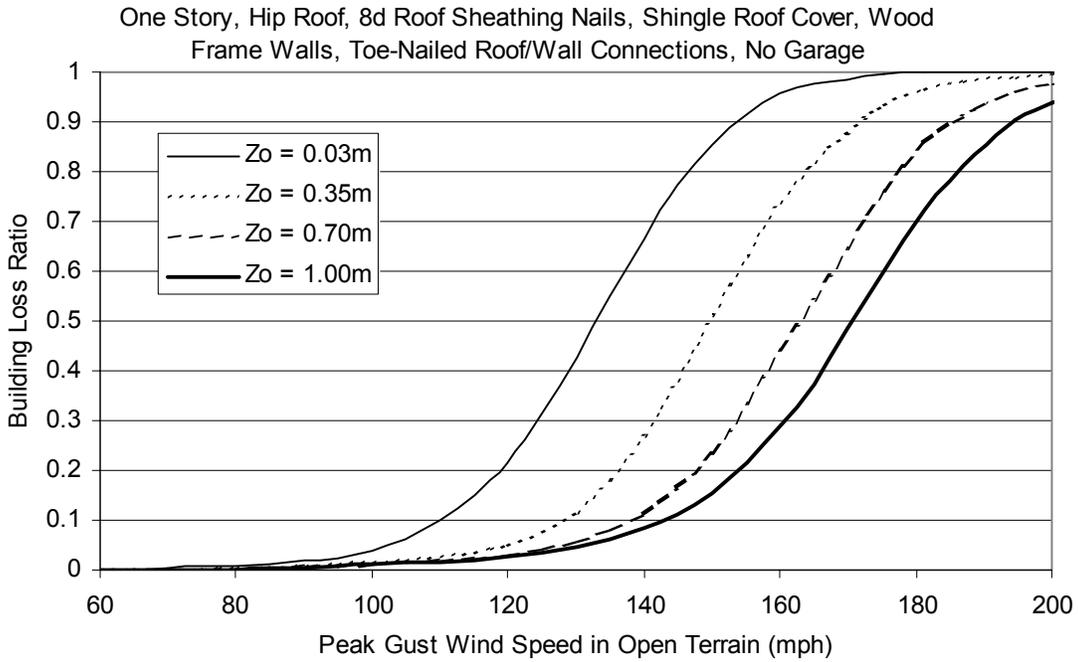
**Figure H.4. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



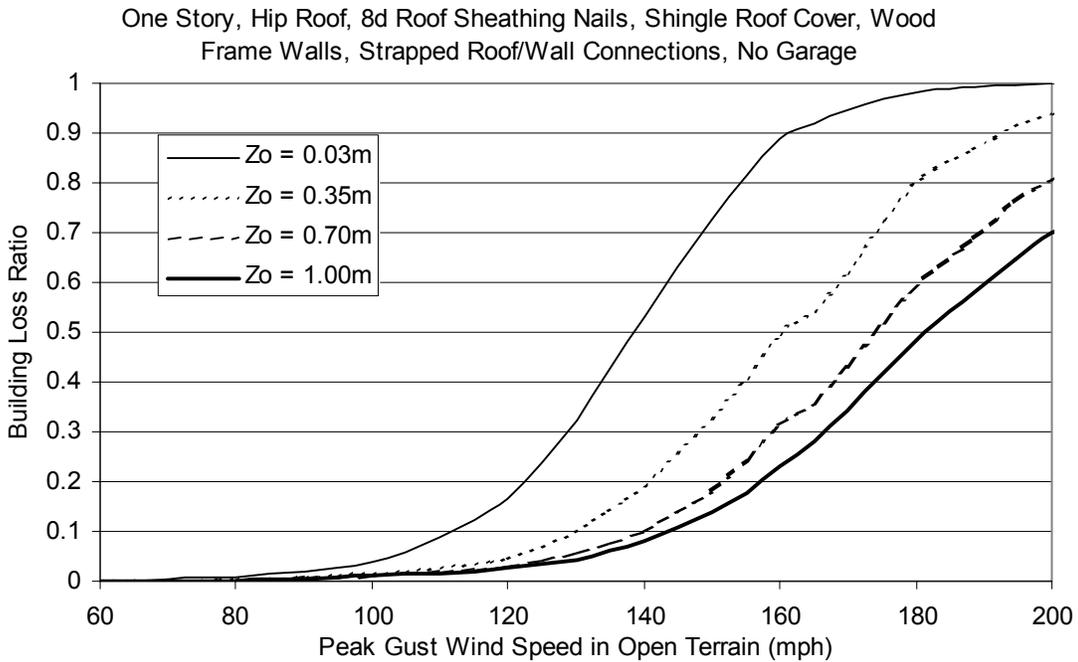
**Figure H.5. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



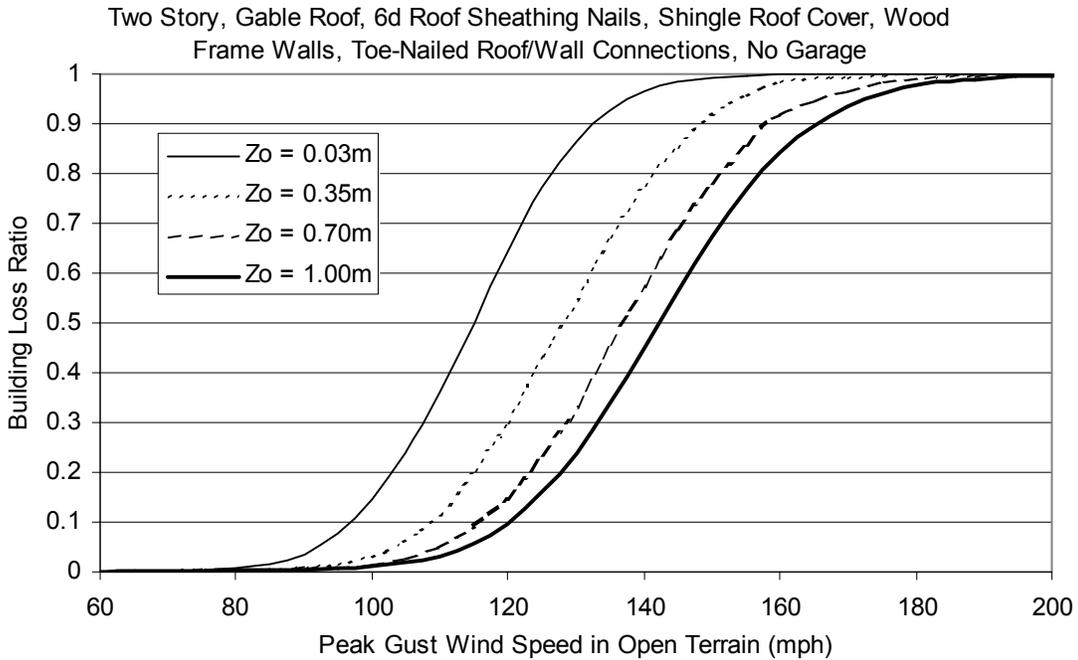
**Figure H.6. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



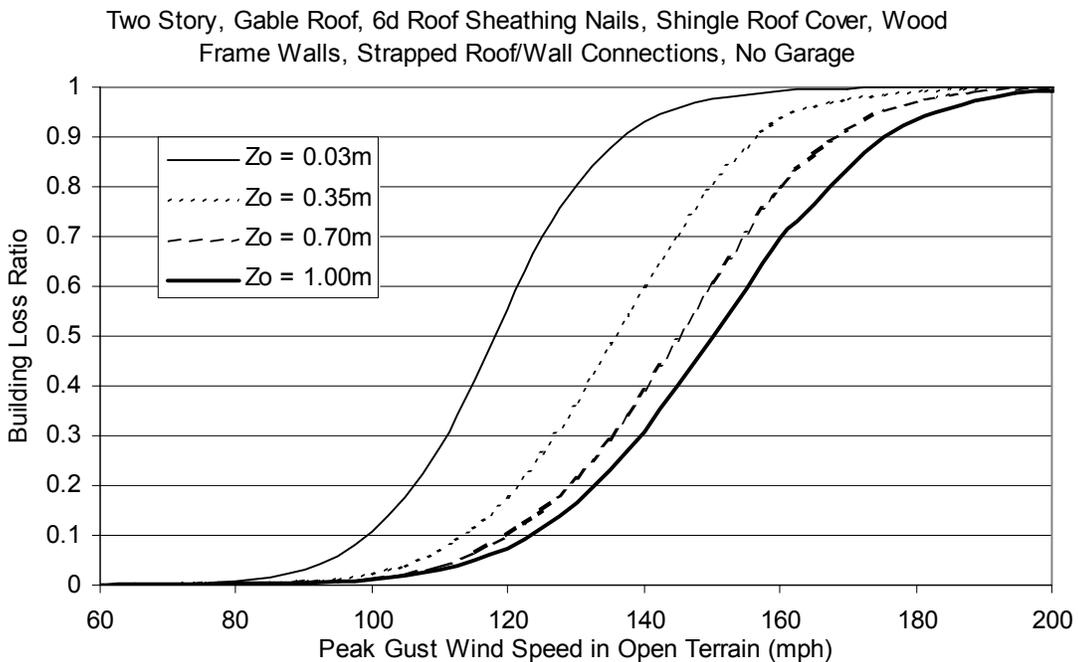
**Figure H.7. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



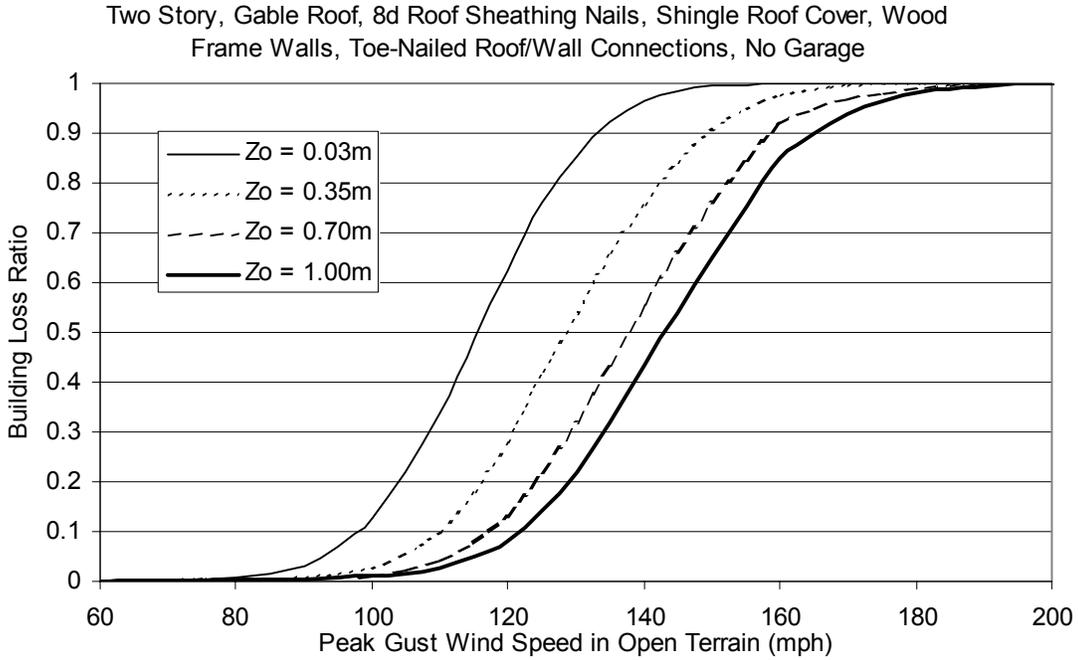
**Figure H.8. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



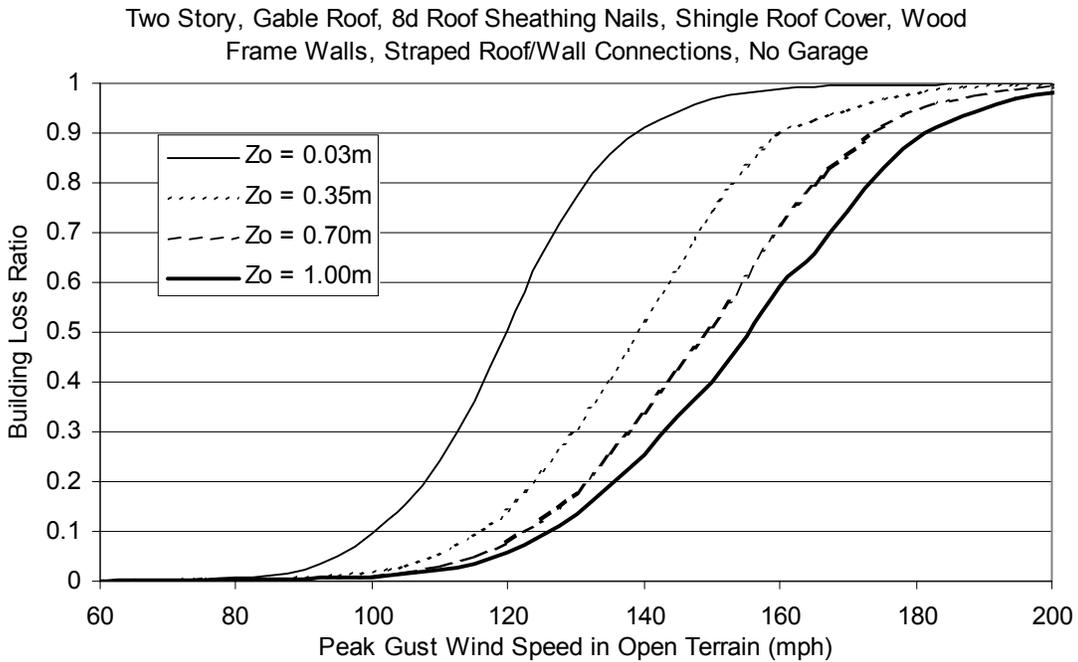
**Figure H.9. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



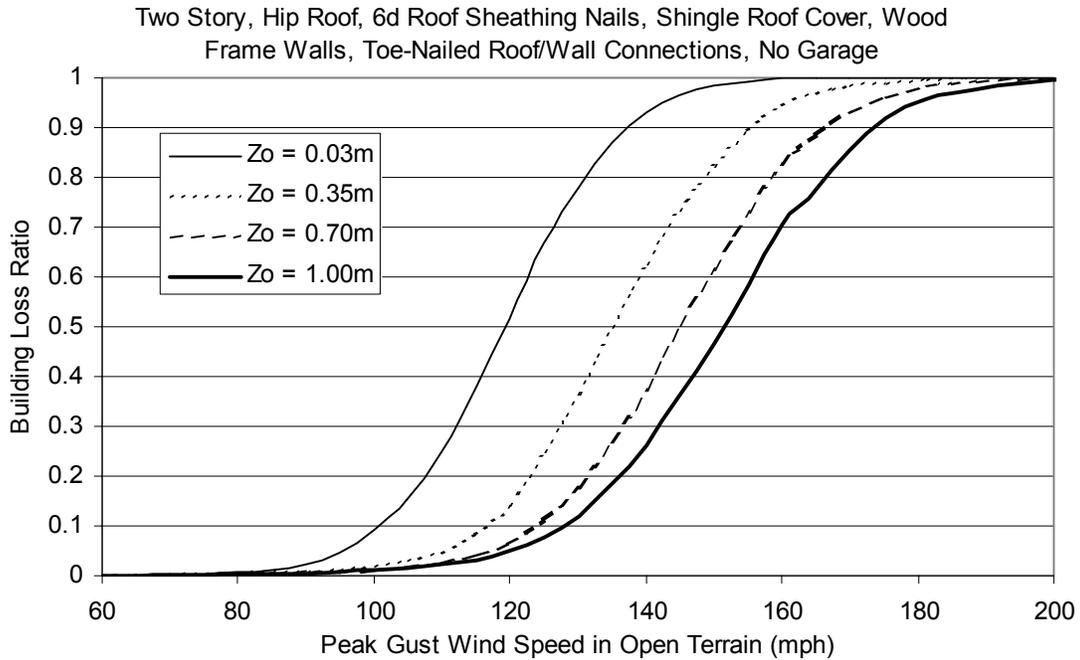
**Figure H.10. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



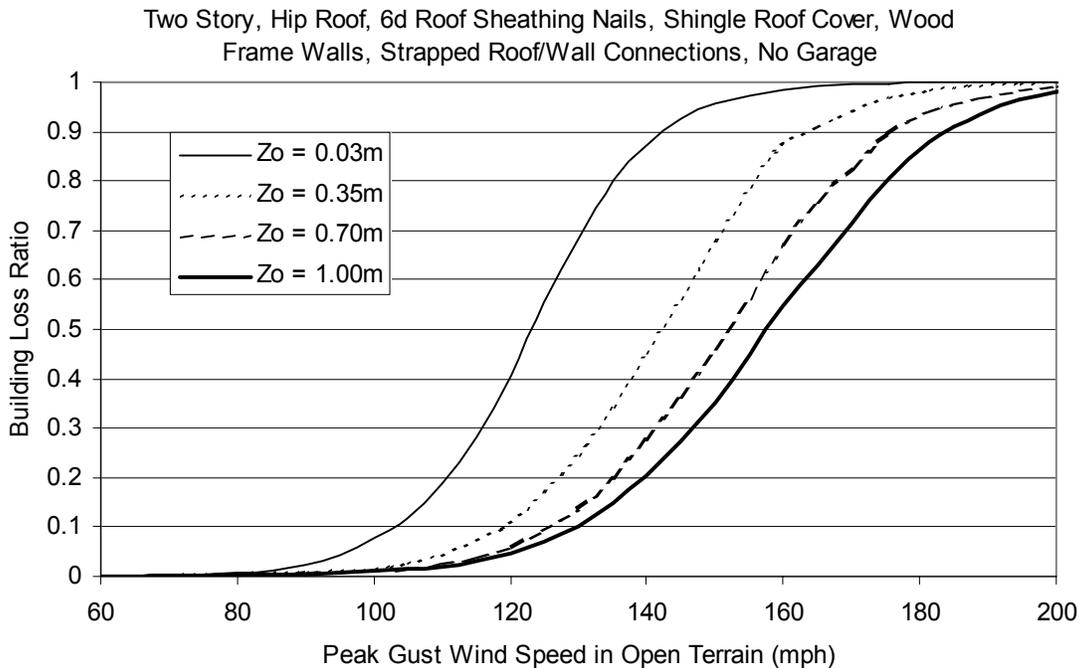
**Figure H.11. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



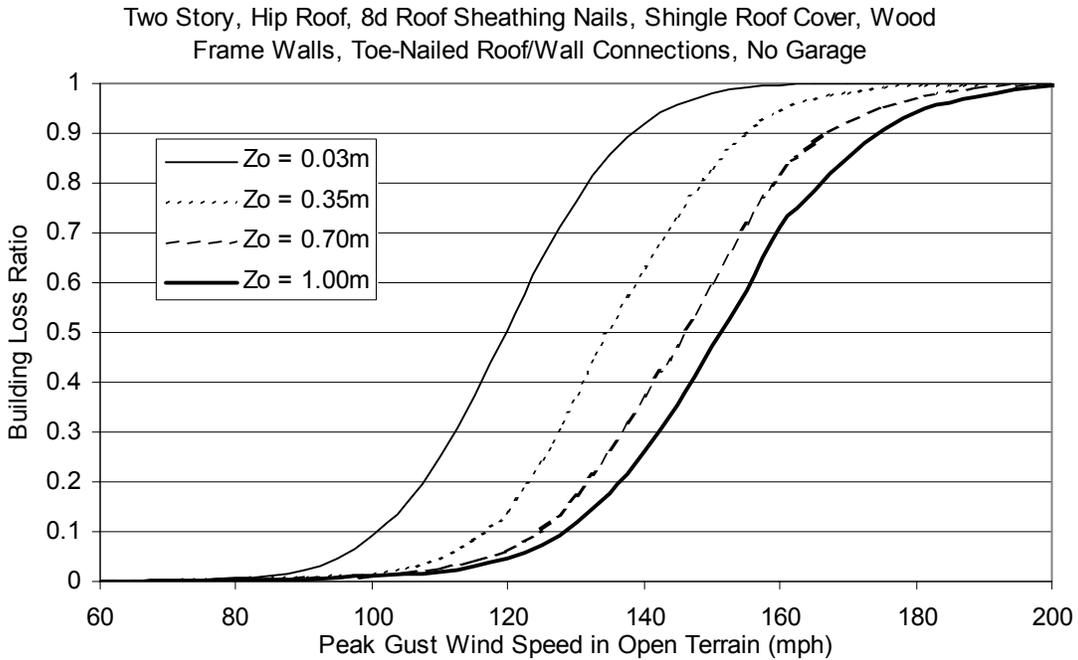
**Figure H.12. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



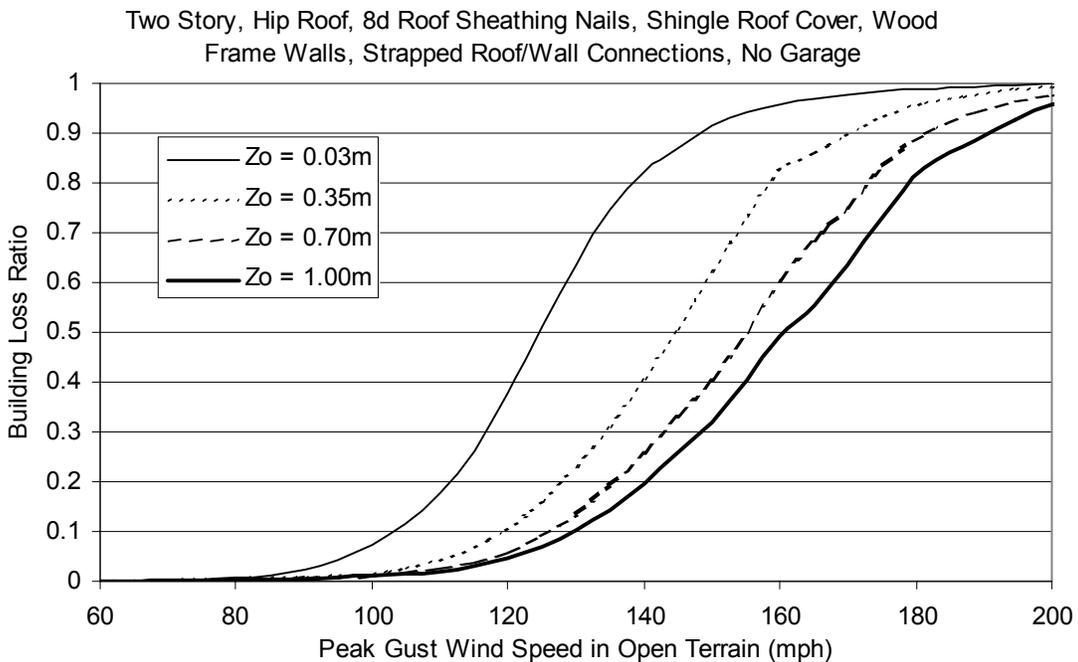
**Figure H.13. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



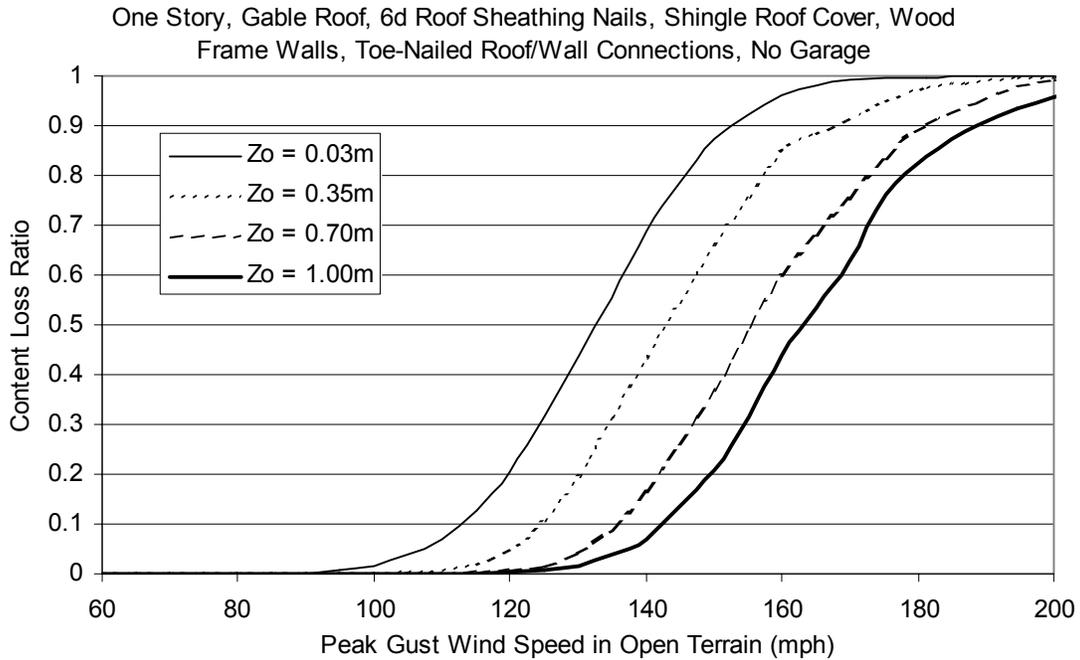
**Figure H.14. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



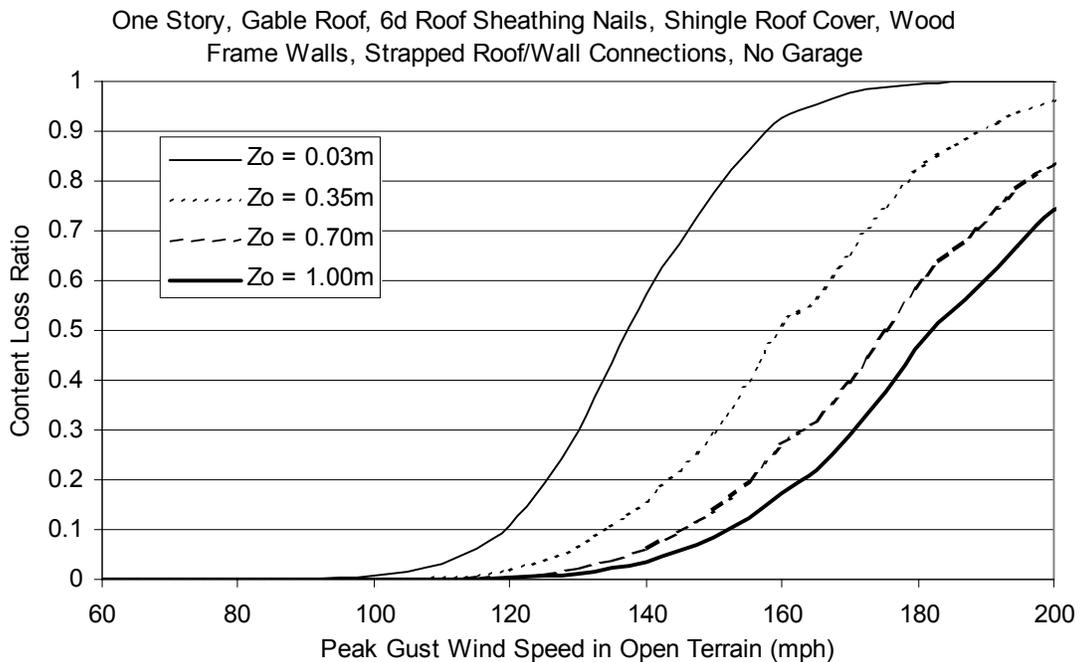
**Figure H.15. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



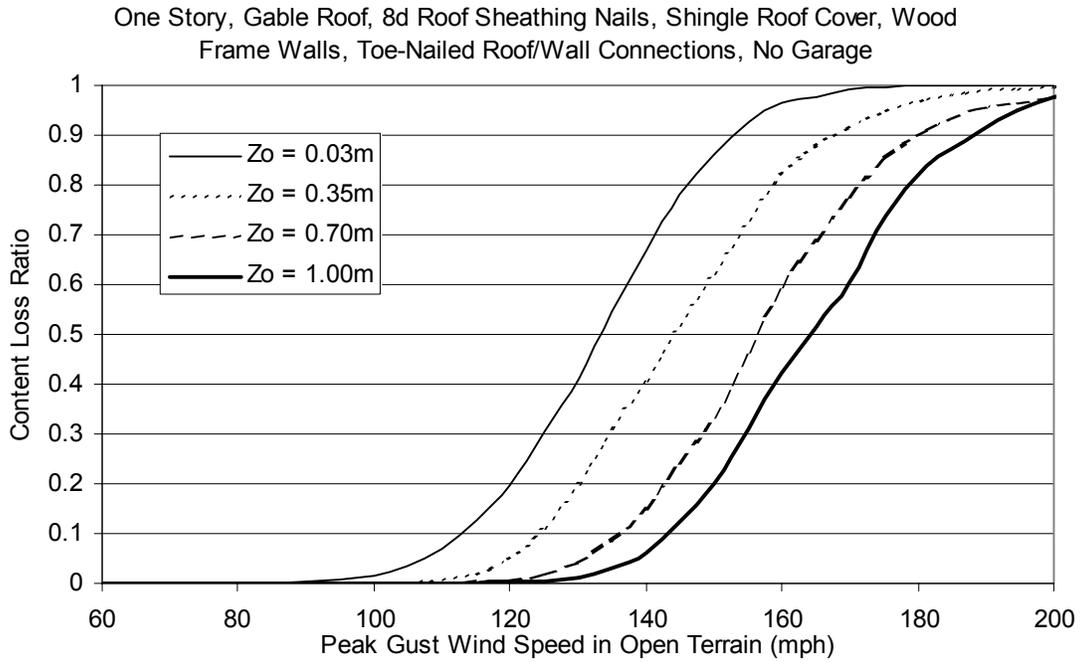
**Figure H.16. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



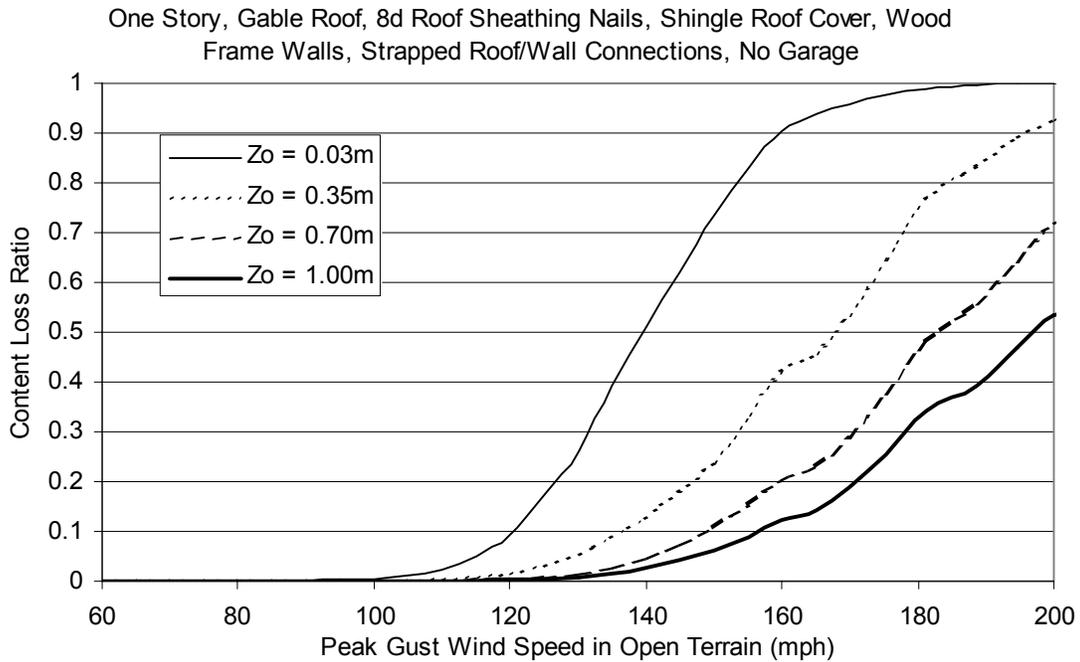
**Figure H.17. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



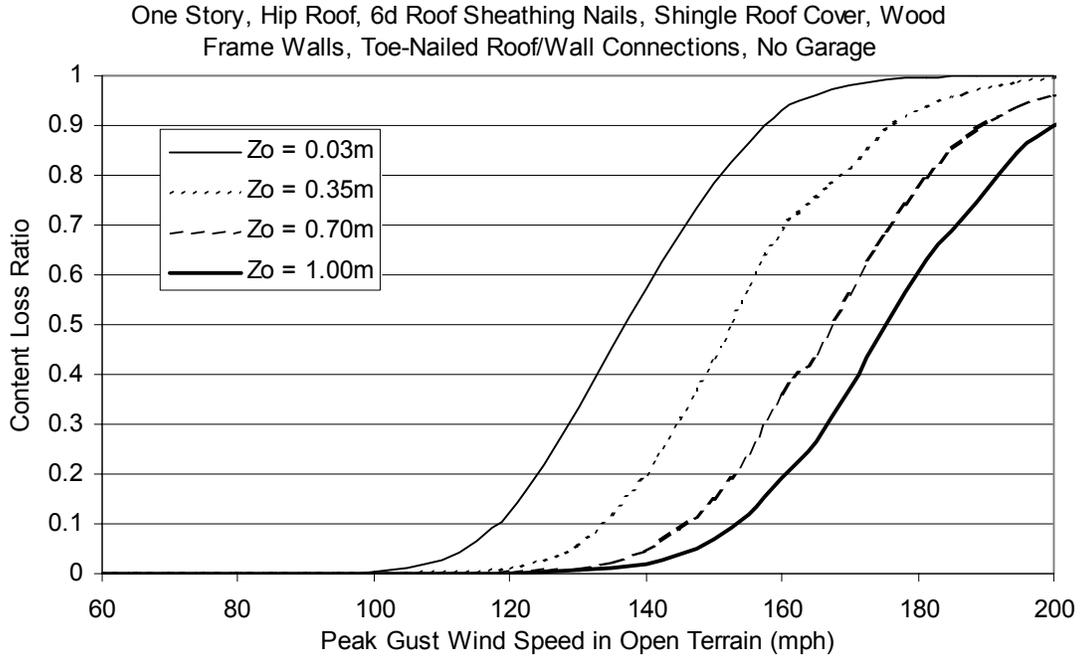
**Figure H.18. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



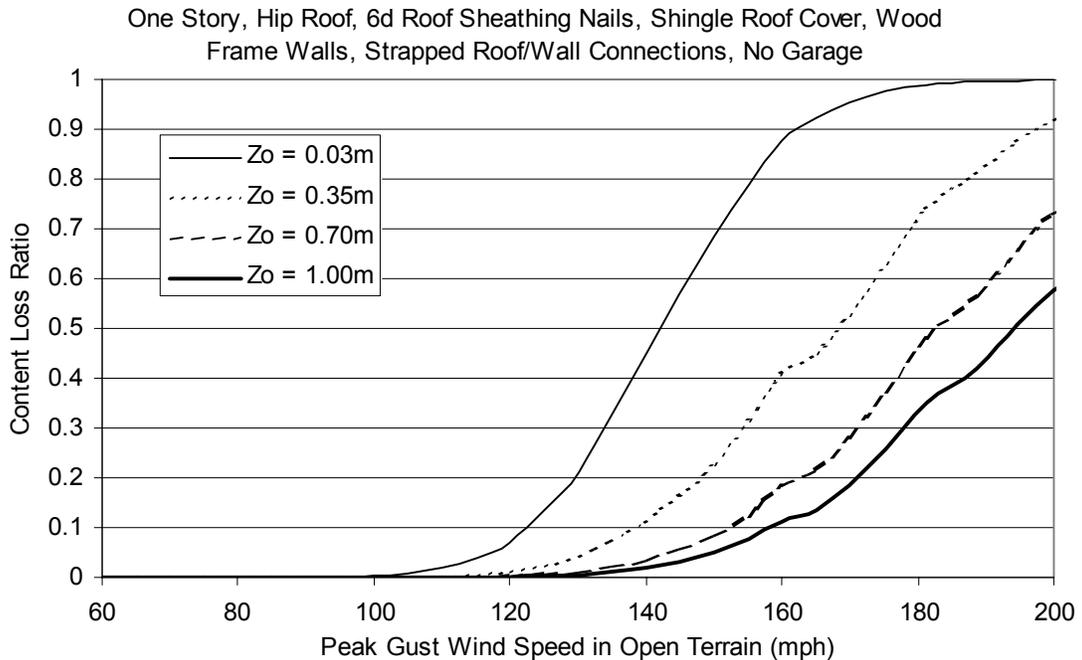
**Figure H.19. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



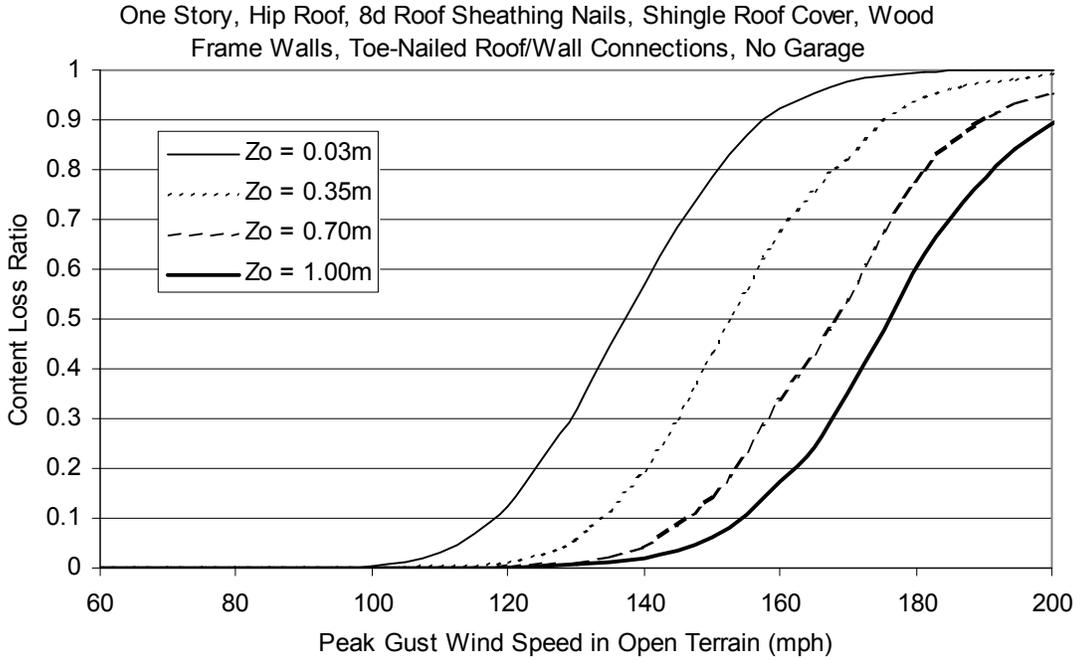
**Figure H.20. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



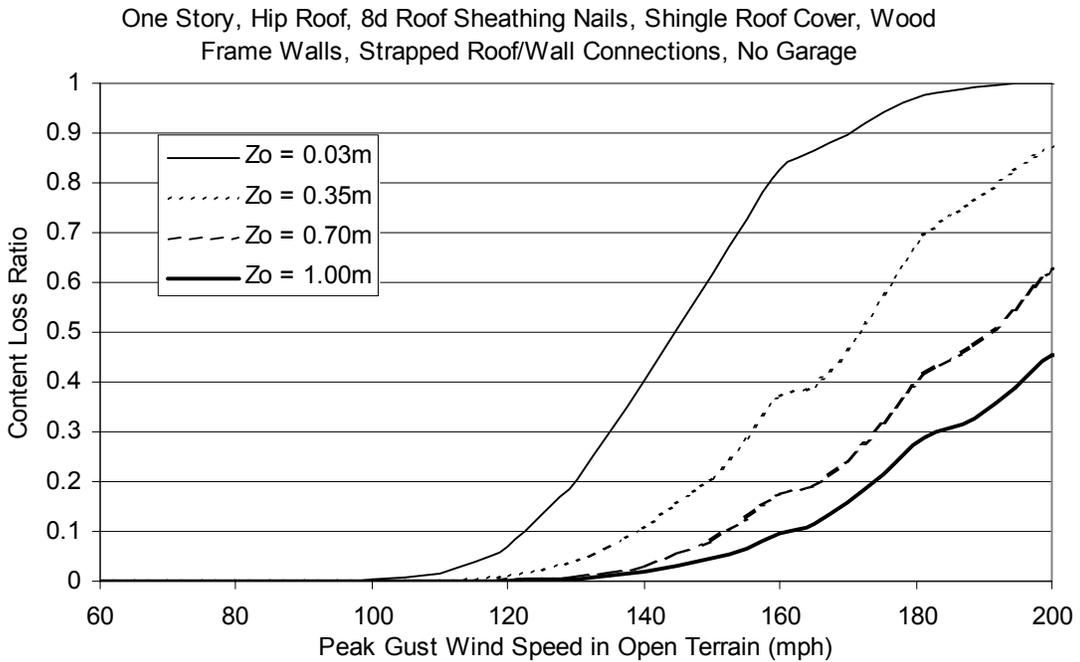
**Figure H.21. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



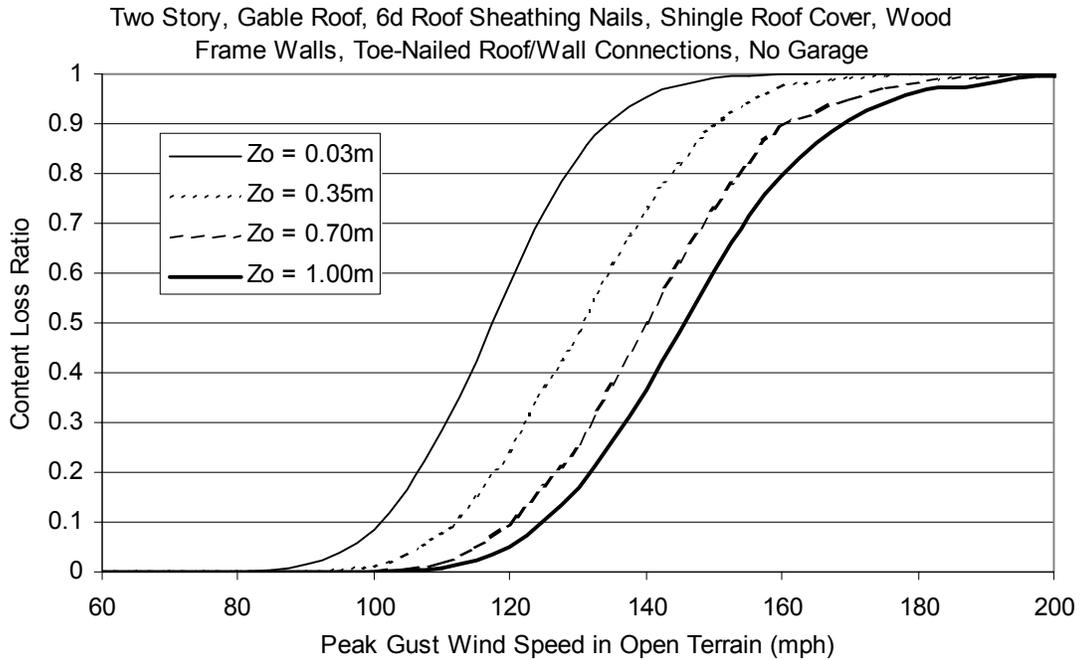
**Figure H.22. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



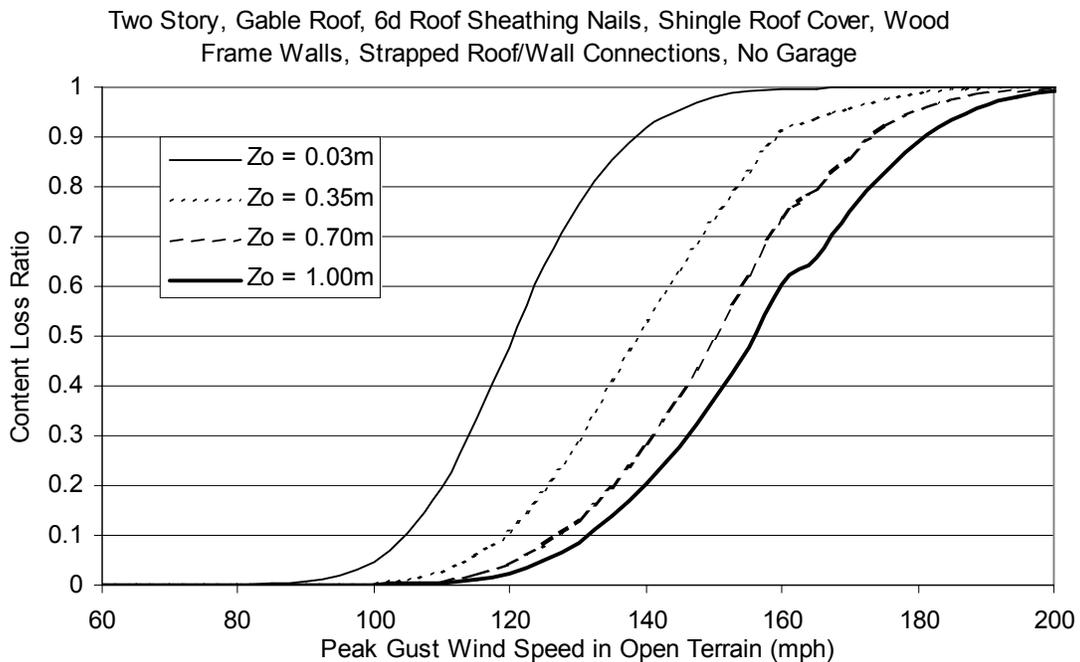
**Figure H.23. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



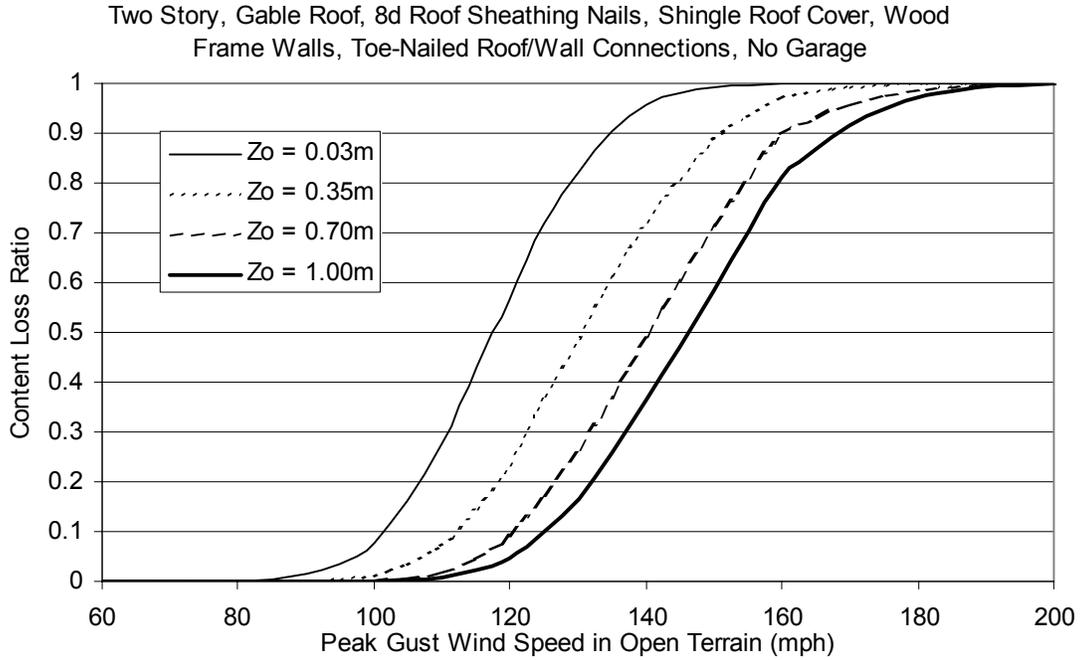
**Figure H.24. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



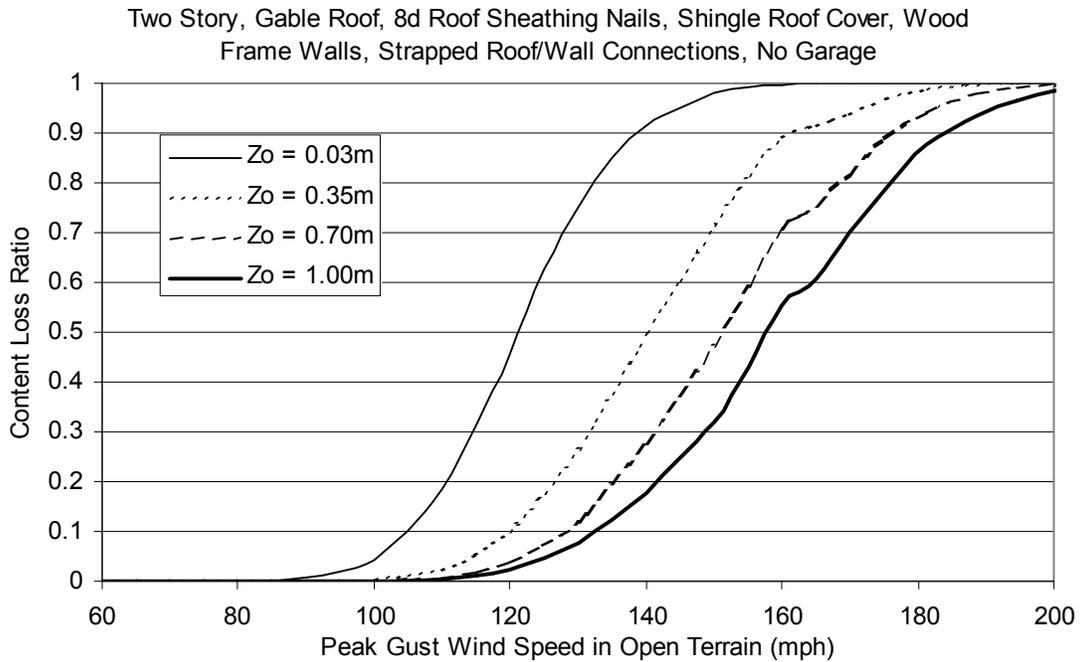
**Figure H.25. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



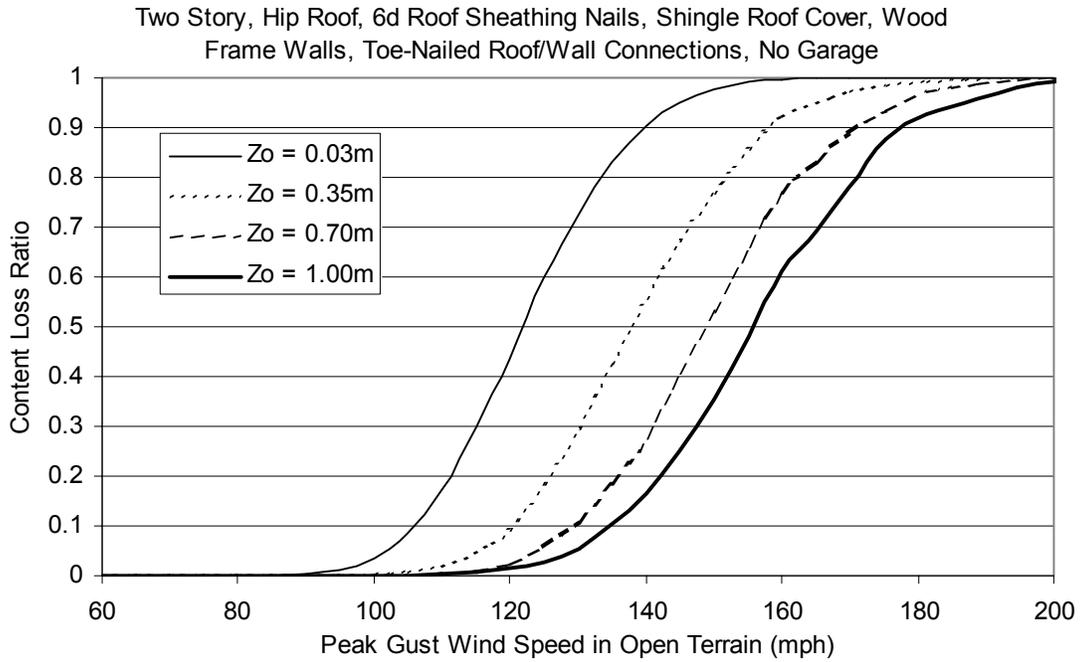
**Figure H.26. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



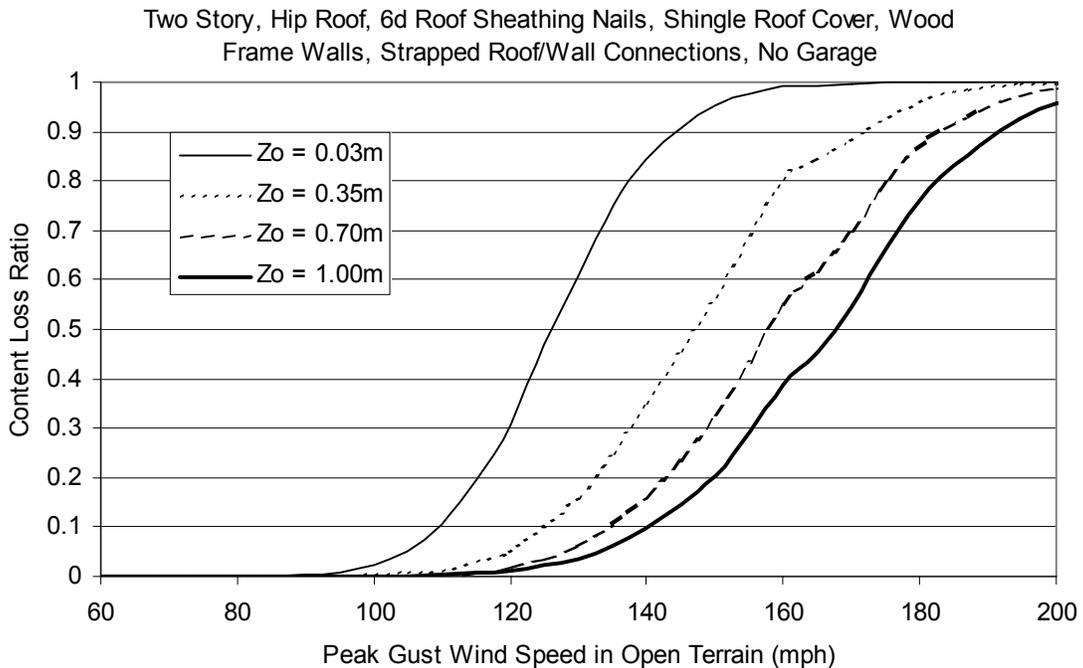
**Figure H.27. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



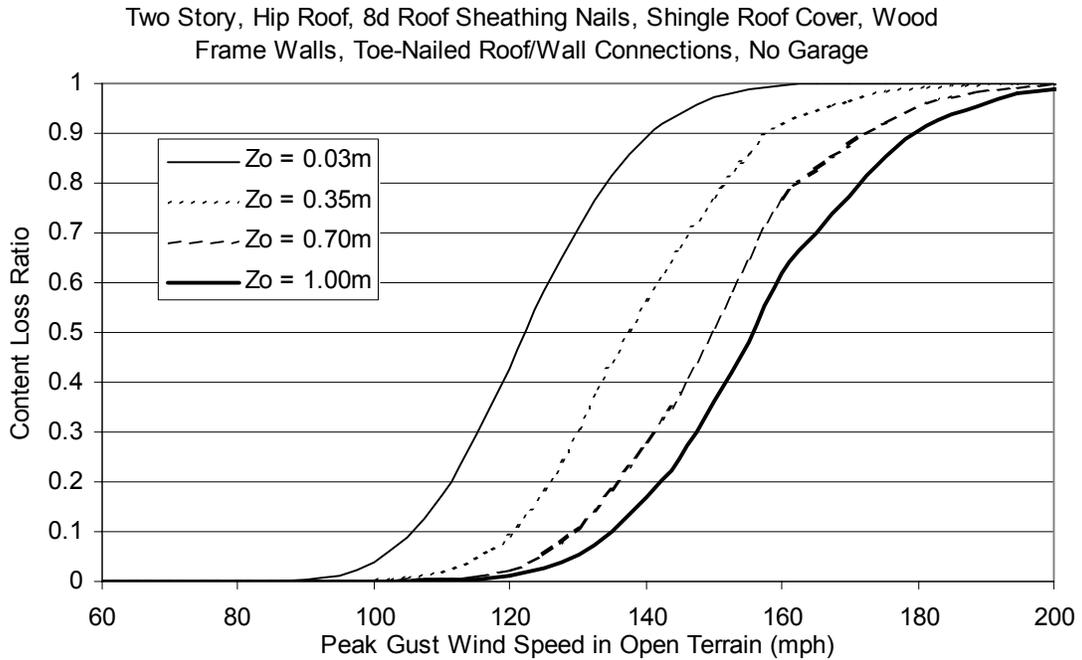
**Figure H.28. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



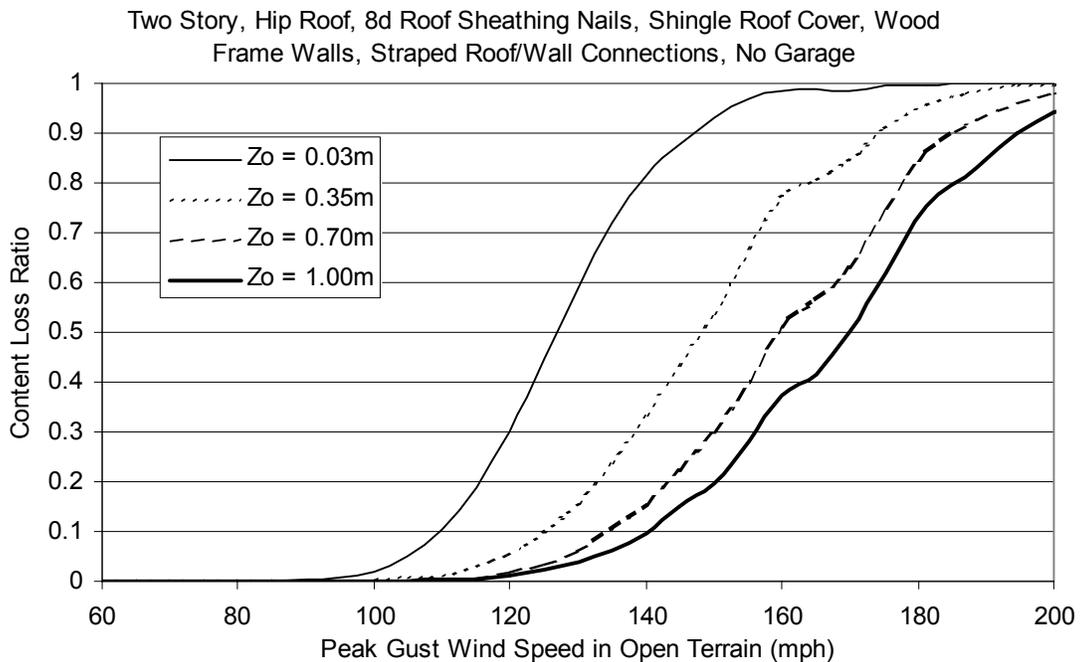
**Figure H.29. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



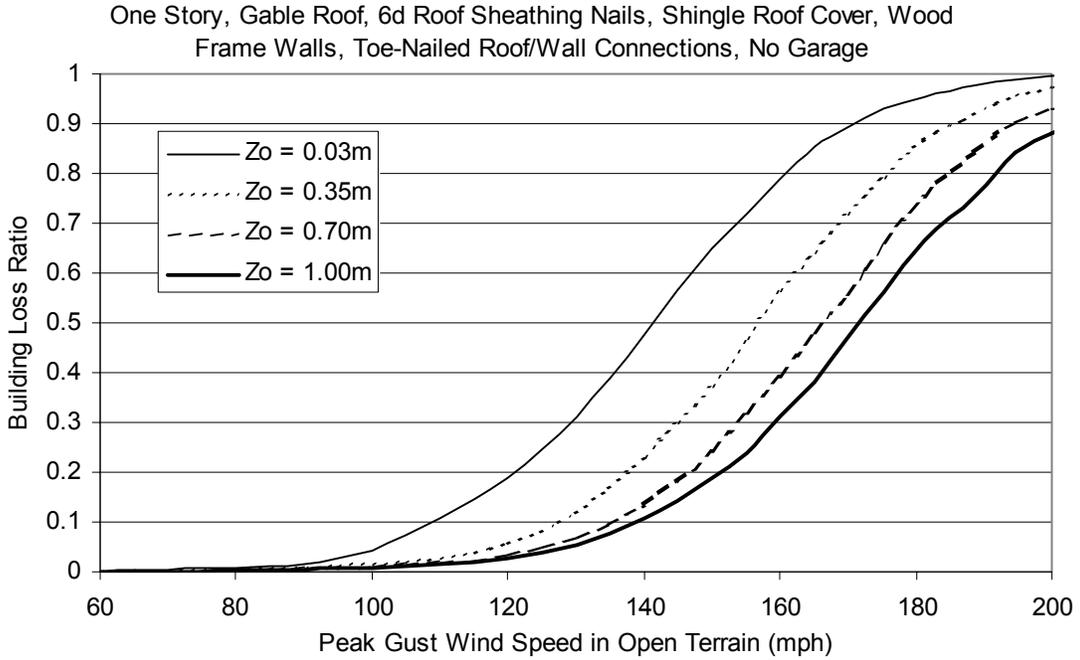
**Figure H.30. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame).**



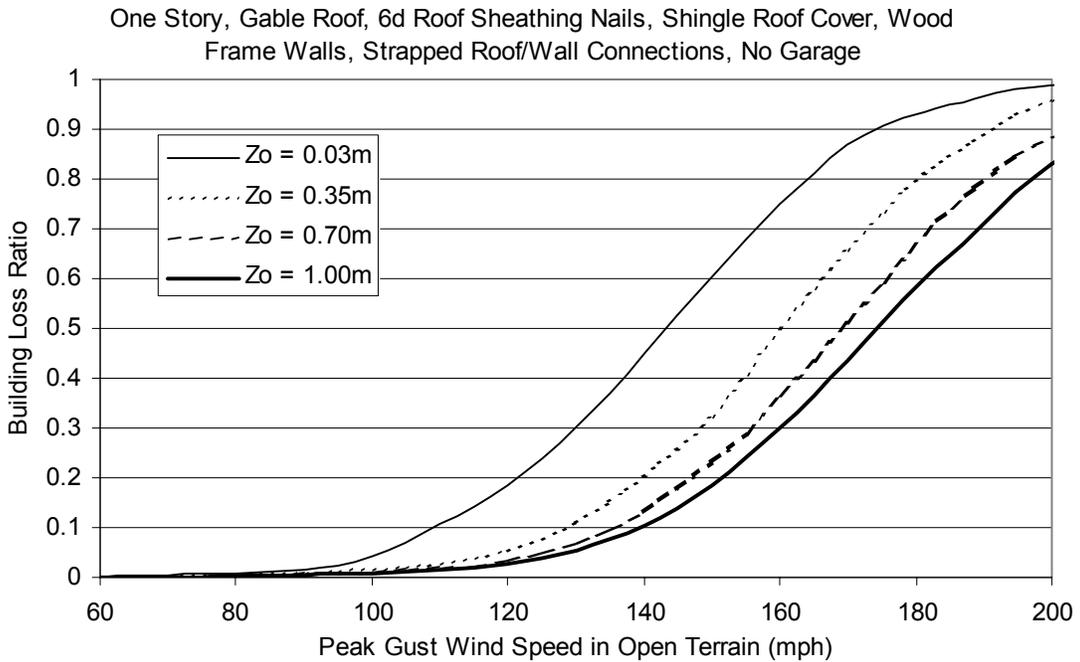
**Figure H.31. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame).**



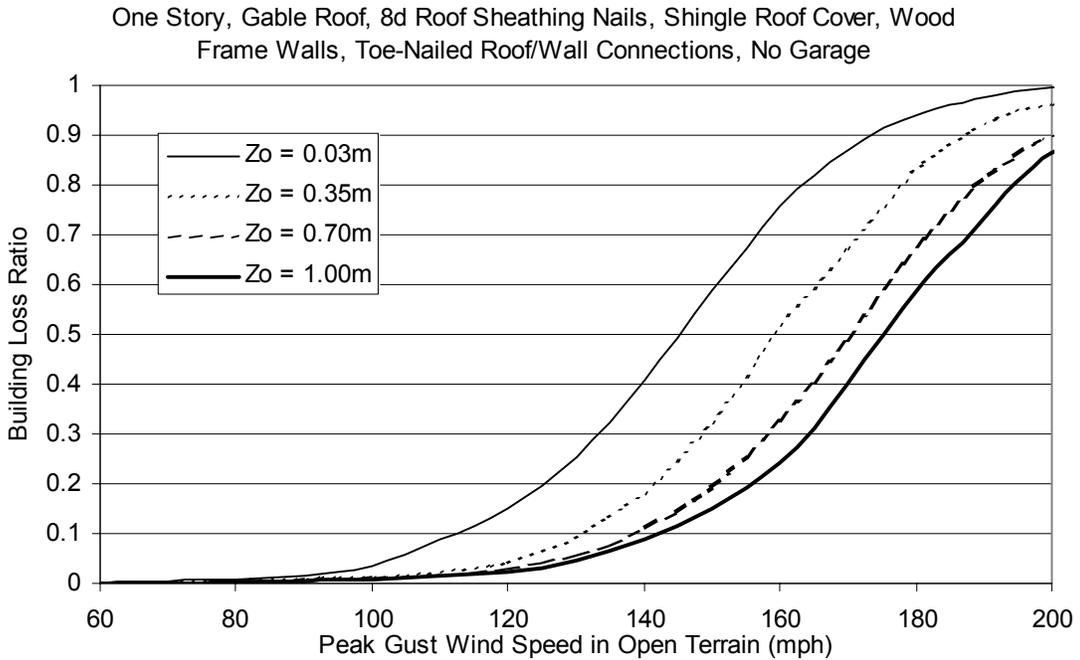
**Figure H.32. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Straped Roof Wall Connections, Wood Frame).**



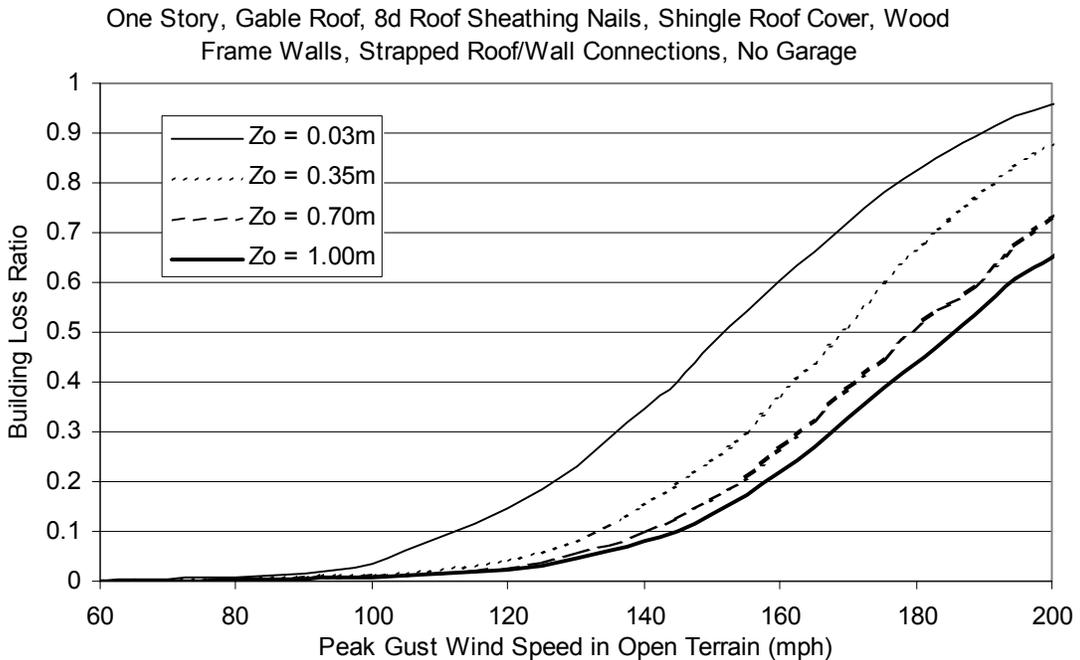
**Figure H.33. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



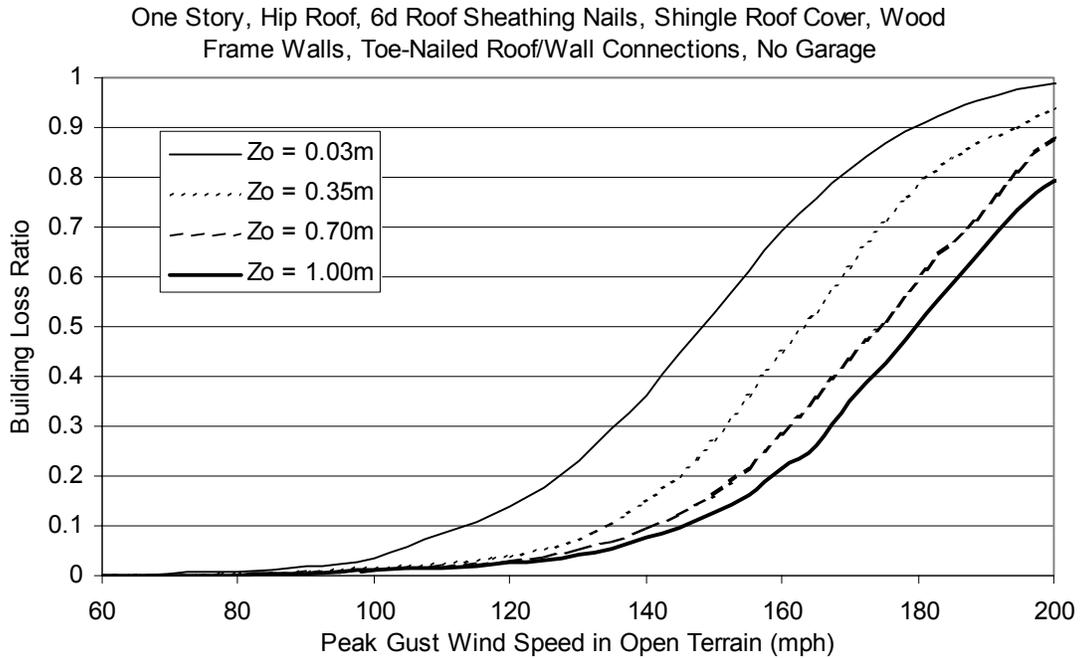
**Figure H.34. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



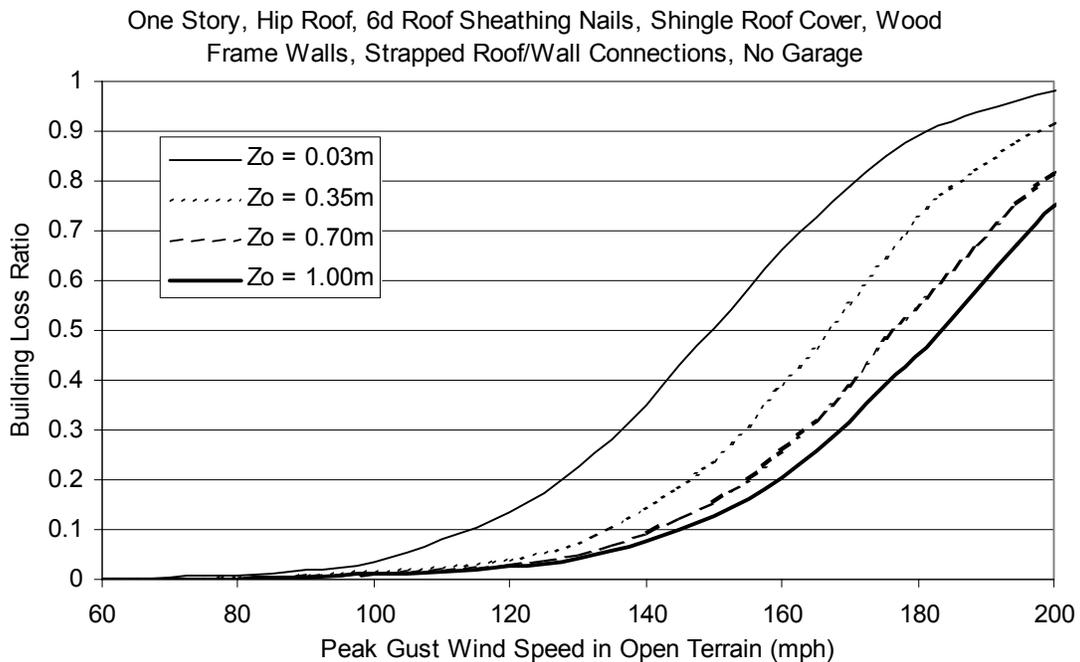
**Figure H.35. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



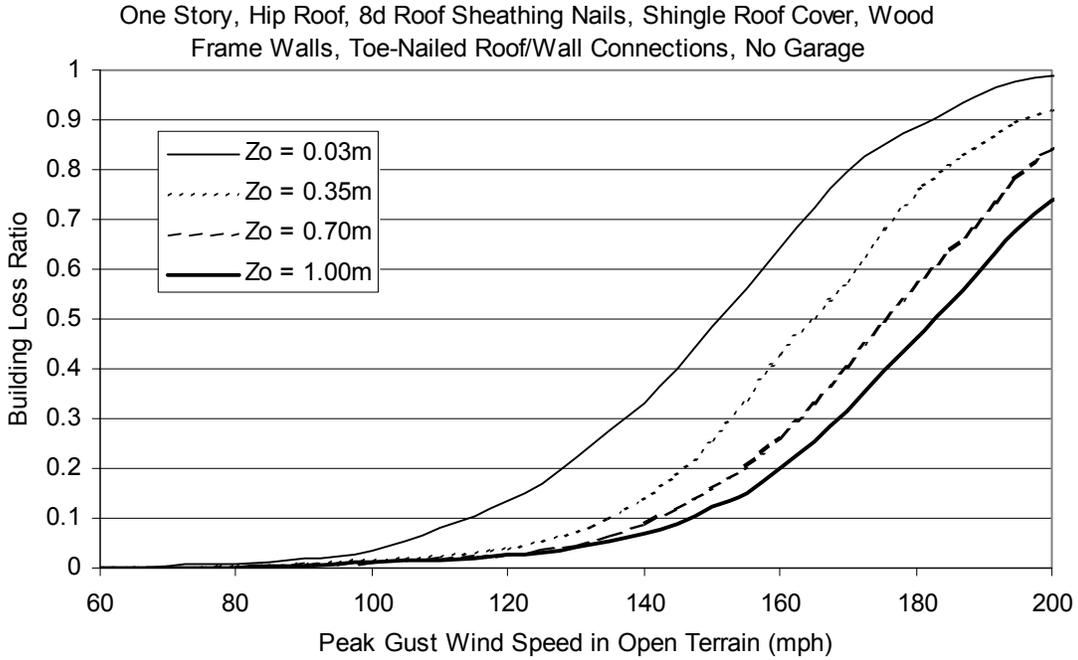
**Figure H.36. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



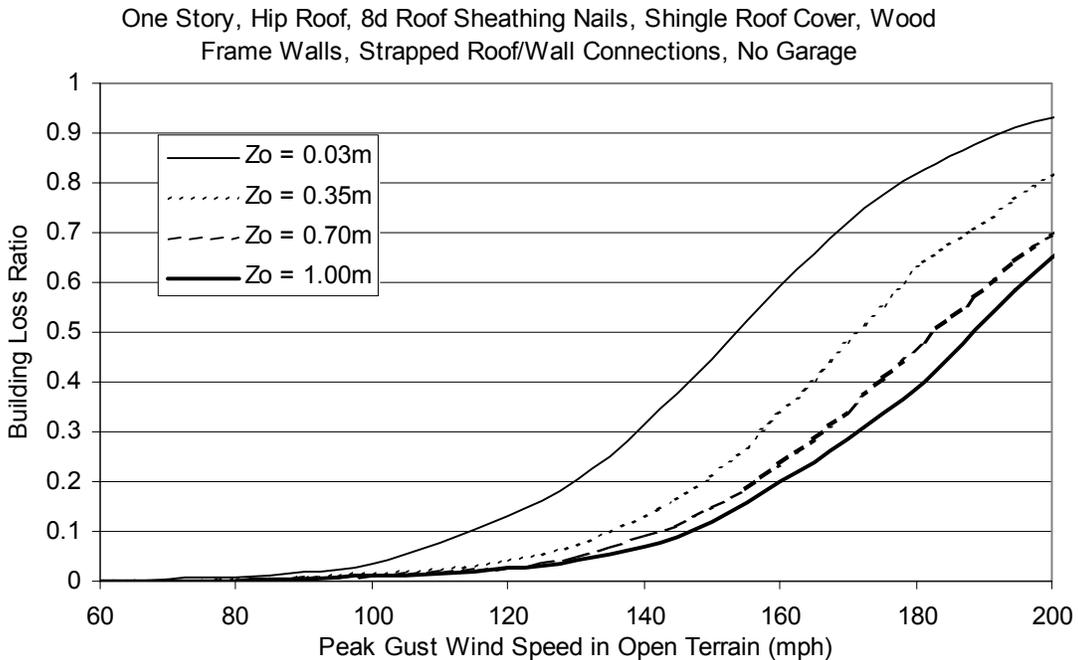
**Figure H.37. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



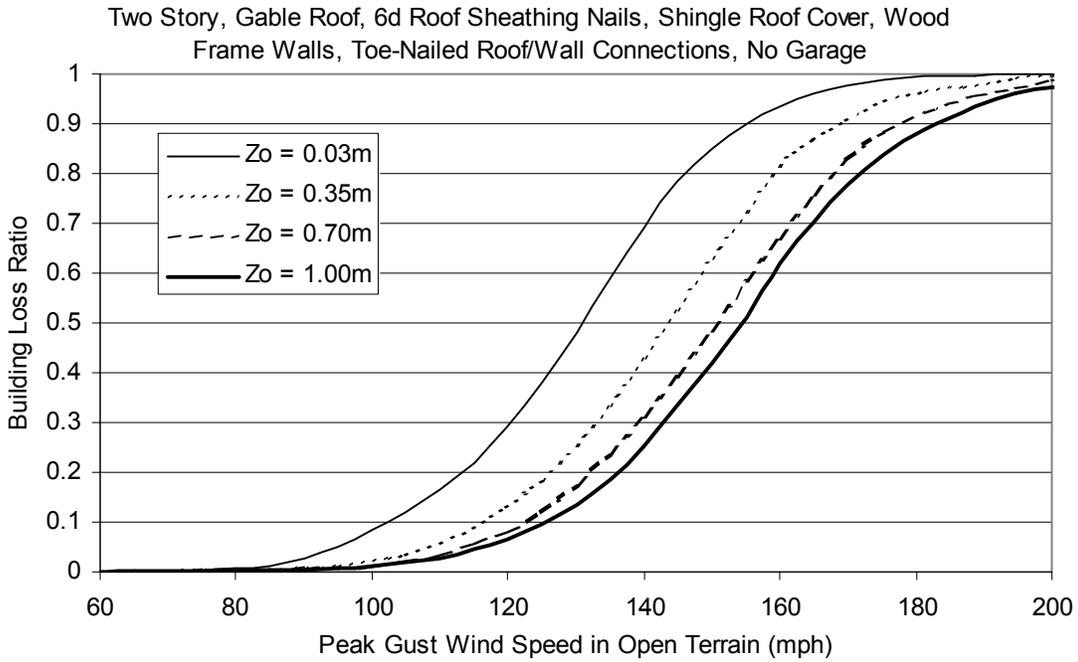
**Figure H.38. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



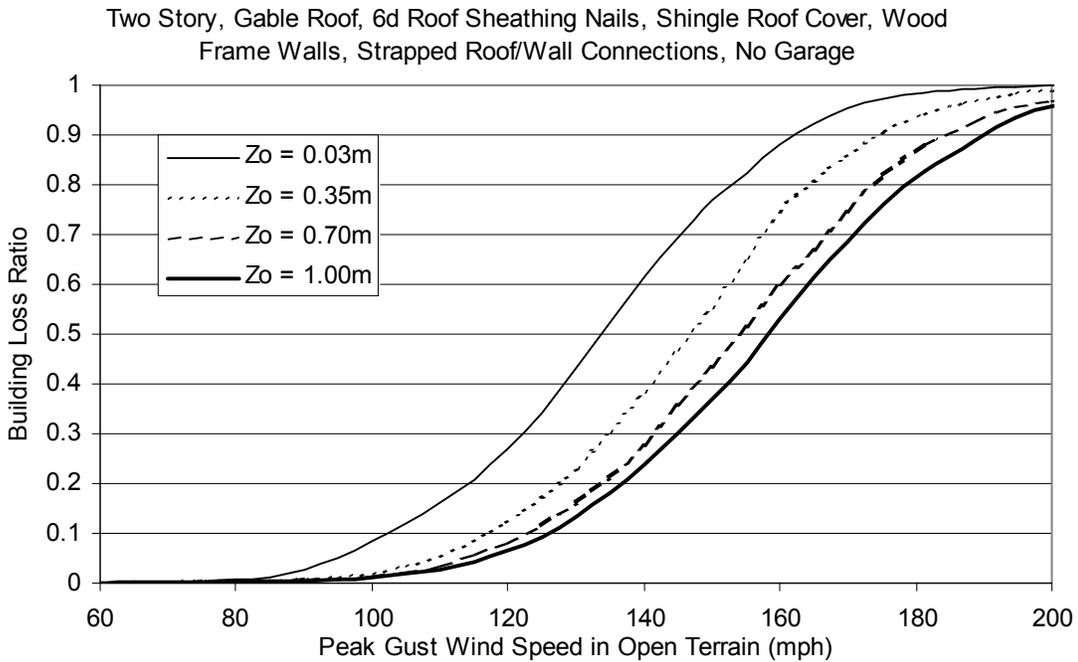
**Figure H.39. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



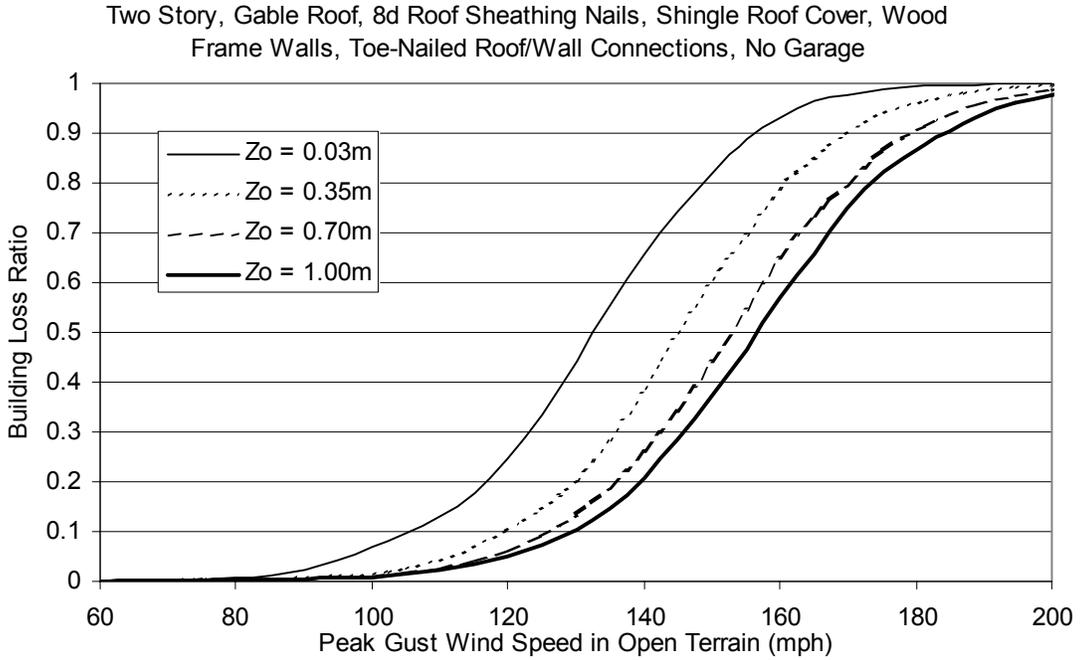
**Figure H.40. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



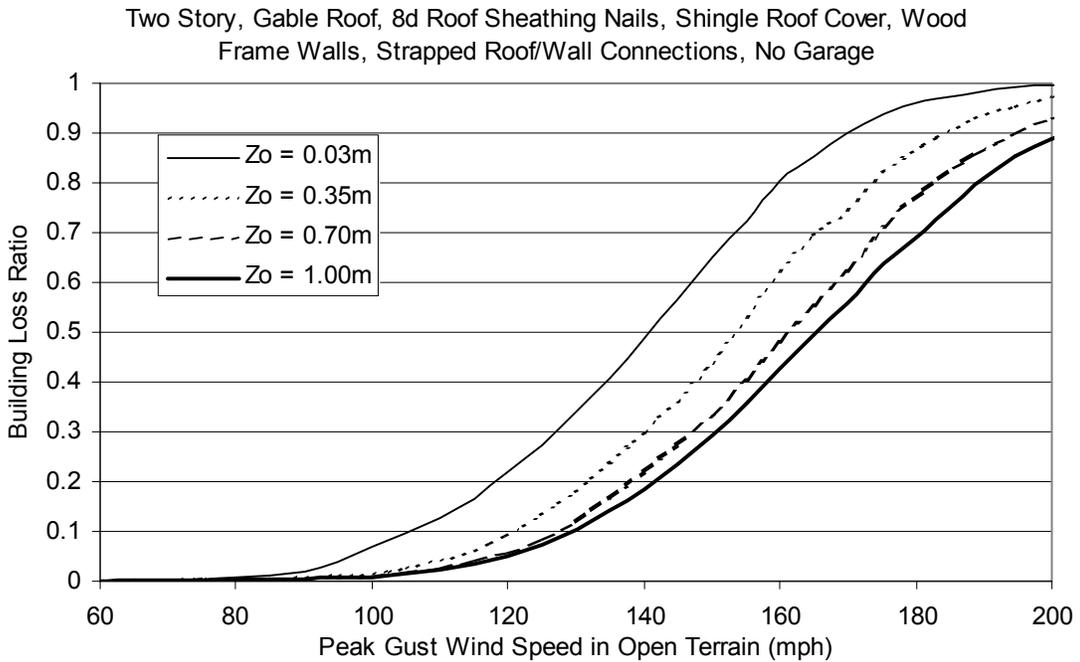
**Figure H.41. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



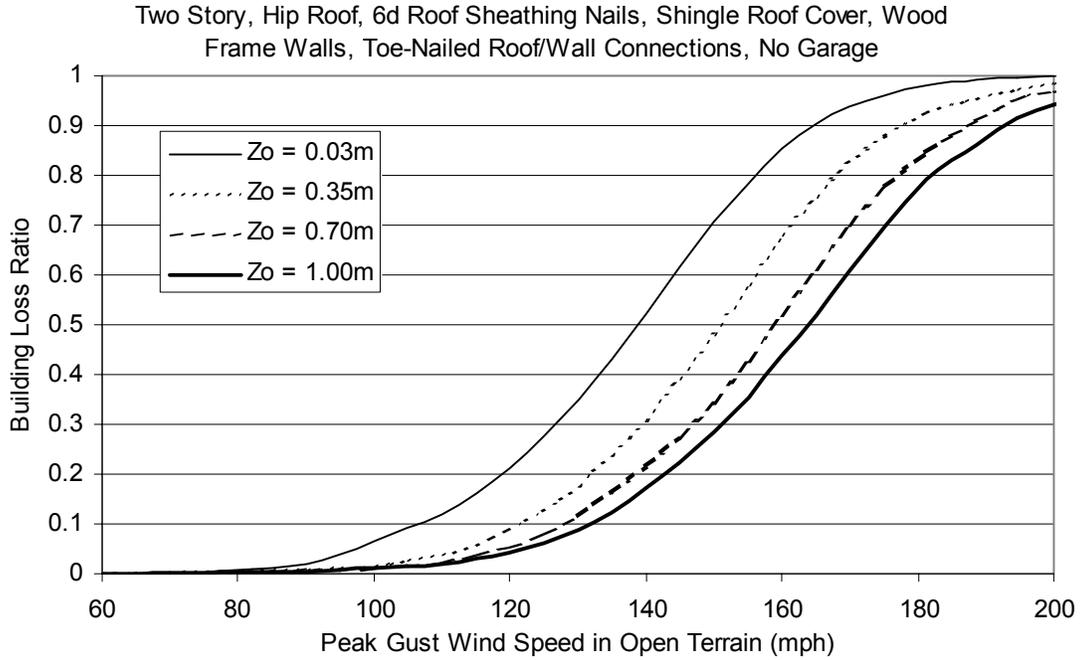
**Figure H.42. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



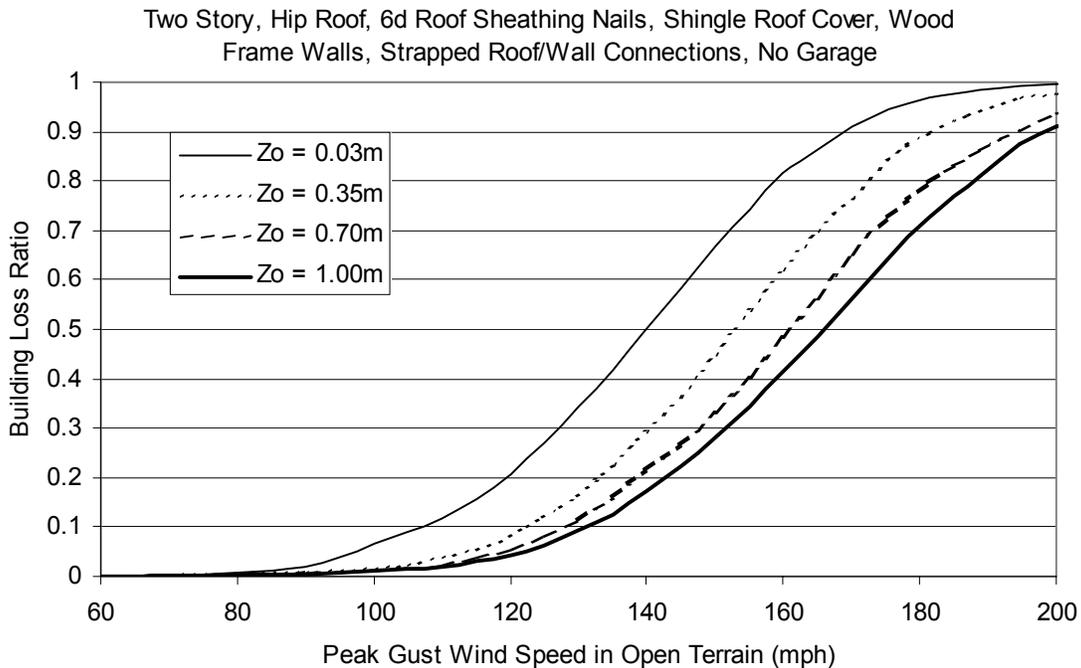
**Figure H.43. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



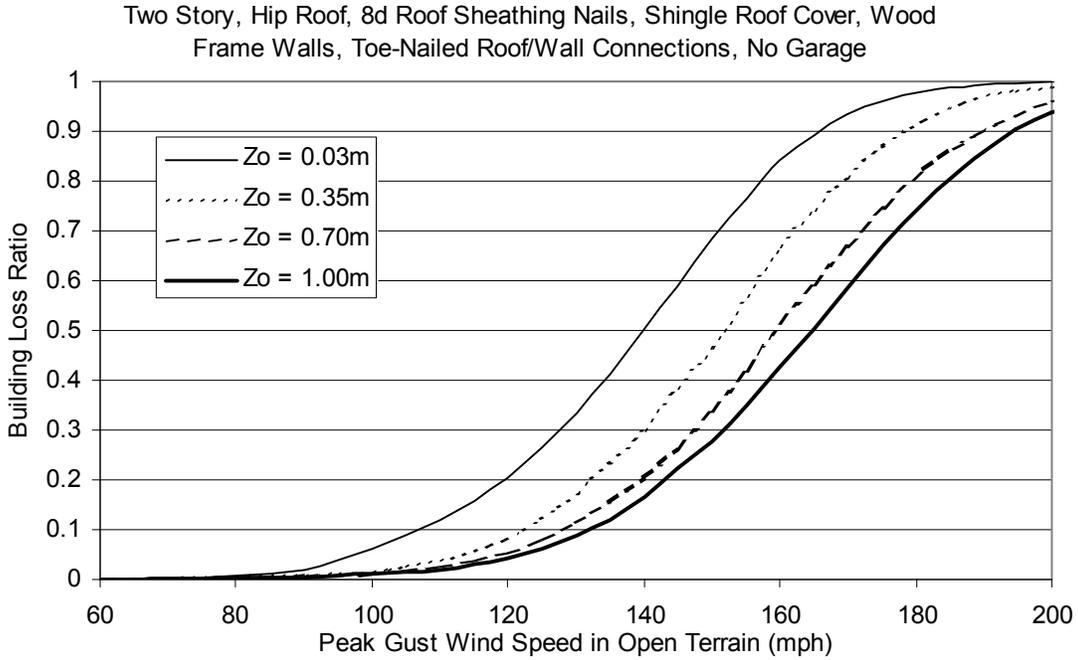
**Figure H.44. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



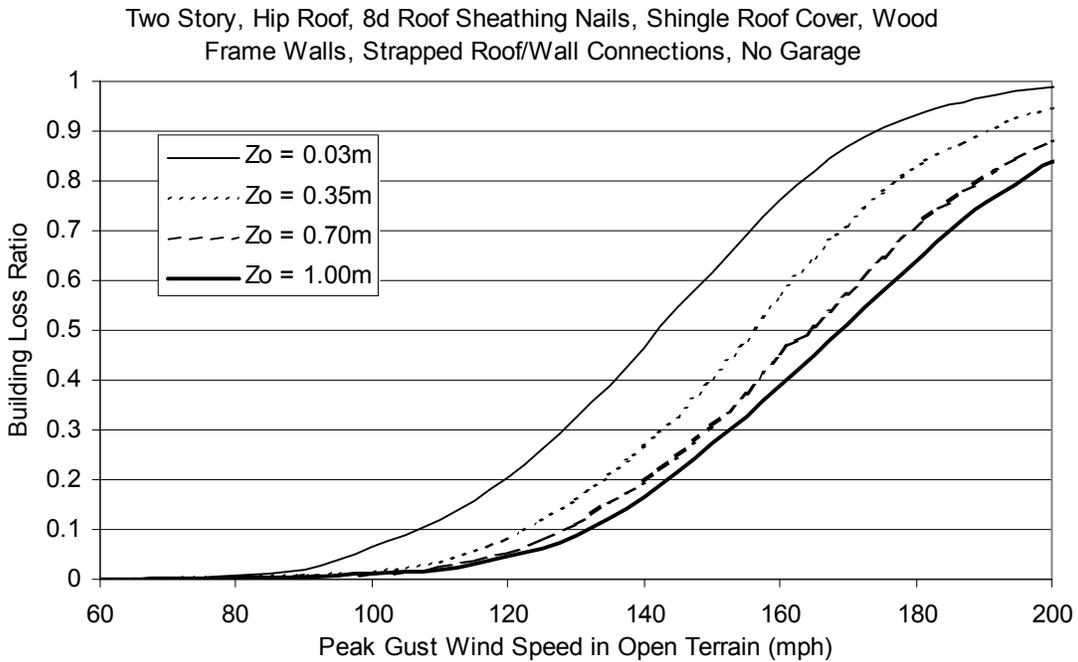
**Figure H.45. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



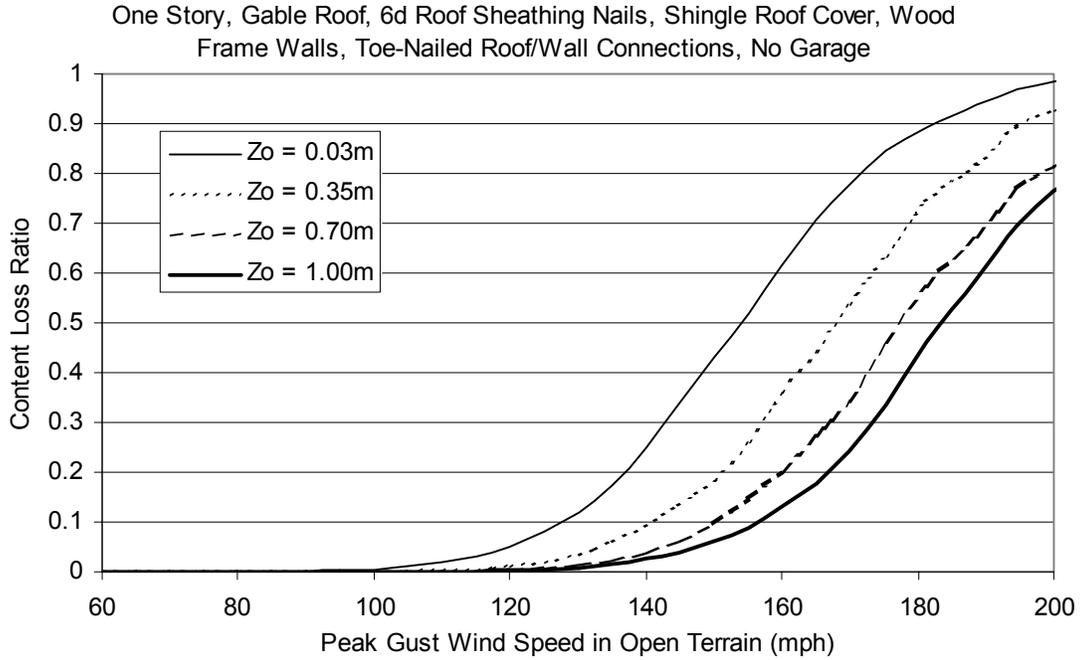
**Figure H.46. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



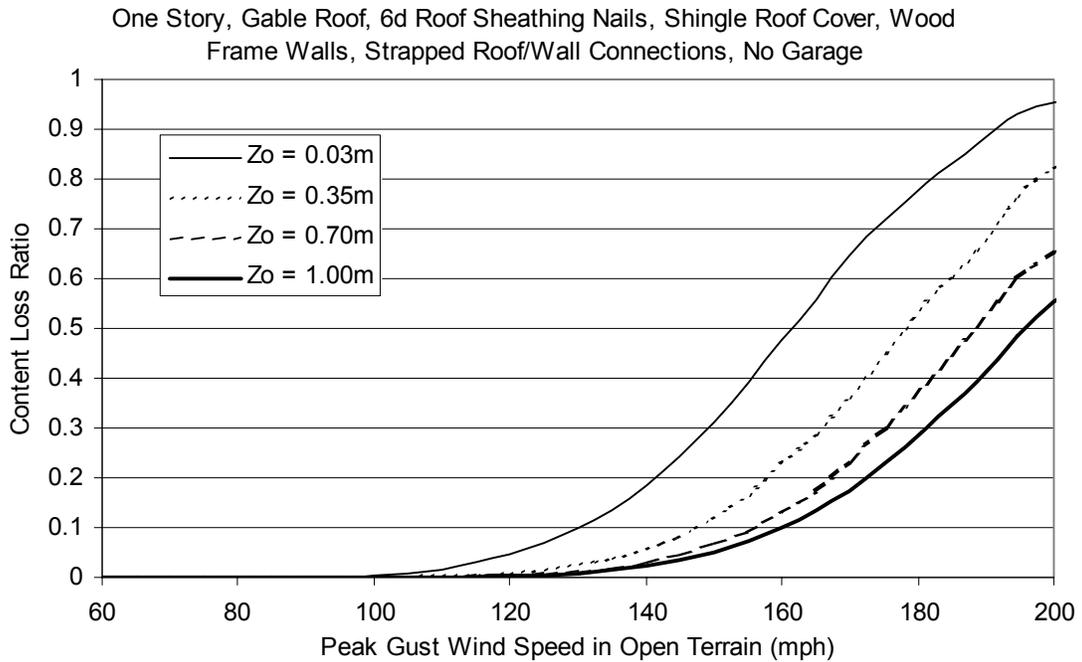
**Figure H.47. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



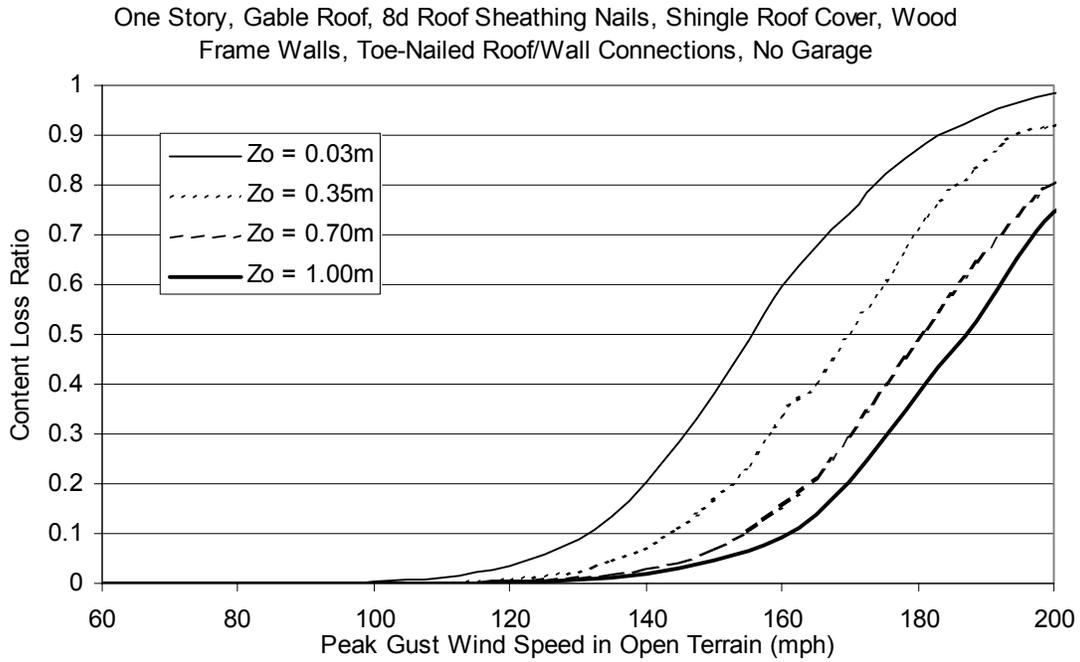
**Figure H.48. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



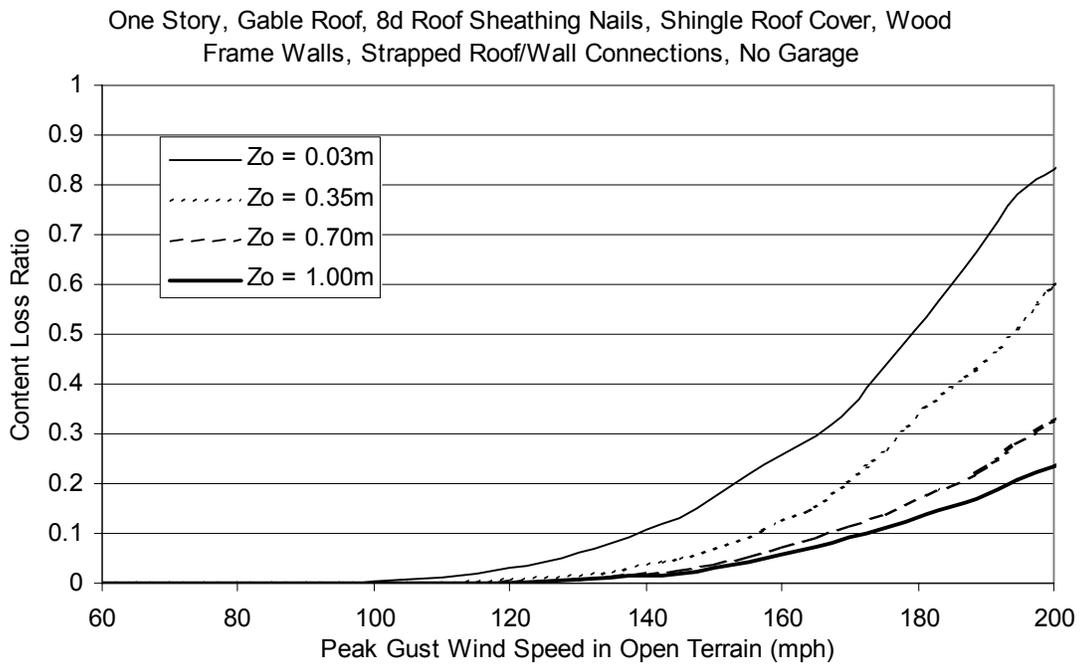
**Figure H.49. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



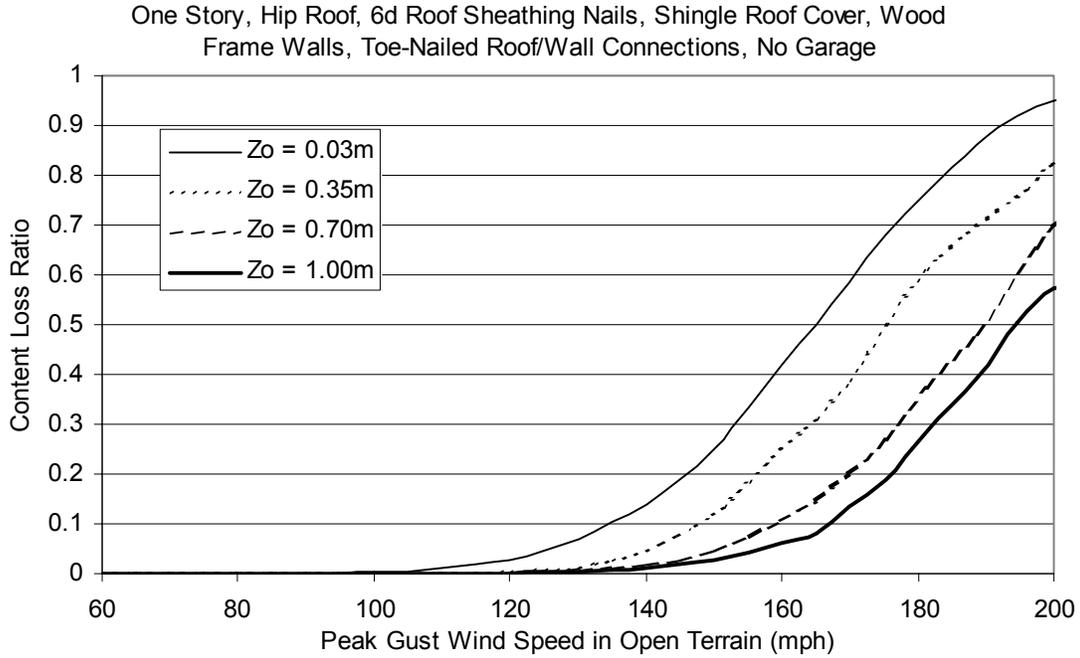
**Figure H.50. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



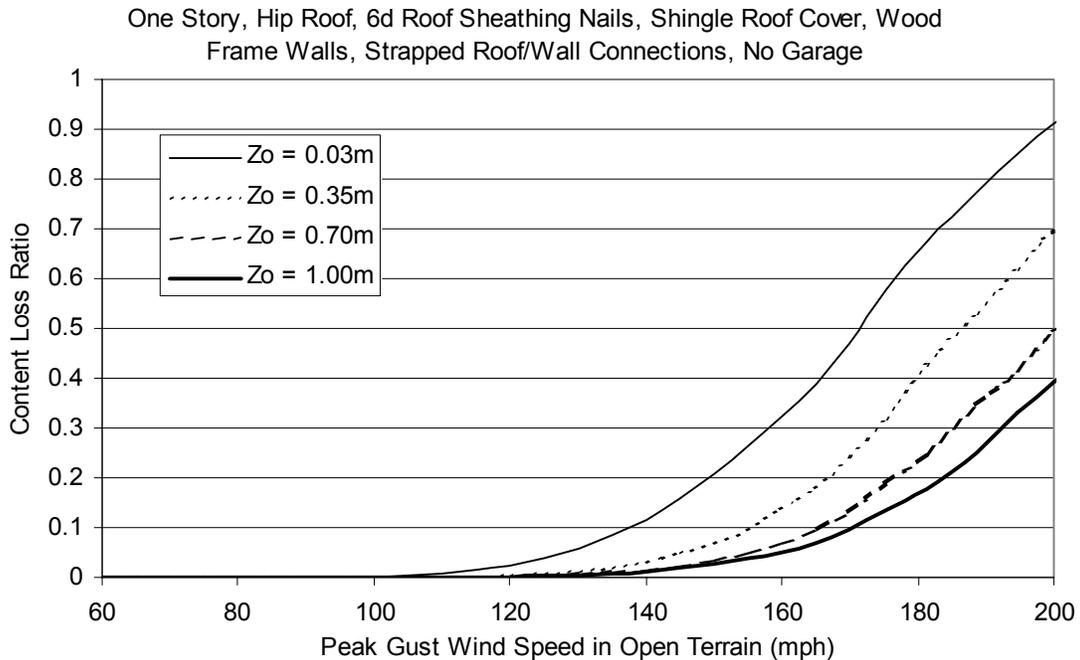
**Figure H.51. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



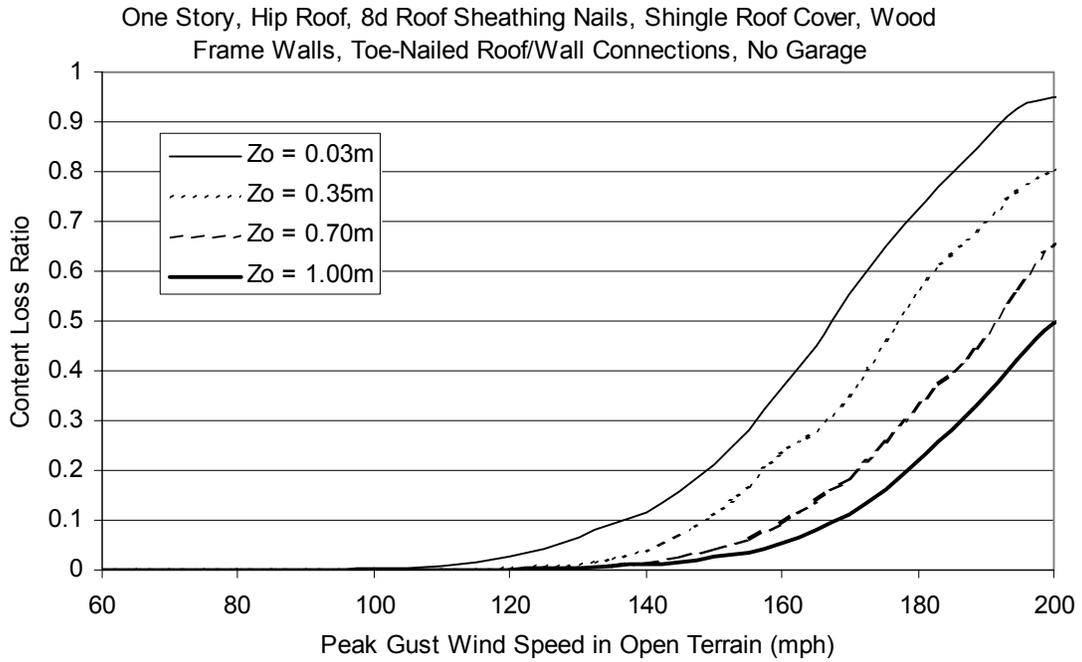
**Figure H.52. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



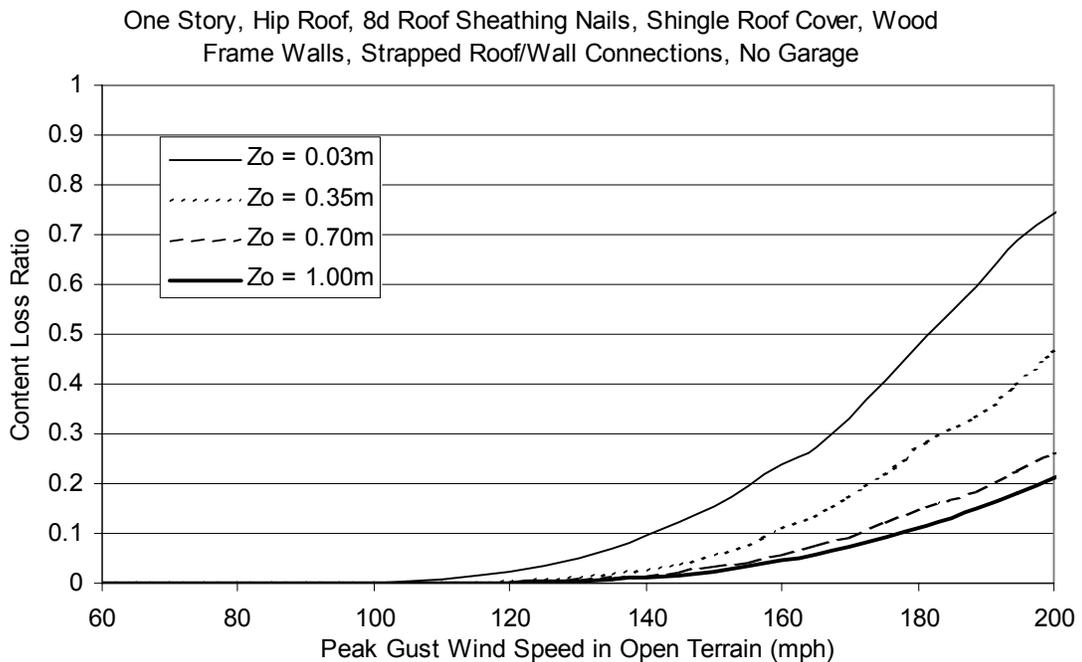
**Figure H.53. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



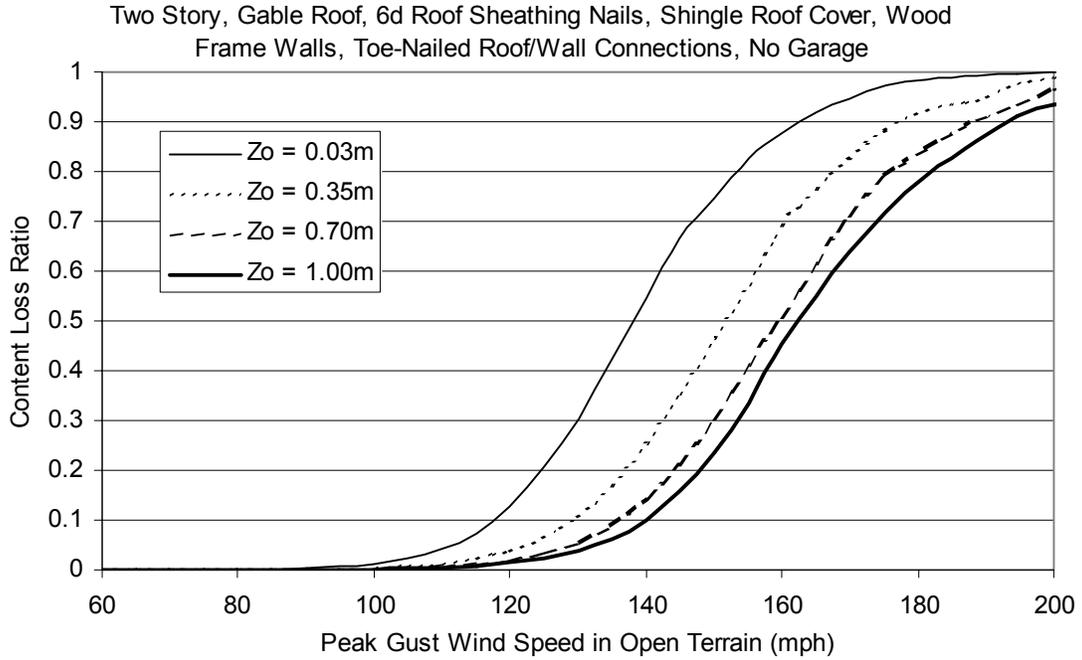
**Figure H.54. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



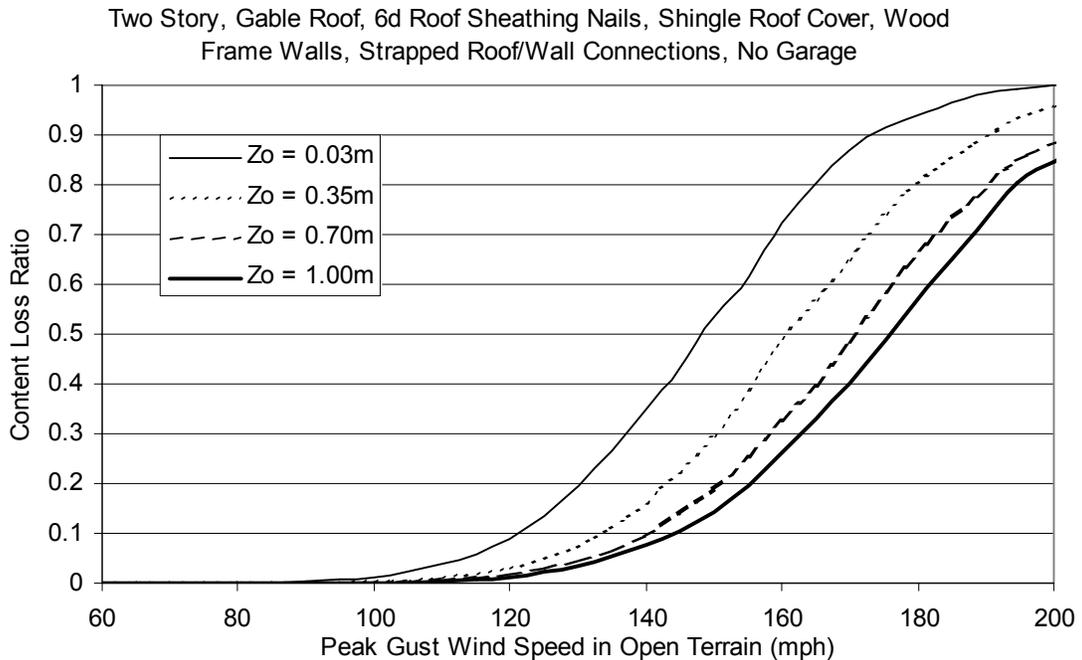
**Figure H.55. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



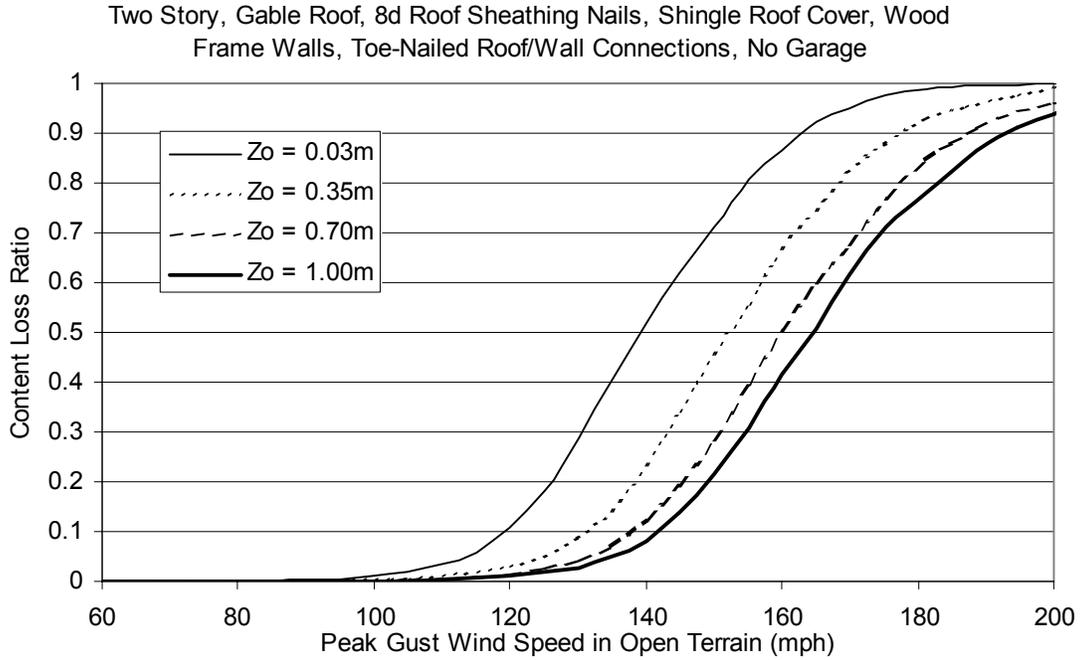
**Figure H.56. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



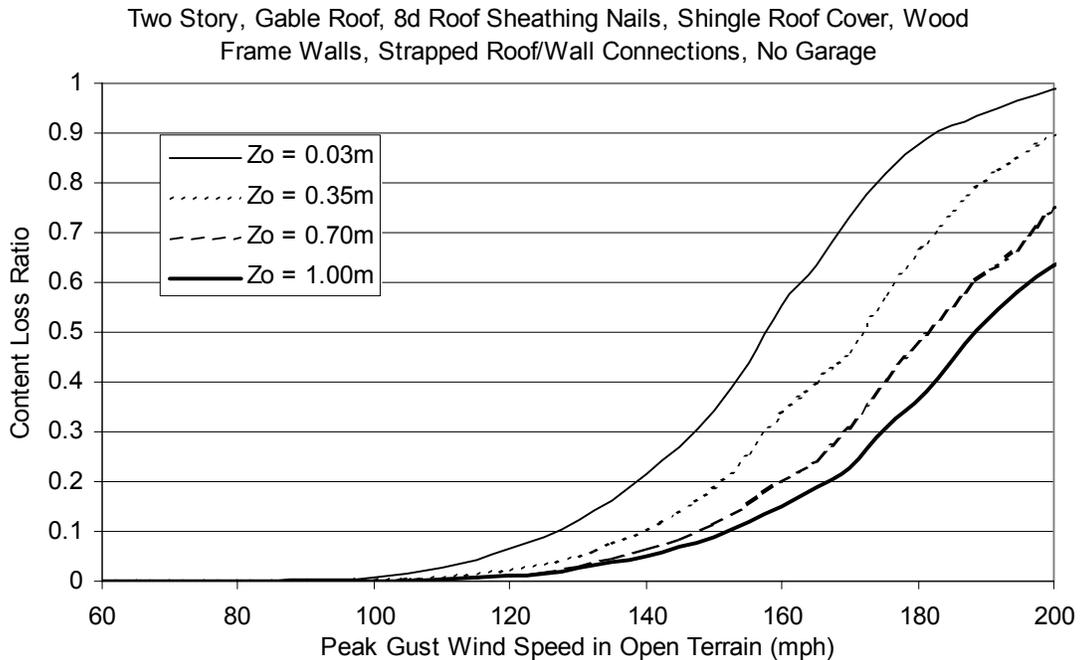
**Figure H.57. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



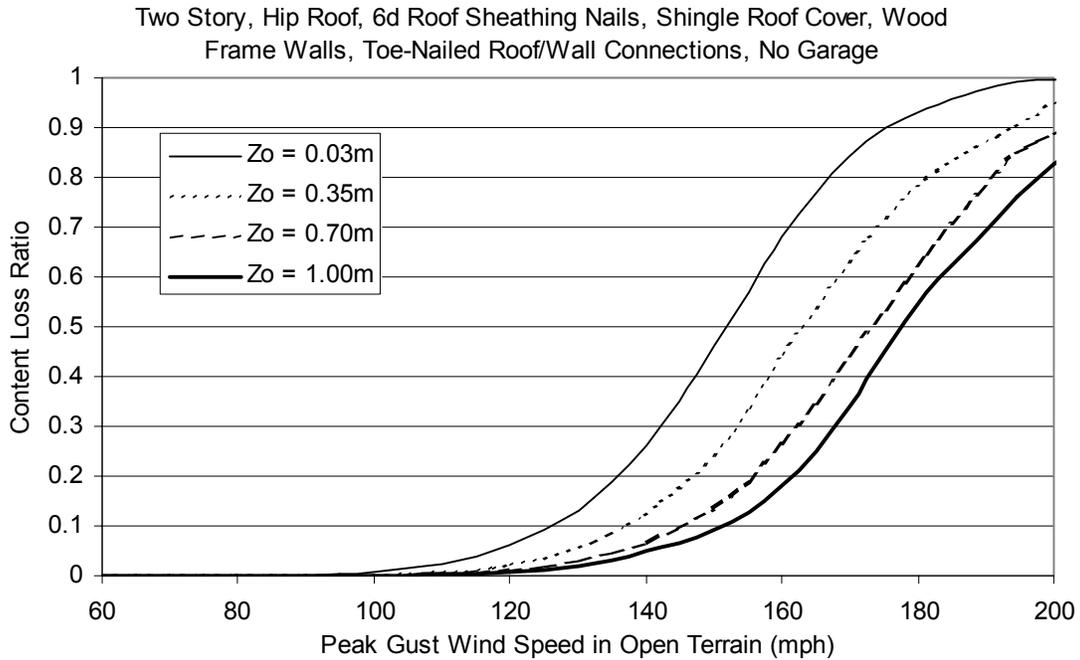
**Figure H.58. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



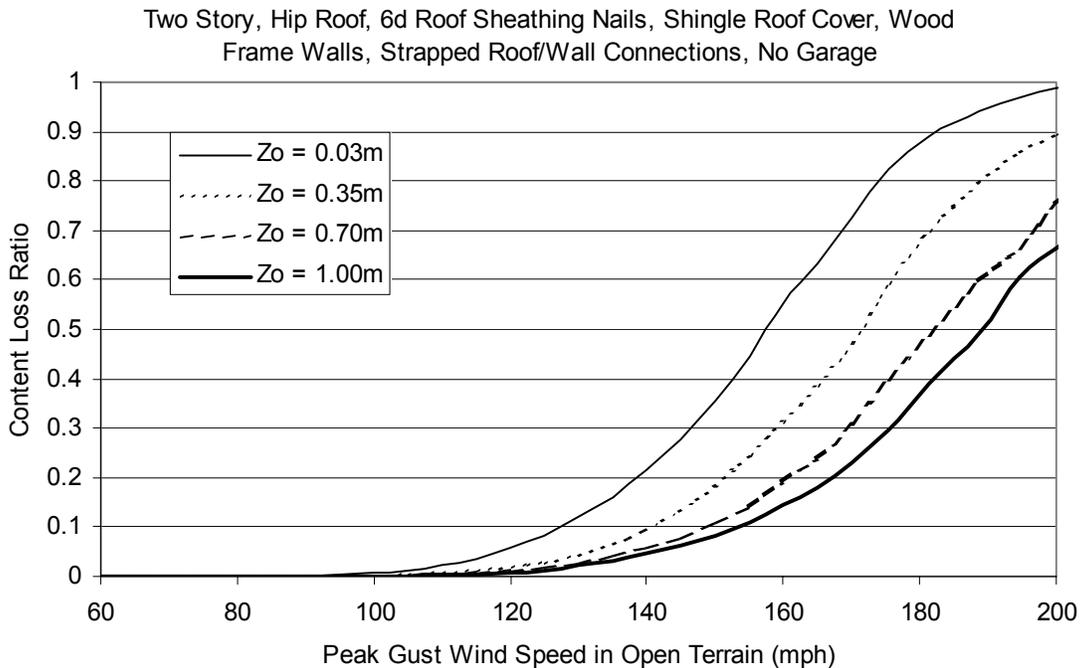
**Figure H.59. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



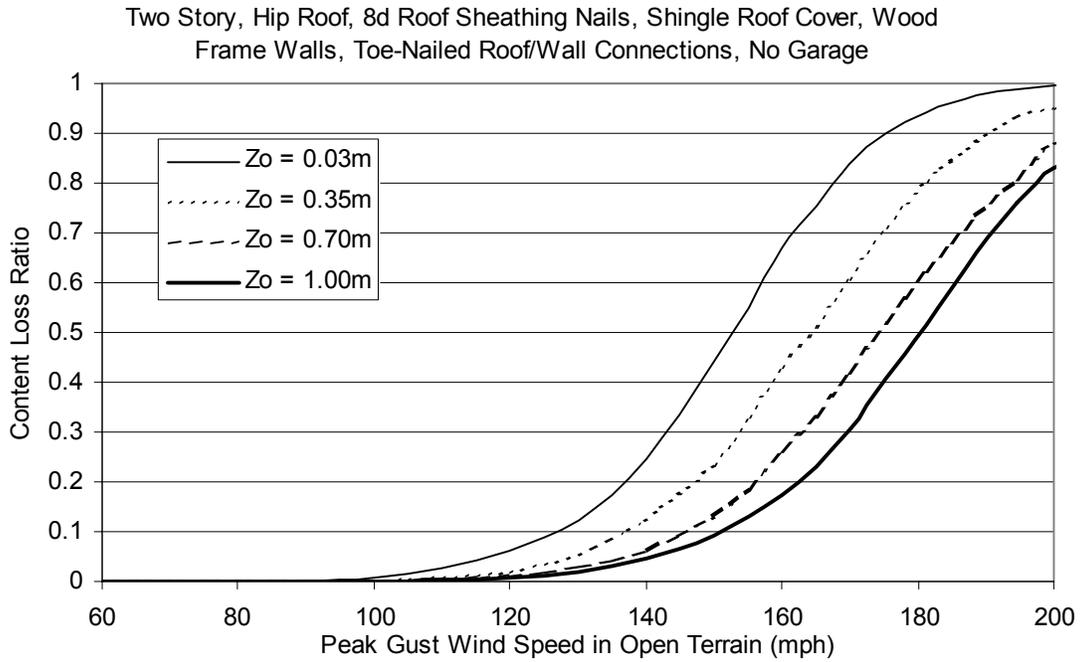
**Figure H.60. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



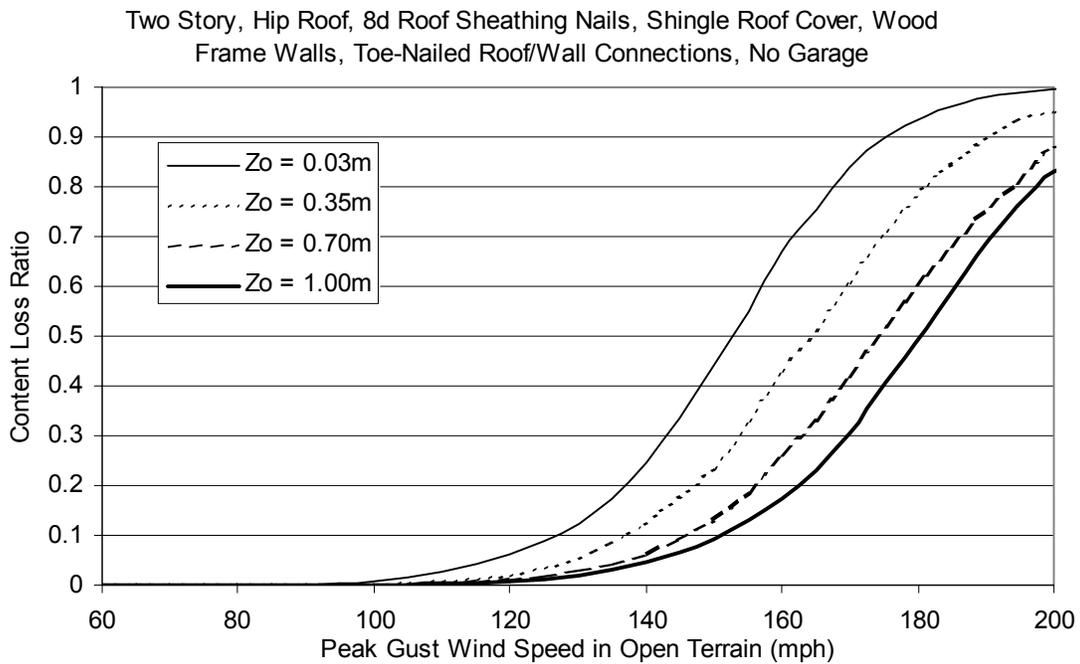
**Figure H.61. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



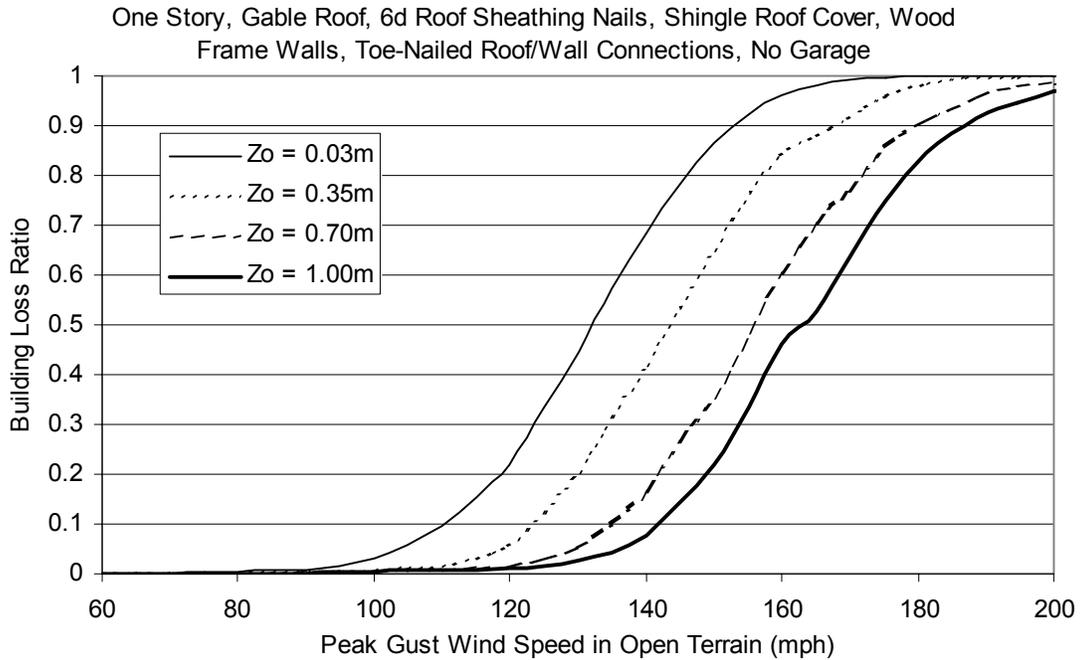
**Figure H.62. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



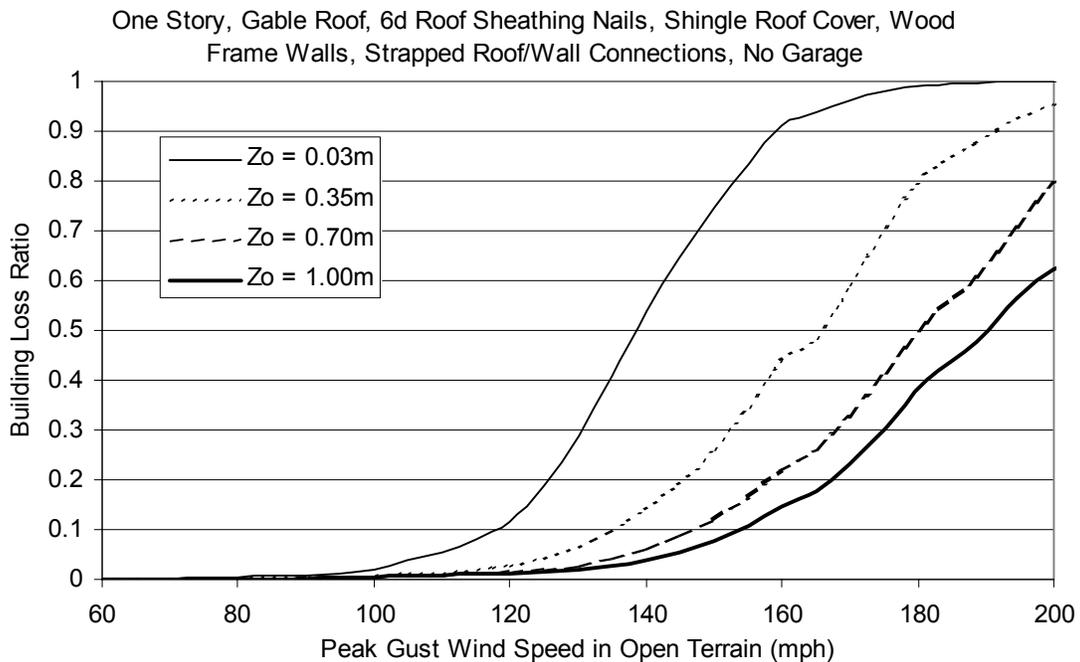
**Figure H.63. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters).**



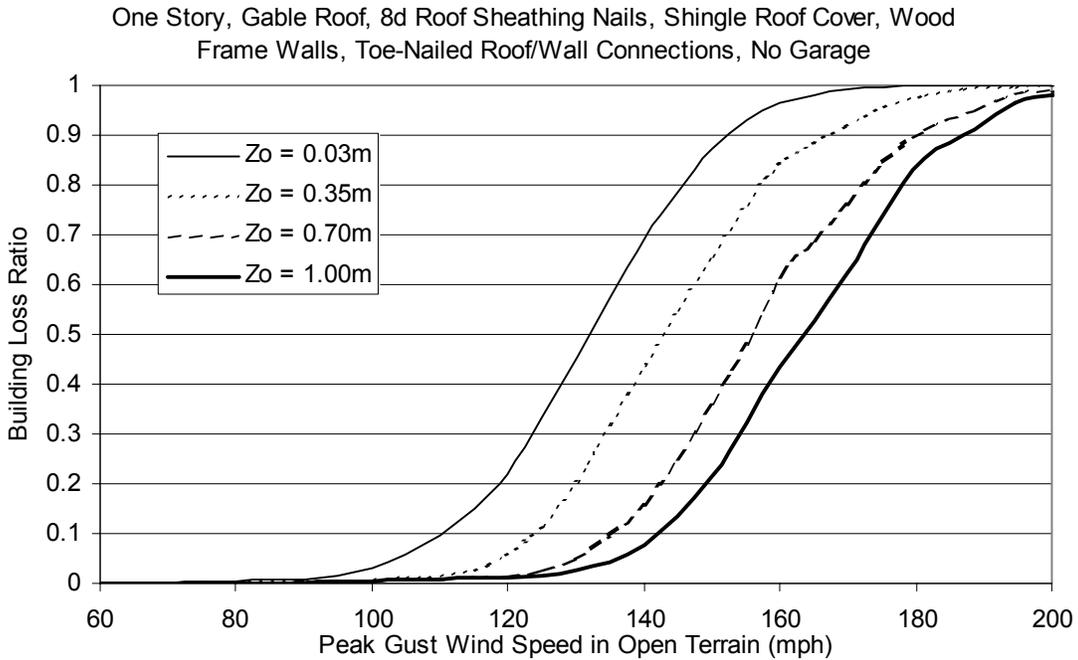
**Figure H.64. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters).**



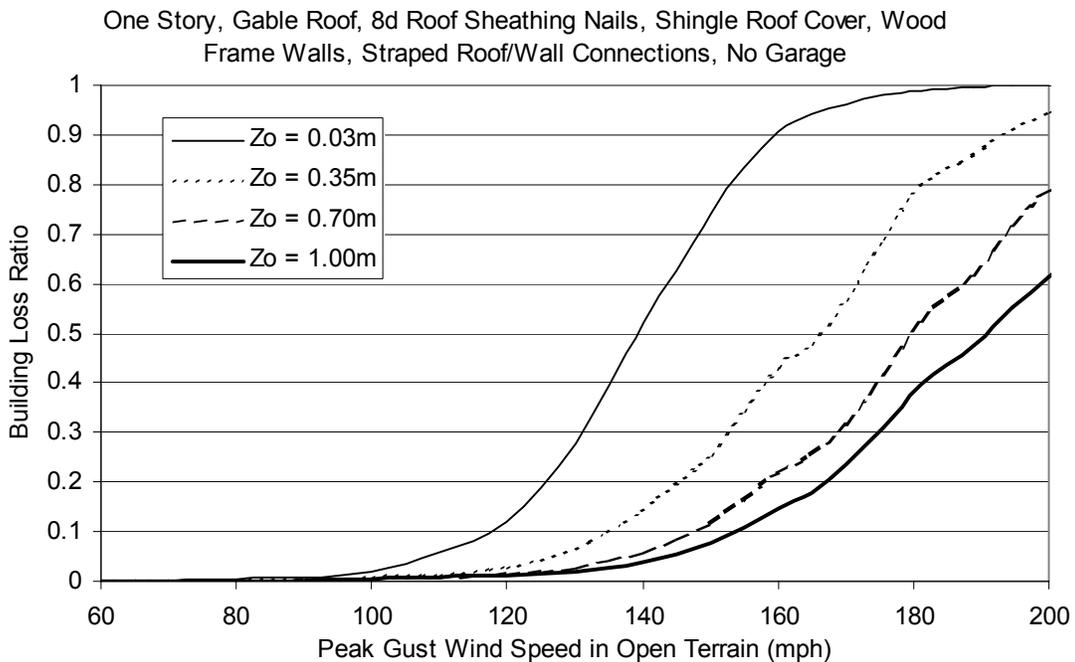
**Figure H.65. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



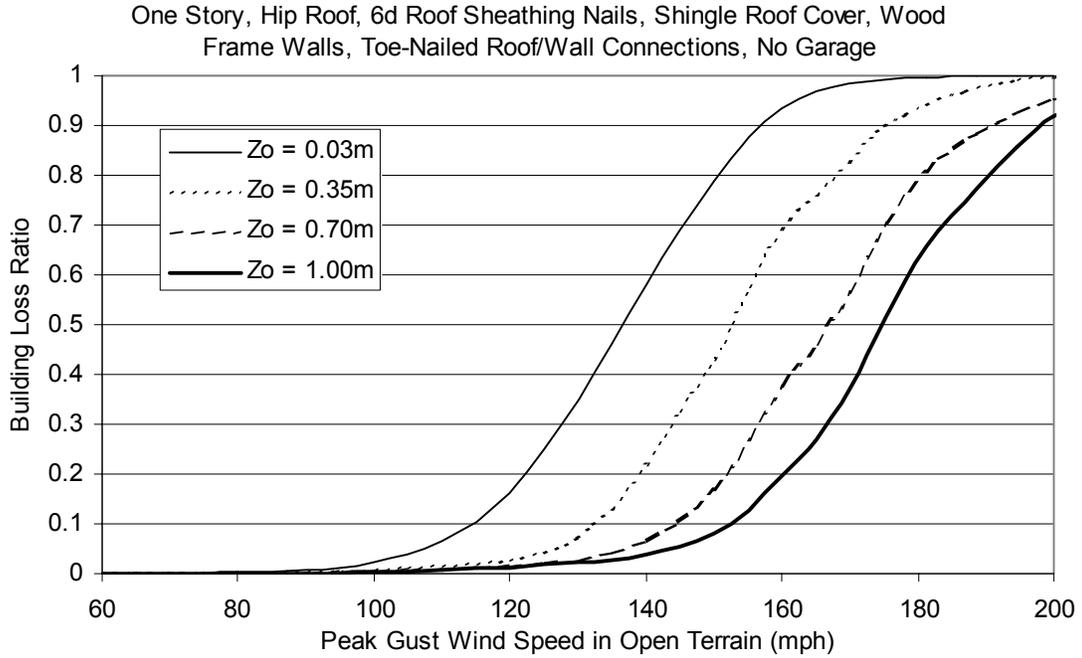
**Figure H.66. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



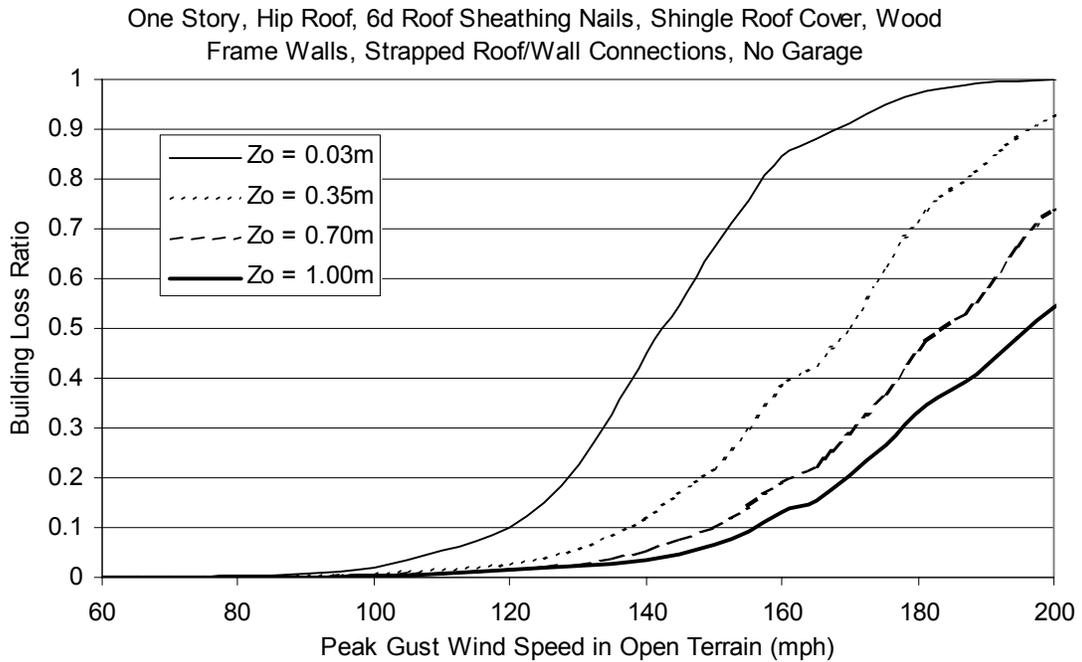
**Figure H.67. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



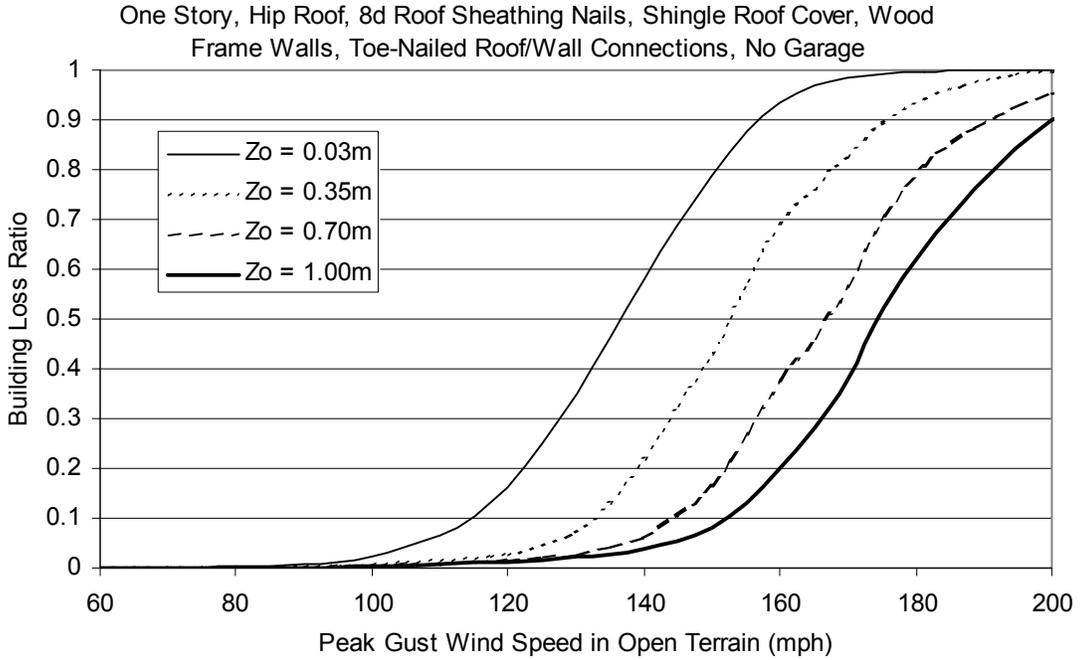
**Figure H.68. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Straped Roof Wall Connections, Wood Frame, Upgraded Roof).**



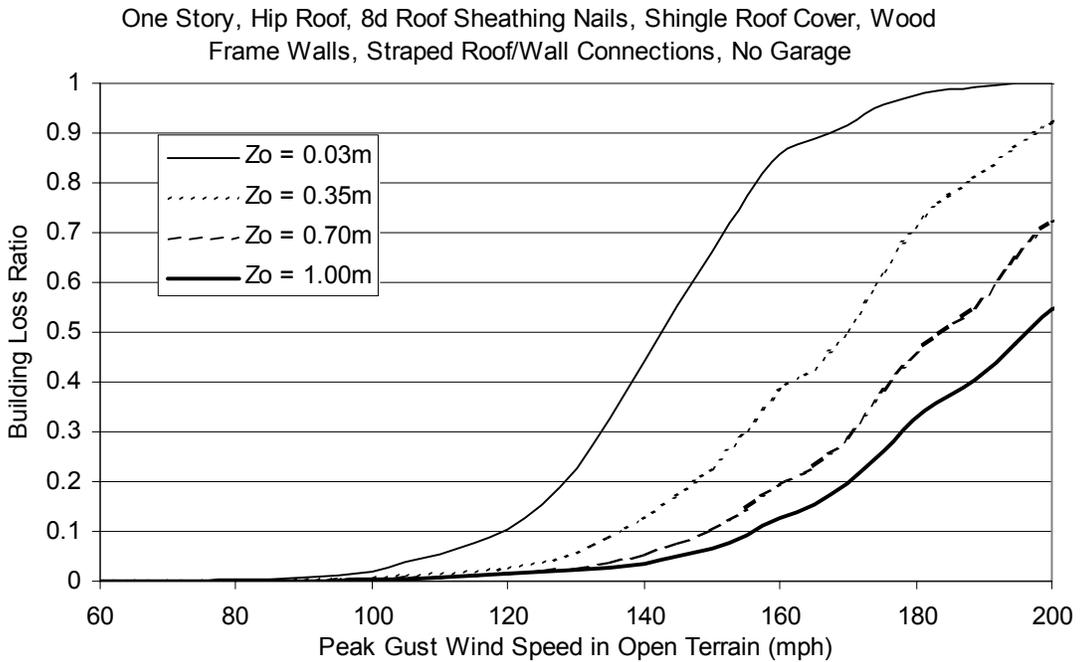
**Figure H.69. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



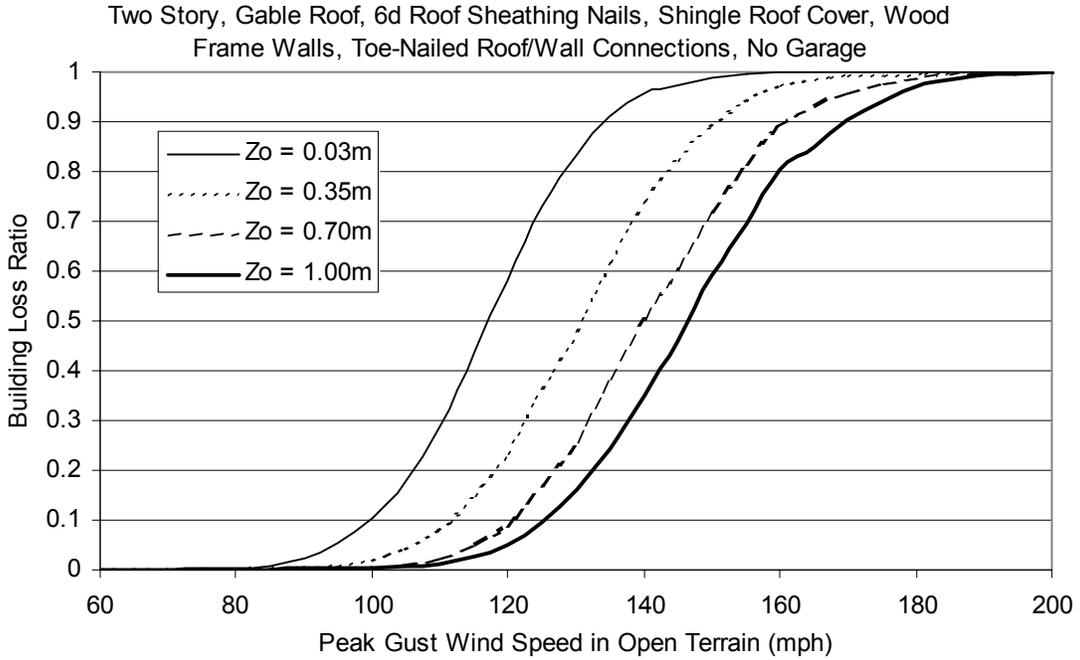
**Figure H.70. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



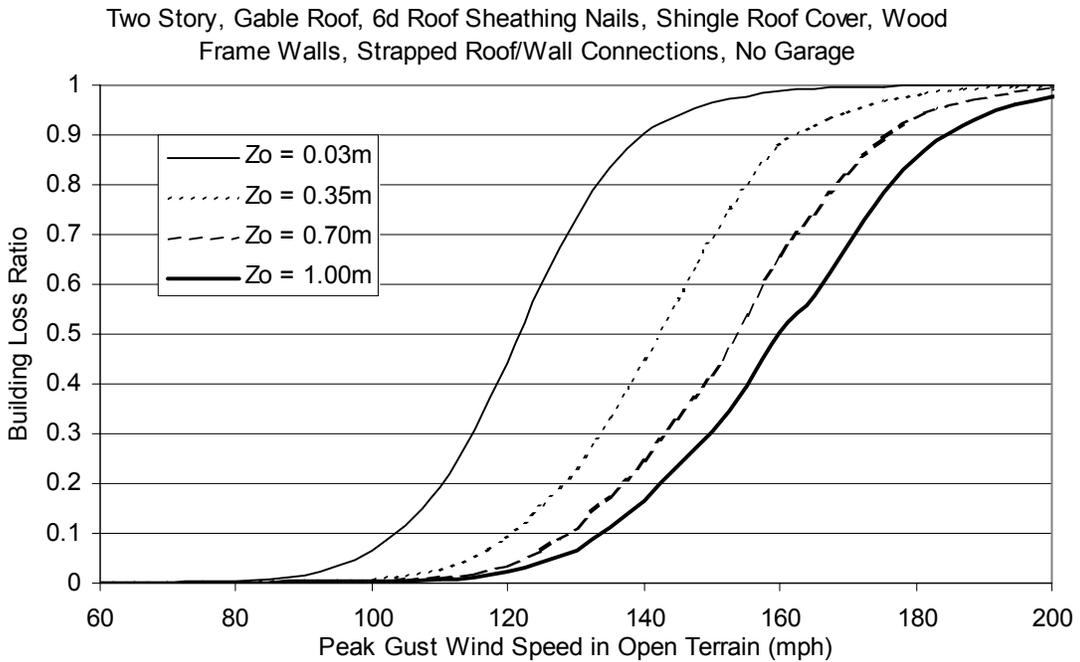
**Figure H.71. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



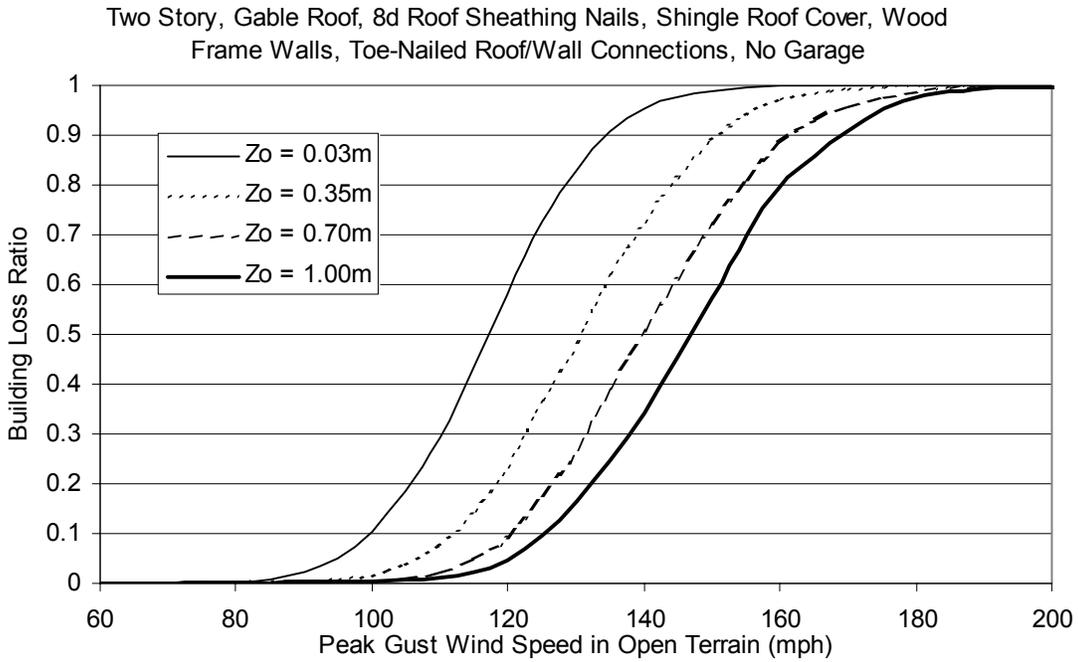
**Figure H.72. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



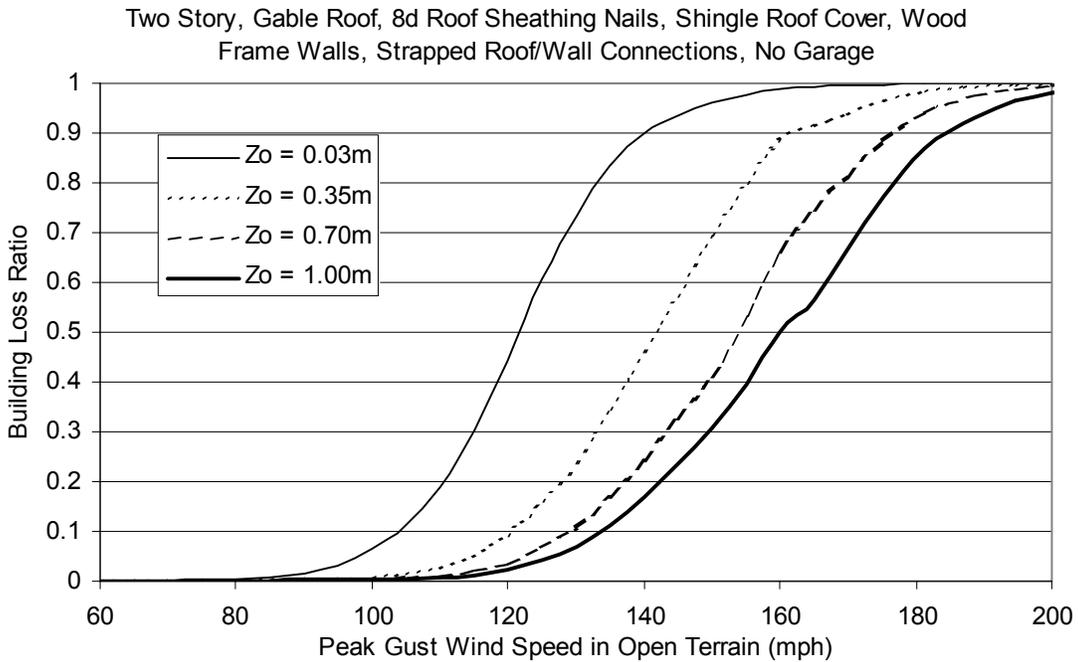
**Figure H.73. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



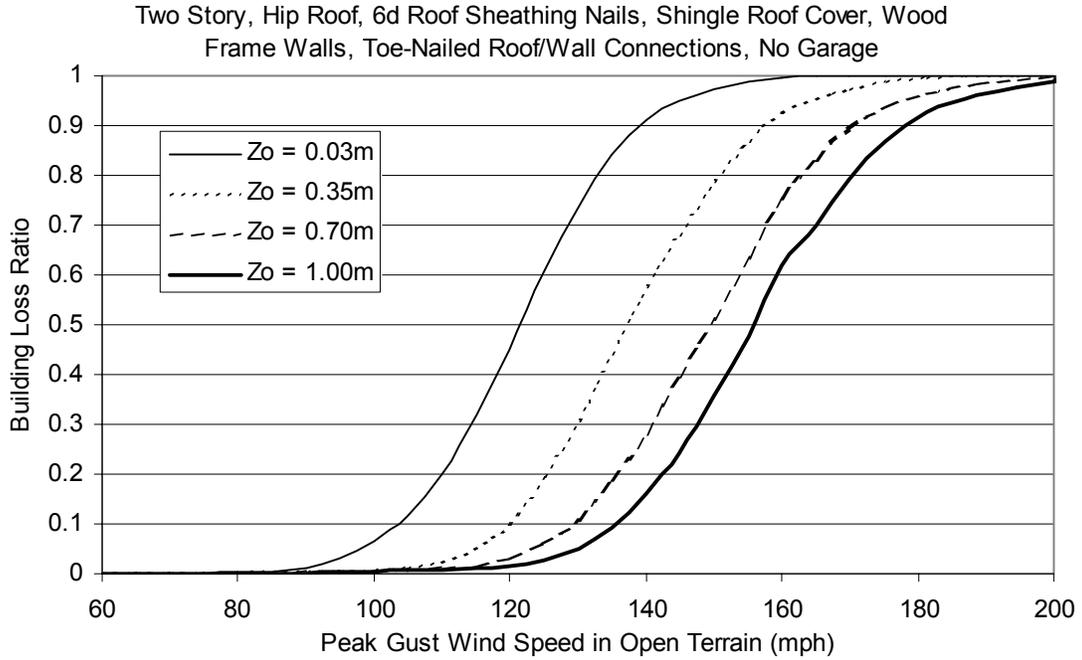
**Figure H.74. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



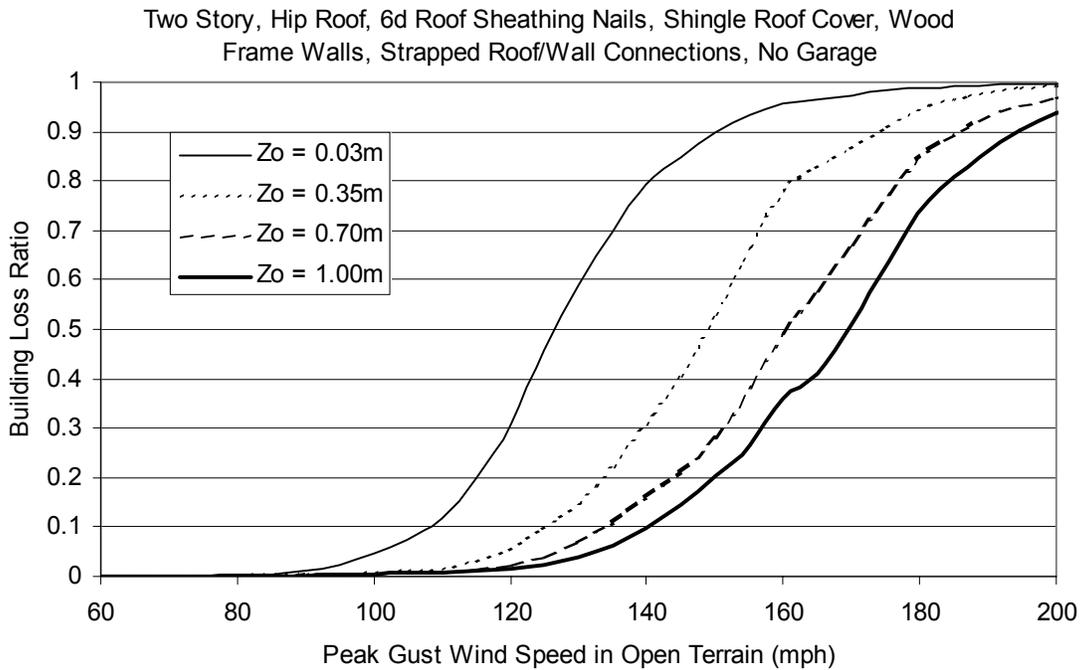
**Figure H.75. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



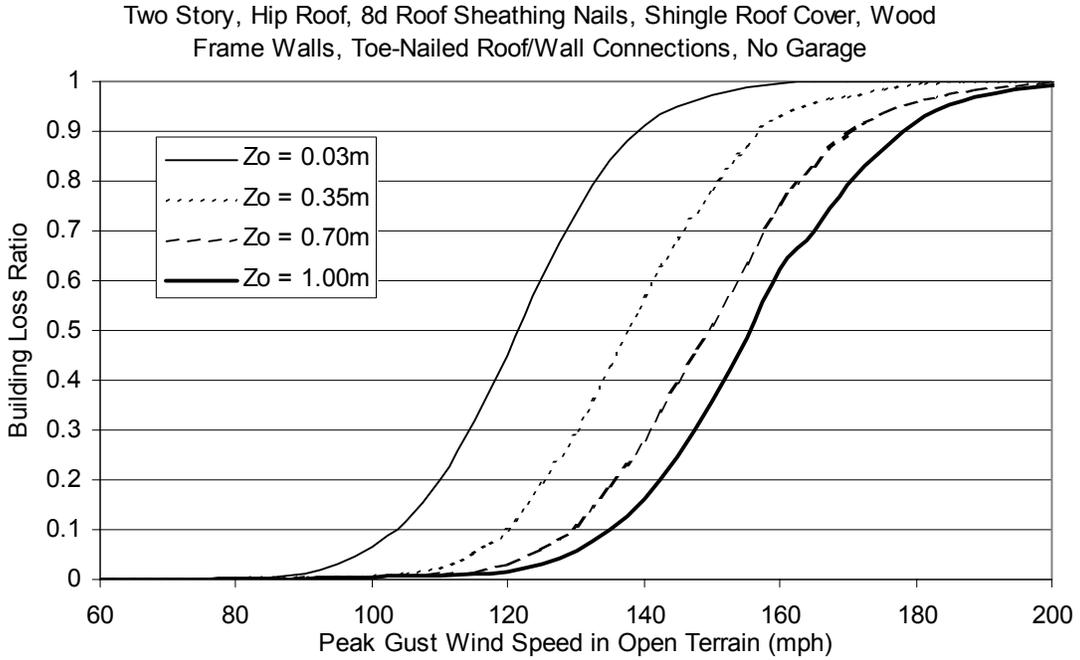
**Figure H.76. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



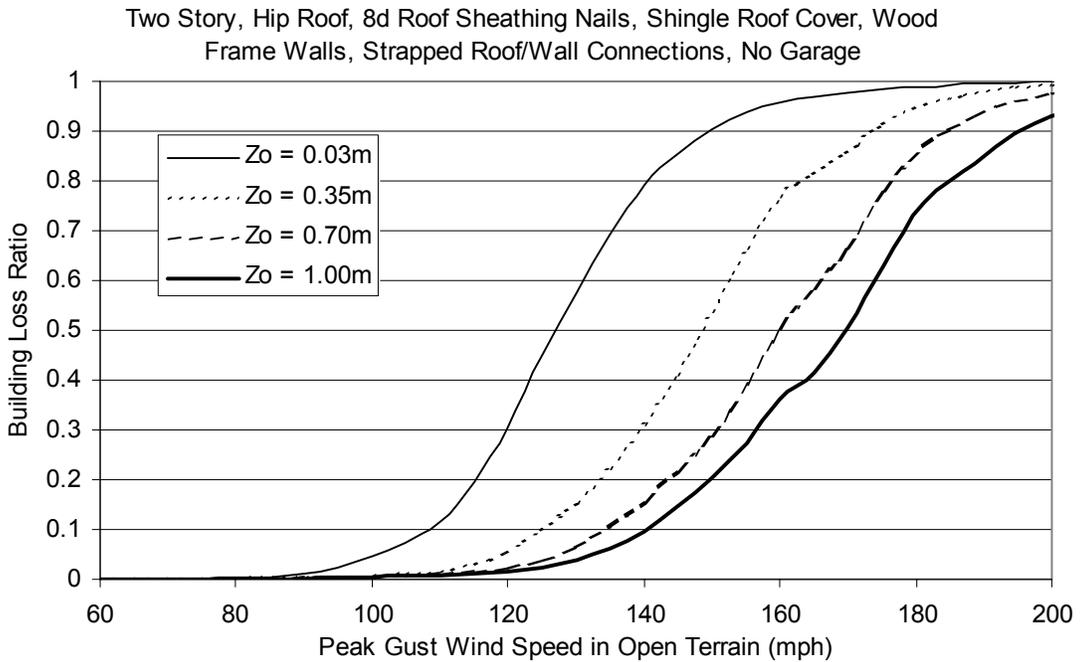
**Figure H.77. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



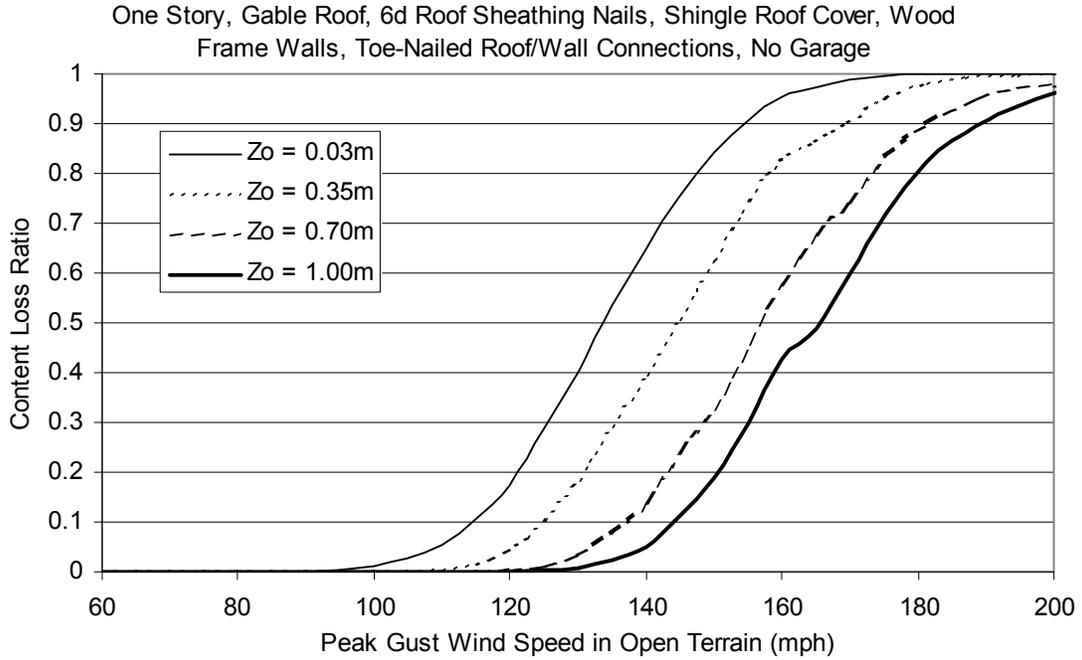
**Figure H.78. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



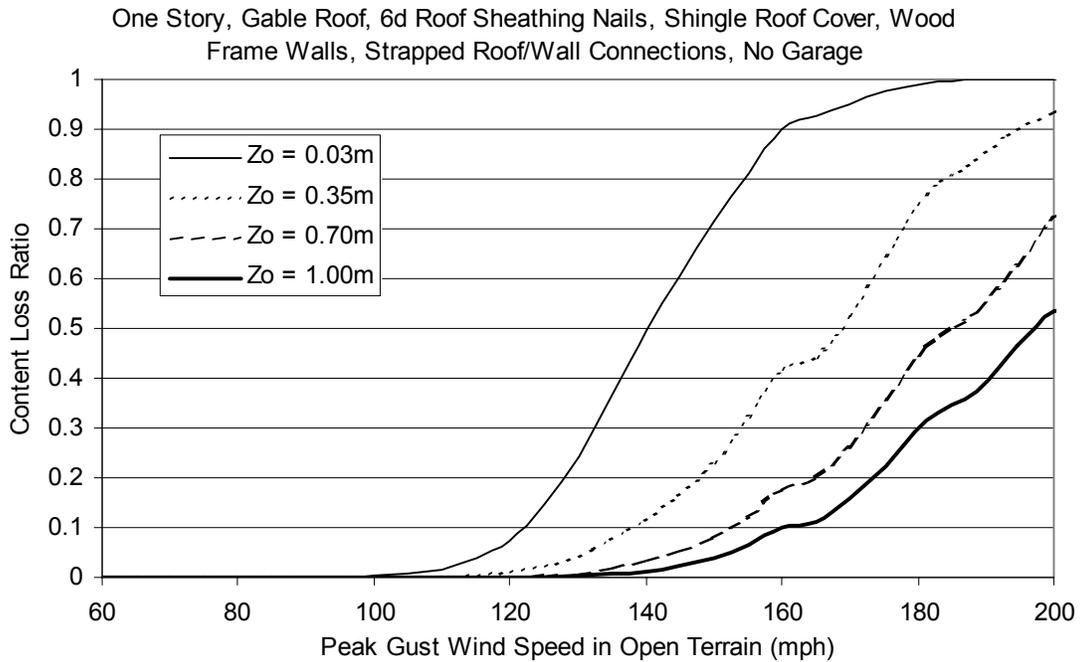
**Figure H.79. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



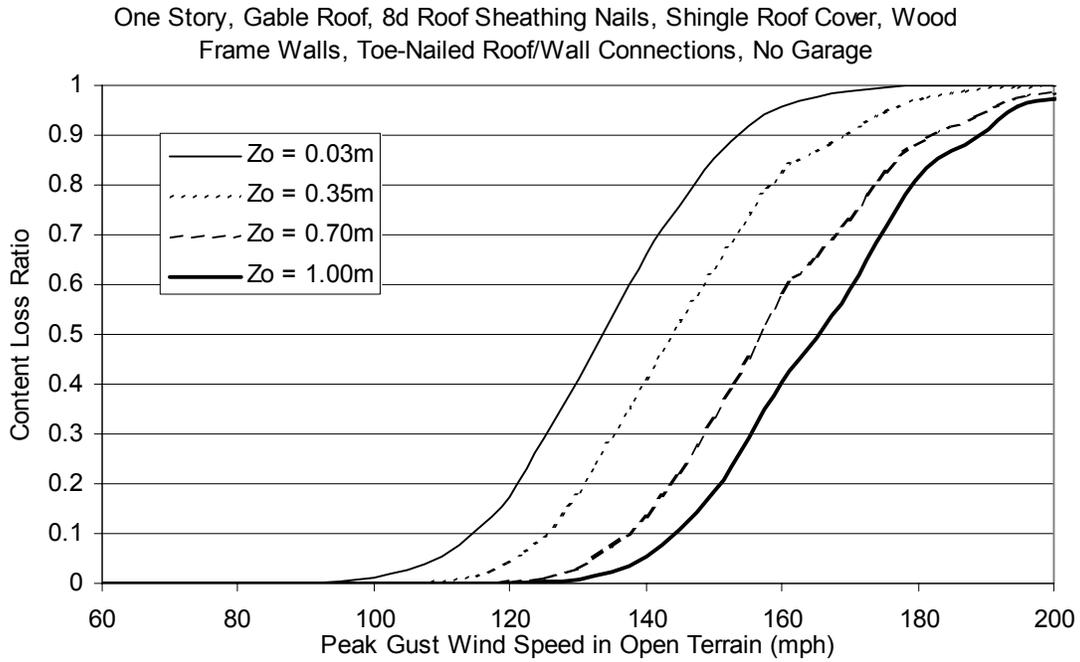
**Figure H.80. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



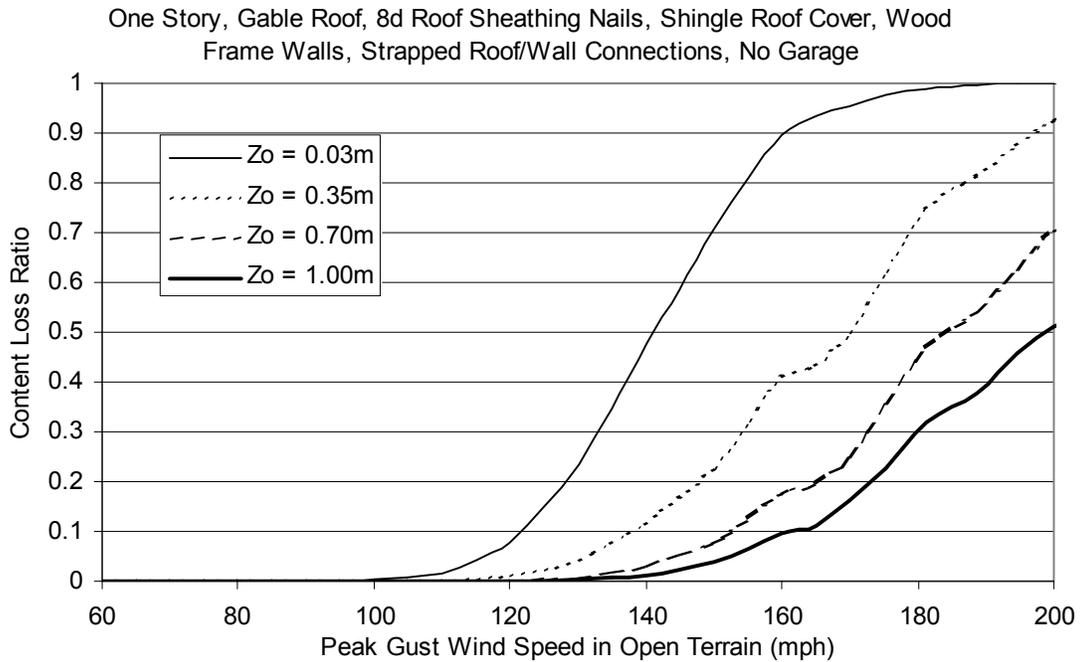
**Figure H.81. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



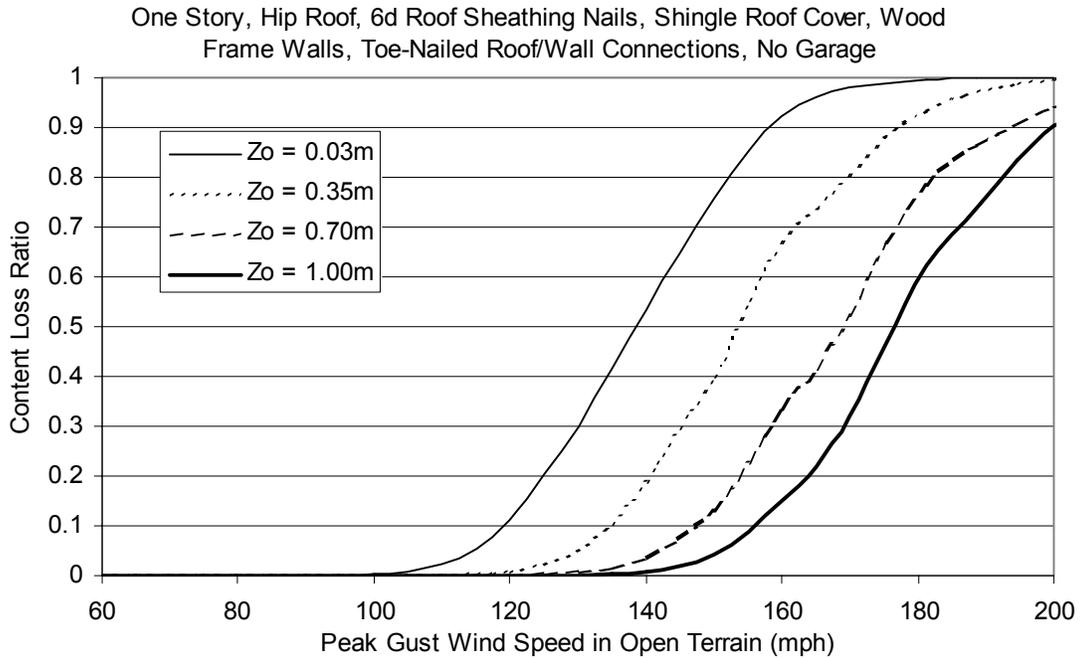
**Figure H.82. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



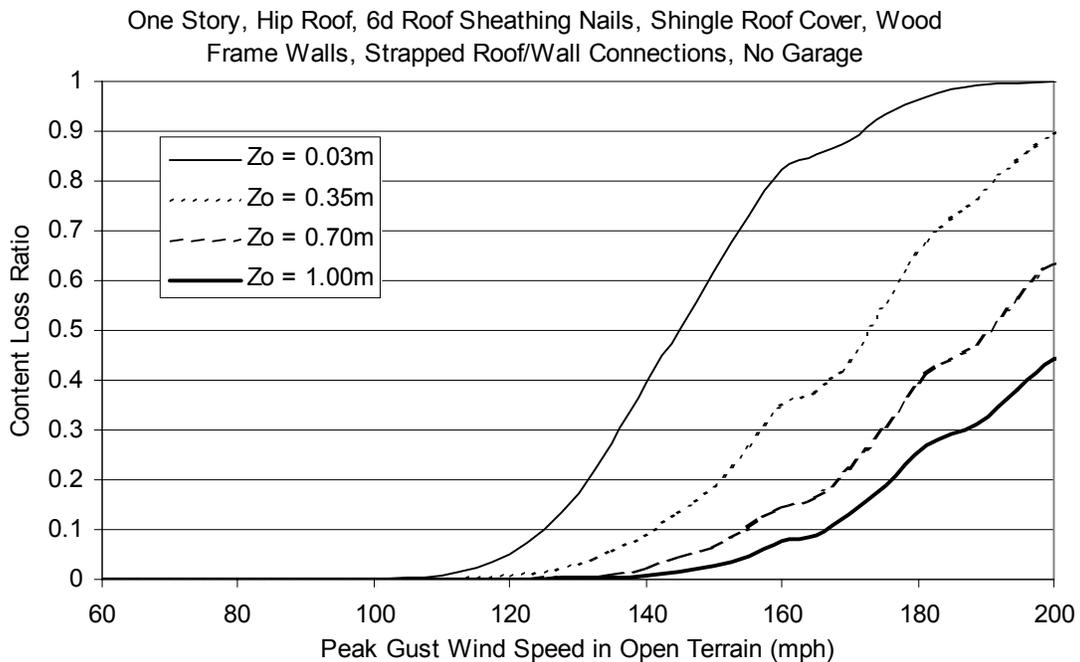
**Figure H.83. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



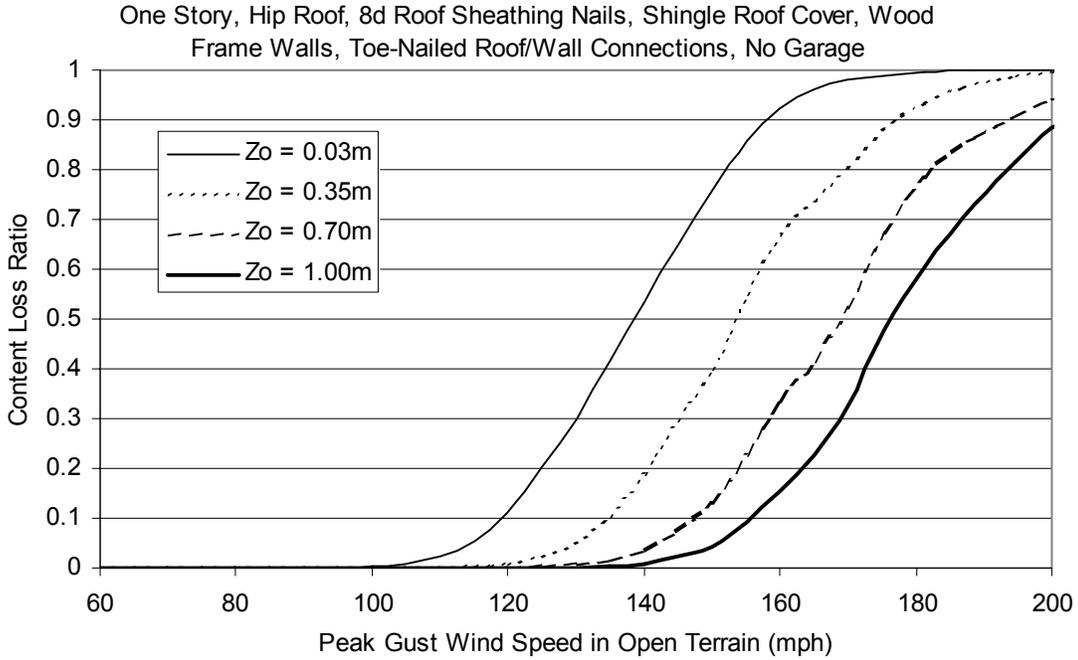
**Figure H.84. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



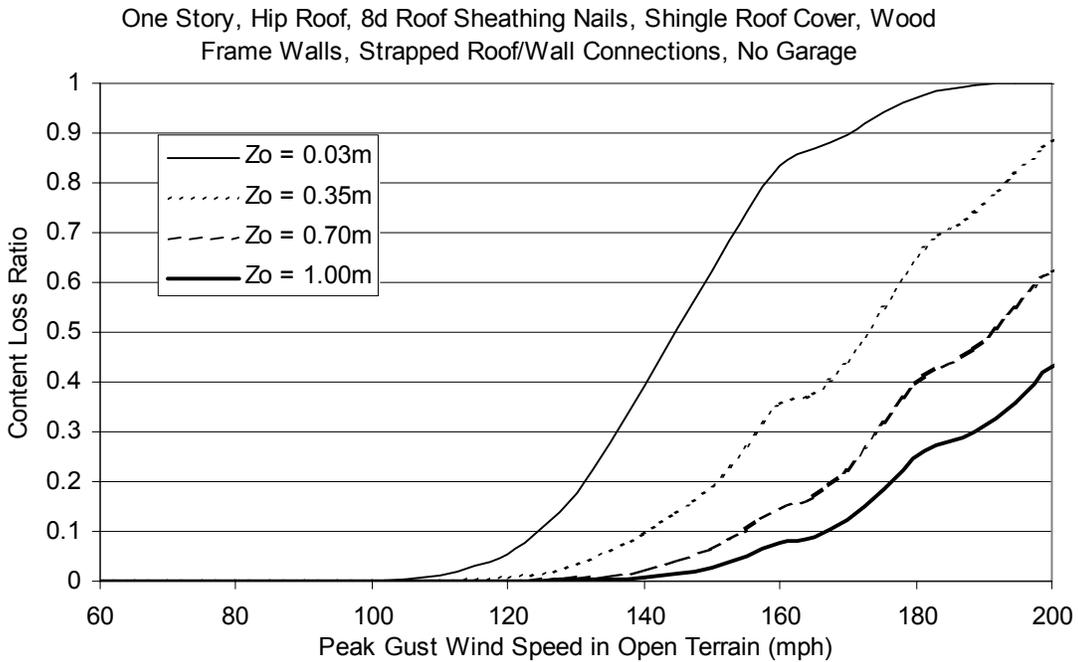
**Figure H.85. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



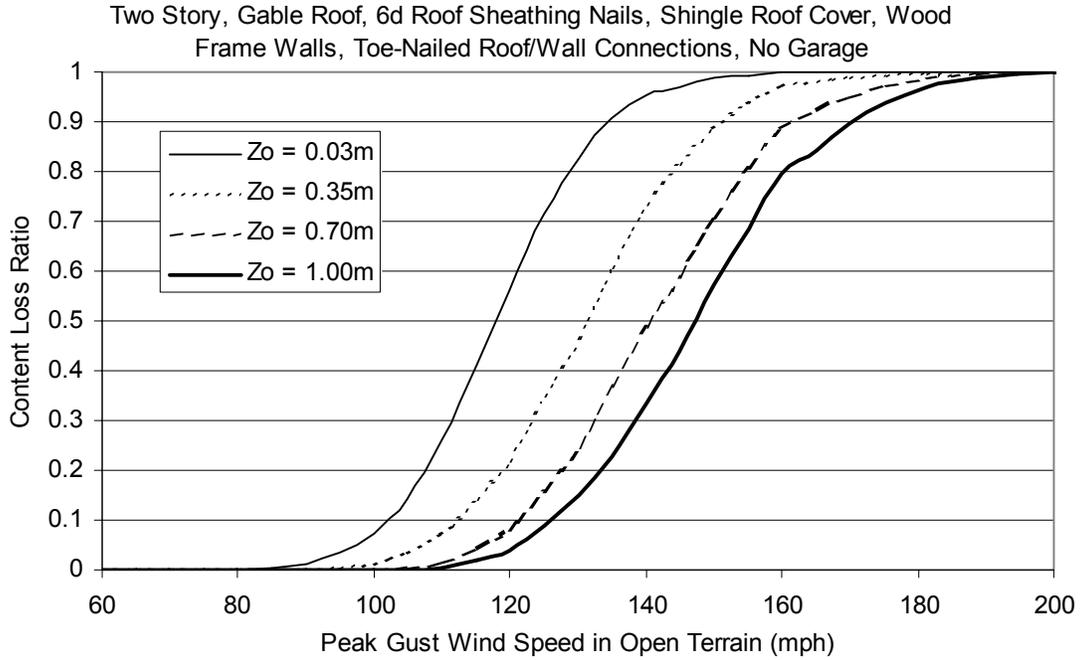
**Figure H.86. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



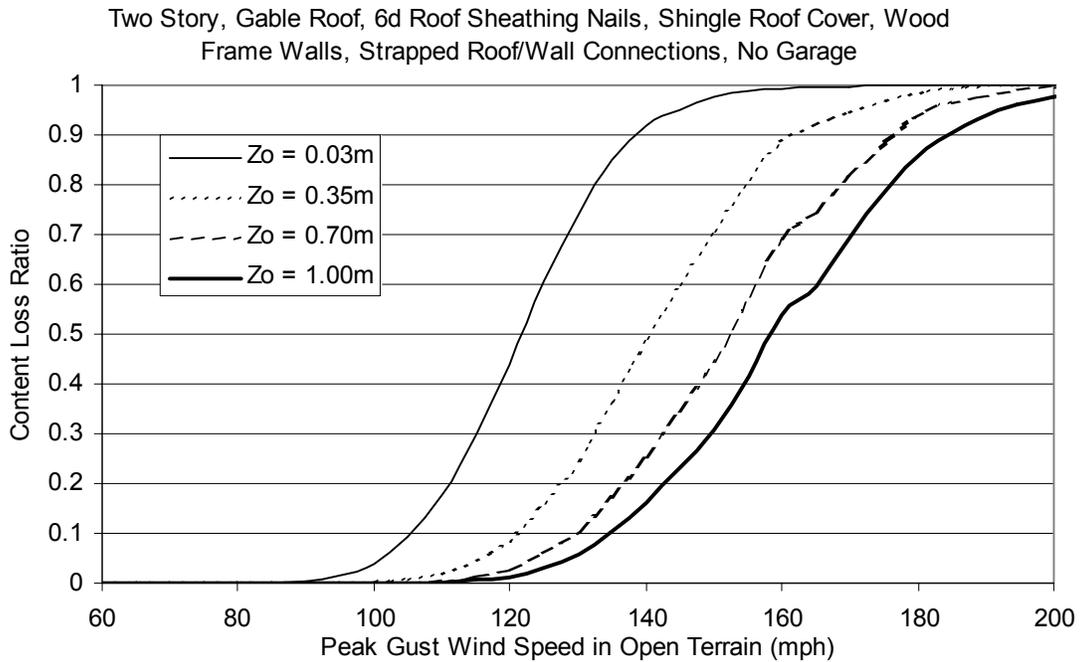
**Figure H.87. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



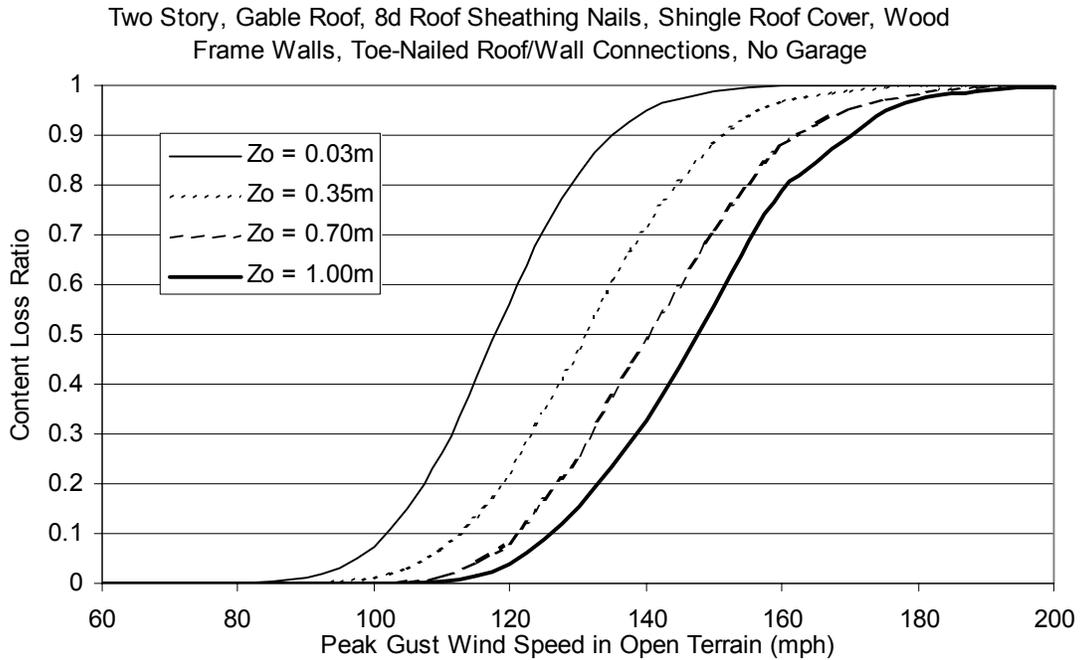
**Figure H.88. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



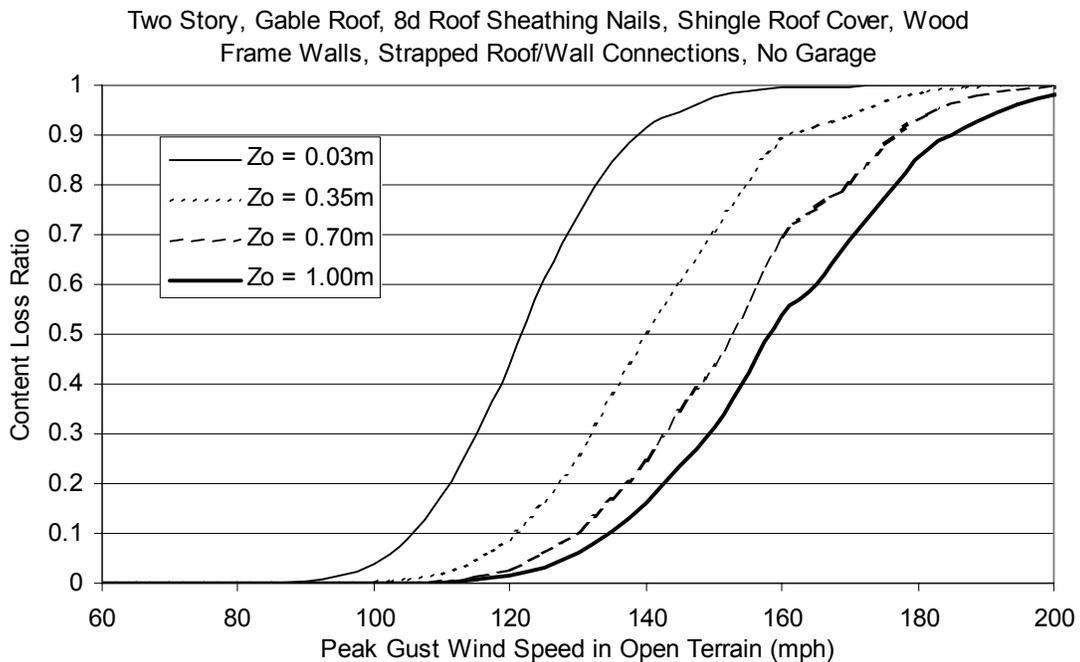
**Figure H.89. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



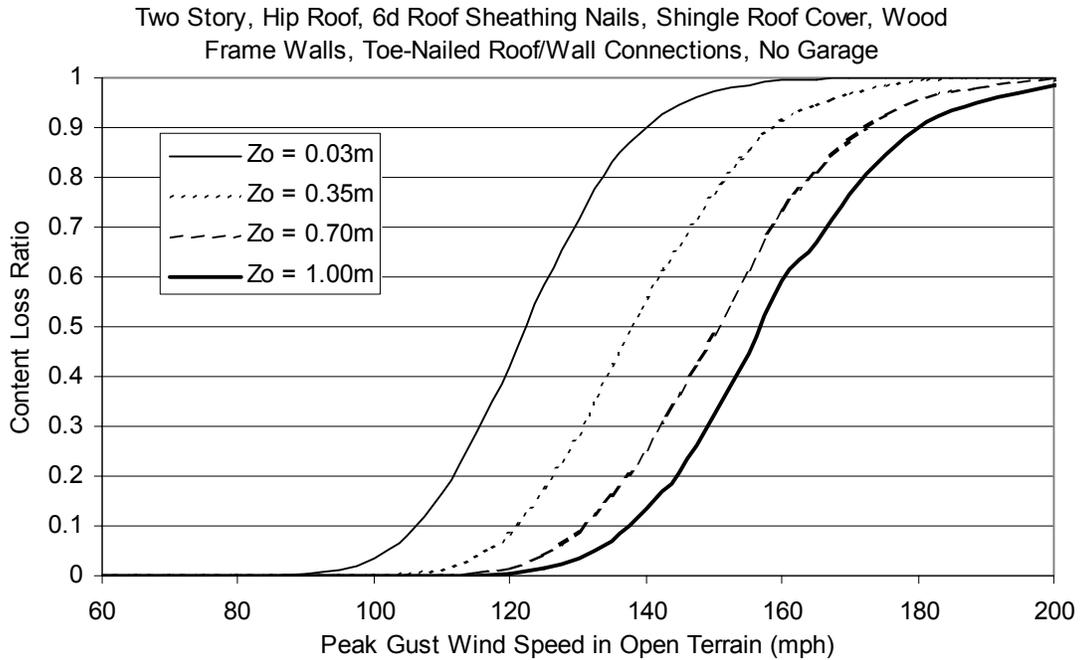
**Figure H.90. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



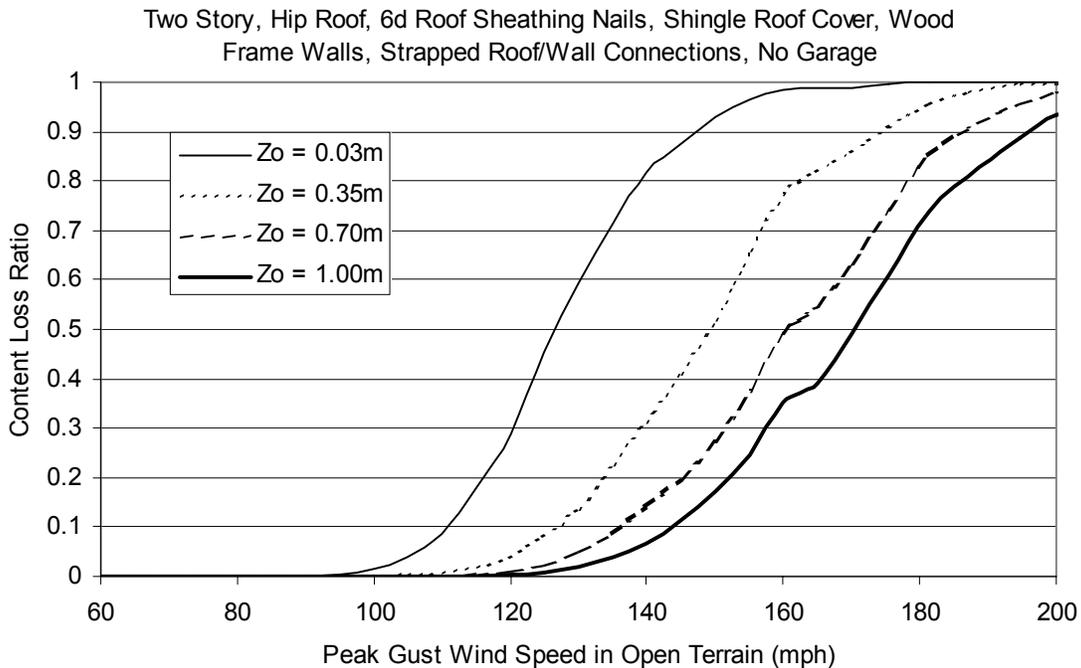
**Figure H.91. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



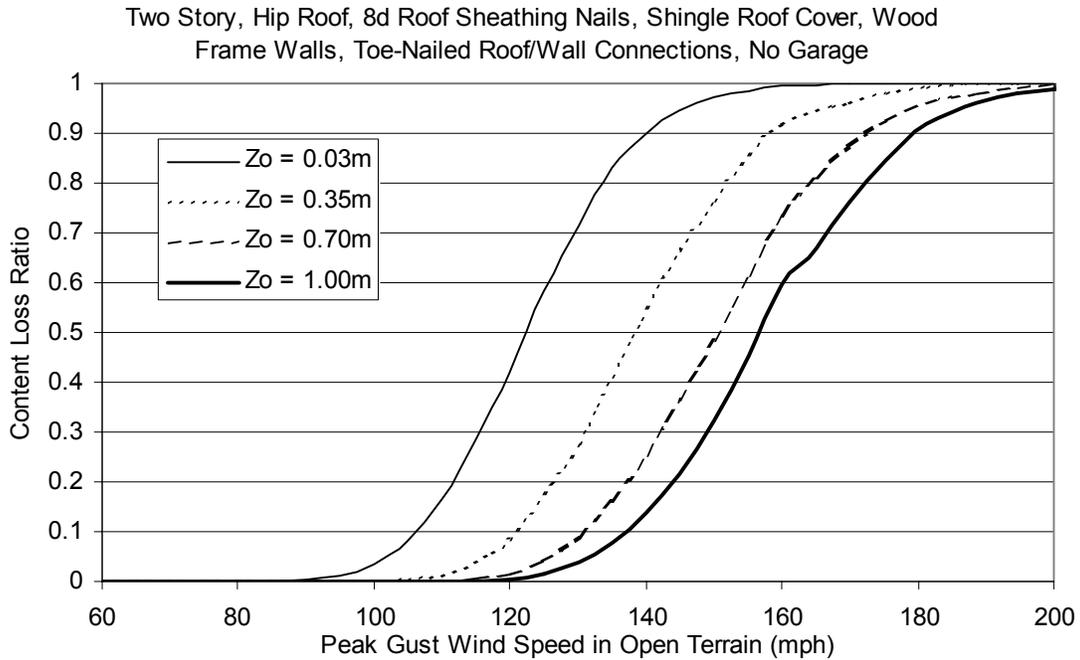
**Figure H.92. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



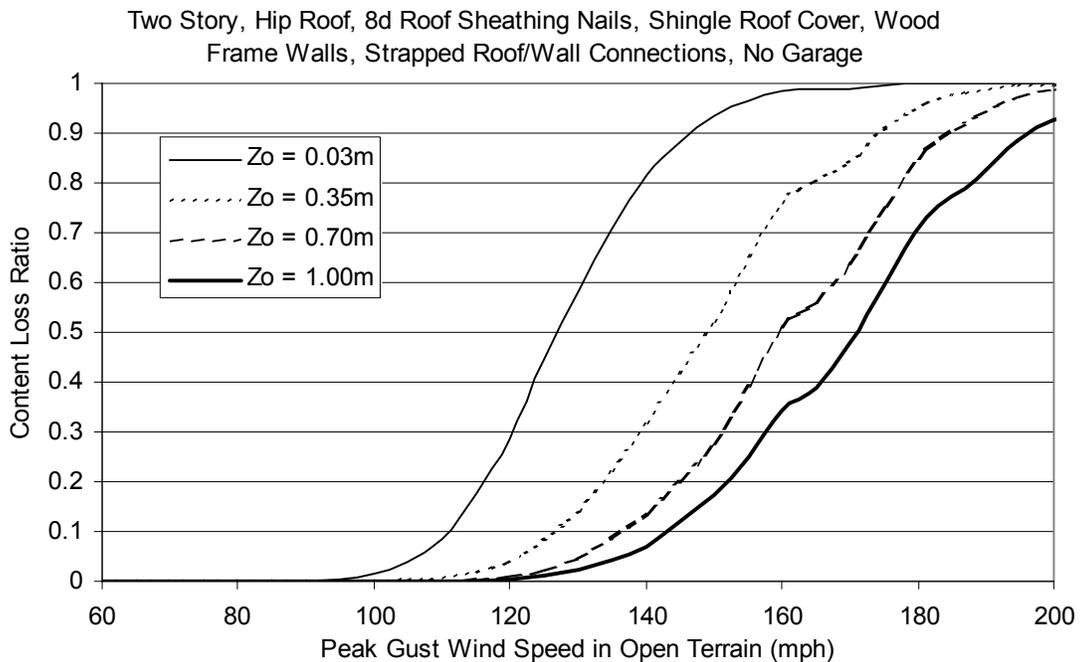
**Figure H.93. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



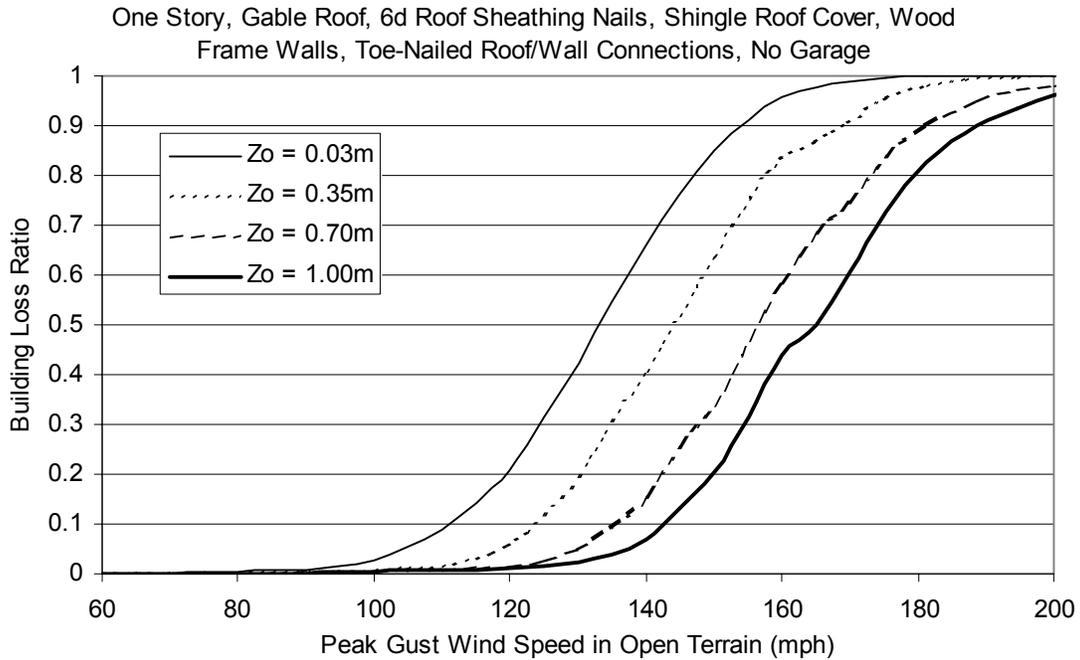
**Figure H.94. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



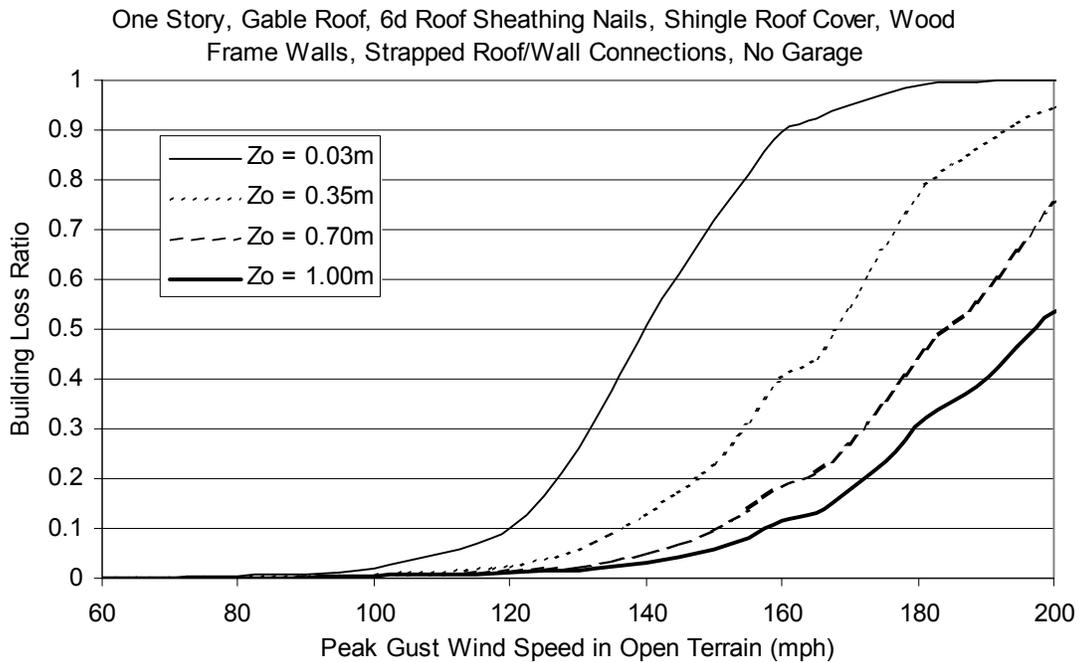
**Figure H.95. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof).**



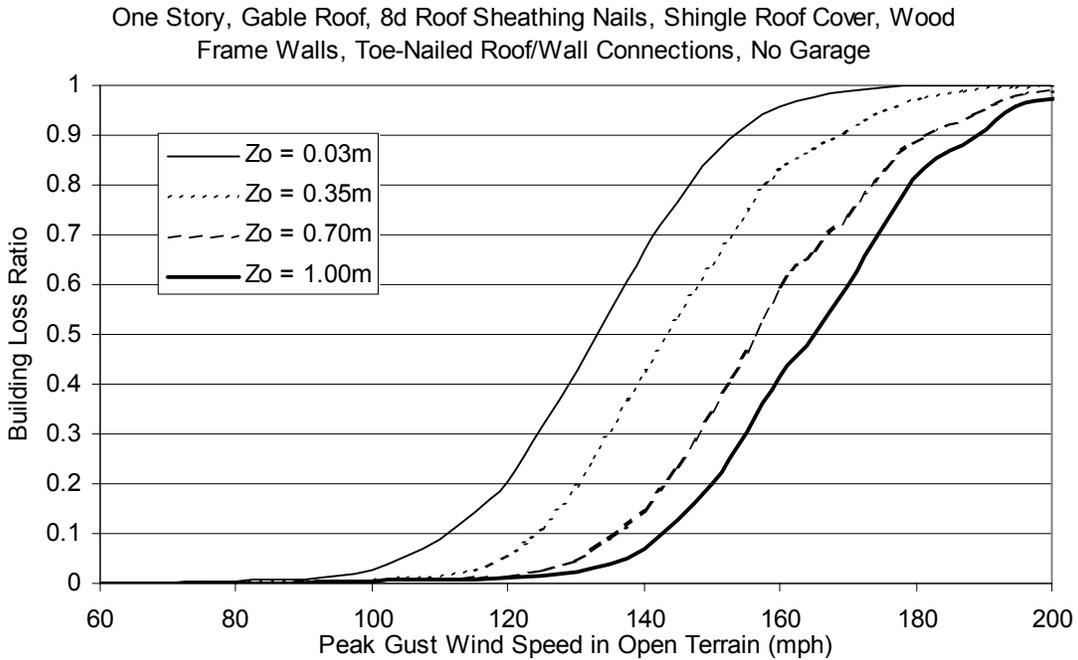
**Figure H.96. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof).**



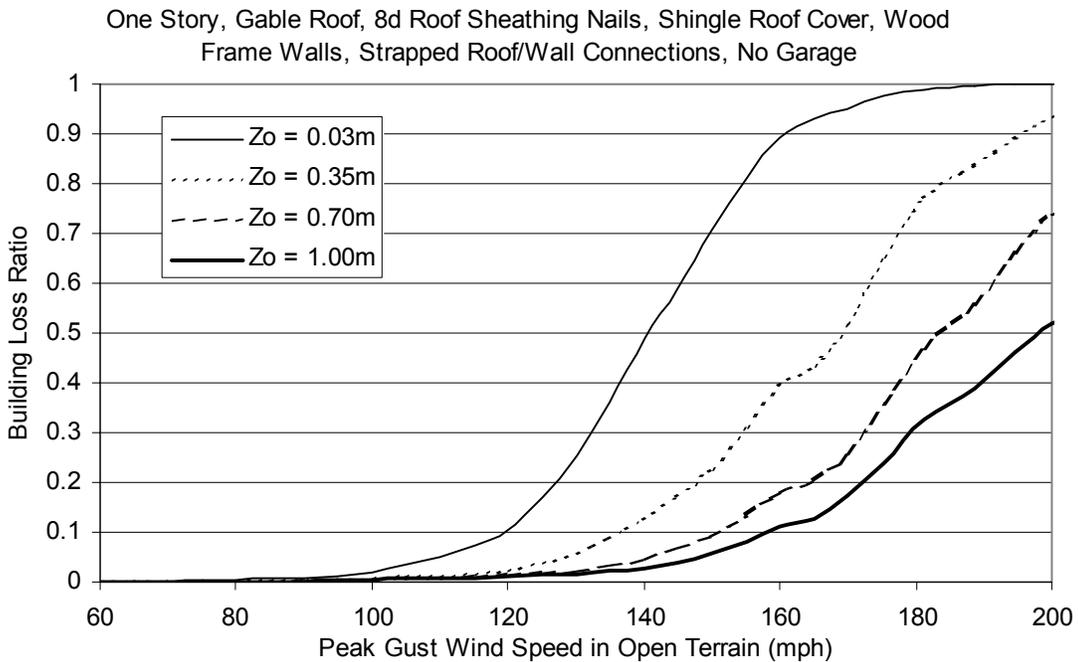
**Figure H.97. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



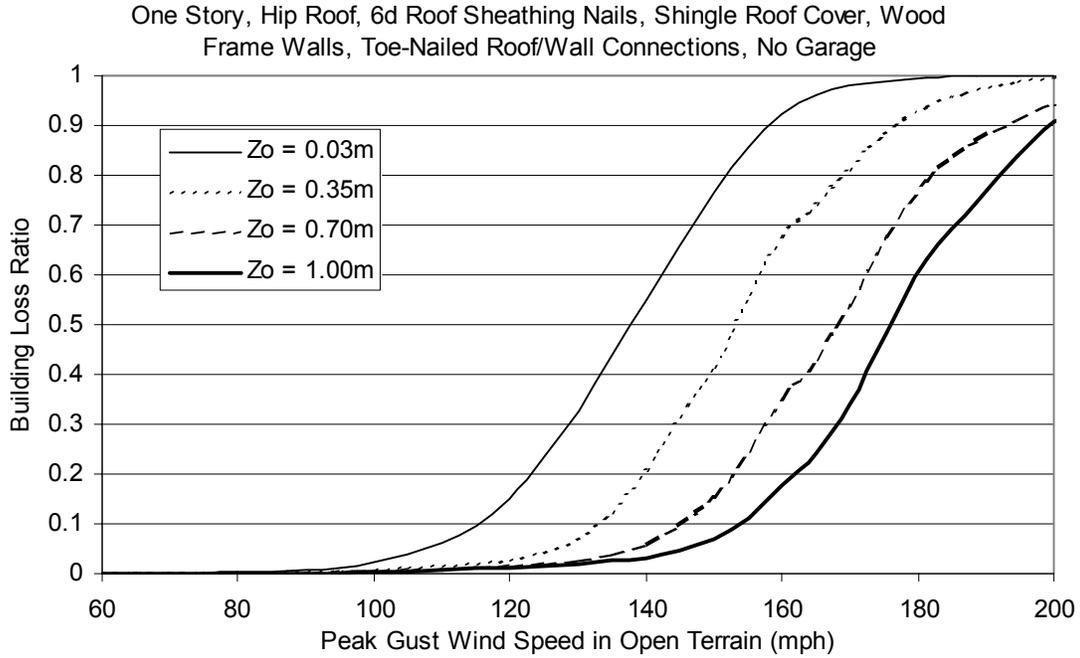
**Figure H.98. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



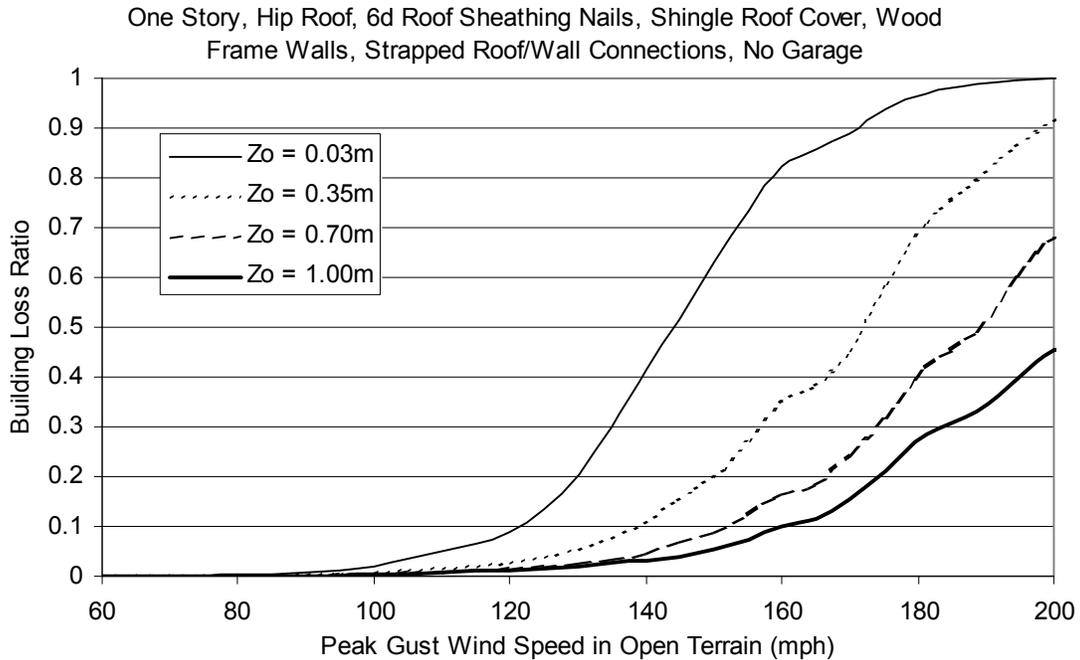
**Figure H.99. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



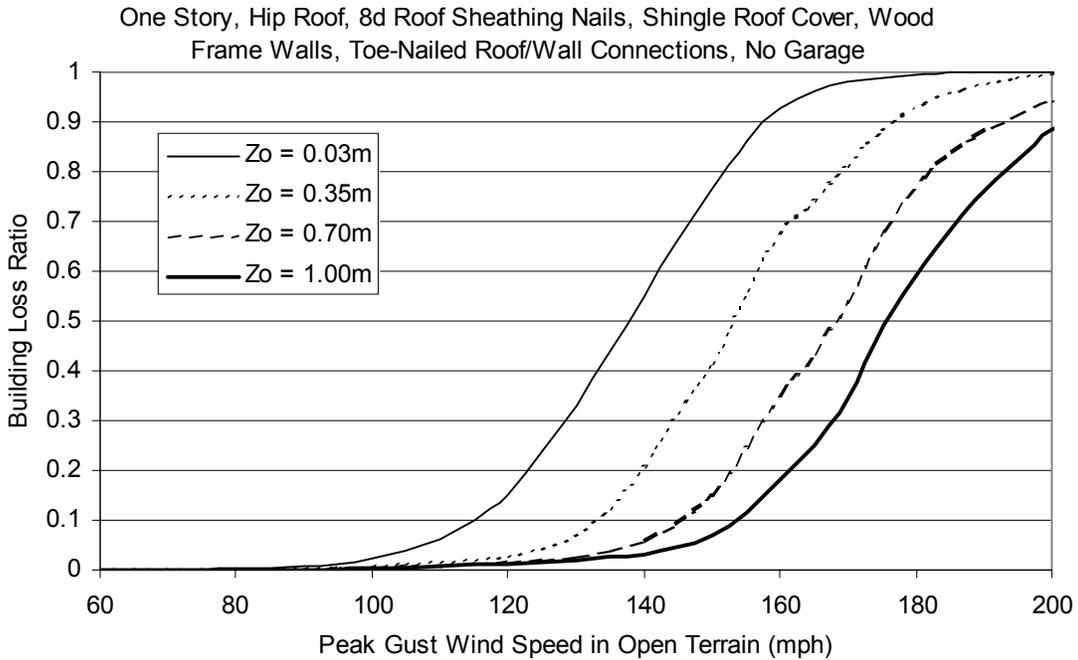
**Figure H.100. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



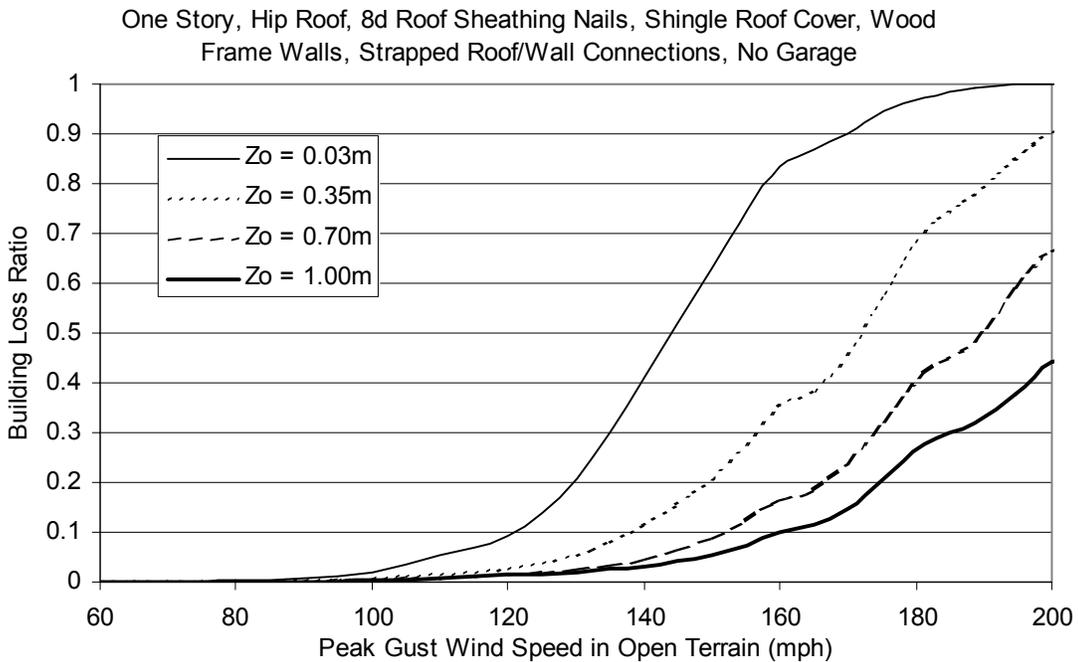
**Figure H.101. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



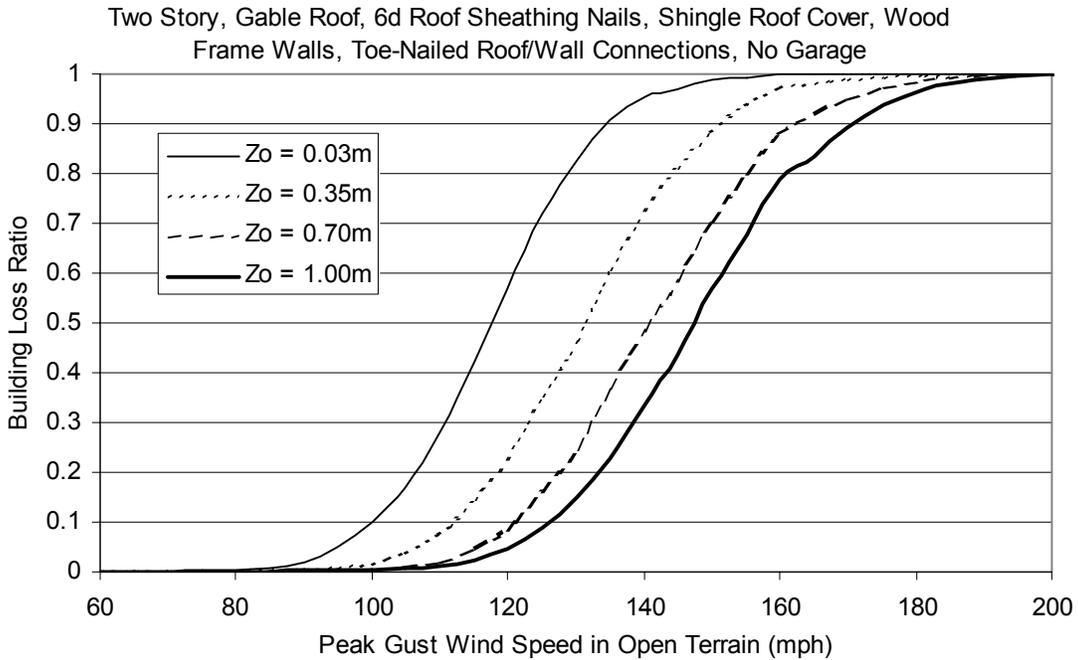
**Figure H.102. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



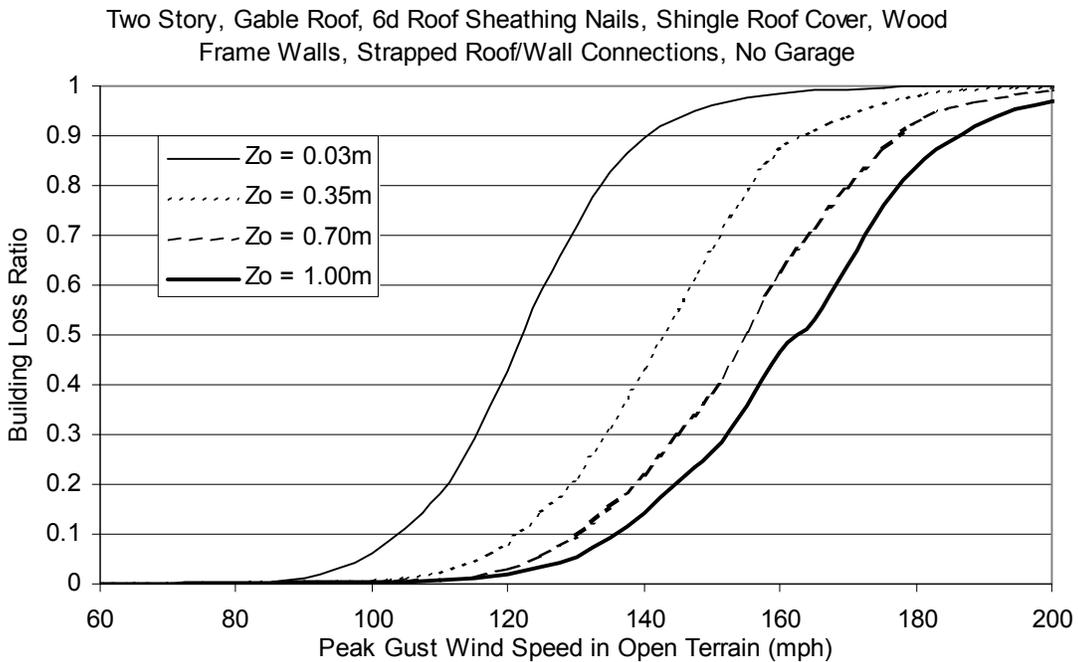
**Figure H.103. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



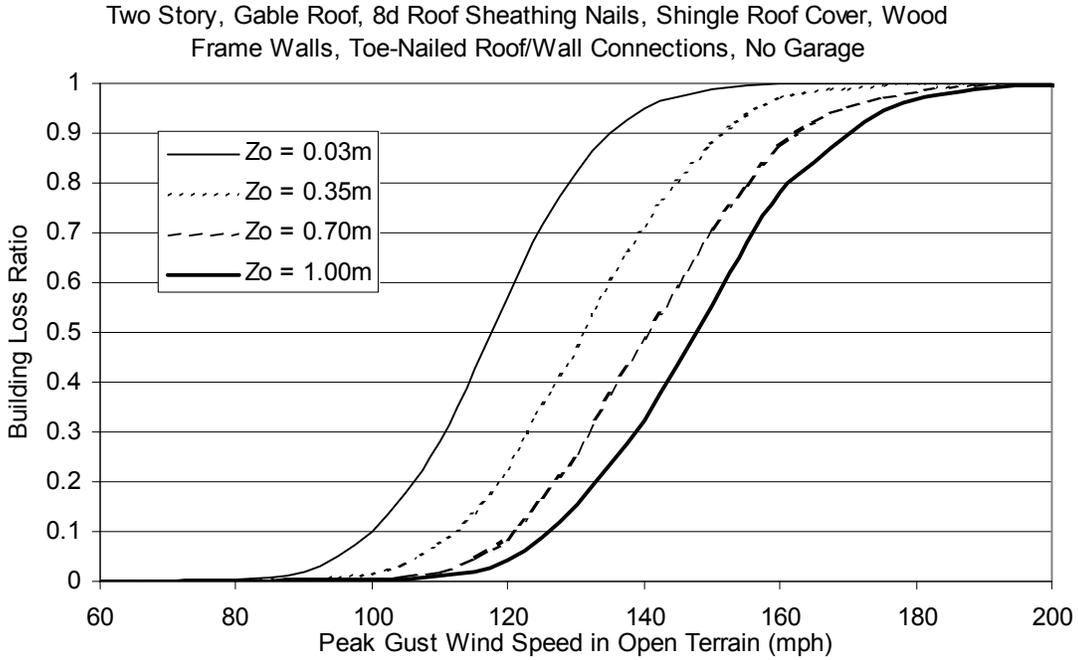
**Figure H.104. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



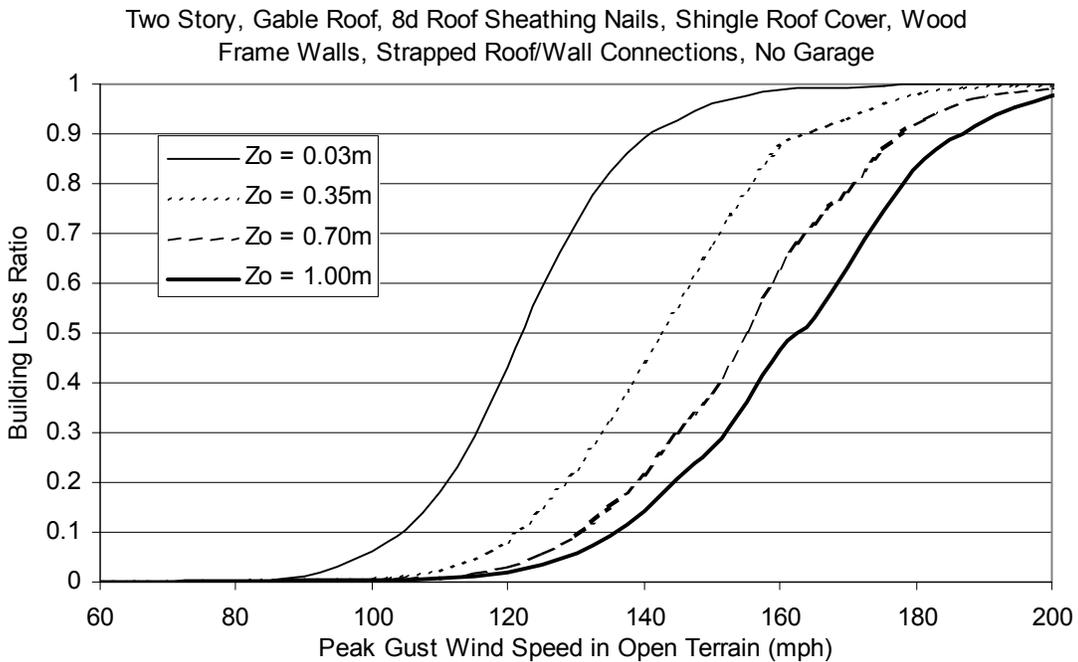
**Figure H.105. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



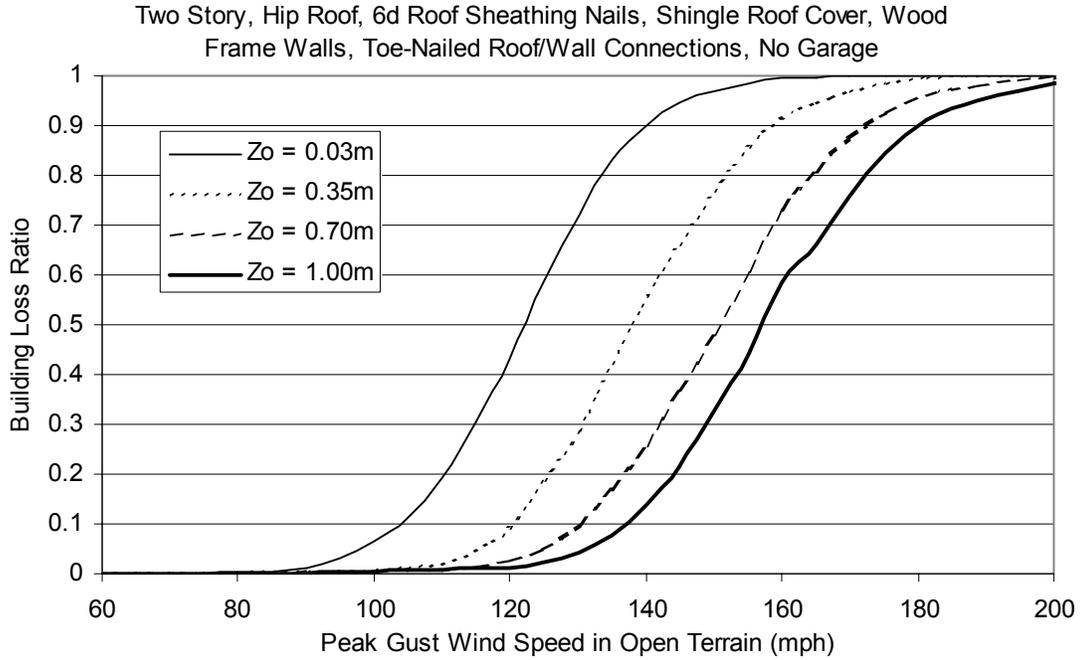
**Figure H.106. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



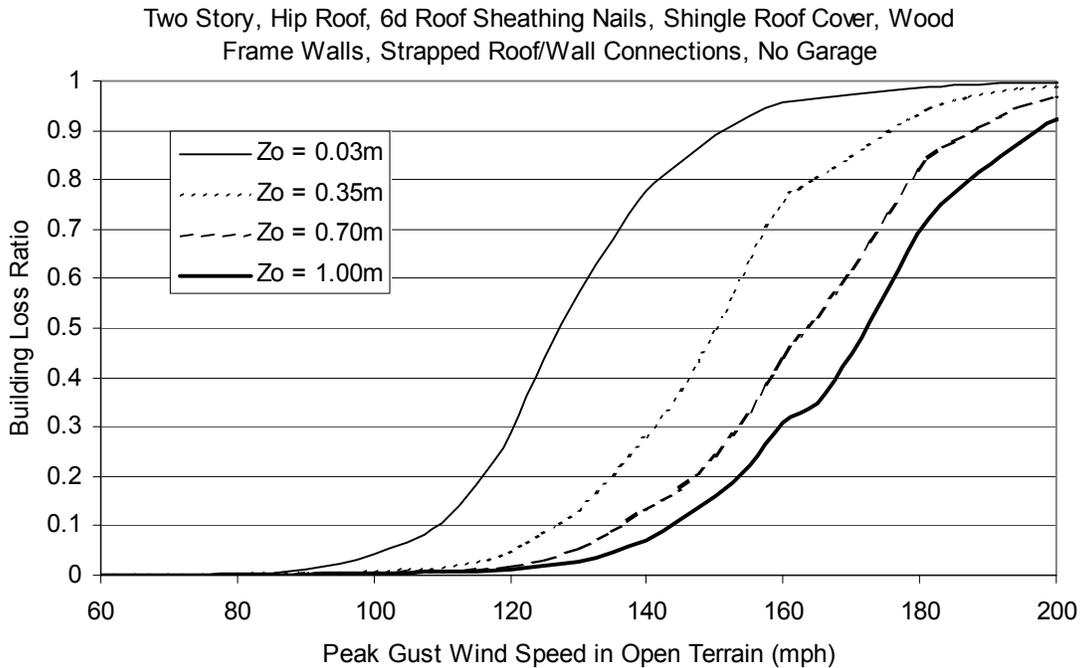
**Figure H.107. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



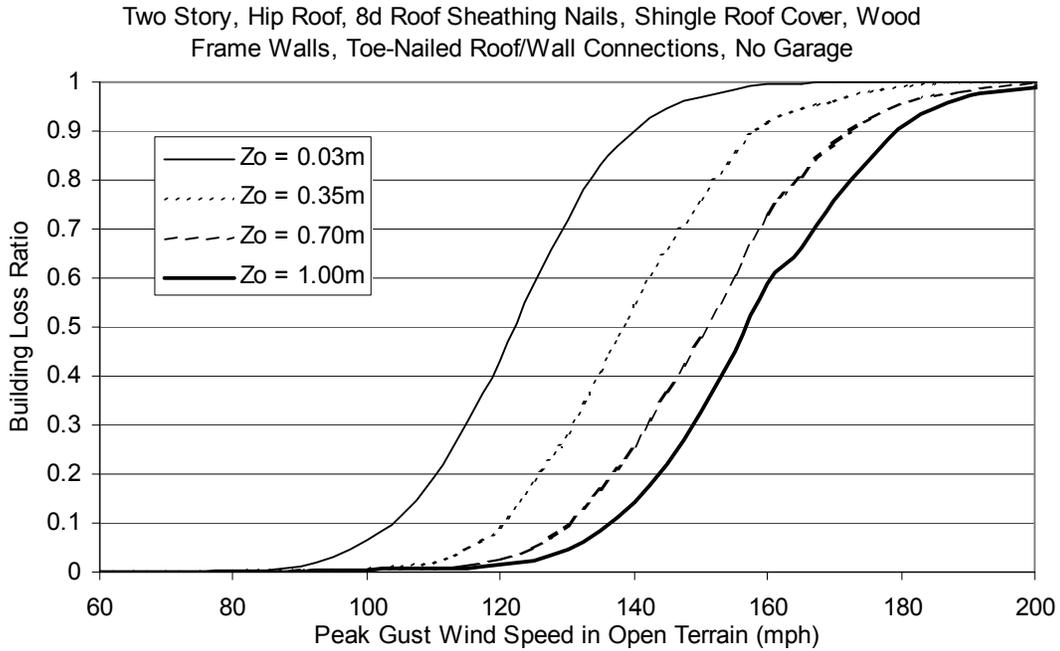
**Figure H.108. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



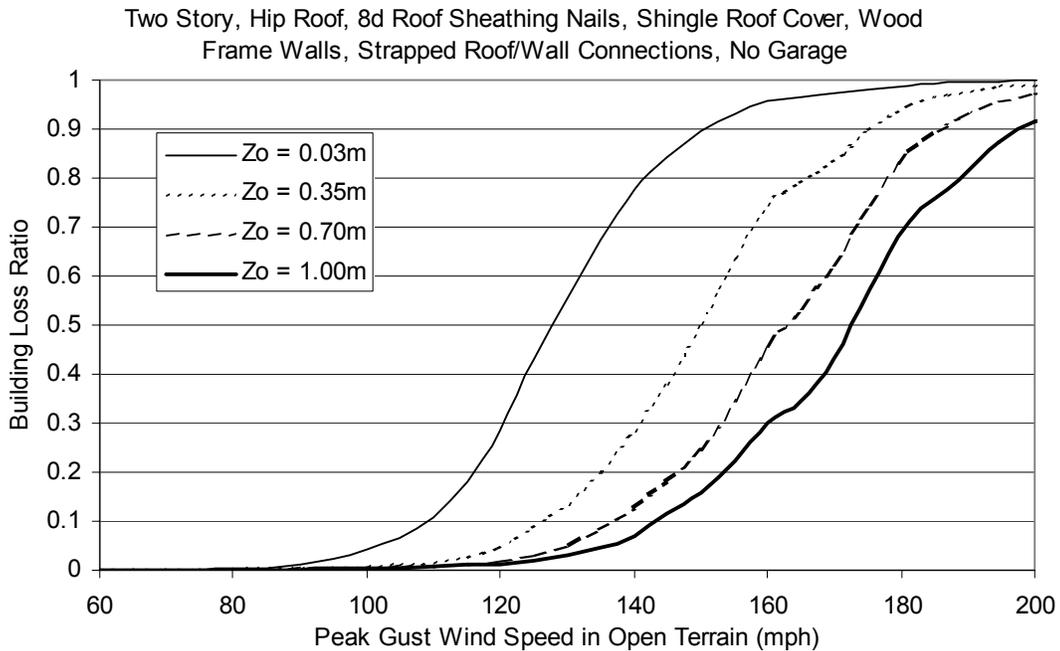
**Figure H.109. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



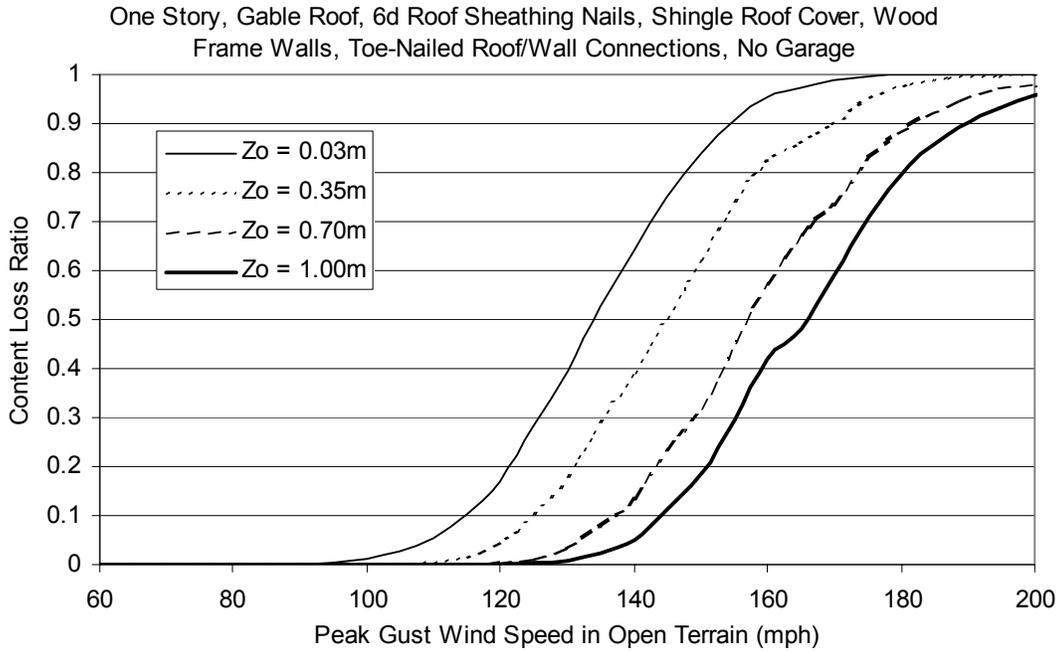
**Figure H.110. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



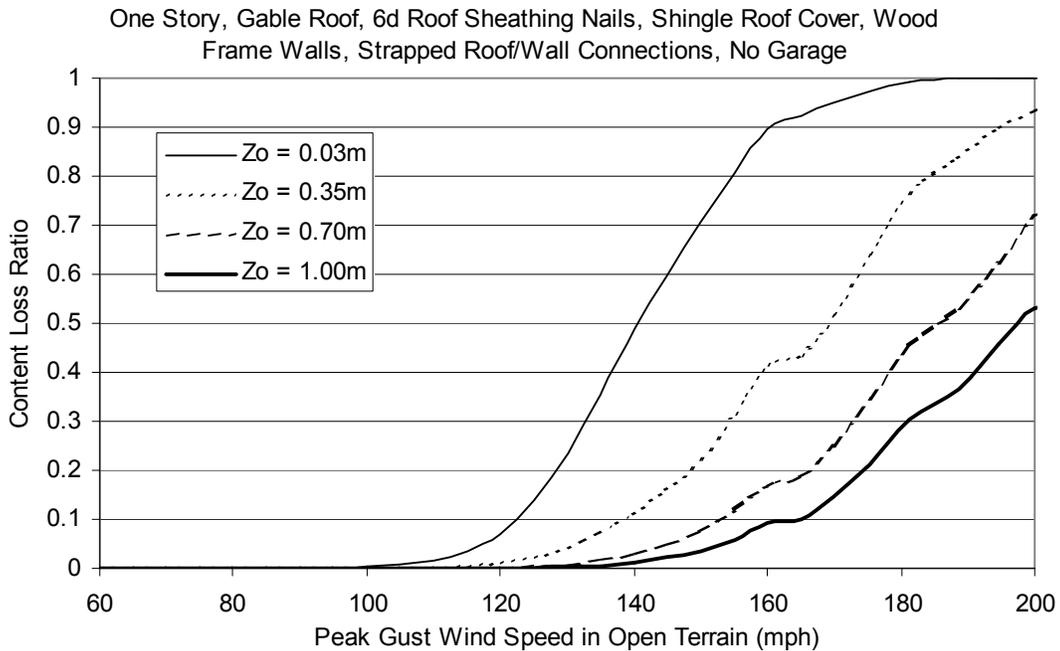
**Figure H.111. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



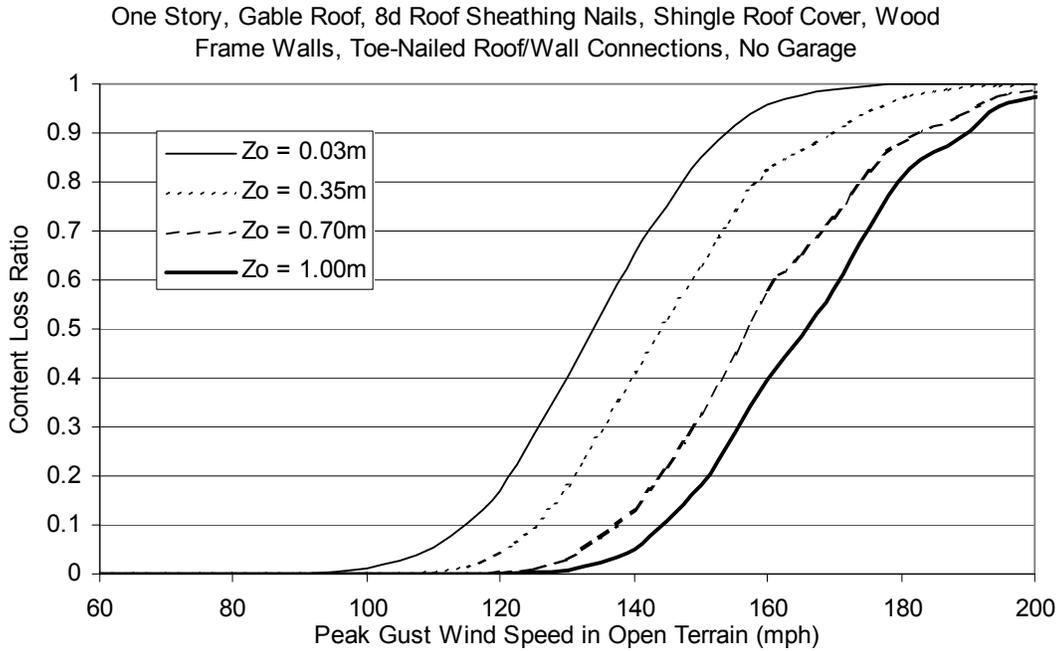
**Figure H.112. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



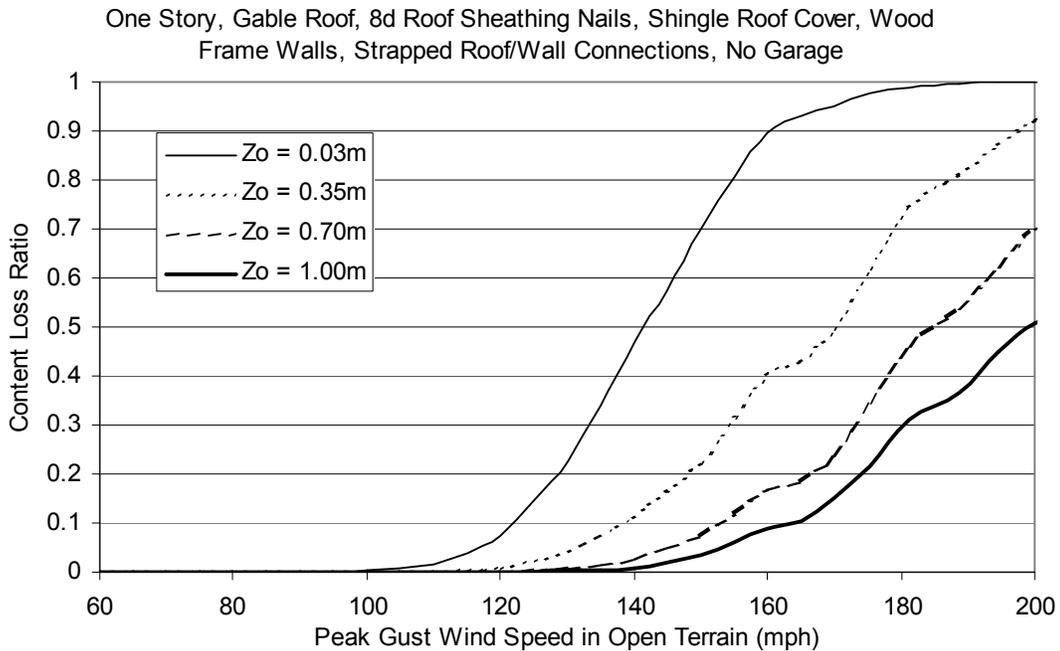
**Figure H.113. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



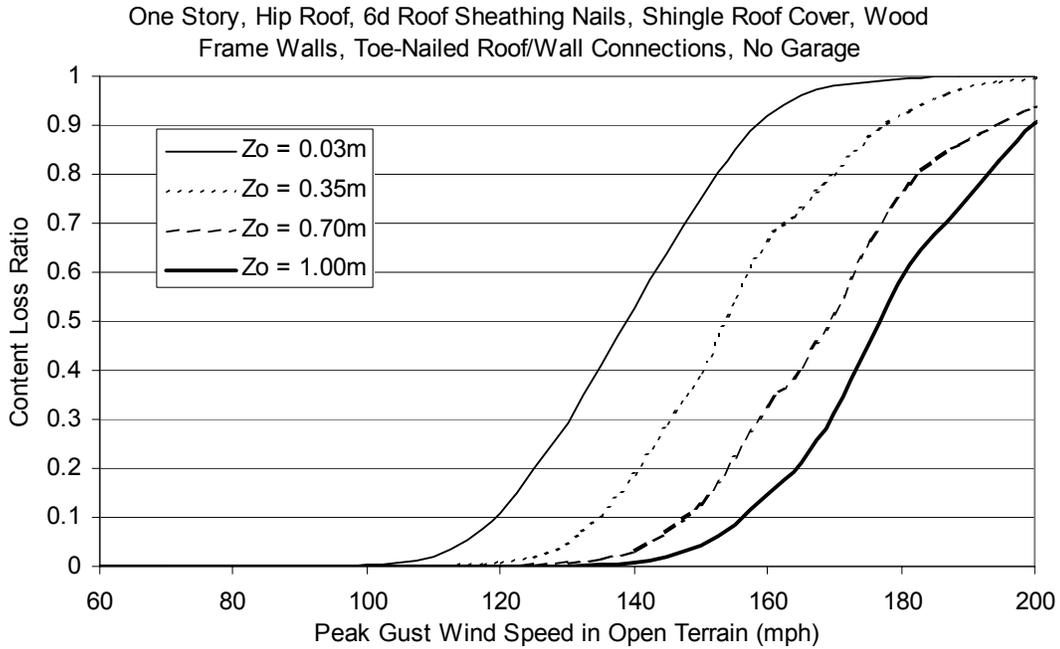
**Figure H.114. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



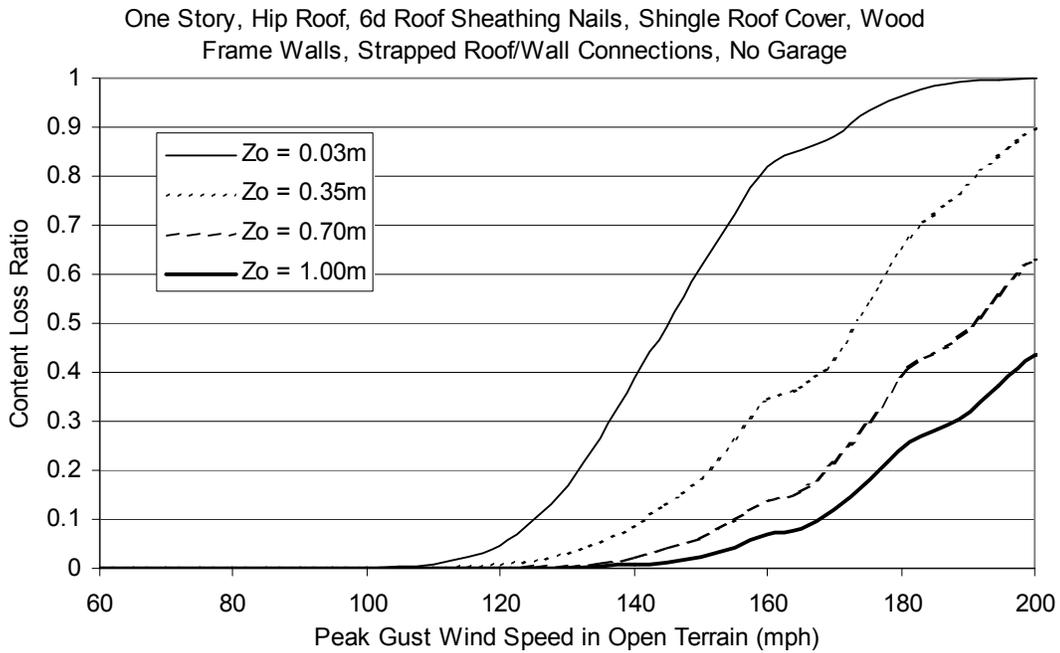
**Figure H.115. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



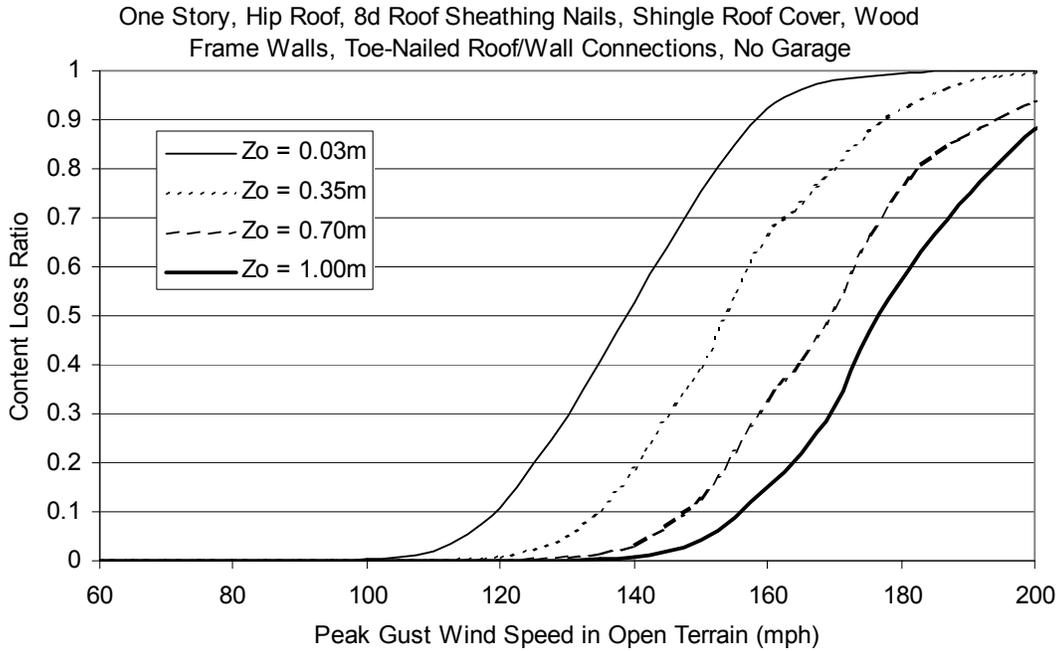
**Figure H.116. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



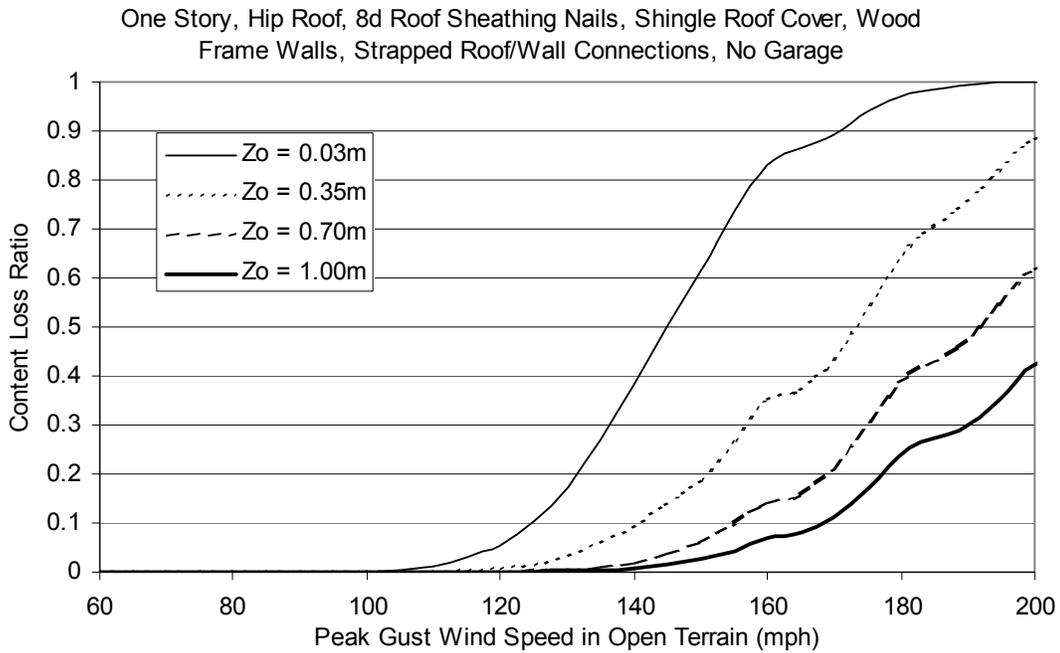
**Figure H.117. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



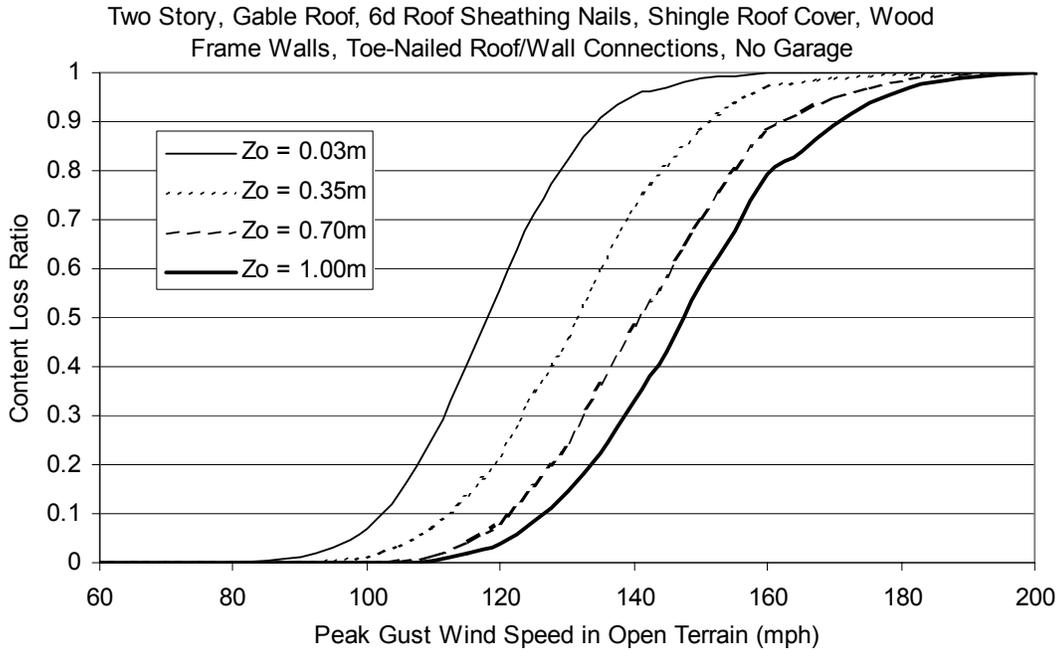
**Figure H.118. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



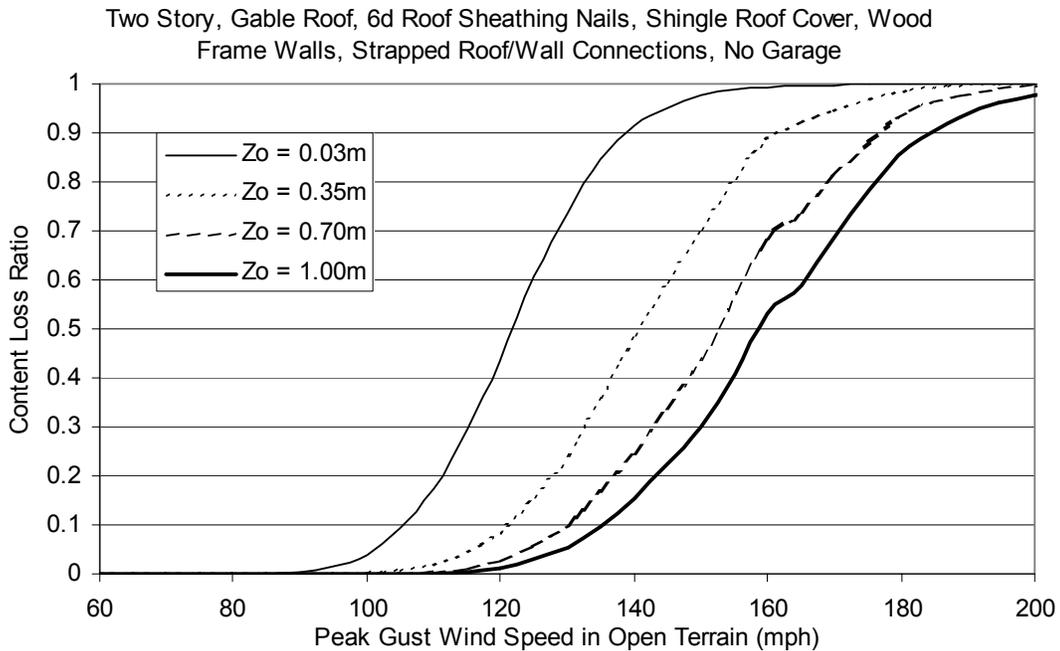
**Figure H.119. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



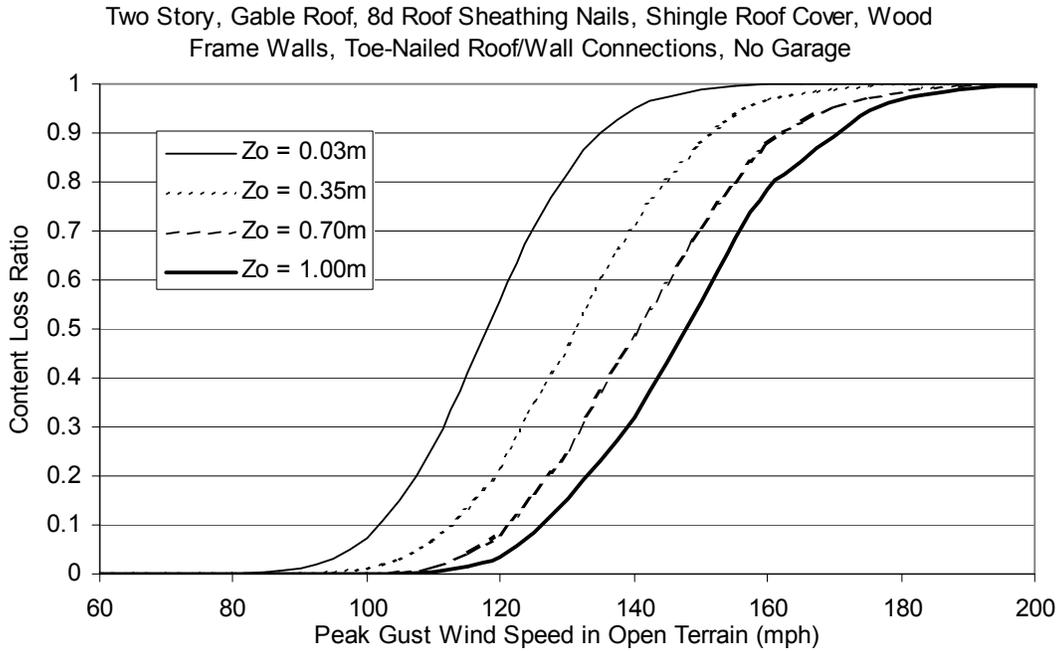
**Figure H.120. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



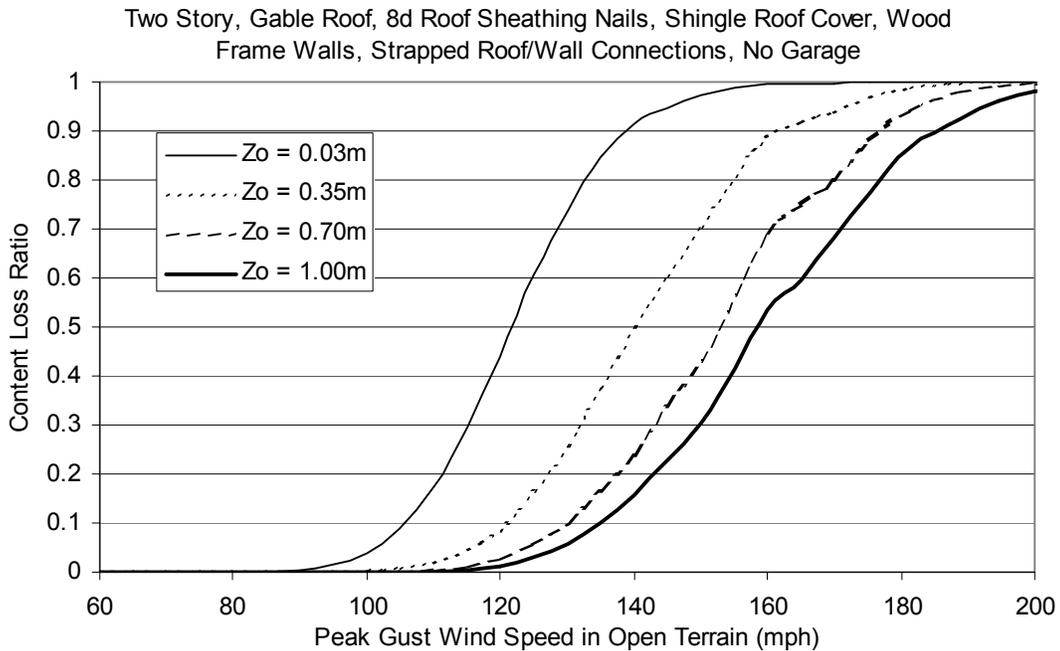
**Figure H.121. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



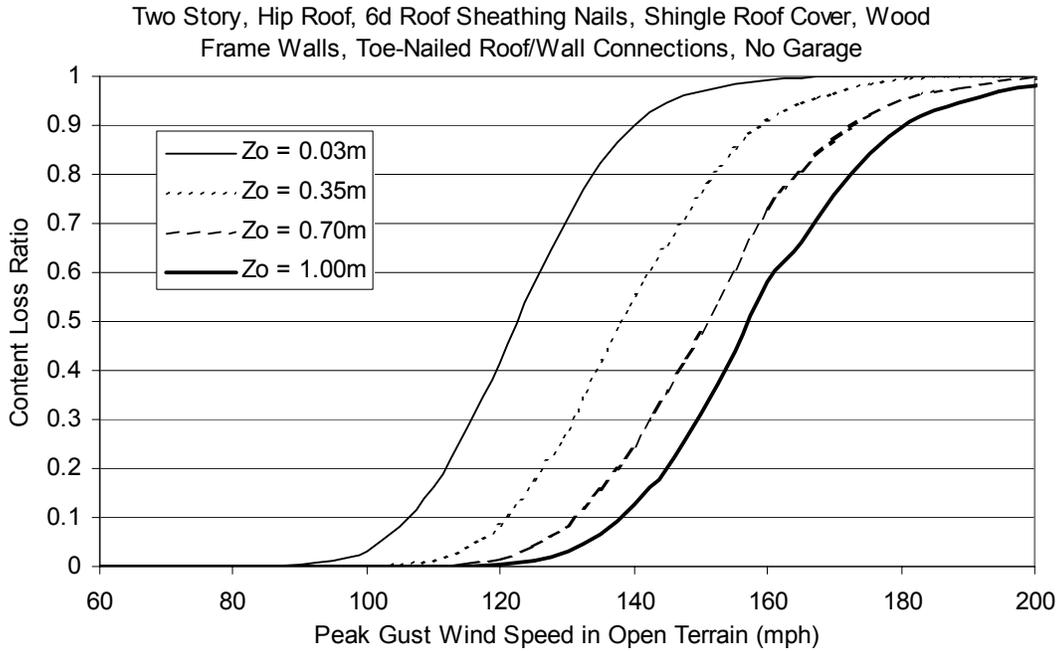
**Figure H.122. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



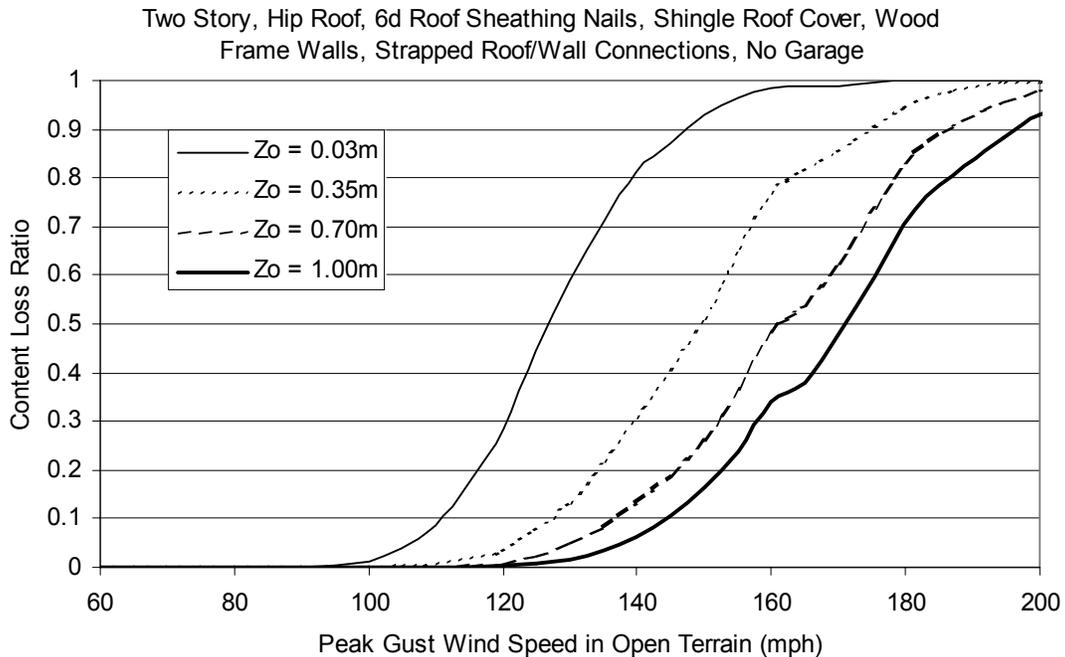
**Figure H.123. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



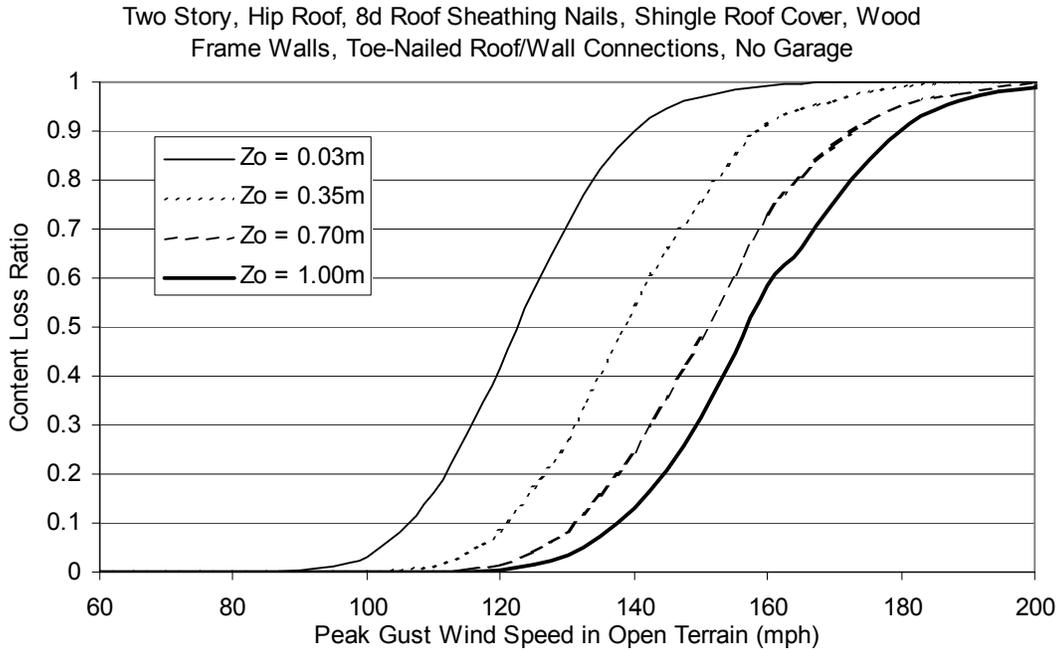
**Figure H.124. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



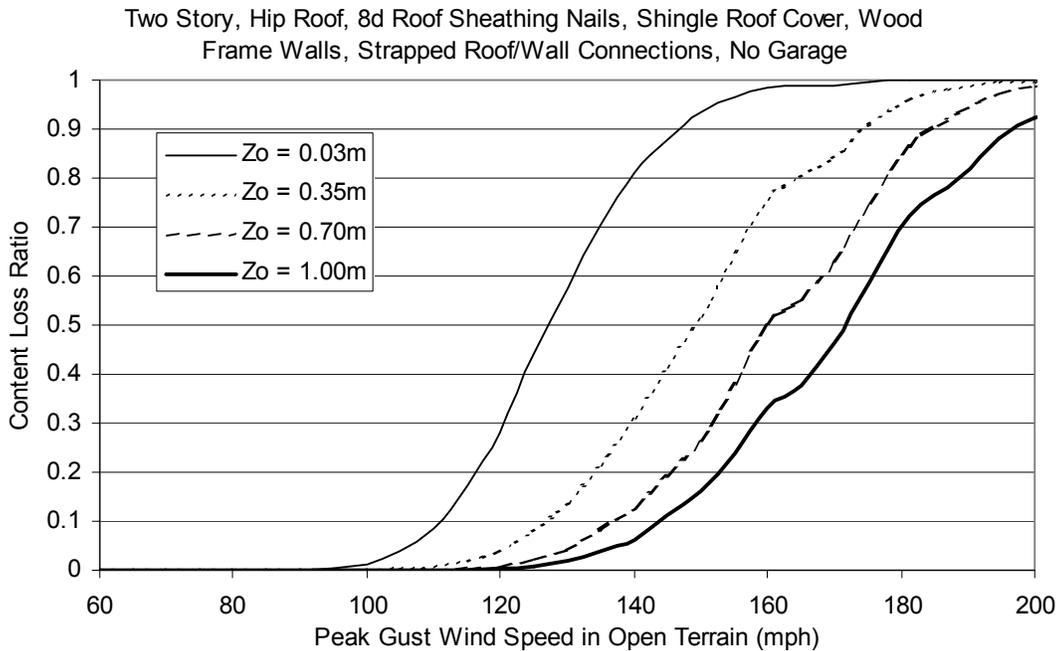
**Figure H.125. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



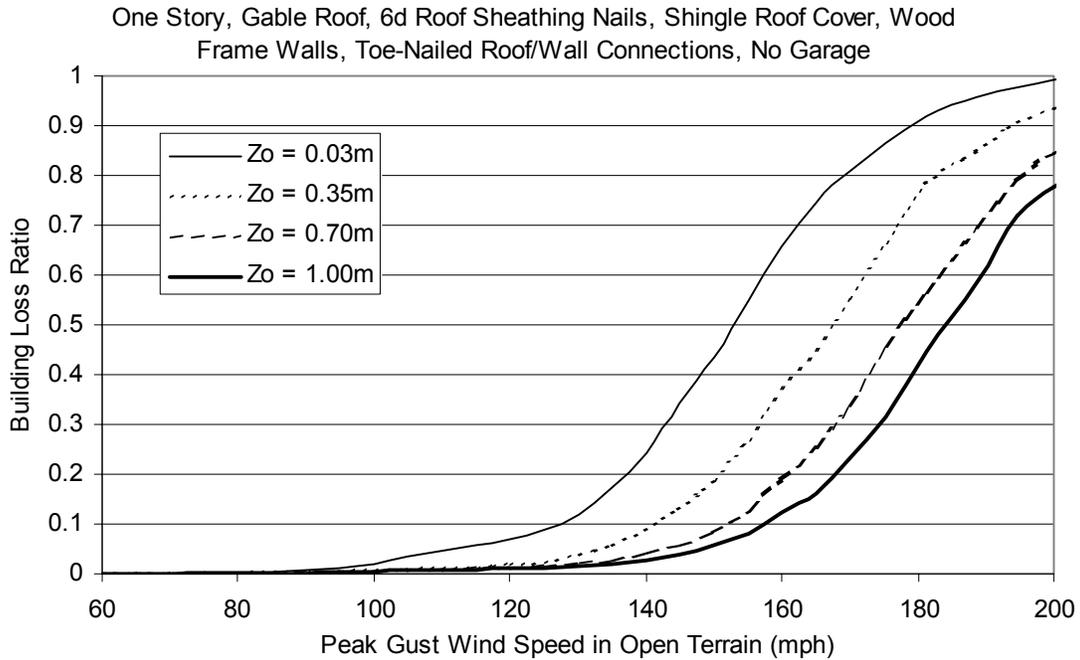
**Figure H.126. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



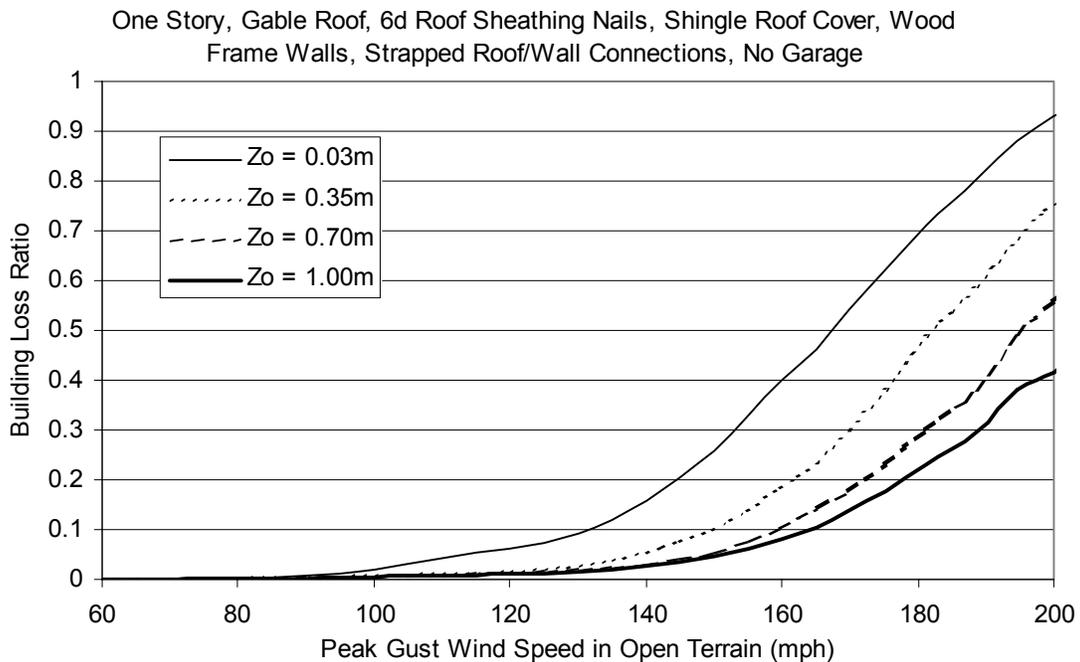
**Figure H.127. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



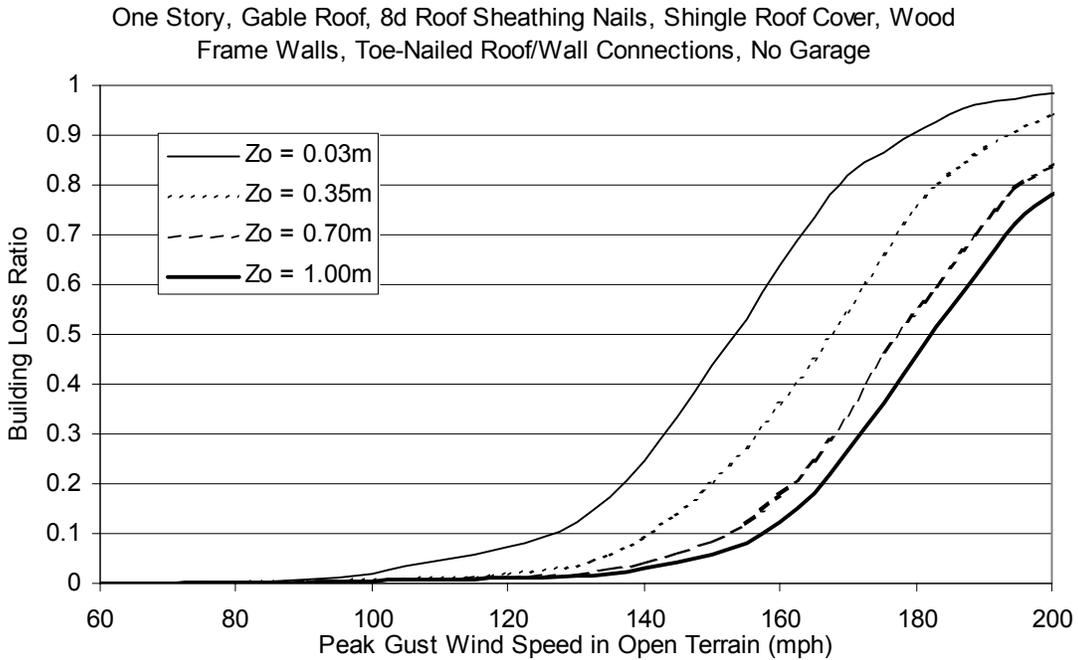
**Figure H.128. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Upgraded Roof and Added Secondary Water Resistance).**



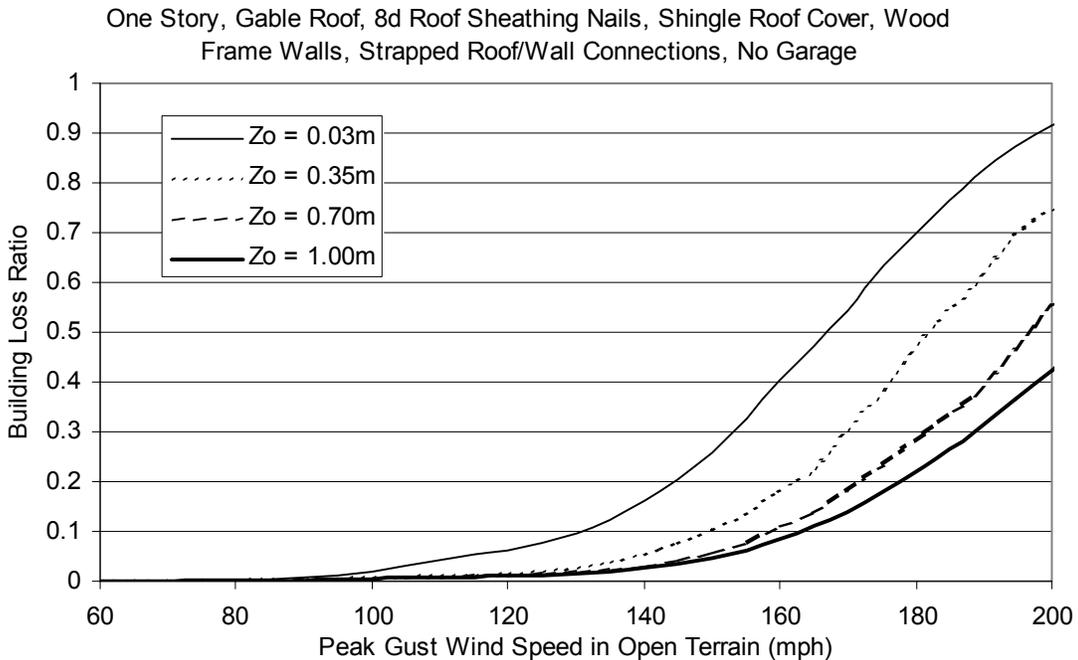
**Figure H.129. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



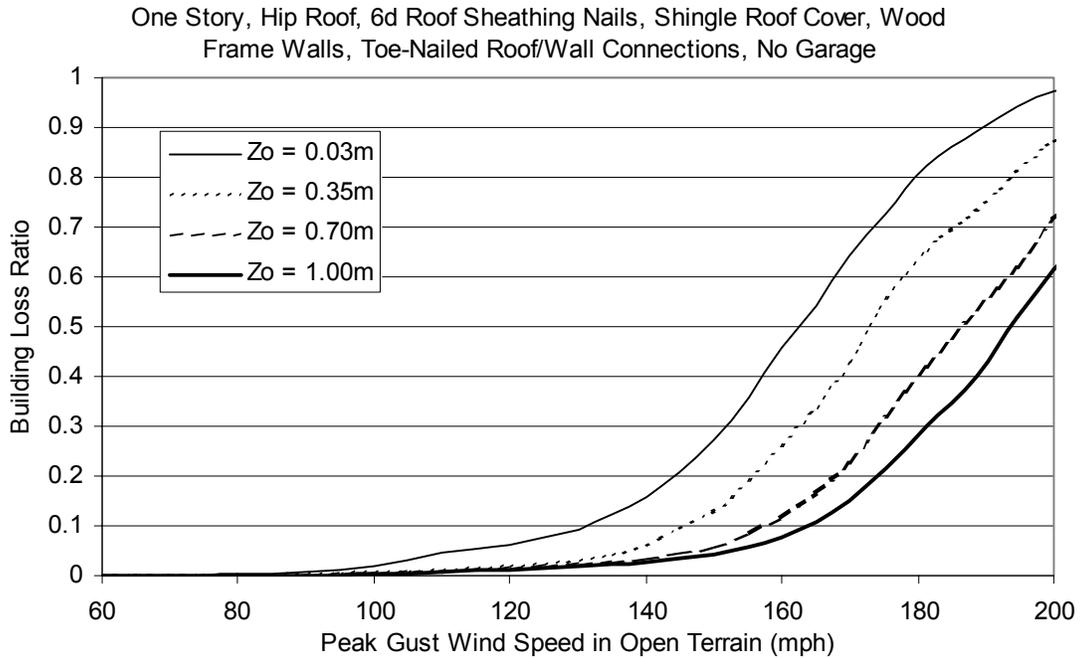
**Figure H.130. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



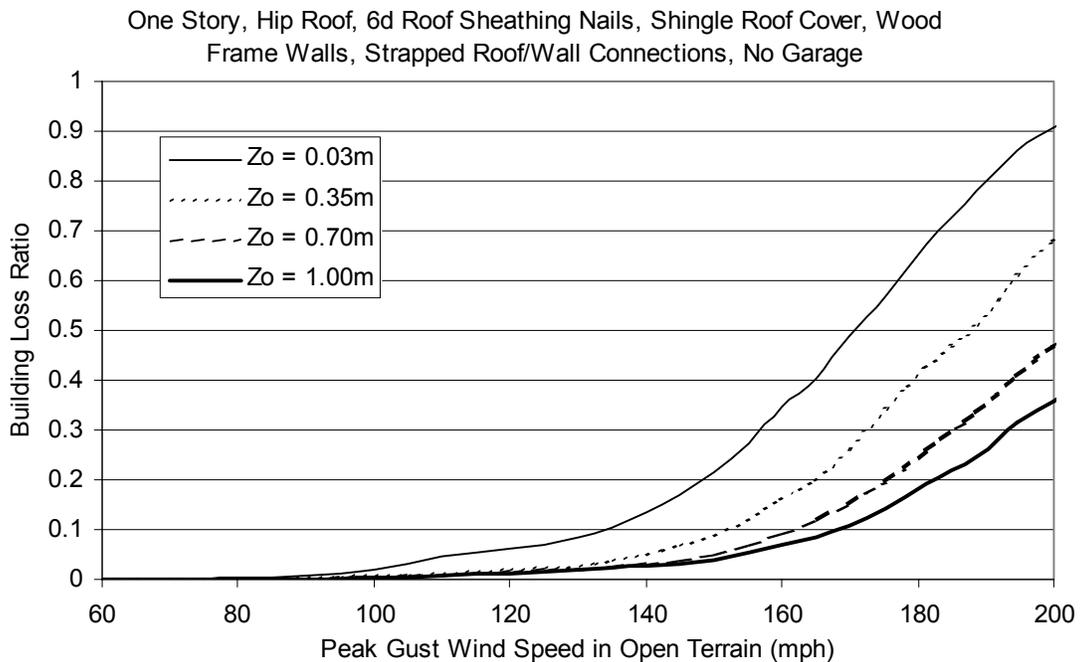
**Figure H.131. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



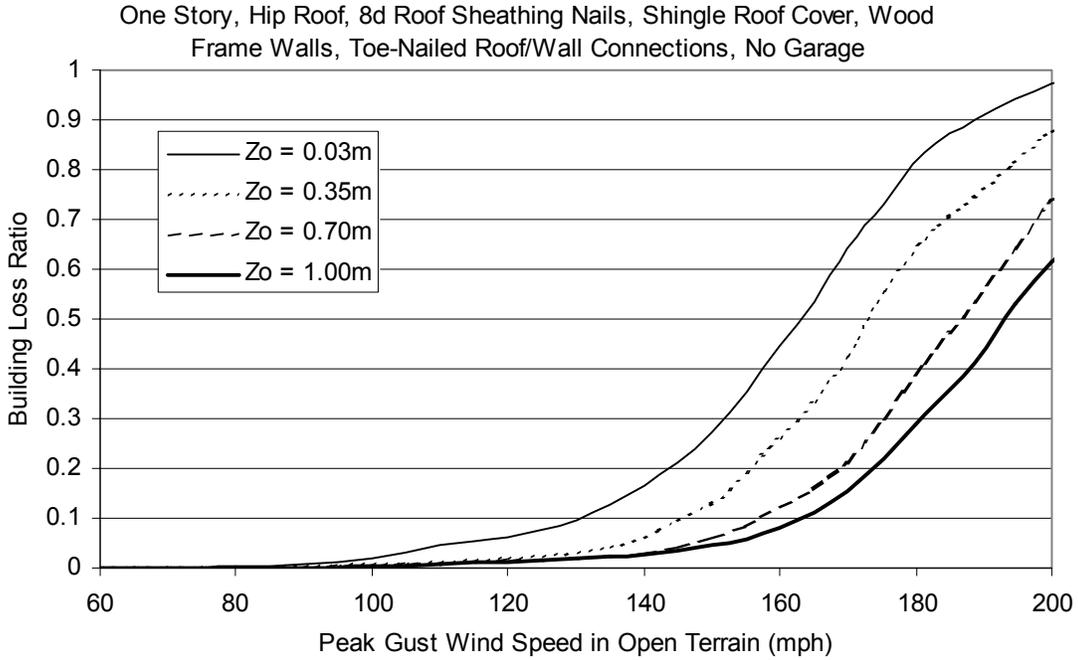
**Figure H.132. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



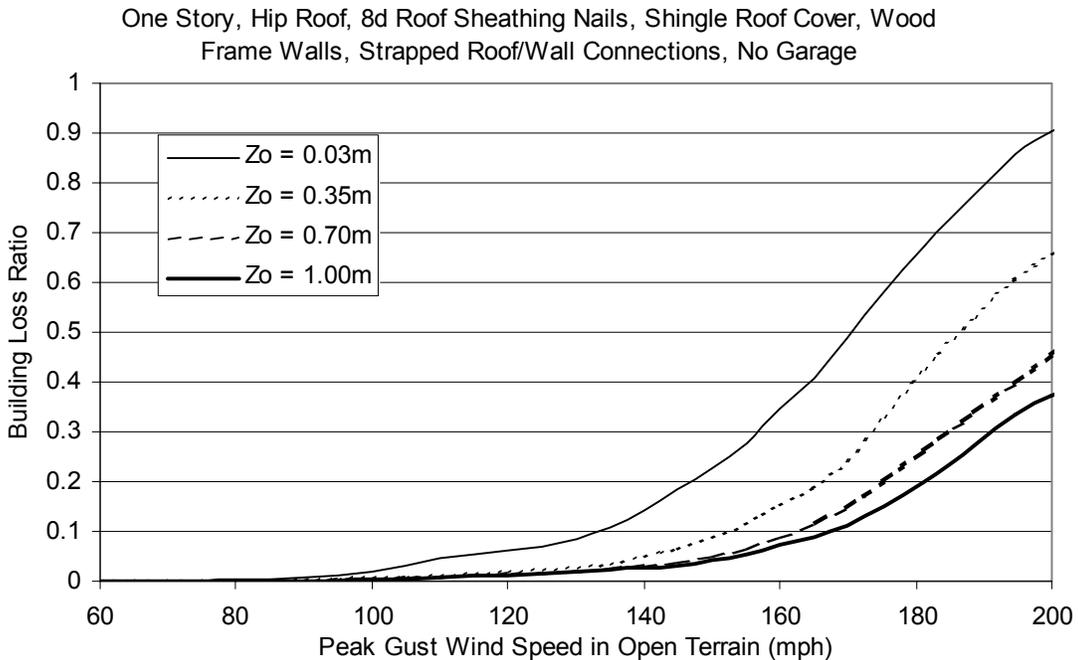
**Figure H.133. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



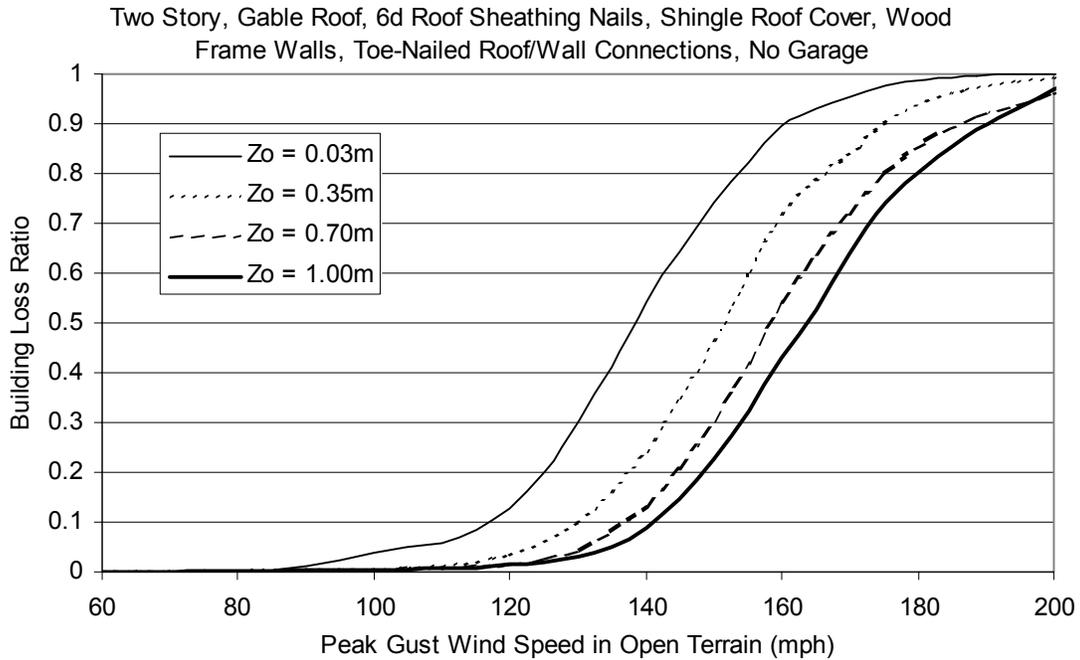
**Figure H.134. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



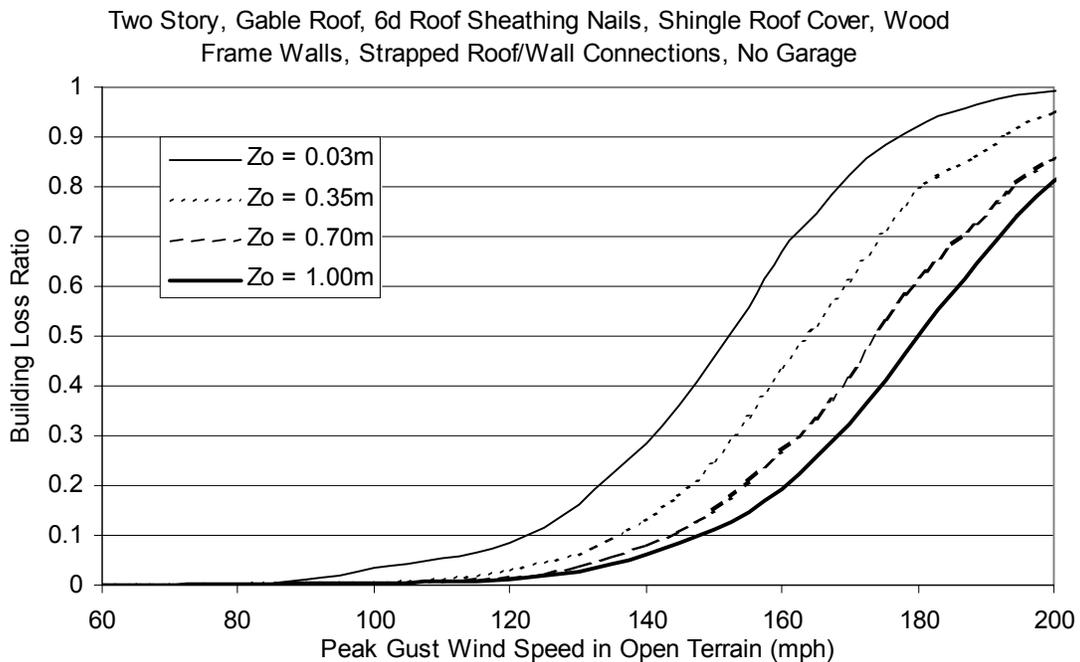
**Figure H.135. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



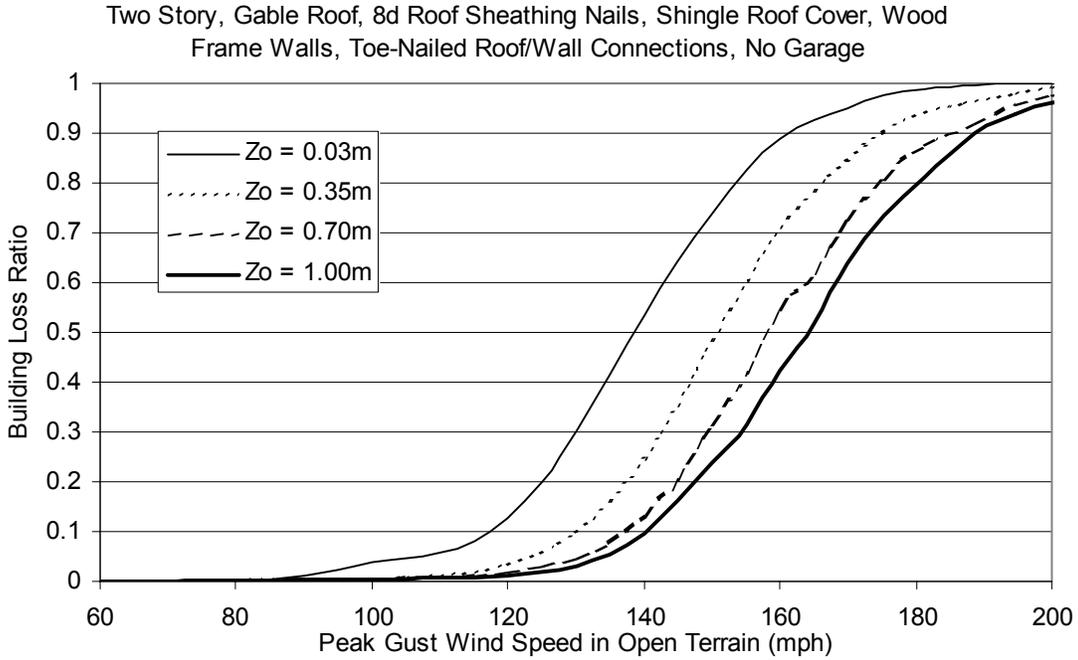
**Figure H.136. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



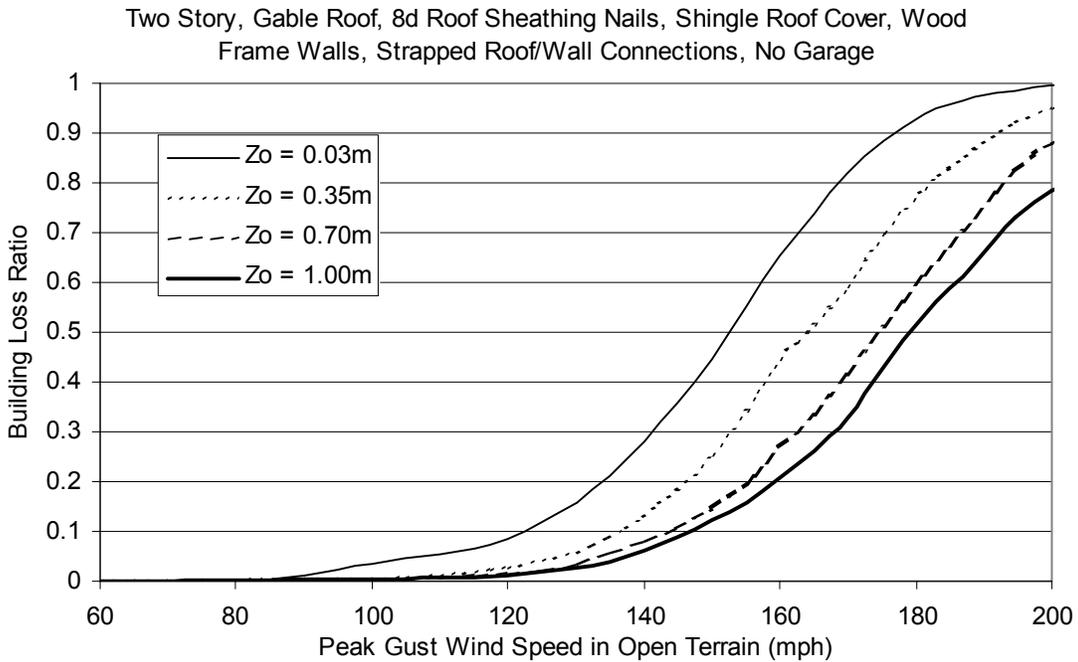
**Figure H.137. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



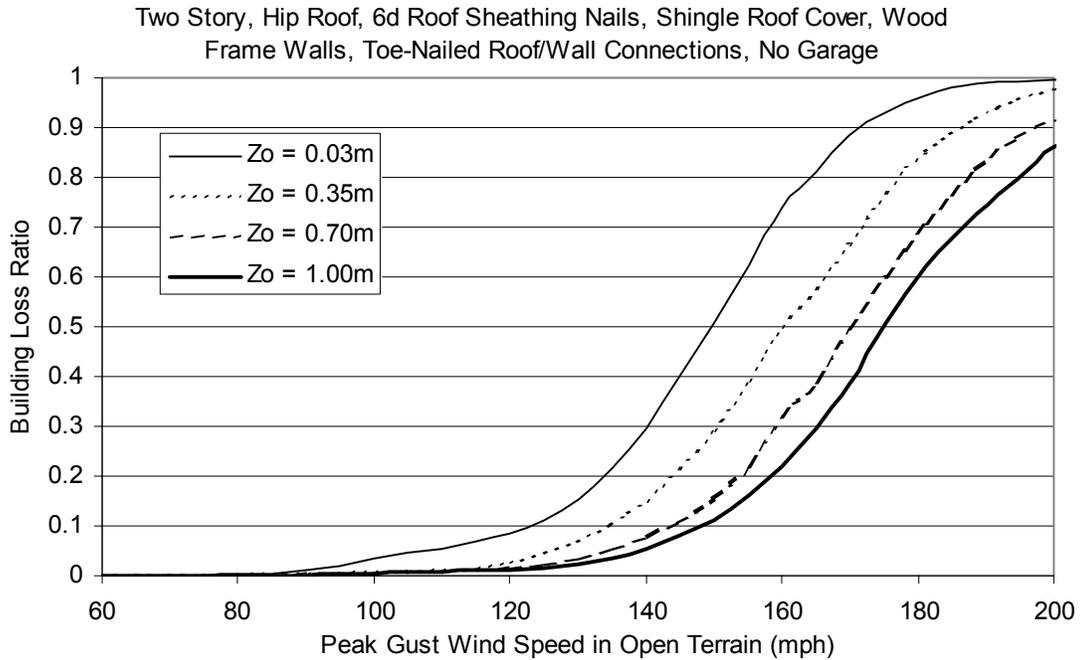
**Figure H.138. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



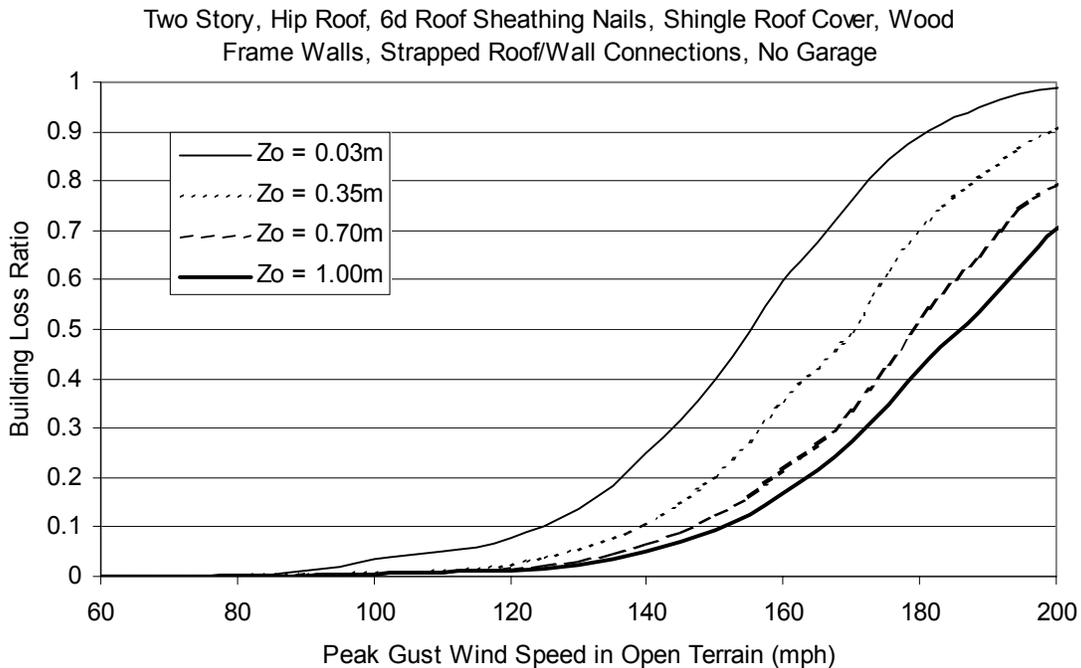
**Figure H.139. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



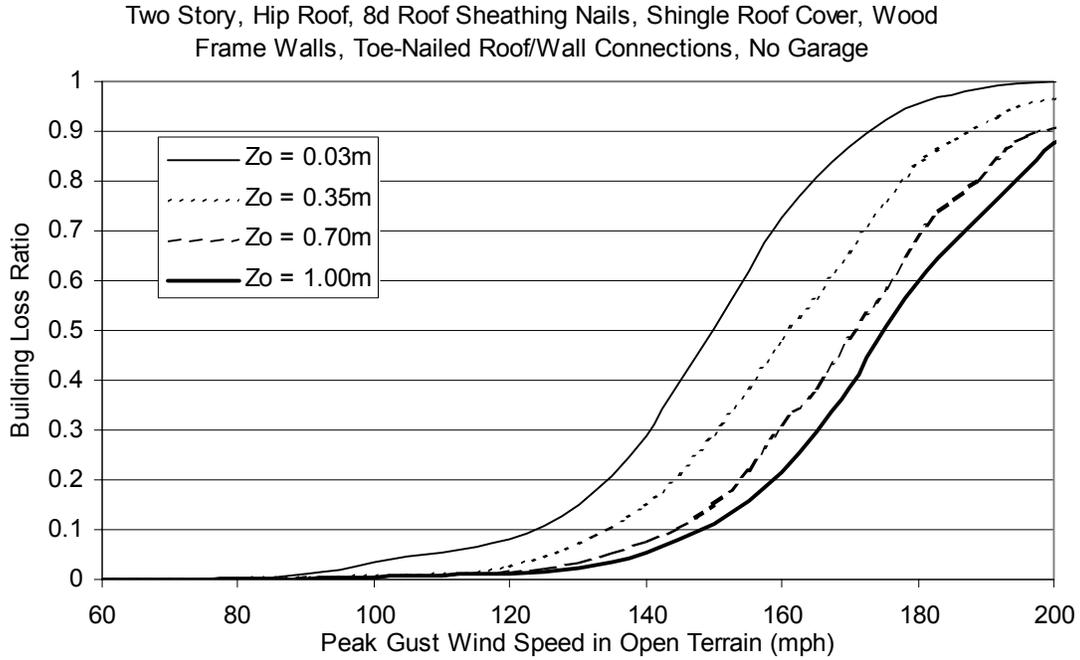
**Figure H.140. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



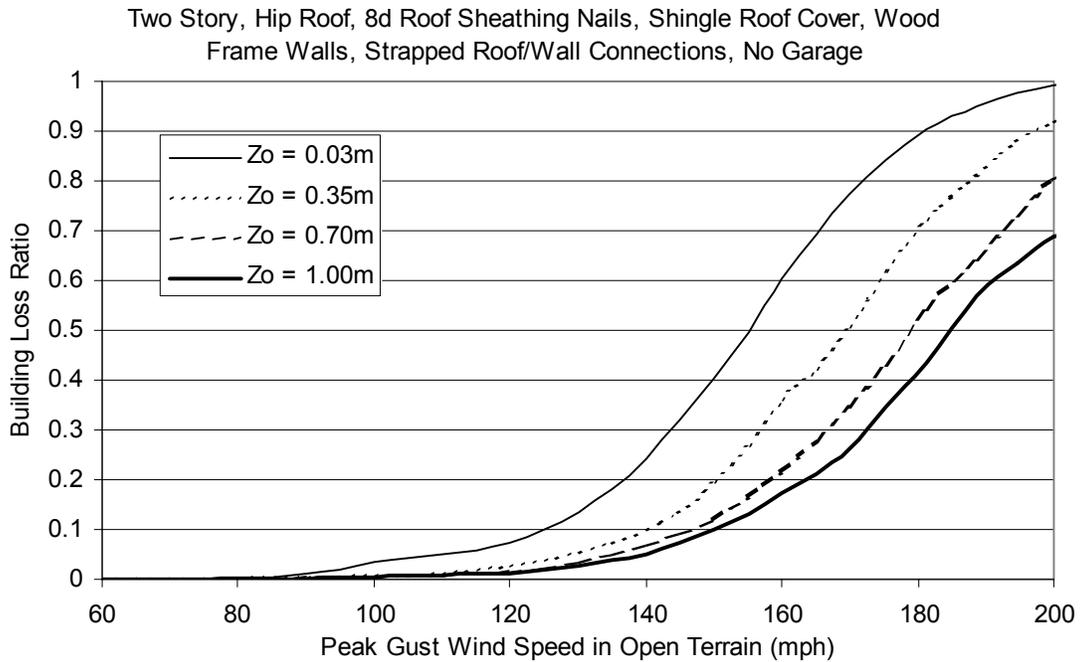
**Figure H.141. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



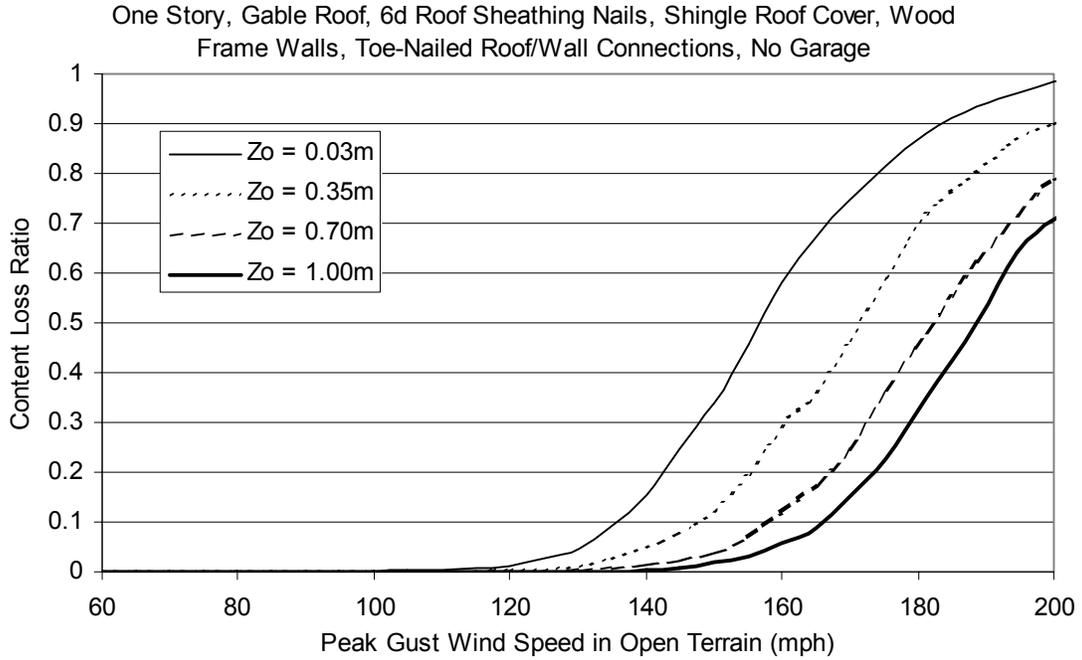
**Figure H.142. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



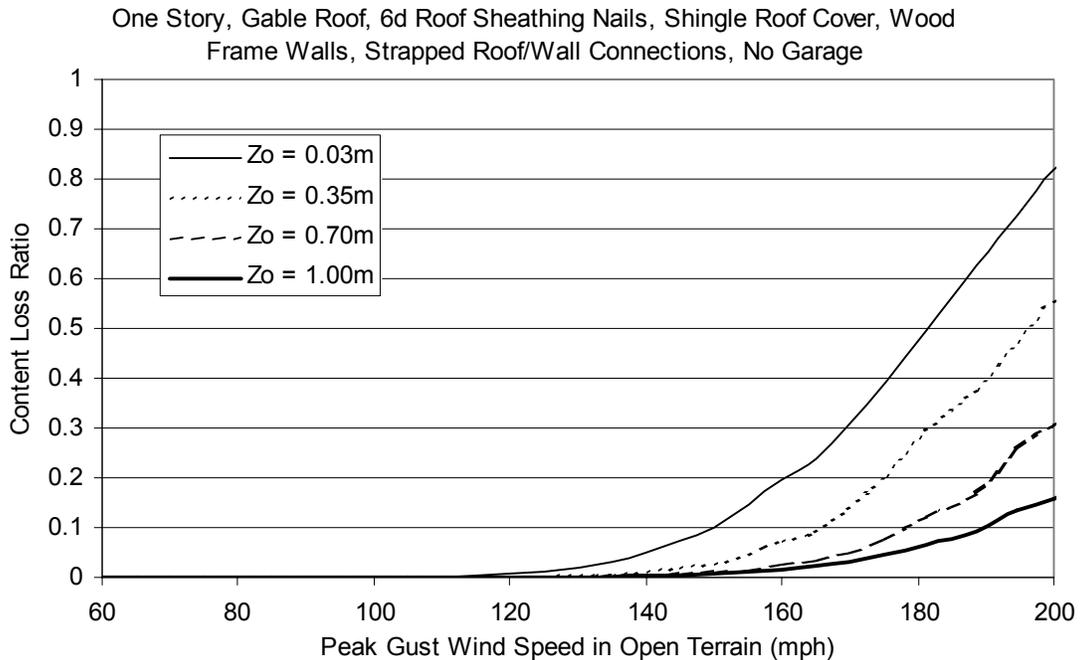
**Figure H.143. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



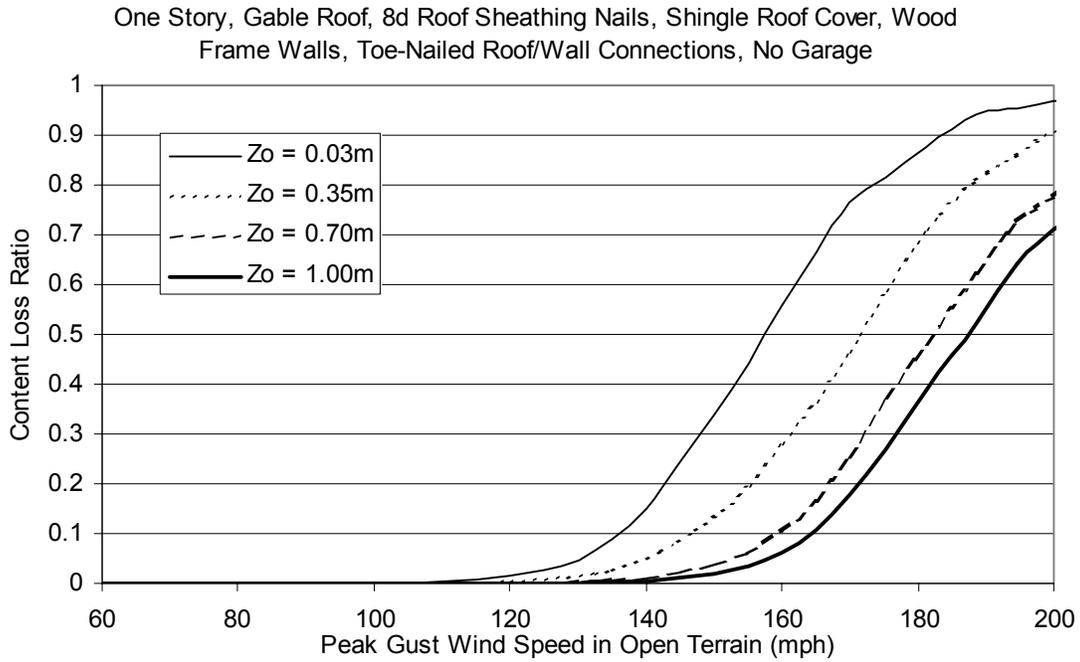
**Figure H.144. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



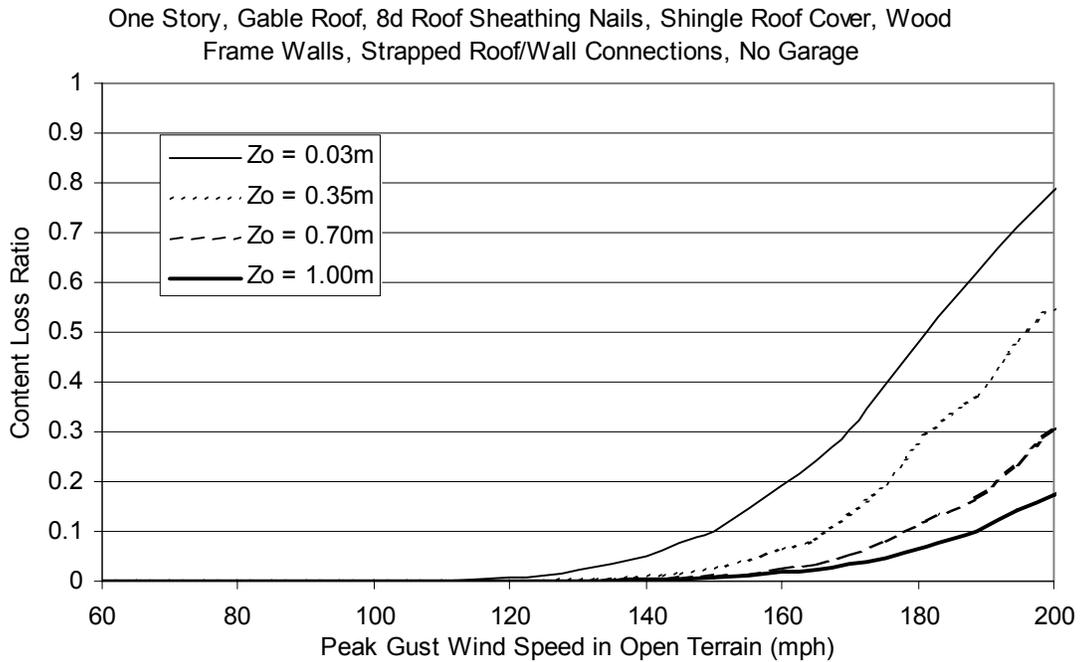
**Figure H.145. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



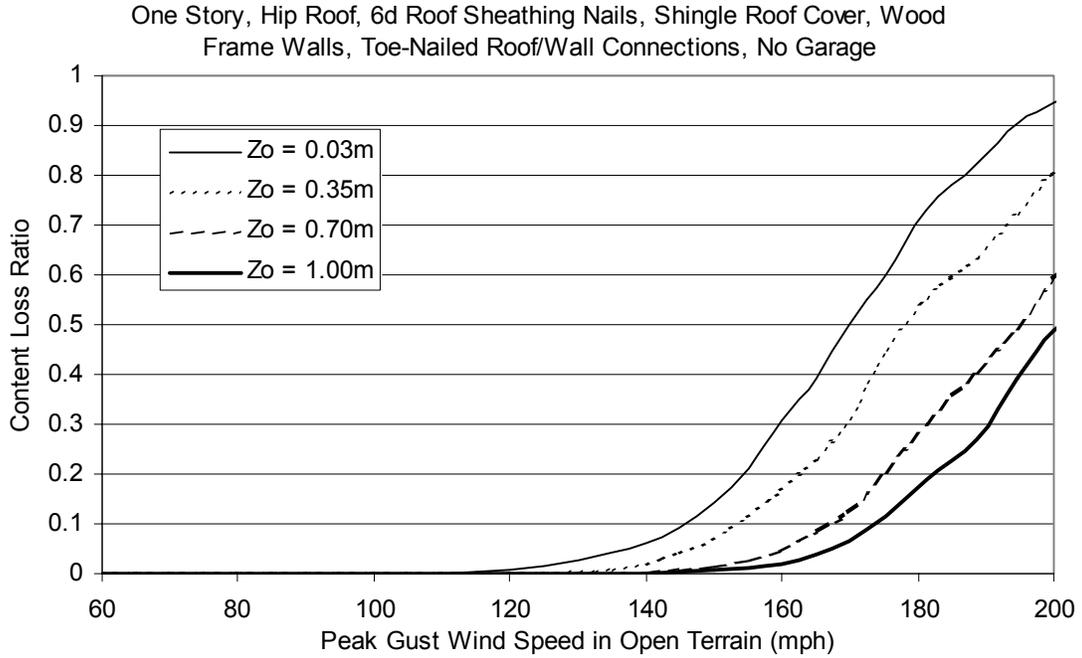
**Figure H.146. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



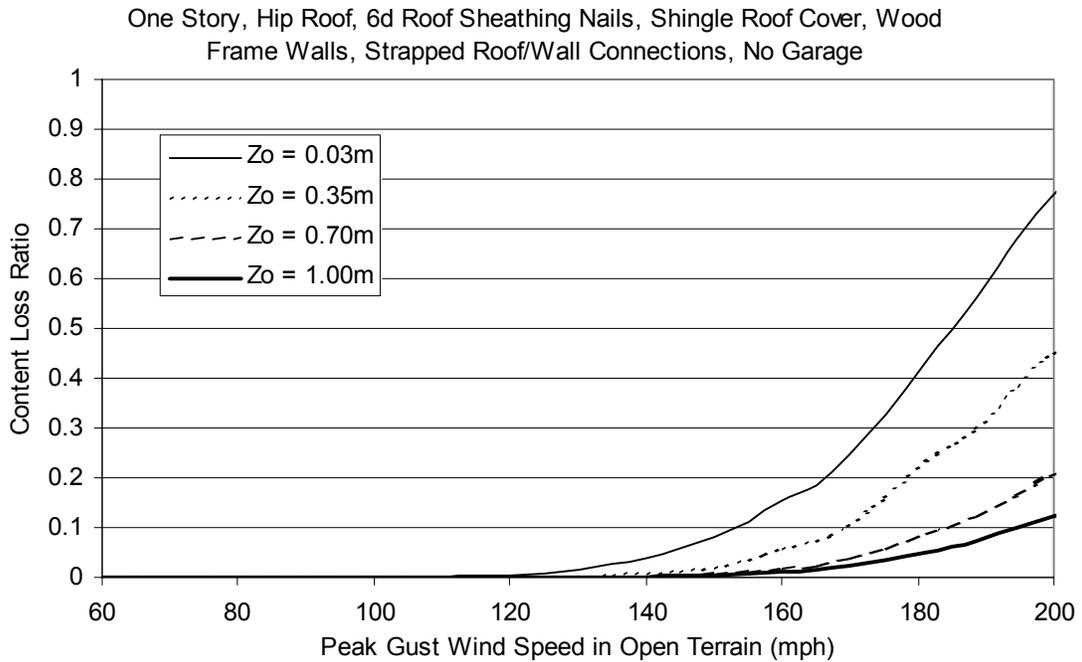
**Figure H.147. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



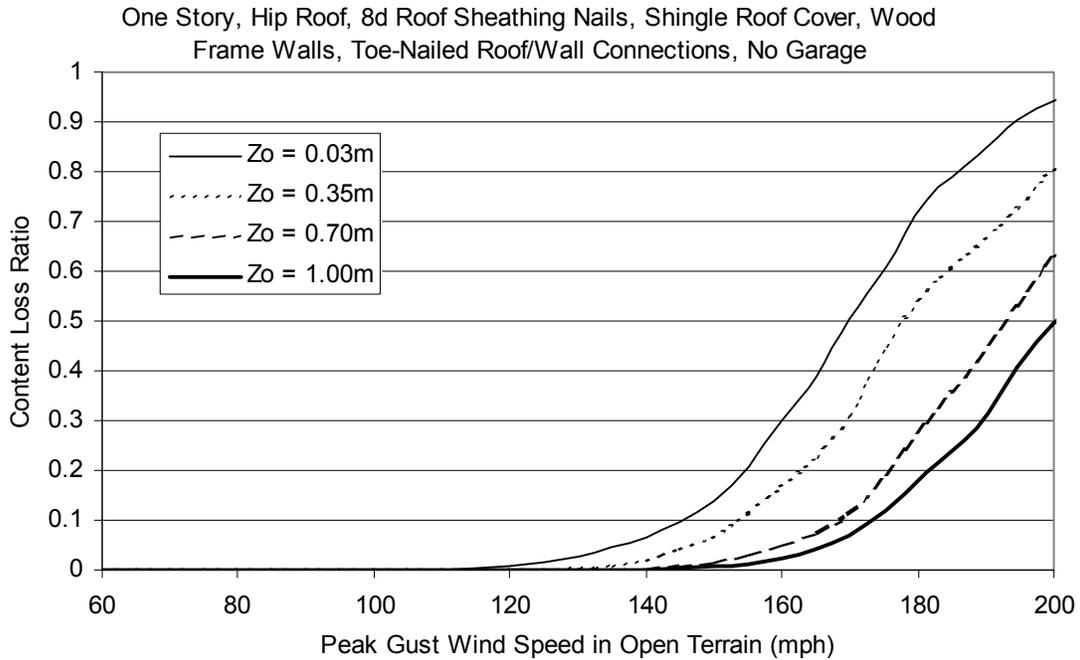
**Figure H.148. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



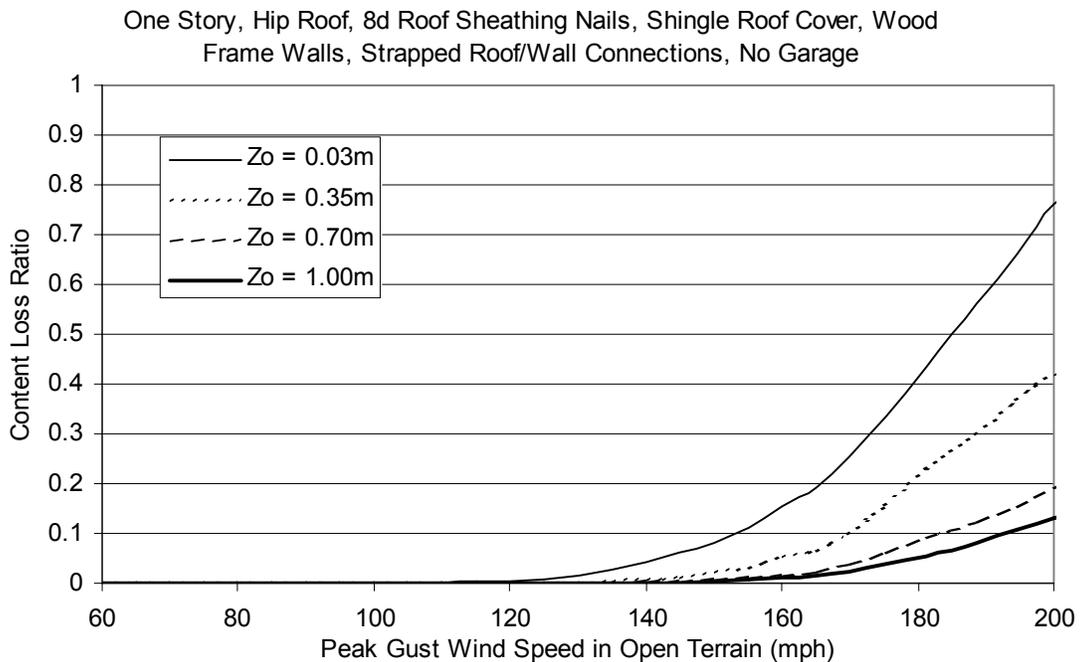
**Figure H.149. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



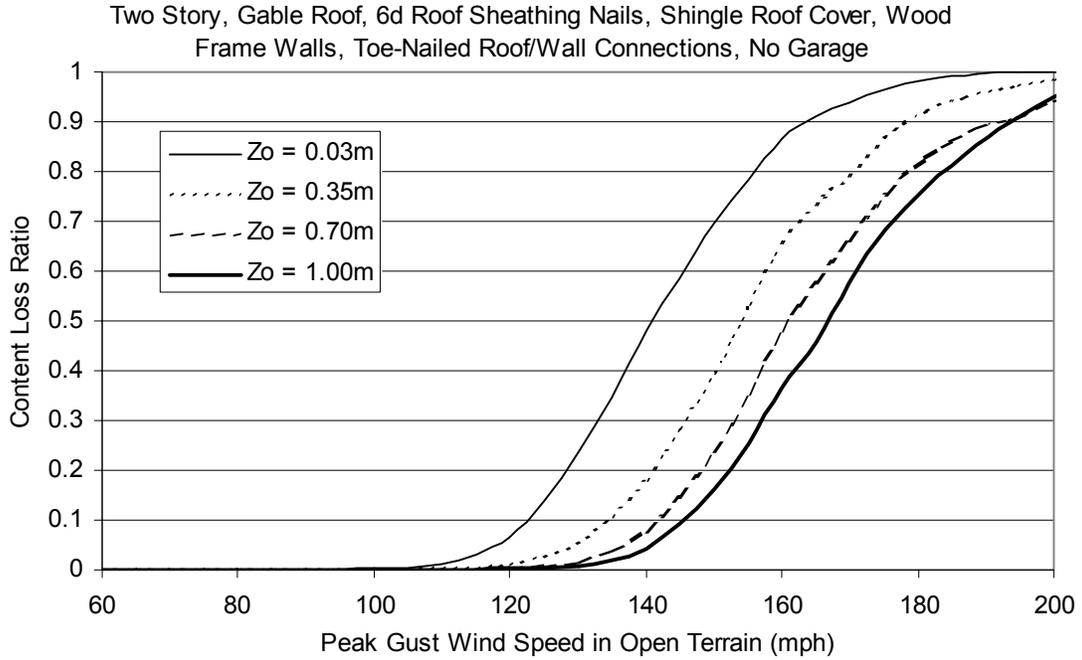
**Figure H.150. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



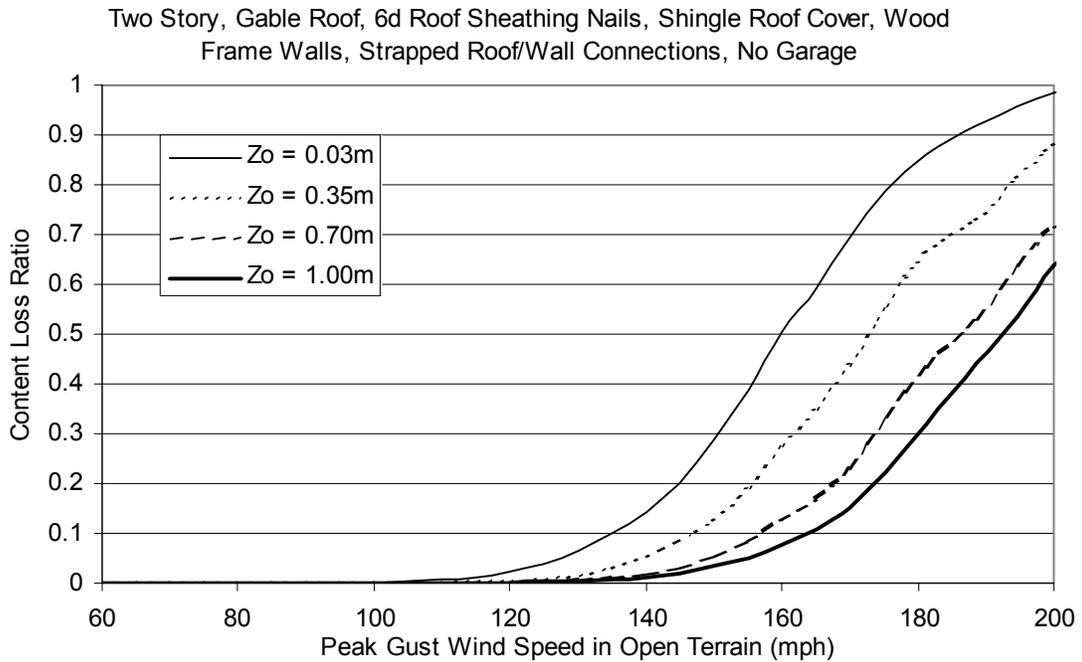
**Figure H.151. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



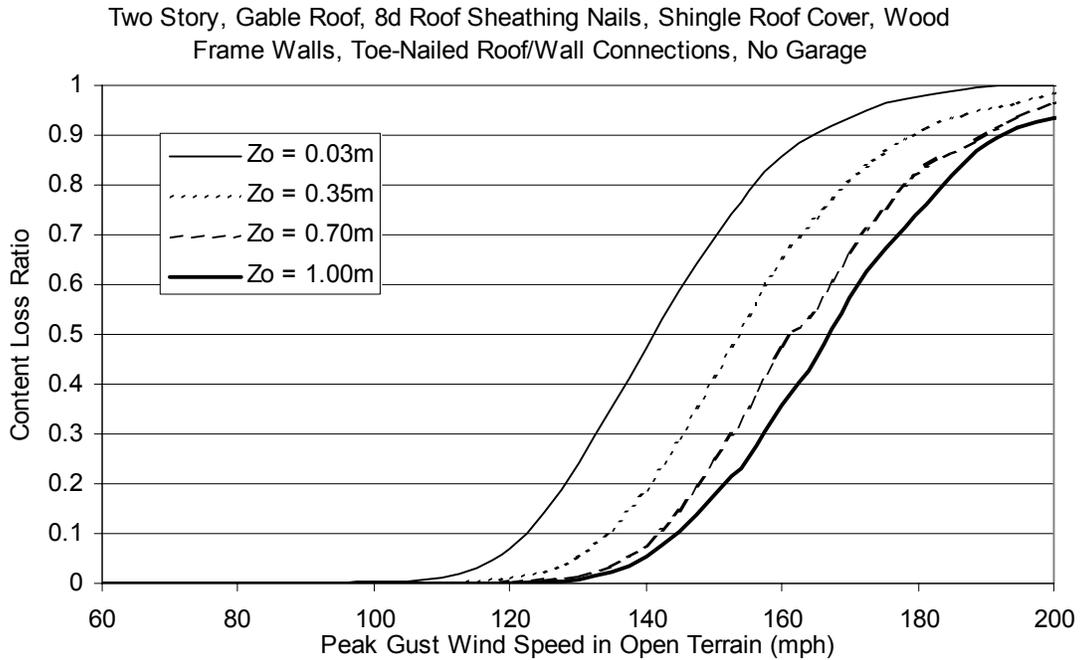
**Figure H.152. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



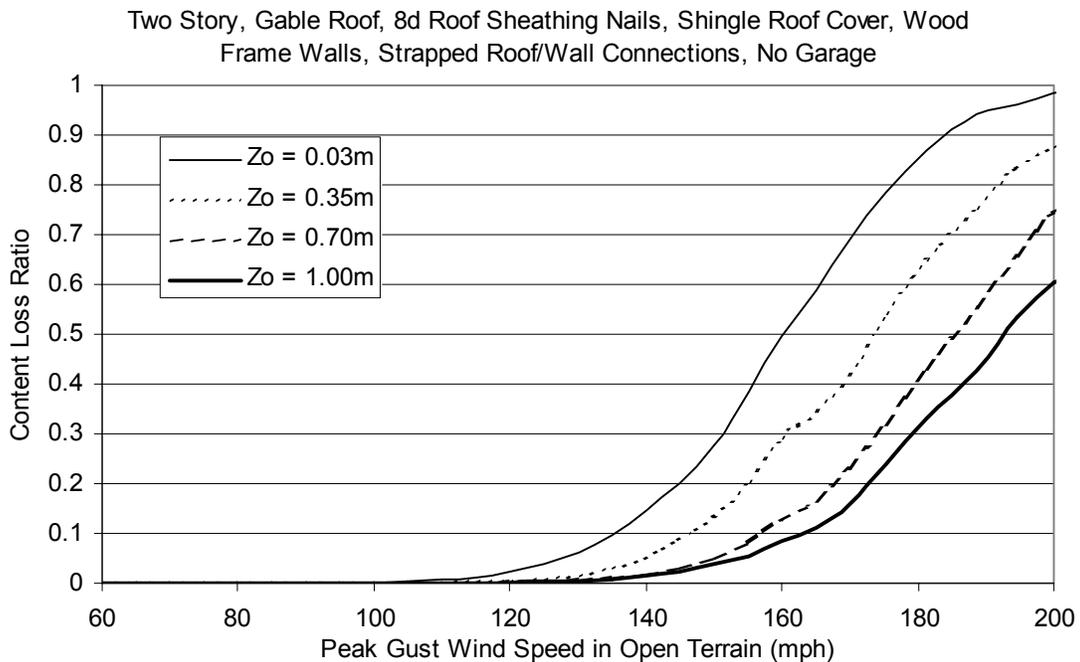
**Figure H.153. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



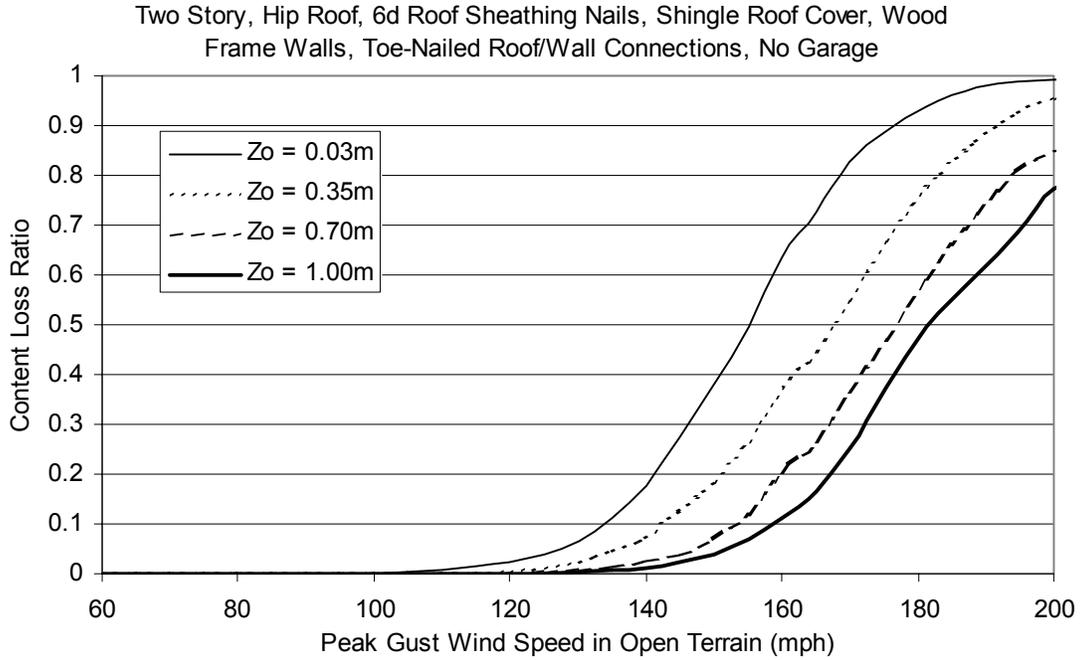
**Figure H.154. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



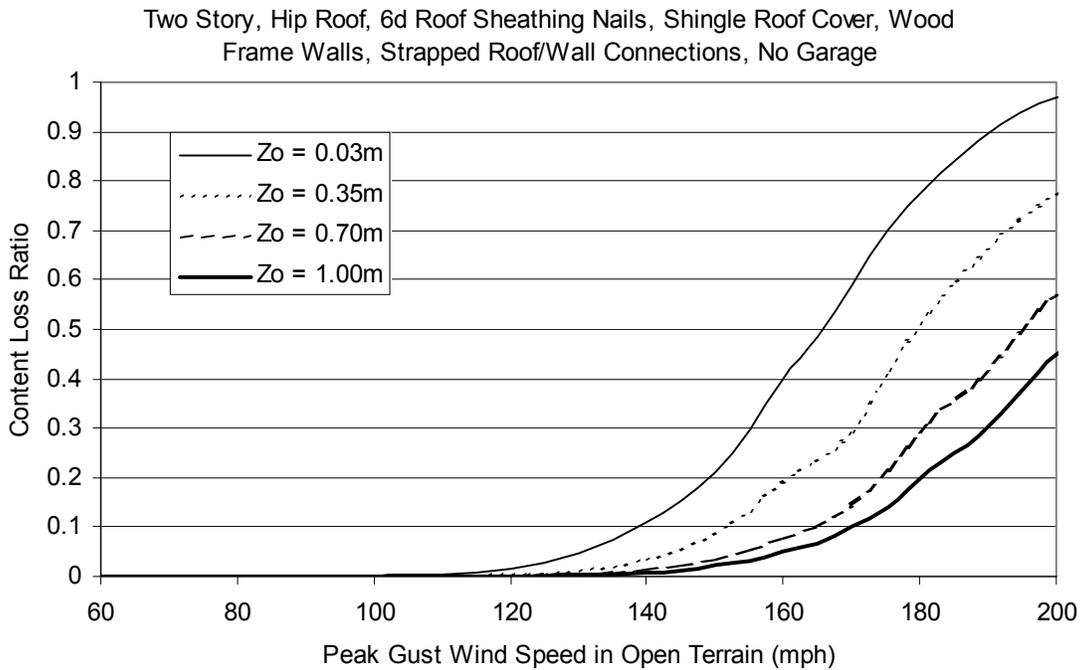
**Figure H.155. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



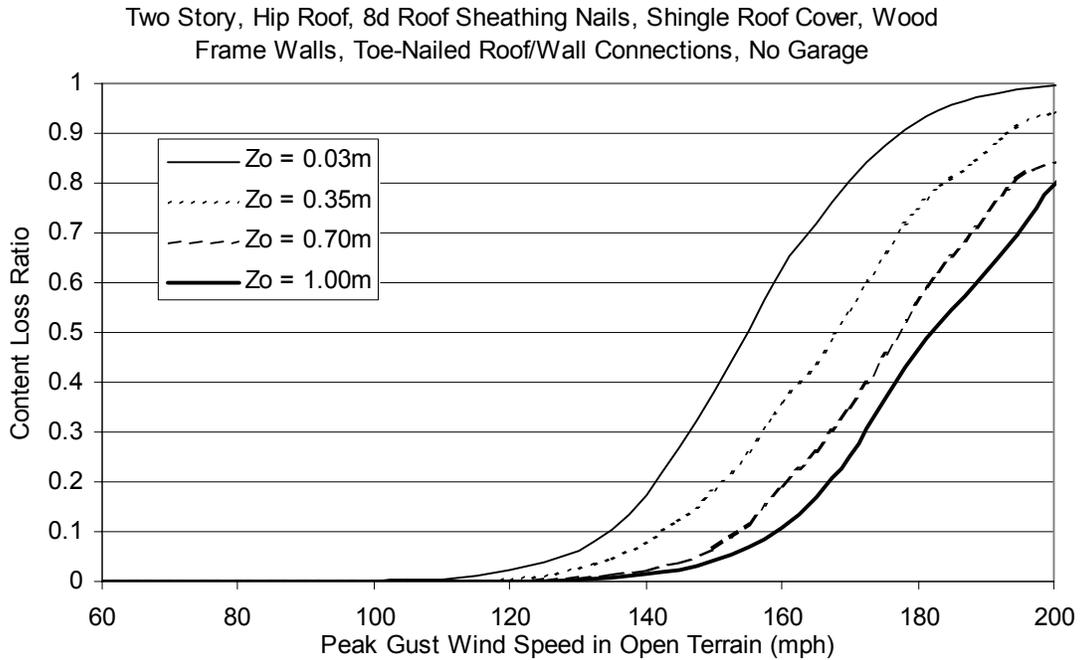
**Figure H.156. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



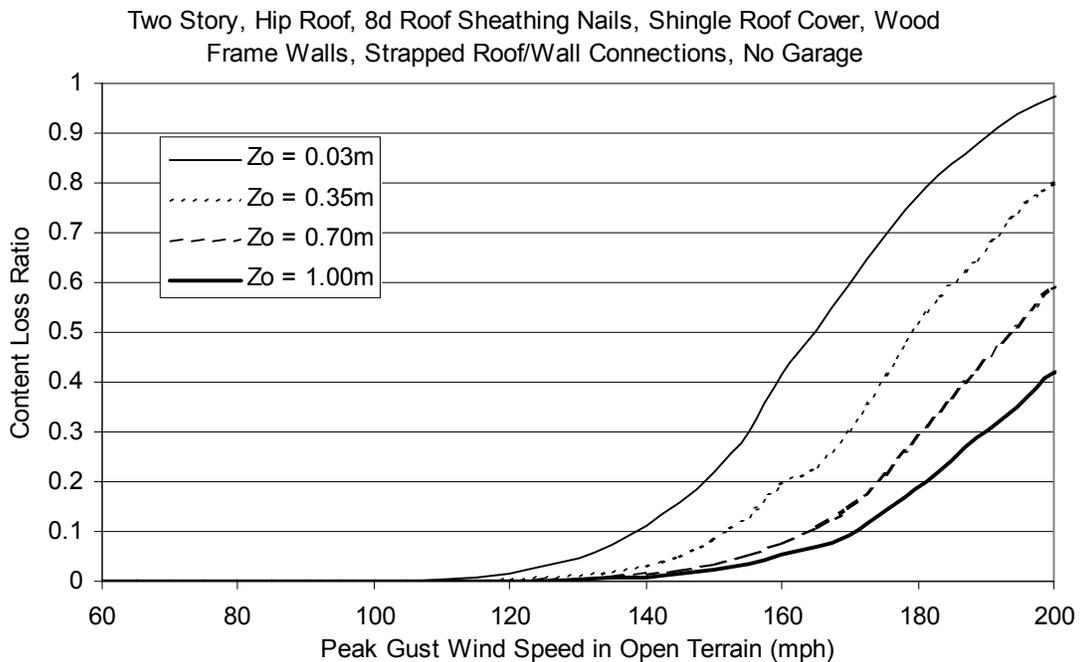
**Figure H.157. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



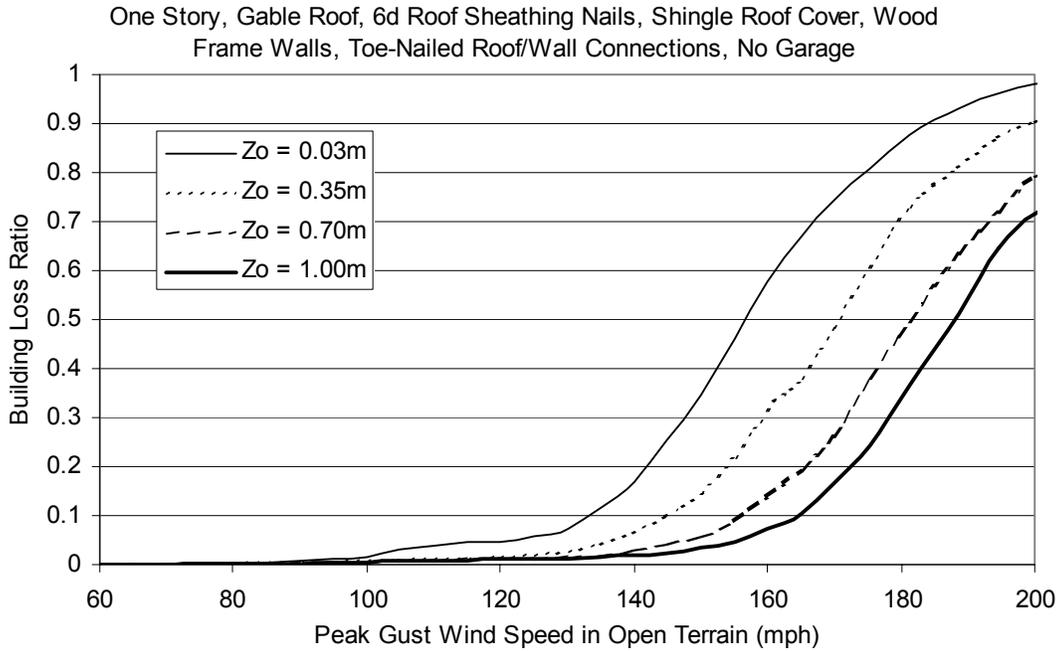
**Figure H.158. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



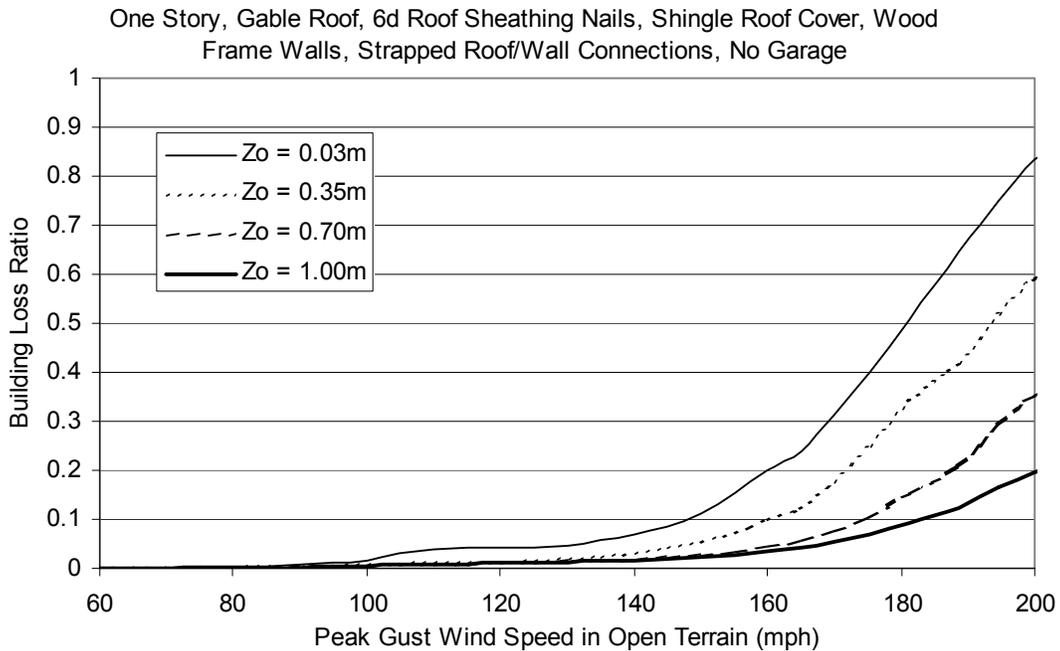
**Figure H.159. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



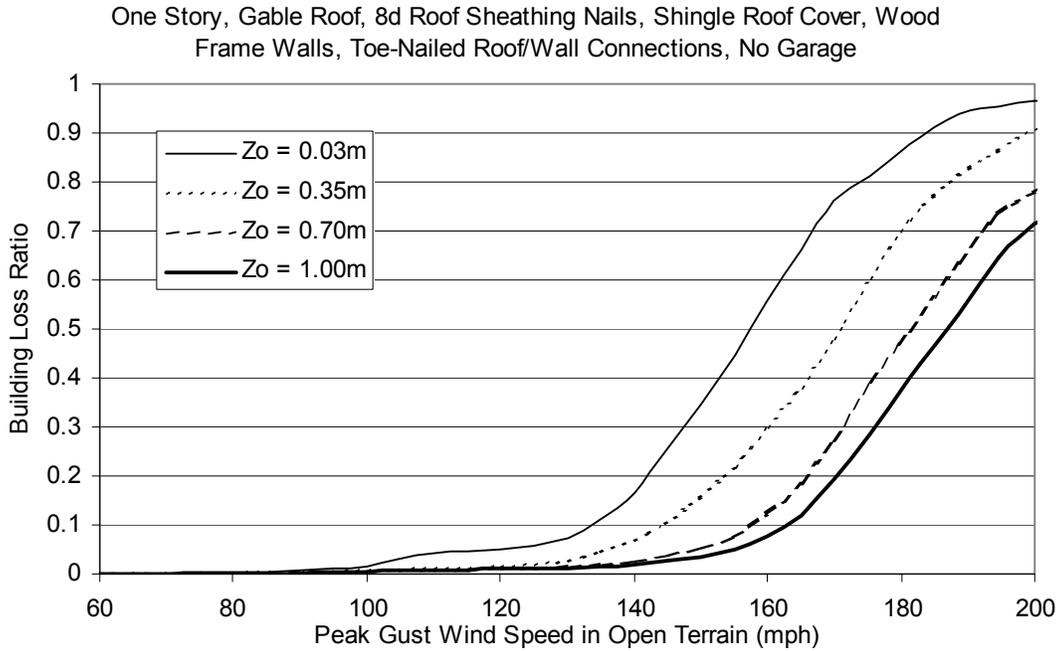
**Figure H.160. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters and Upgraded Roof).**



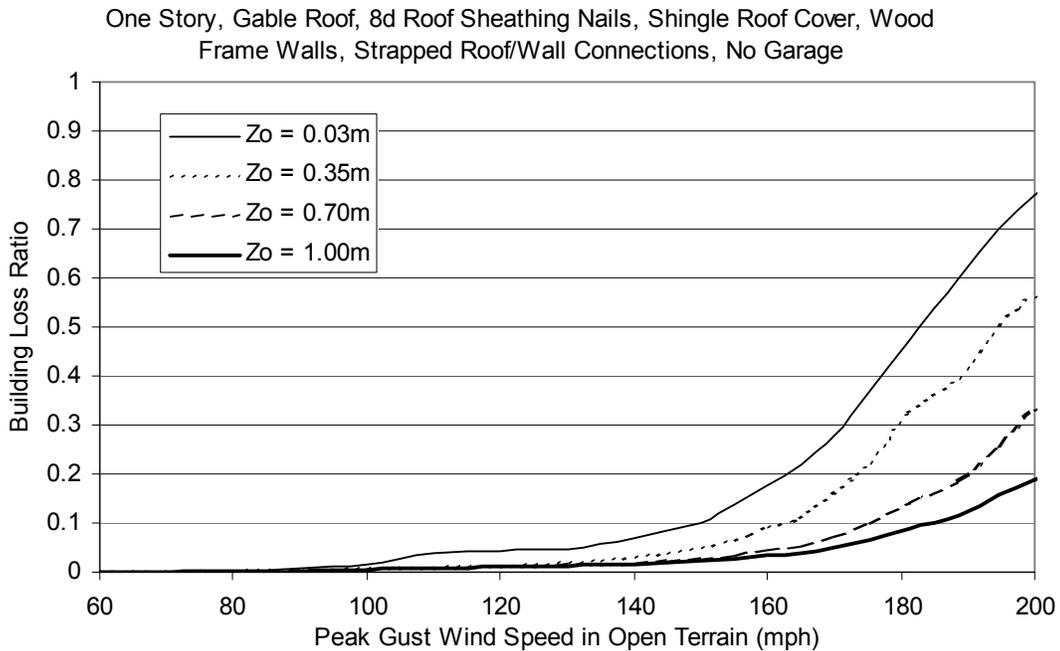
**Figure H.161. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



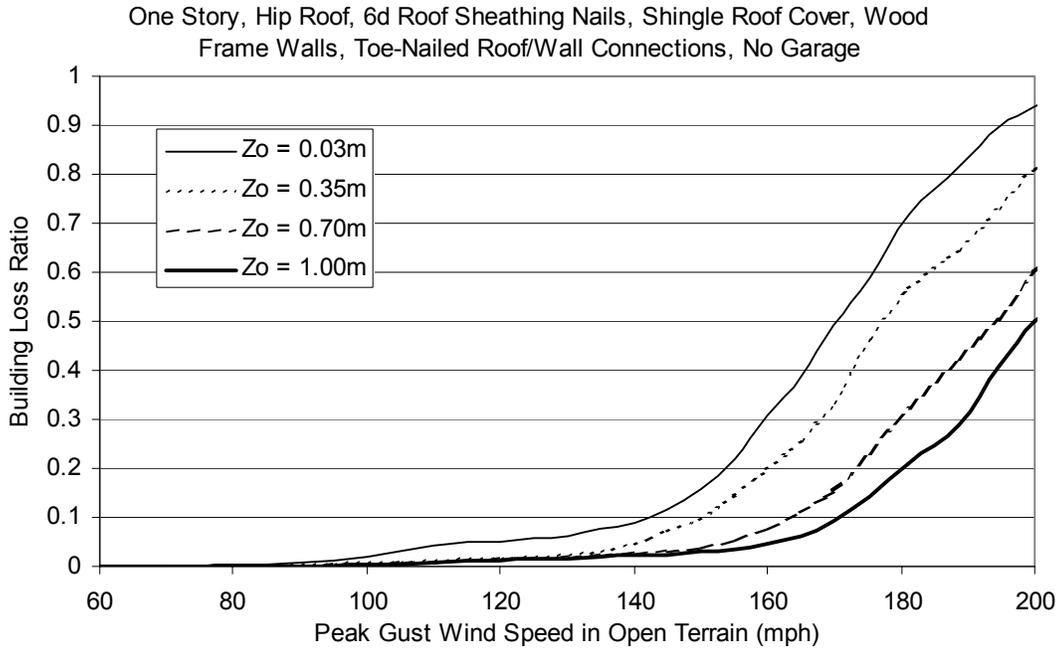
**Figure H.162. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



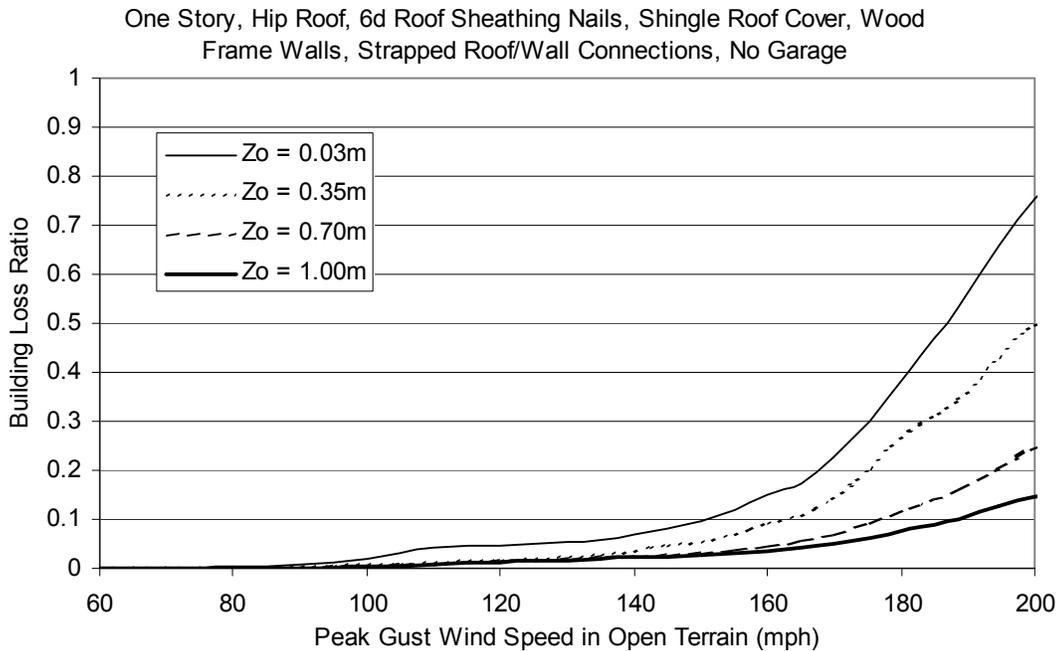
**Figure H.163. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



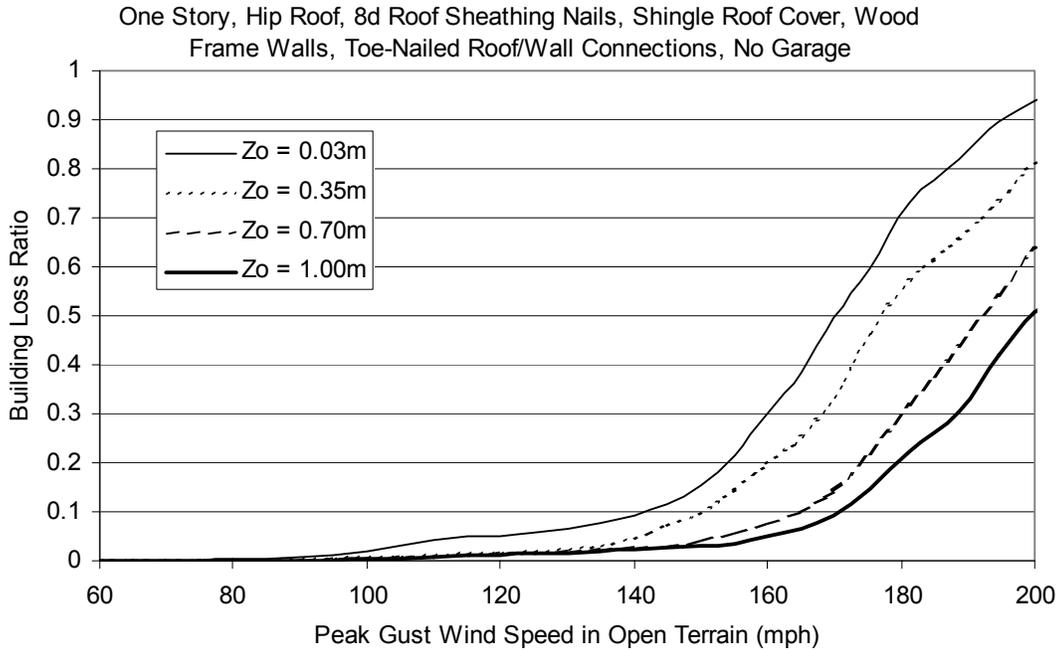
**Figure H.164. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



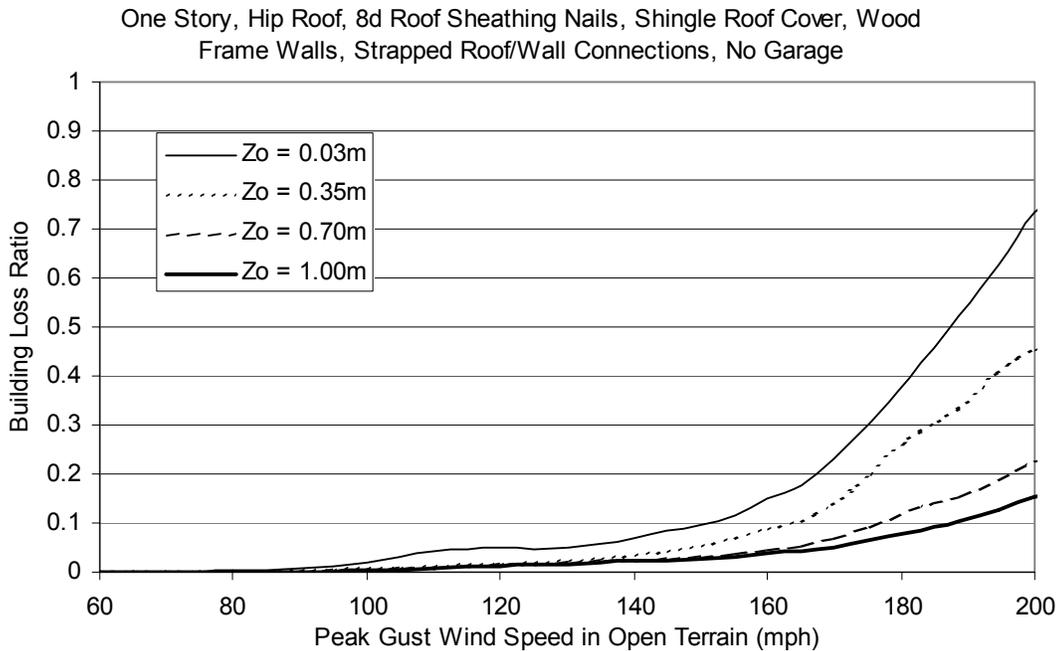
**Figure H.165. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



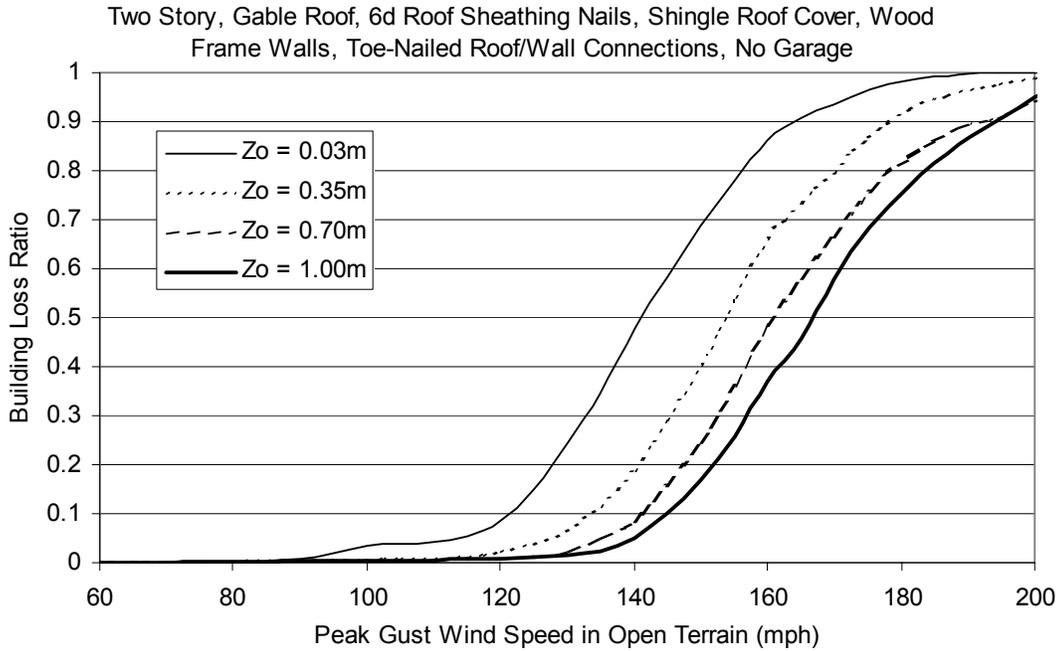
**Figure H.166. Building Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



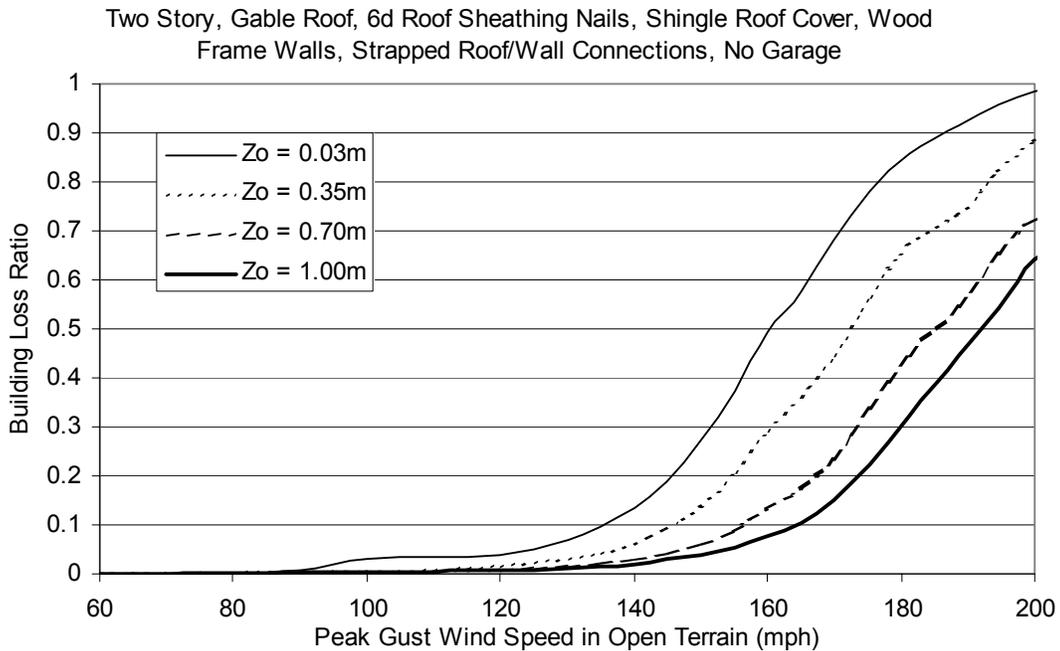
**Figure H.167. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



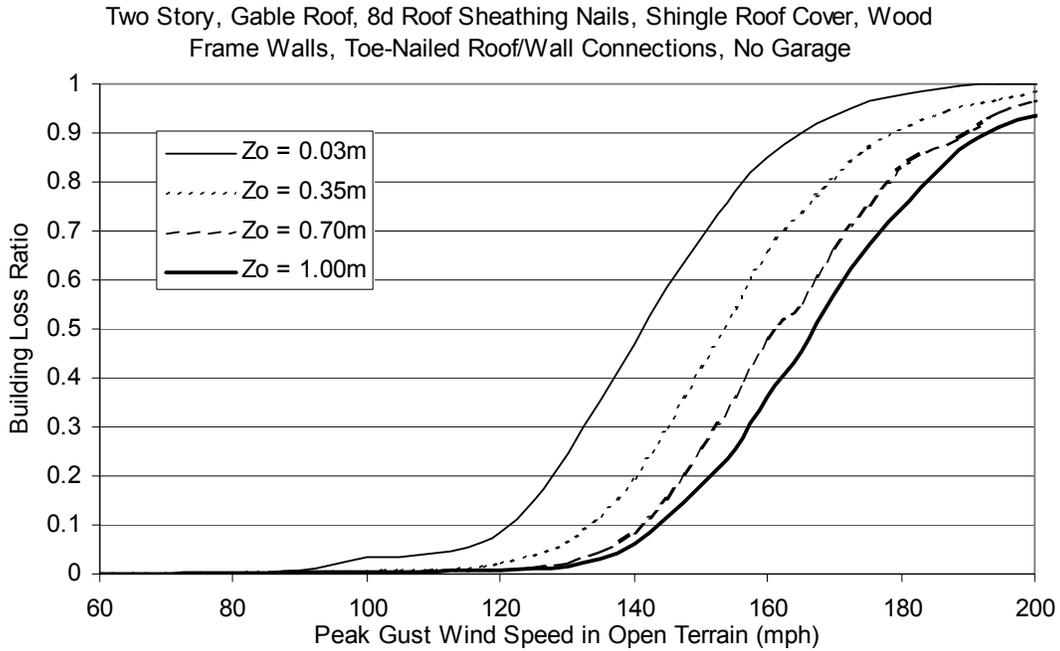
**Figure H.168. Building Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



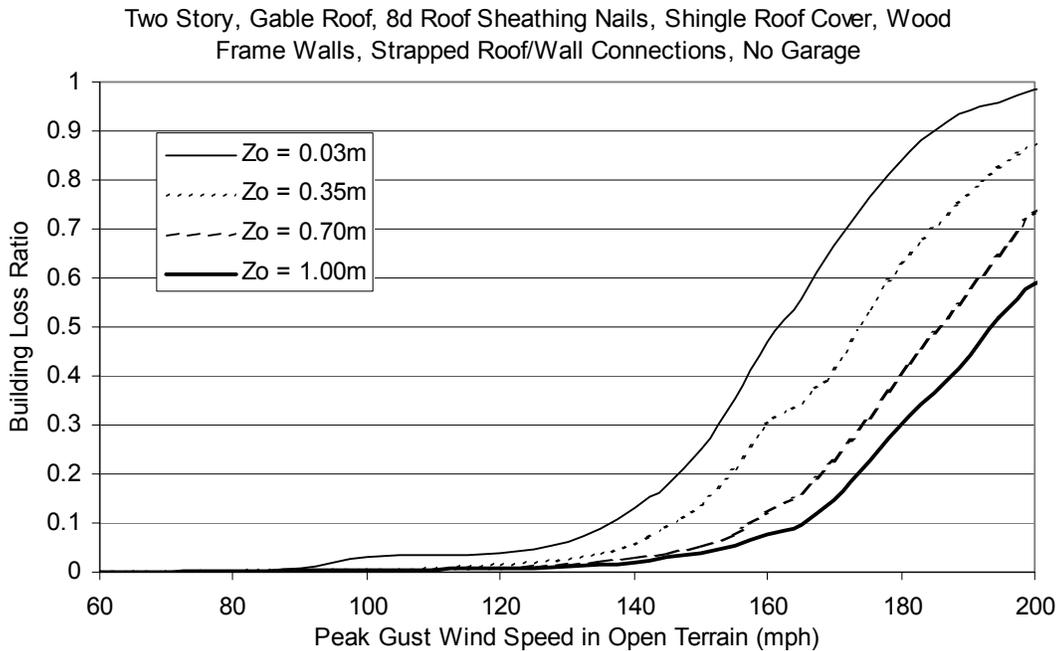
**Figure H.169. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



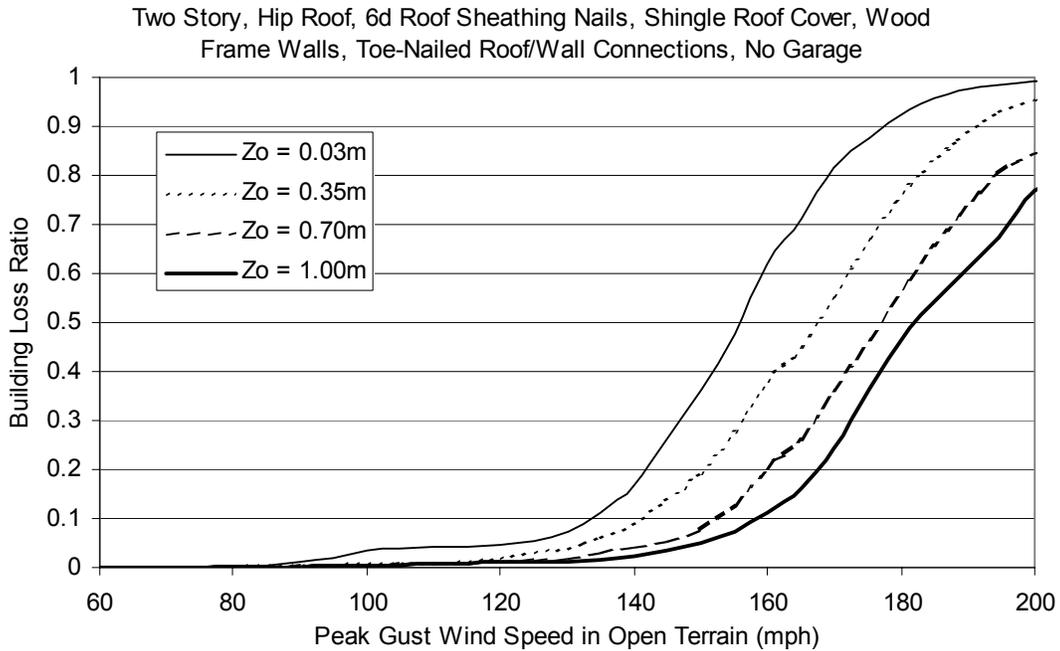
**Figure H.170. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



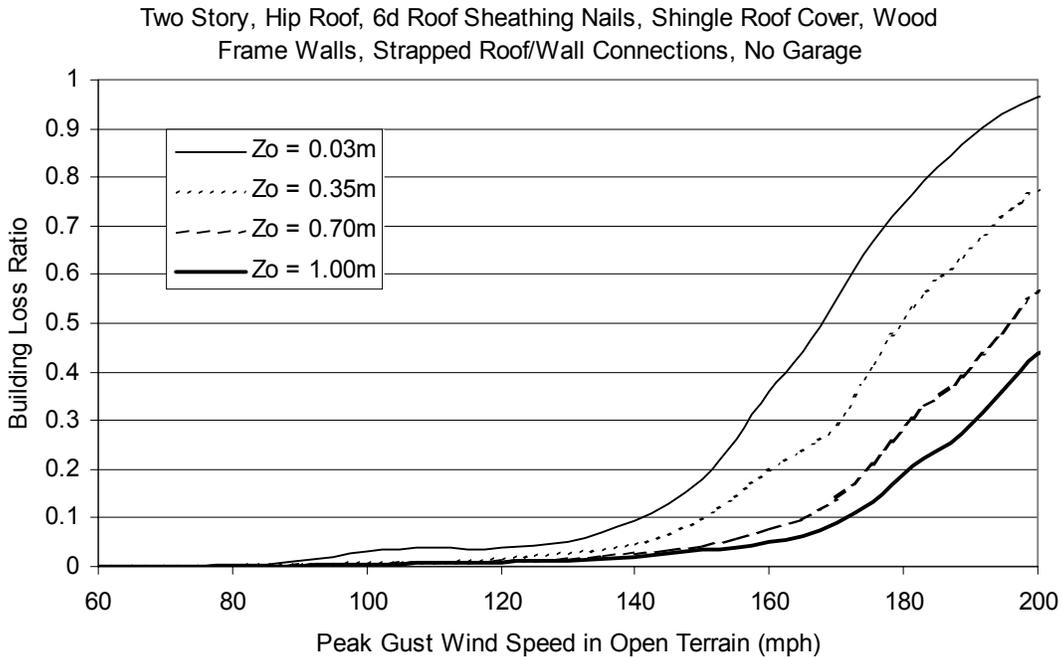
**Figure H.171. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



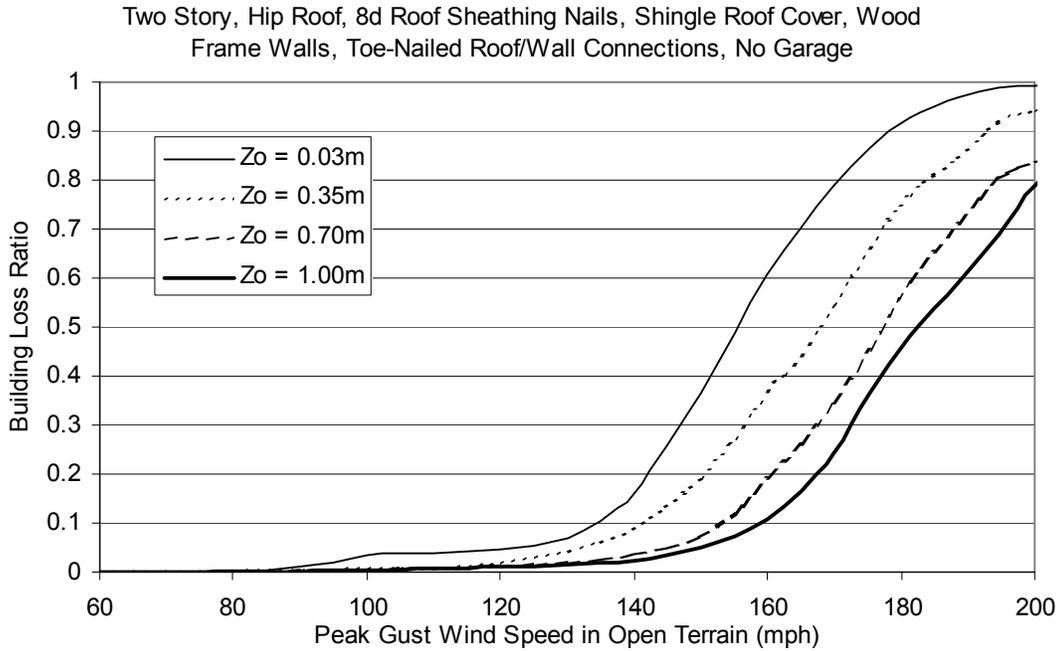
**Figure H.172. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



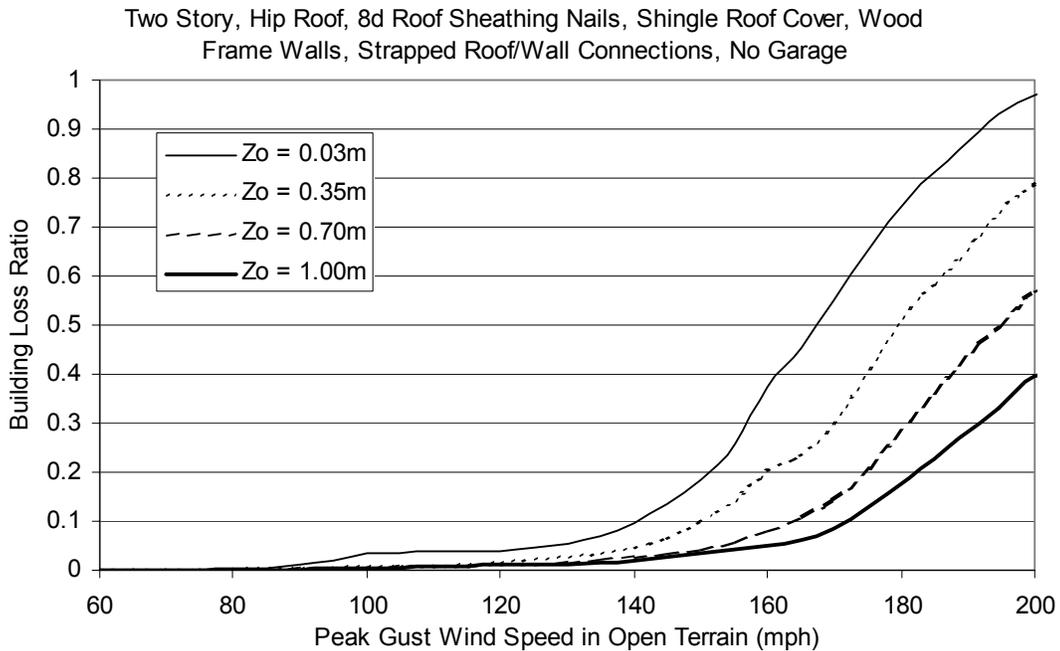
**Figure H.173. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



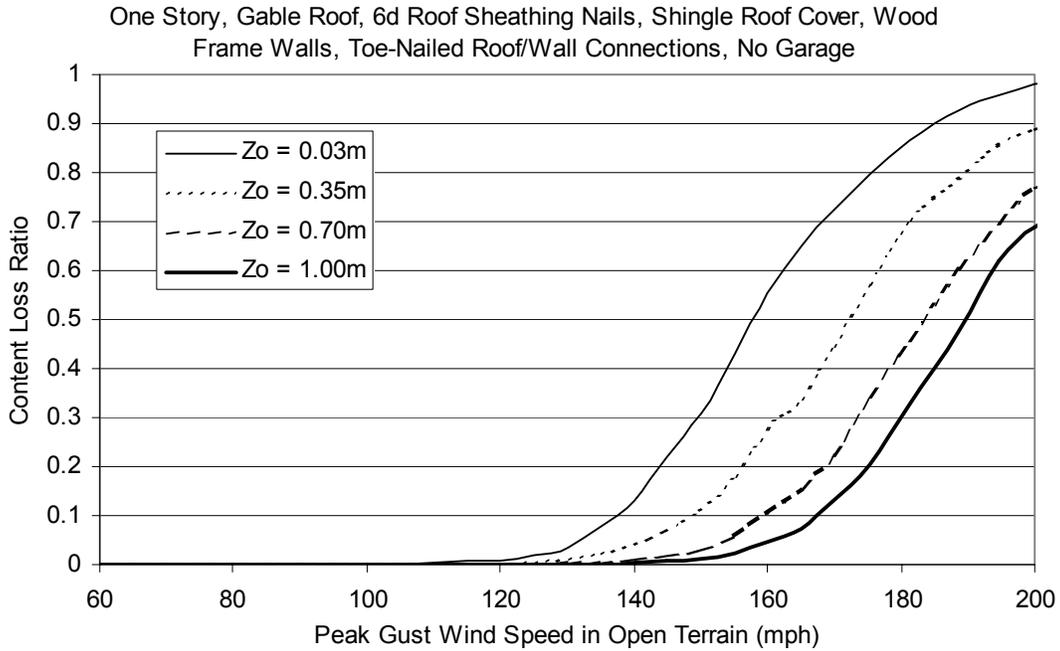
**Figure H.174. Building Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



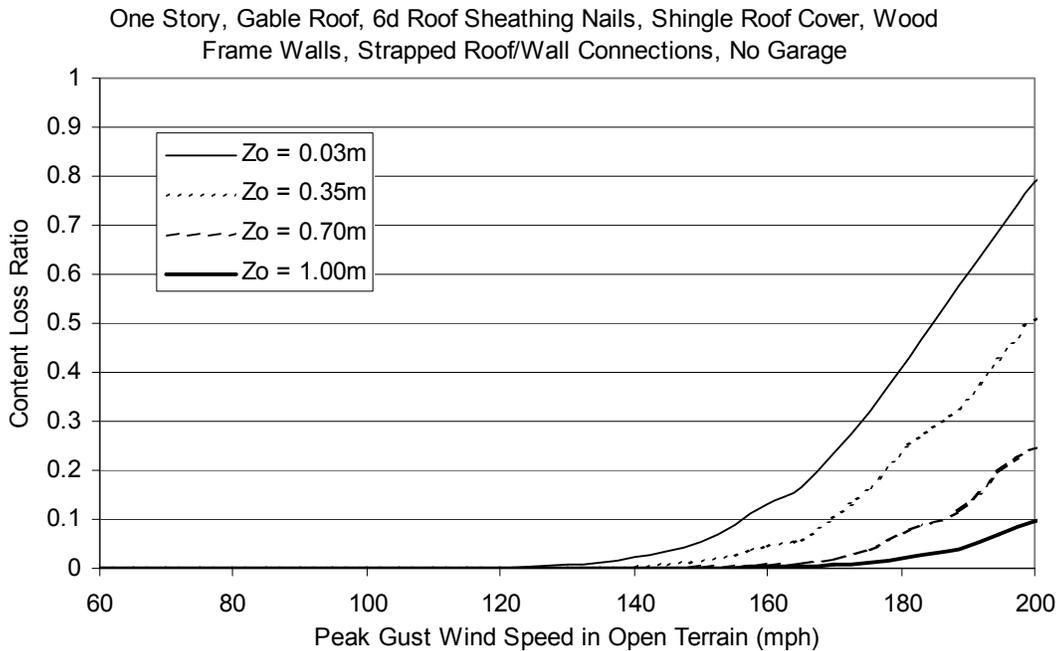
**Figure H.175. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



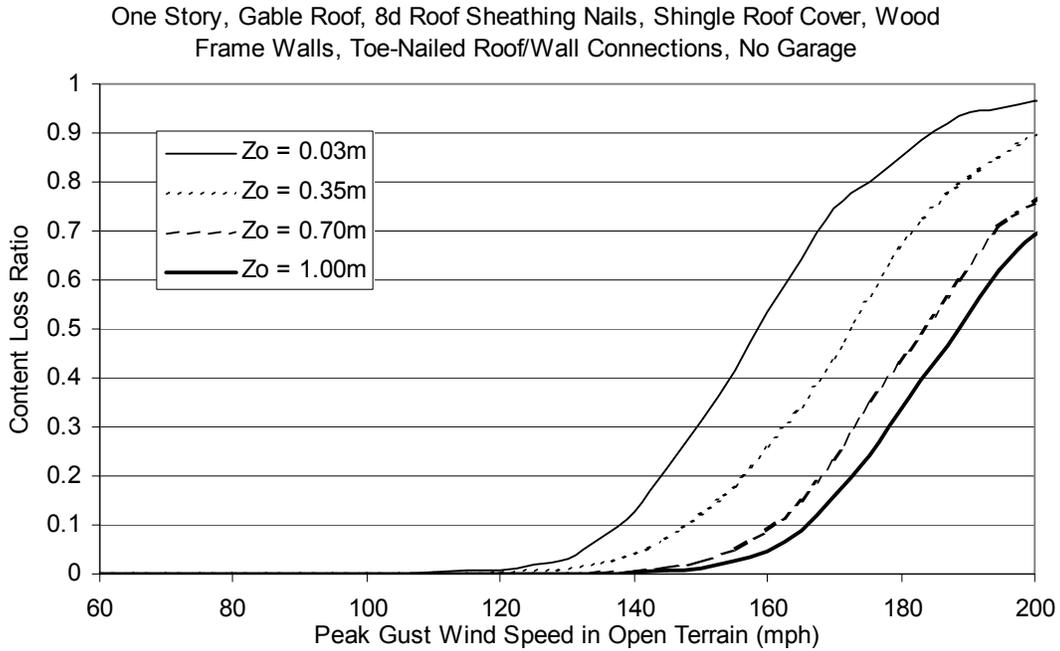
**Figure H.176. Building Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



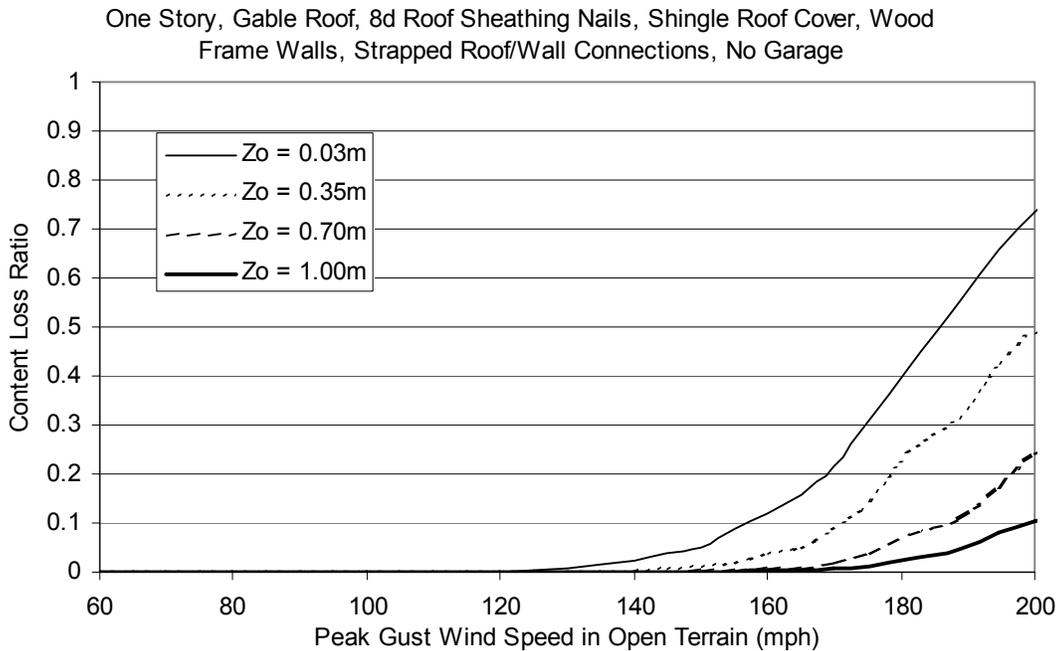
**Figure H.177. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



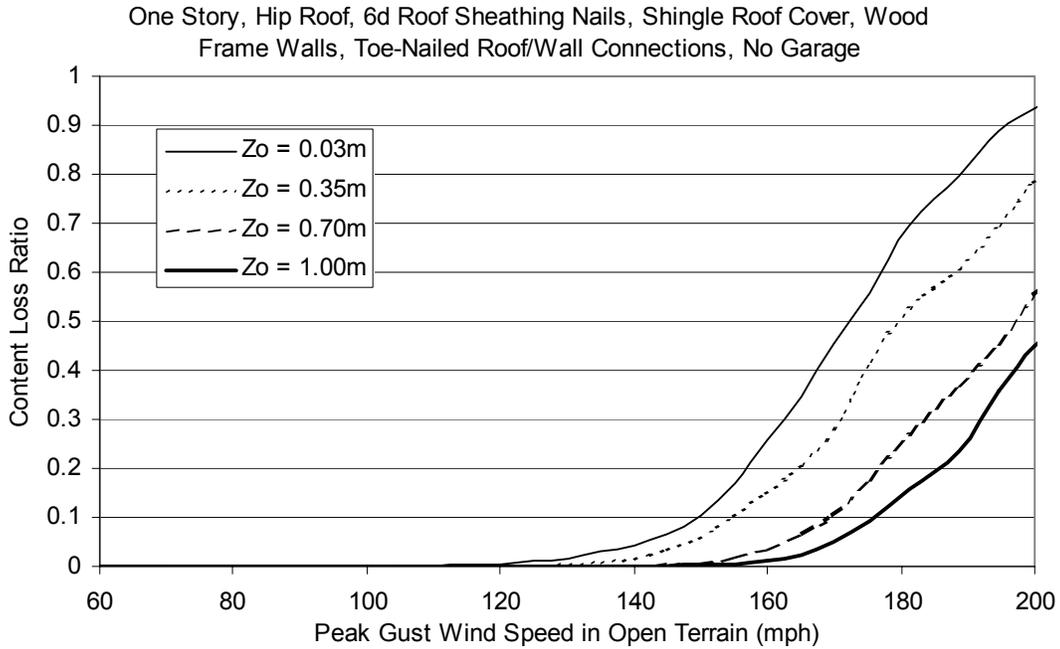
**Figure H.178. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



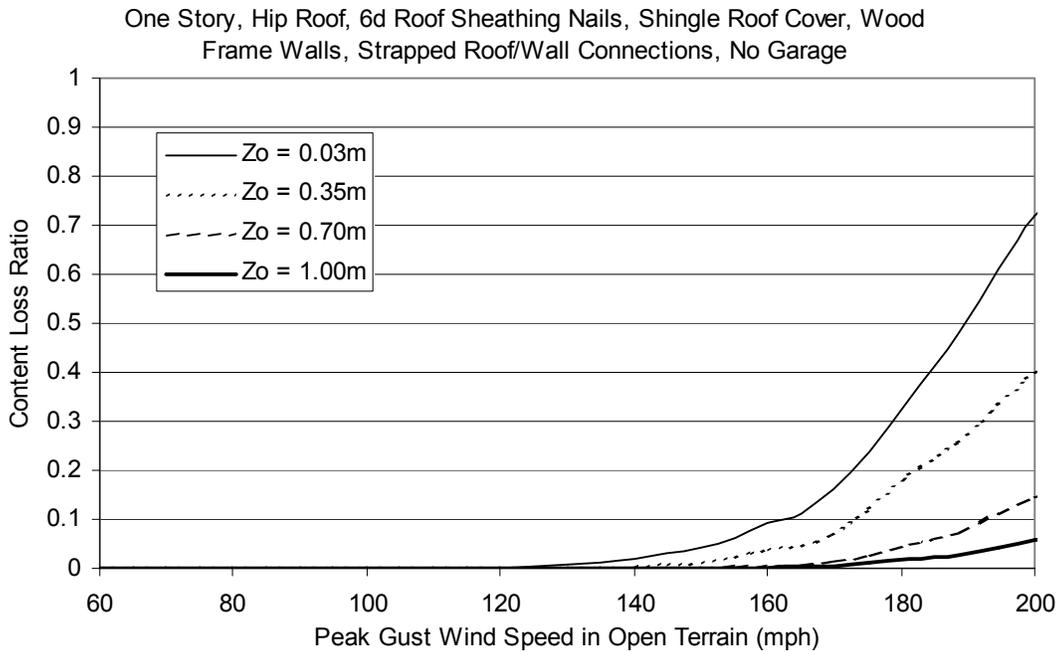
**Figure H.179. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



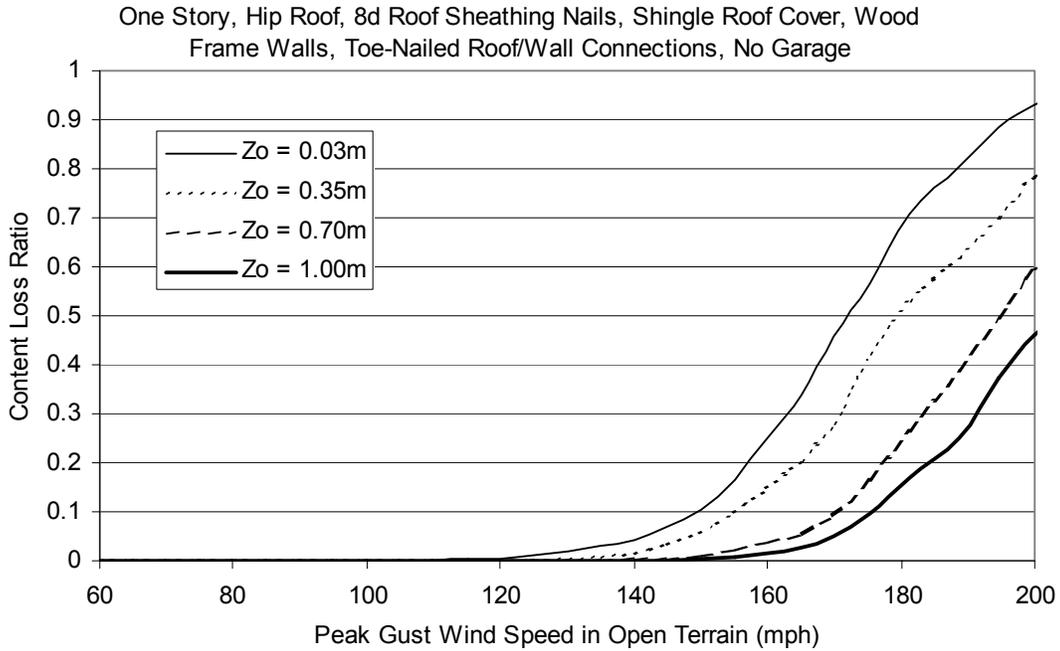
**Figure H.180. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



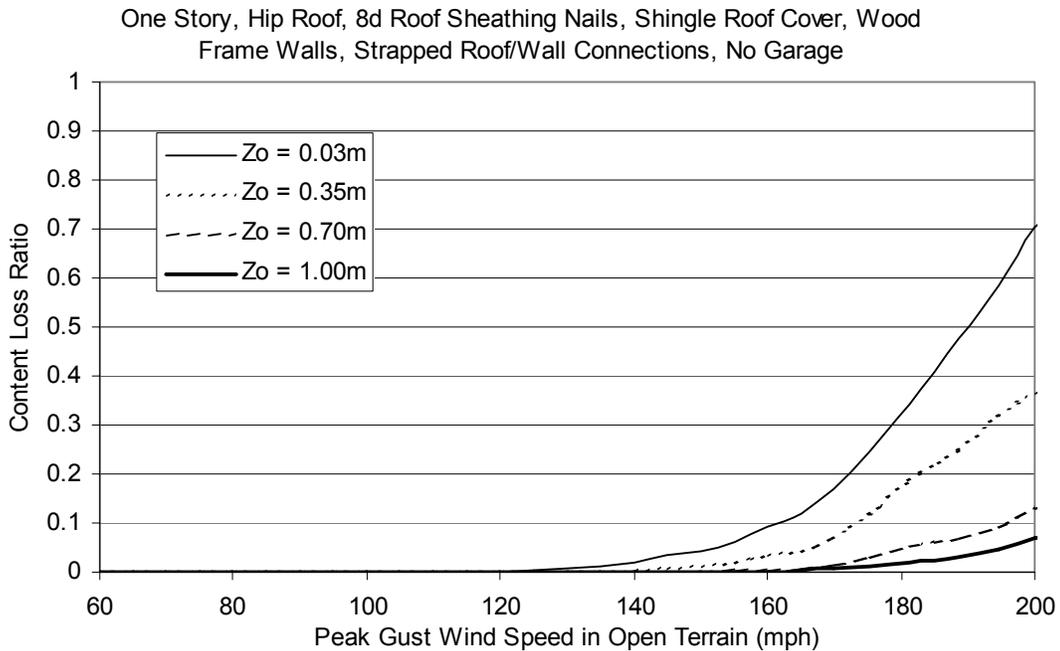
**Figure H.181. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



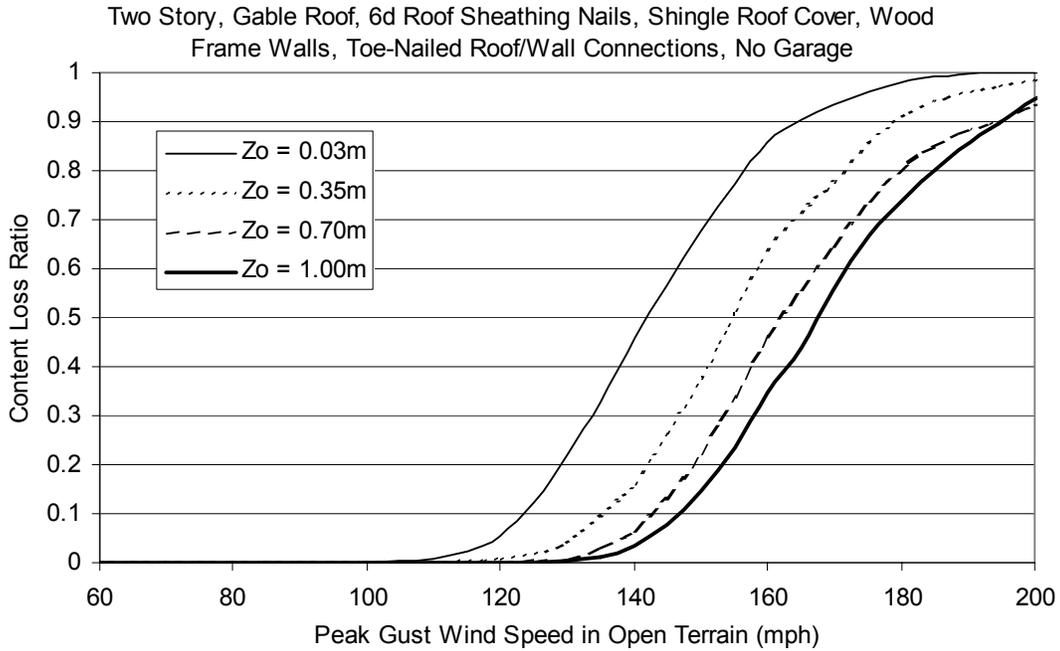
**Figure H.182. Content Loss Function for Single Family Residential Building (One Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



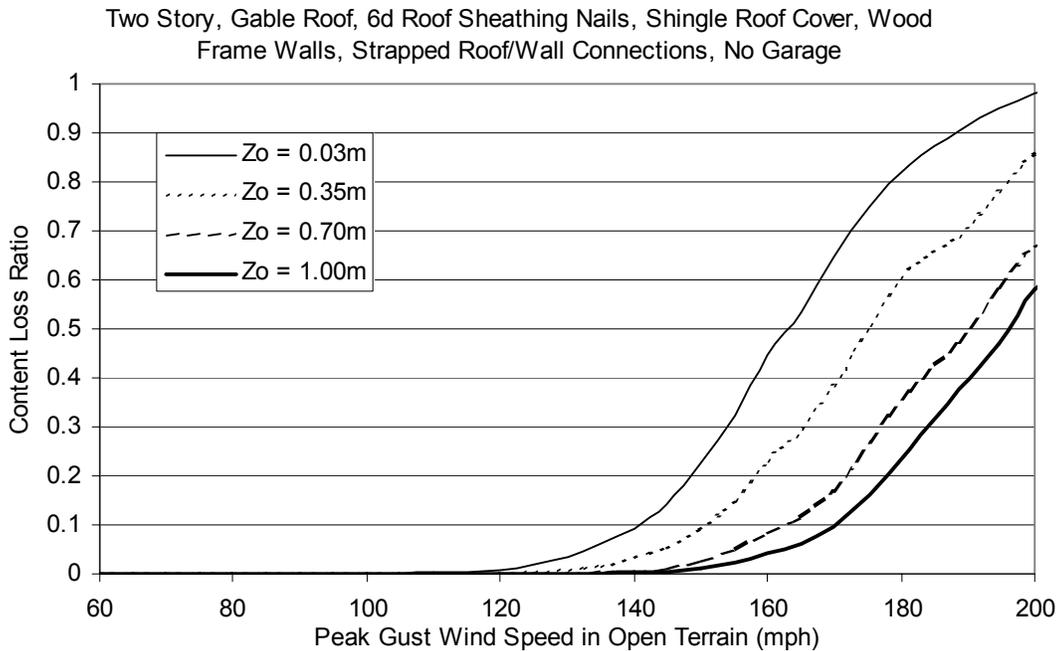
**Figure H.183. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



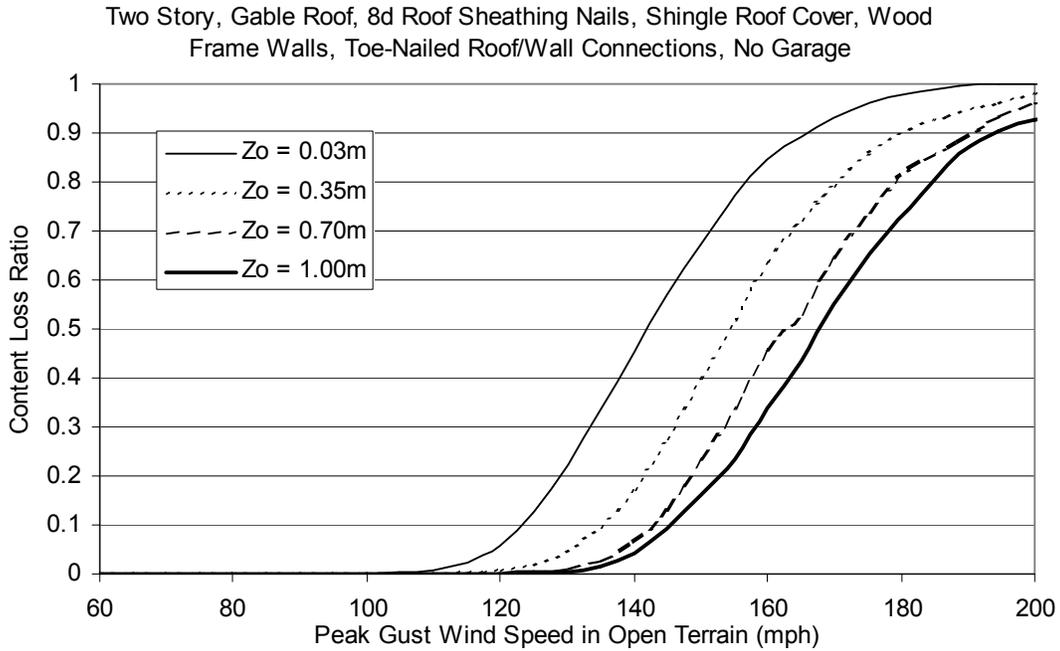
**Figure H.184. Content Loss Function for Single Family Residential Building (One Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



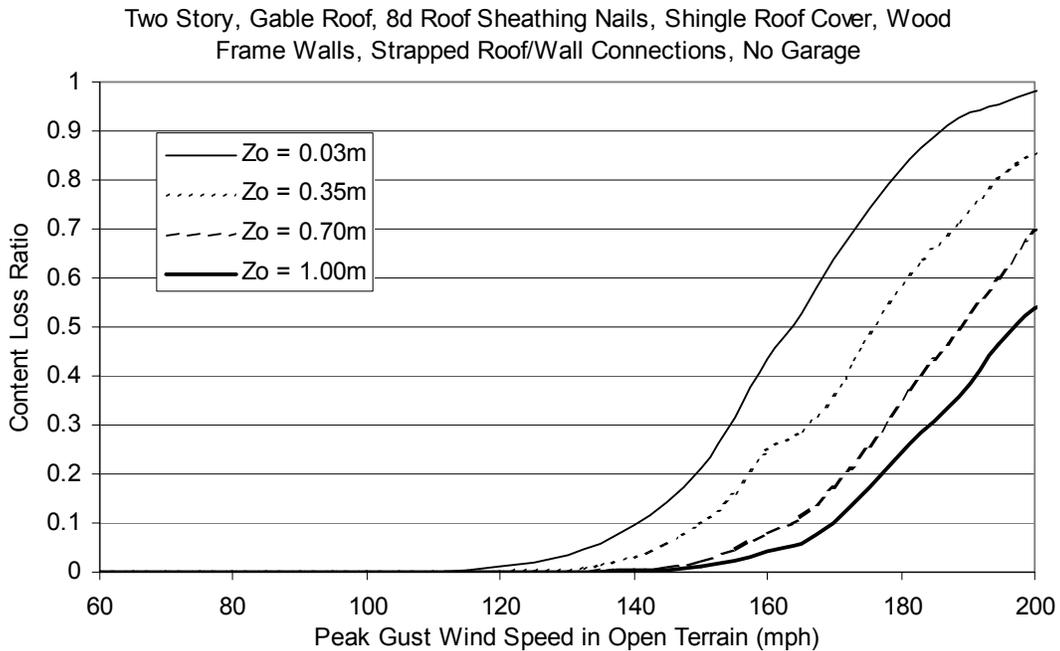
**Figure H.185. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



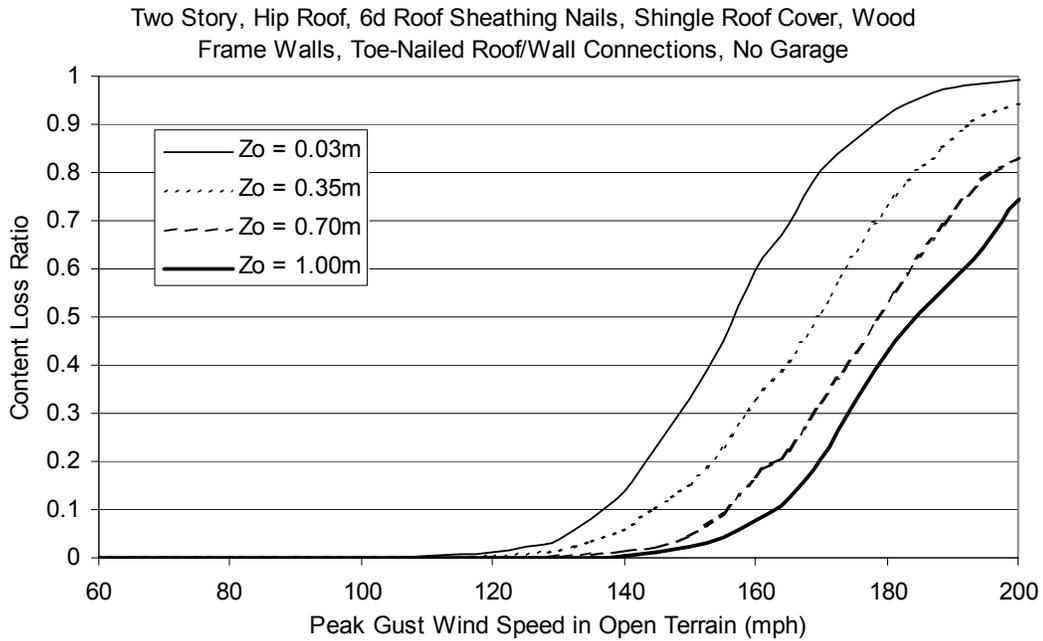
**Figure H.186. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



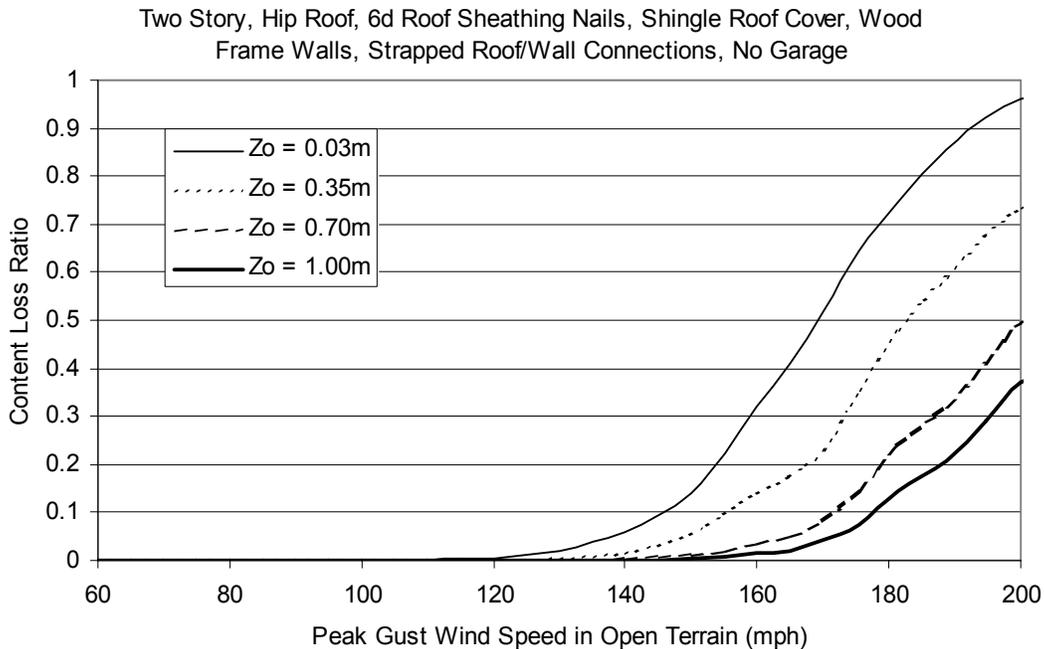
**Figure H.187. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



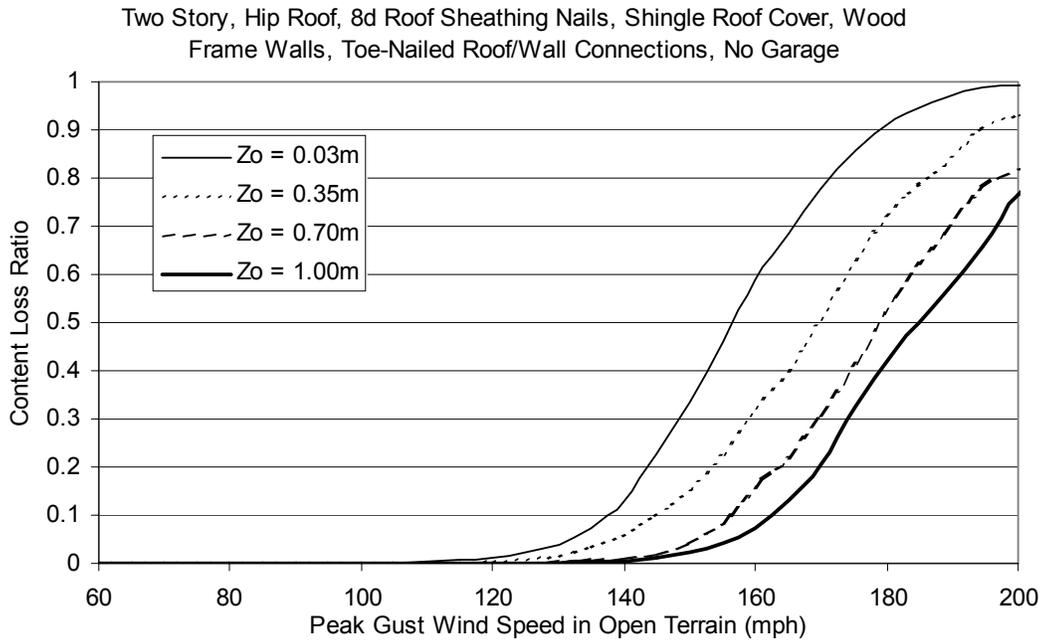
**Figure H.188. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Gable Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



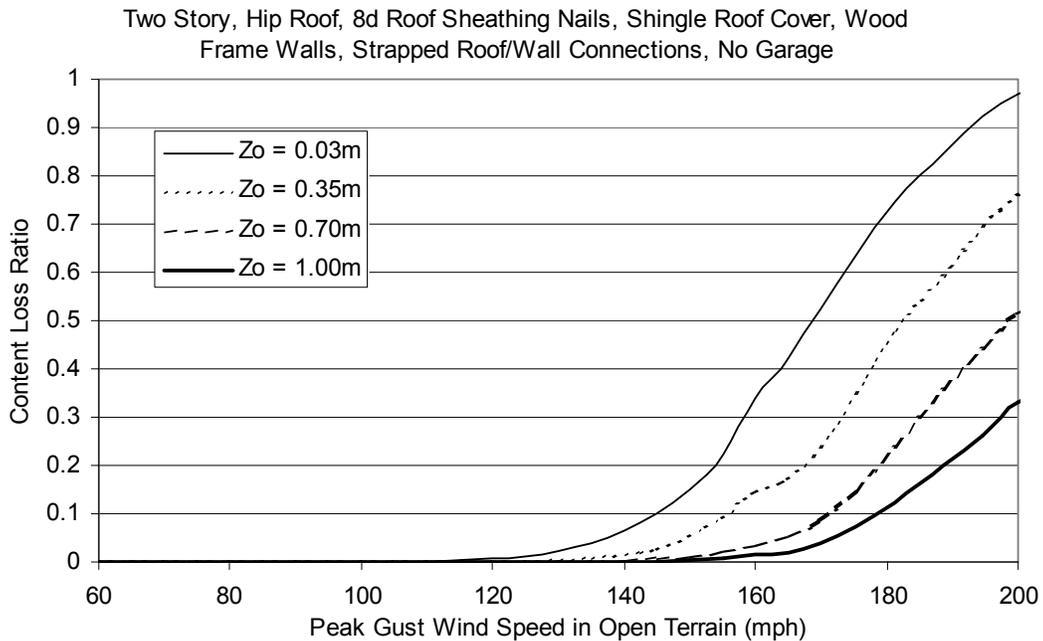
**Figure H.189. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



**Figure H.190. Content Loss Function for Single Family Residential Building (Two Story, 6d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



**Figure H.191. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Toe-Nailed Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance).**



**Figure H.192. Content Loss Function for Single Family Residential Building (Two Story, 8d Roof Sheathing Nails, Hip Roof, No Garage, Strapped Roof Wall Connections, Wood Frame, Installed Shutters, Upgraded Roof and Added Secondary Water Resistance)**



**Appendix I.**  
**Loss Functions for Manufactured Homes**

## Appendix I. Loss Functions for Manufactured Homes

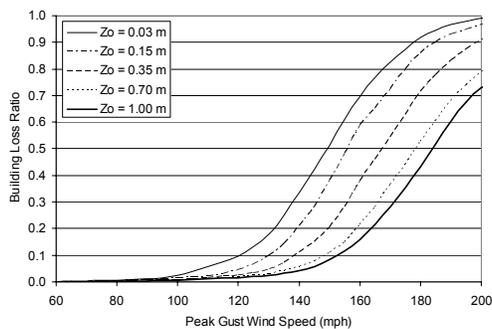
This appendix presents loss functions for manufactured homes (see Section 7.8). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

Table I.1 lists the figures provided in this appendix.

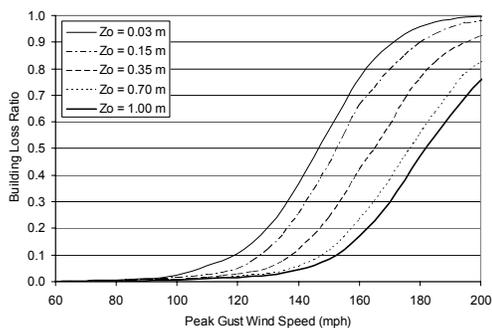
**Table I.1. Loss Functions for Manufactured Homes**

Figure	Loss Type
I.1	Building
I.2	Content

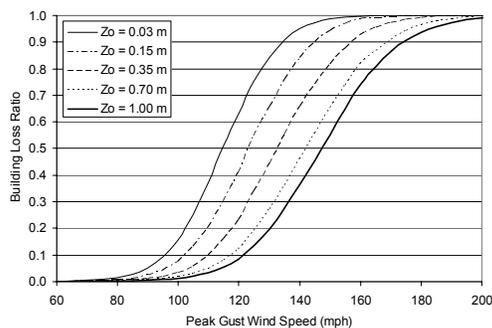
1994 HUD – Wind Zone III, Tied Down



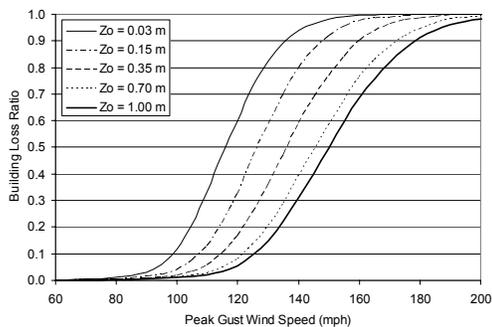
1994 HUD – Wind Zone II, Tied Down



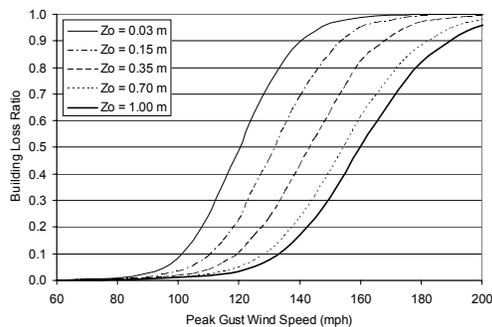
1994 HUD – Wind Zone II, Tied Down



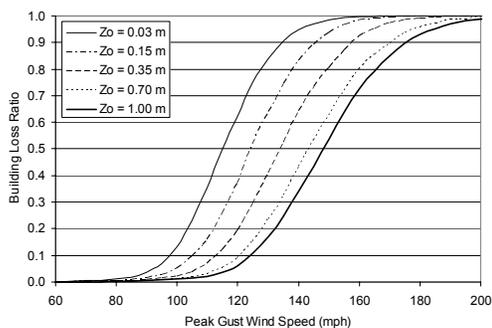
HUD, Tied Down



HUD, Not Tied Down



Pre-HUD, Tied Down



Pre-HUD, Not Tied Down

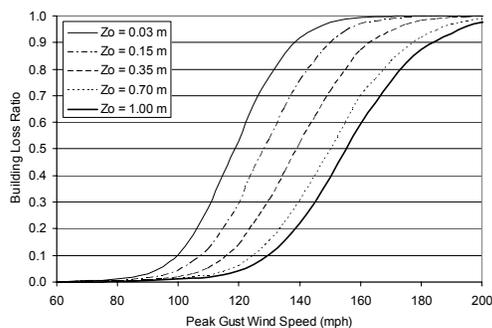
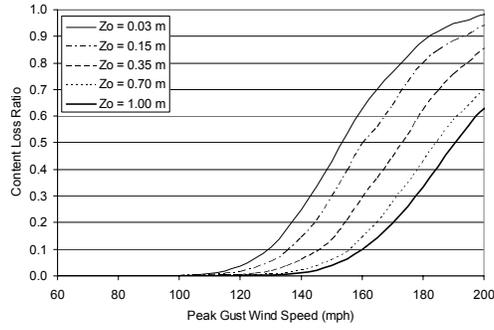
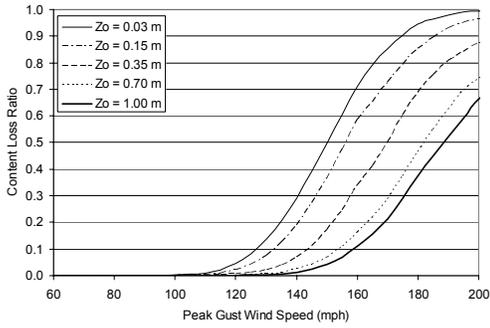


Figure I.1. Building Loss Functions for Manufactured Homes.

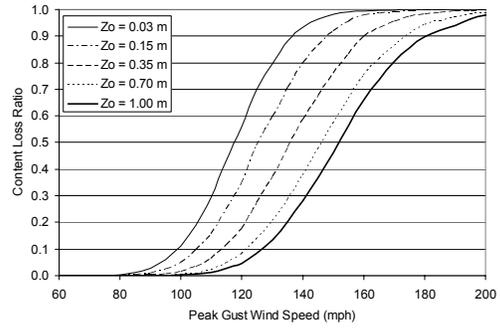
1994 HUD – Wind Zone III, Tied Down



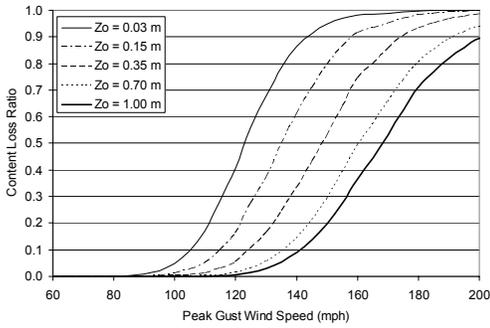
1994 HUD – Wind Zone II, Tied Down



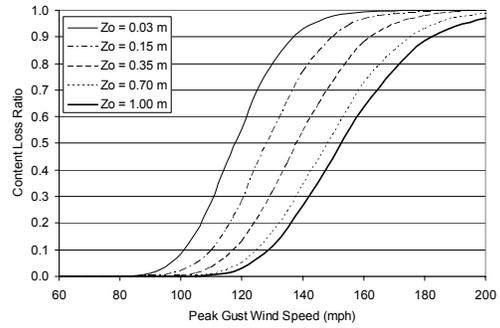
1994 HUD – Wind Zone II, Tied Down



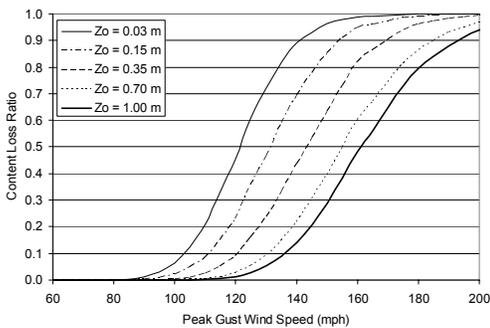
HUD, Tied Down



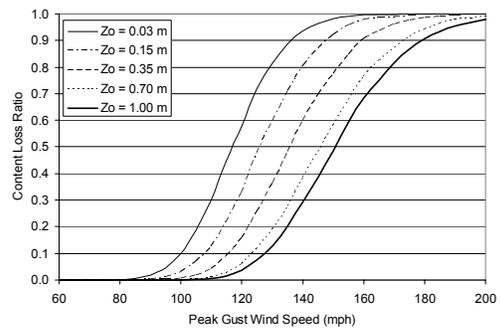
HUD, Not Tied Down



Pre-HUD, Tied Down



Pre-HUD, Not Tied Down



**Figure I.2. Content Loss Functions for Manufactured Homes.**

**Appendix J.**  
**Loss Functions for Marginally- or Non-Engineered**  
**Hotel/Motel and Multi-Family Residential Buildings**

## Appendix J. Loss Functions for Marginally- or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings

This appendix presents loss functions for marginally-engineered hotel/motel and multi-family residential buildings (see Section 7.10). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

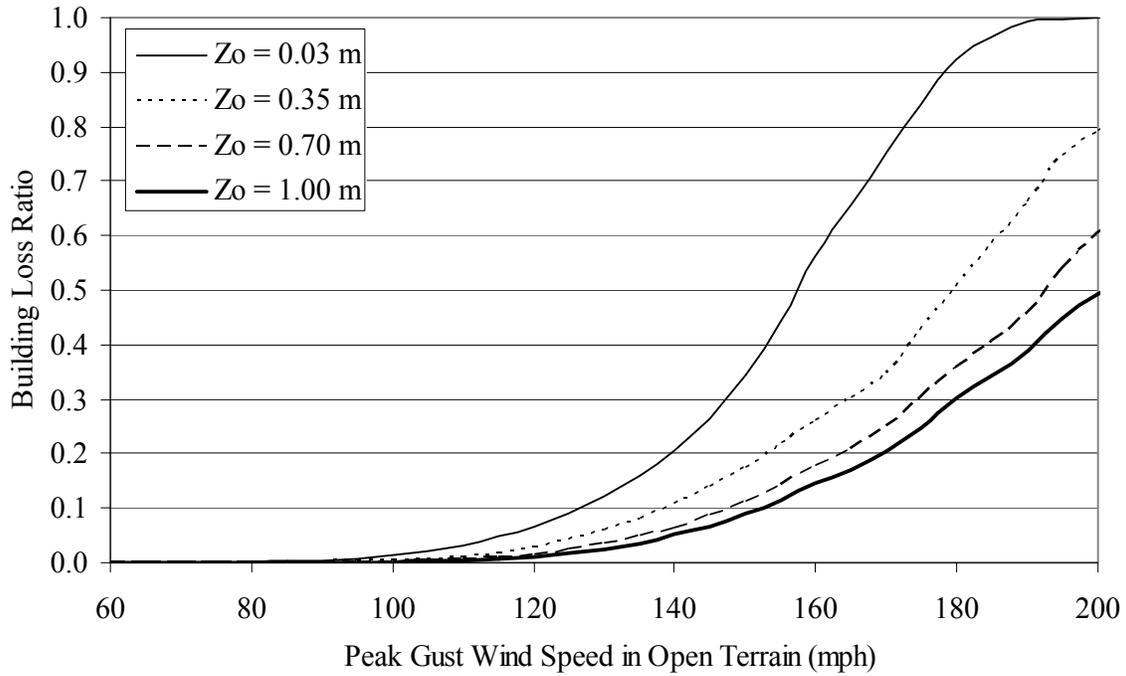
Table J.1 lists the figures provided in this appendix. Two sets of thirteen figures are shown. The first set of thirteen figures (Figures J.1 through J.13) show building loss ratios and the second set (Figures J.14 through J.26) shown content loss ratios. The first figure in each set of thirteen shows loss results for a one-story building with 8d roof sheathing nails, strapped roof-wall connections, wood frame walls and a gable roof with shingles. The remaining twelve plots in each set show loss results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

**Table J.1. Sample Loss Functions for Marginally-Engineered or Non-Engineered  
Hotel/Motel and Multi-Family Residential Buildings**

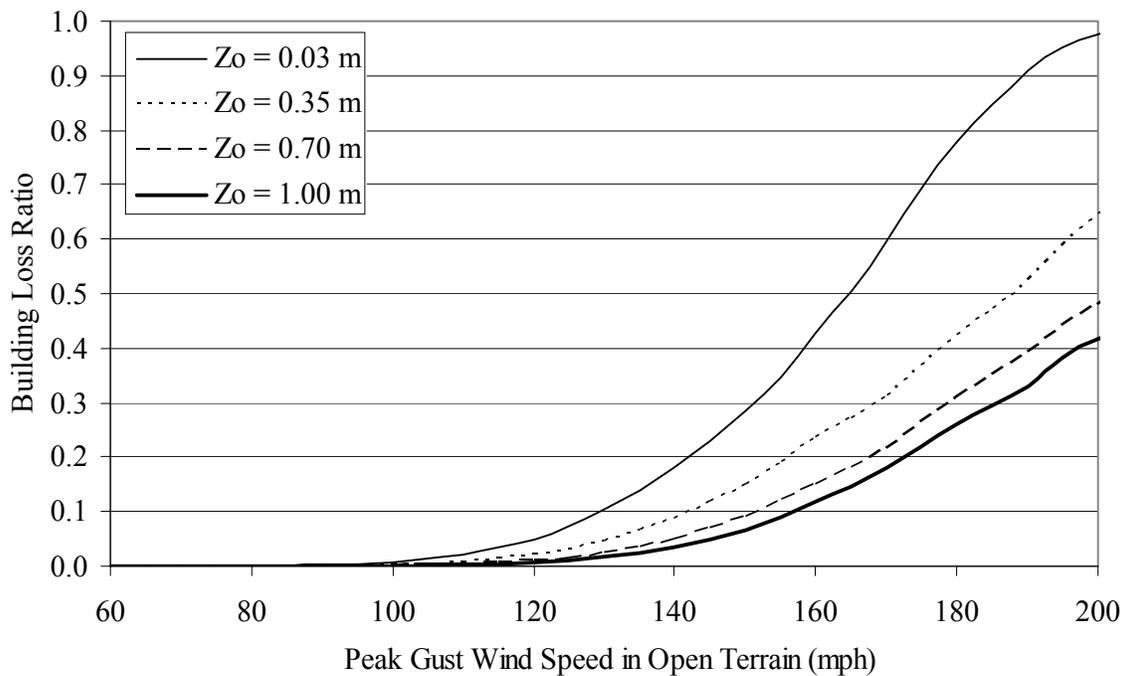
Figure	Loss Type	Walls	Stories	Sheathing	Roof/ Wall	Roof Shape	Roof Cover
J.1	Building	WFR	1	8d	Strap	Gable	Shingles
J.2	Building	WFR	1	8d	Strap	<b>Hip</b>	Shingles
J.3	Building	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Average</b>
J.4	Building	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Poor</b>
J.5	Building	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Average</b>
J.6	Building	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Poor</b>
J.7	Building	WFR	1	<b>6d</b>	Strap	Gable	Shingles
J.8	Building	WFR	1	8d	<b>Toe-Nail</b>	Gable	Shingles
J.9	Building	<b>URM</b>	1	8d	Strap	Gable	Shingles
J.10	Building	<b>RM</b>	1	8d	Strap	Gable	Shingles
J.11	Building	WFR	<b>2</b>	8d	Strap	Gable	Shingles
J.12	Building	WFR	<b>3</b>	8d	Strap	Gable	Shingles
J.13	Building	WFR	<b>4</b>	8d	Strap	Gable	Shingles

**Table J.1. Sample Loss Functions for Marginally-Engineered or Non-Engineered Hotel/Motel and Multi-Family Residential Buildings (concluded)**

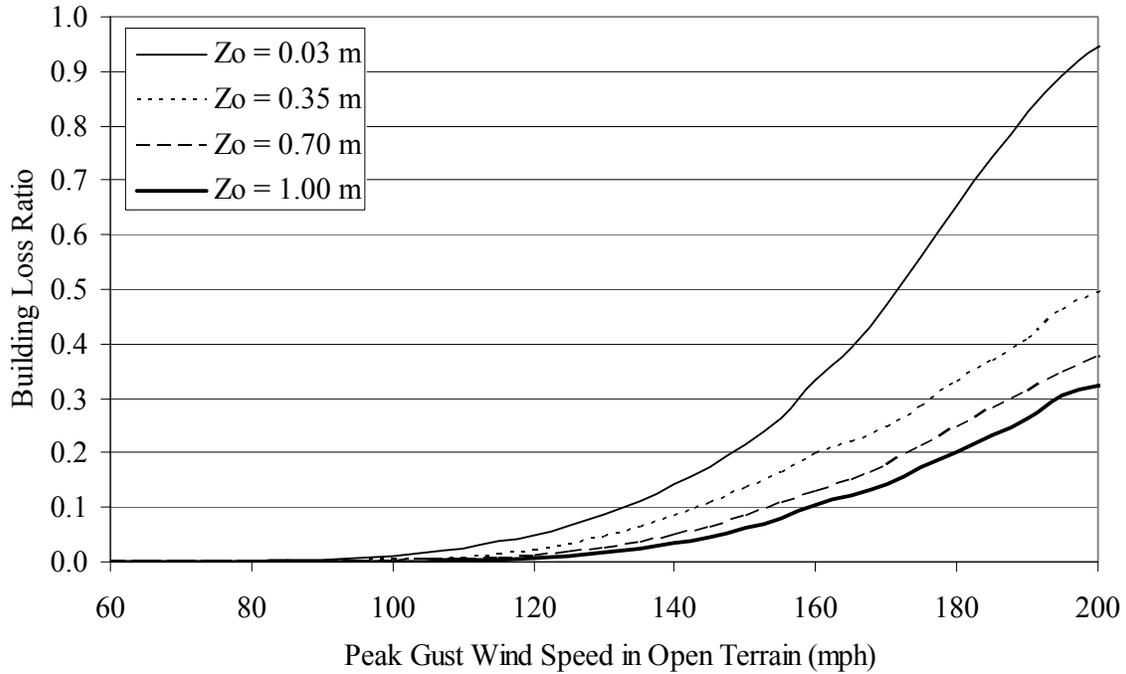
Figure	Loss Type	Walls	Stories	Sheathing	Roof/ Wall	Roof Shape	Roof Cover
J.14	<b>Content</b>	WFR	1	8d	Strap	Gable	Shingles
J.15	Content	WFR	1	8d	Strap	<b>Hip</b>	Shingles
J.16	Content	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Average</b>
J.17	Content	WFR	1	8d	Strap	<b>Flat</b>	<b>BUR, Poor</b>
J.18	Content	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Average</b>
J.19	Content	WFR	1	8d	Strap	<b>Flat</b>	<b>EPDM, Poor</b>
J.20	Content	WFR	1	<b>6d</b>	Strap	Gable	Shingles
J.21	Content	WFR	1	8d	<b>Toe-Nail</b>	Gable	Shingles
J.22	Content	<b>URM</b>	1	8d	Strap	Gable	Shingles
J.23	Content	<b>RM</b>	1	8d	Strap	Gable	Shingles
J.24	Content	WFR	<b>2</b>	8d	Strap	Gable	Shingles
J.25	Content	WFR	<b>3</b>	8d	Strap	Gable	Shingles
J.26	Content	WFR	<b>4</b>	8d	Strap	Gable	Shingles



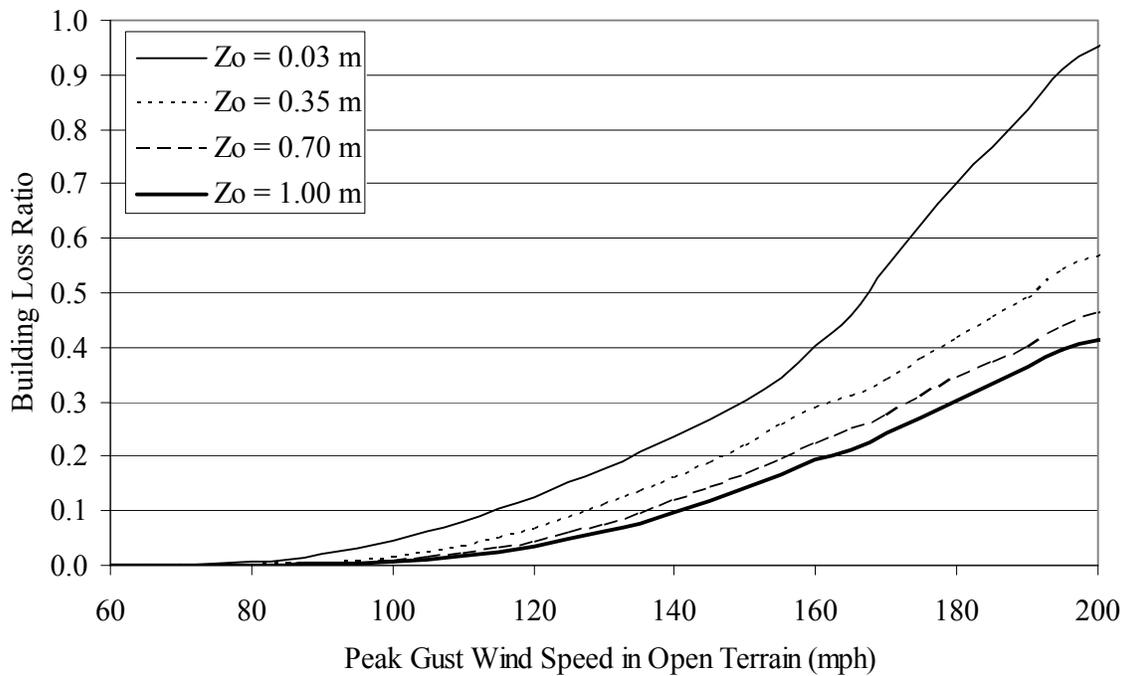
**Figure J.1. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



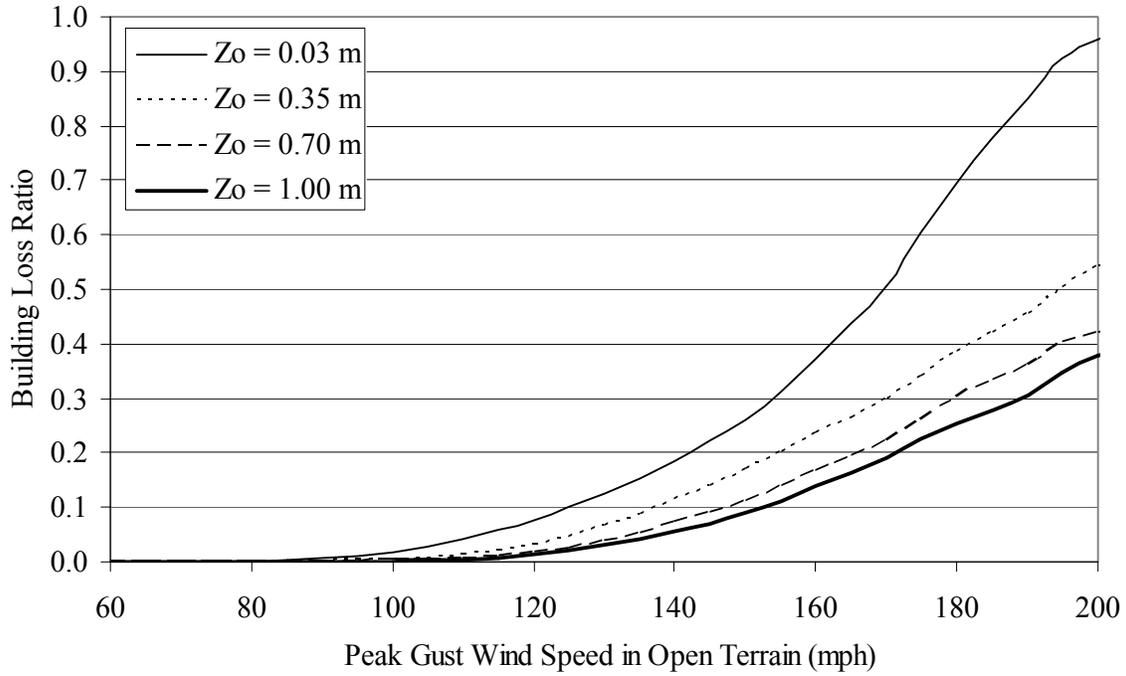
**Figure J.2. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Hip Roof with Shingles.**



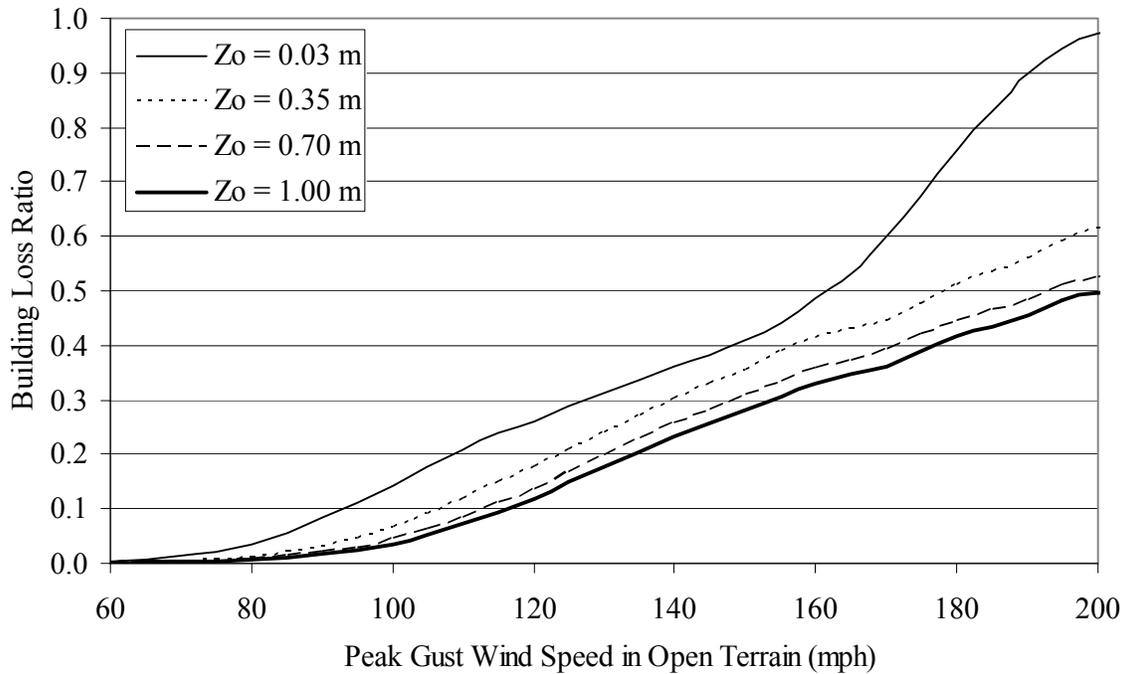
**Figure J.3. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality BUR.**



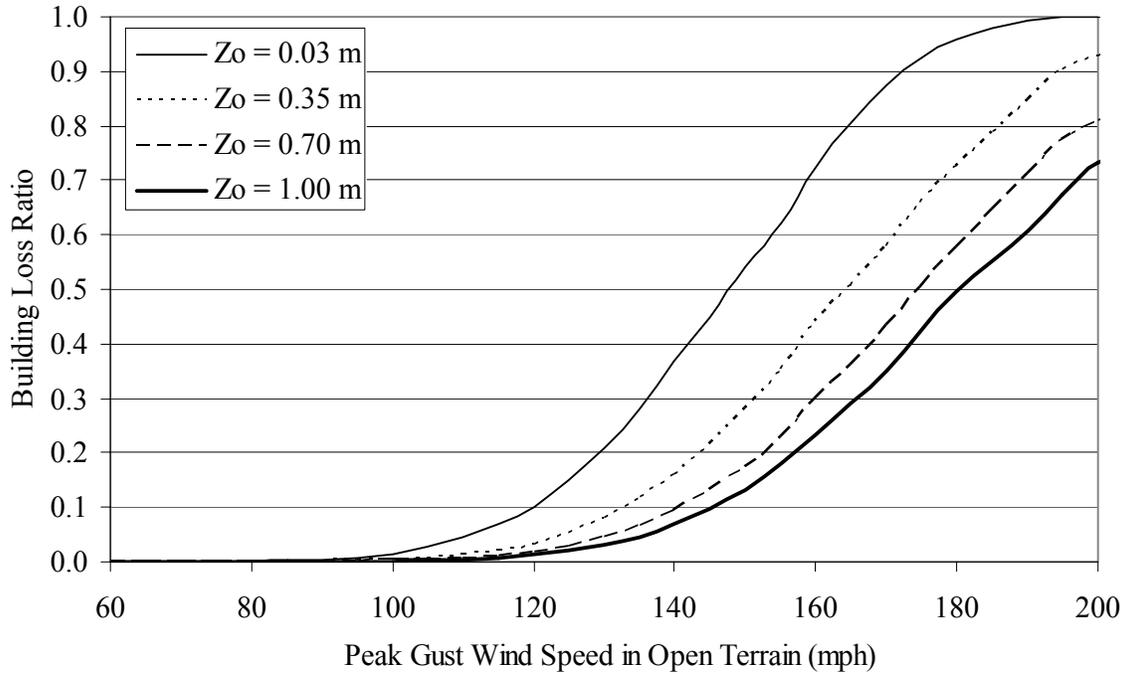
**Figure J.4. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality BUR.**



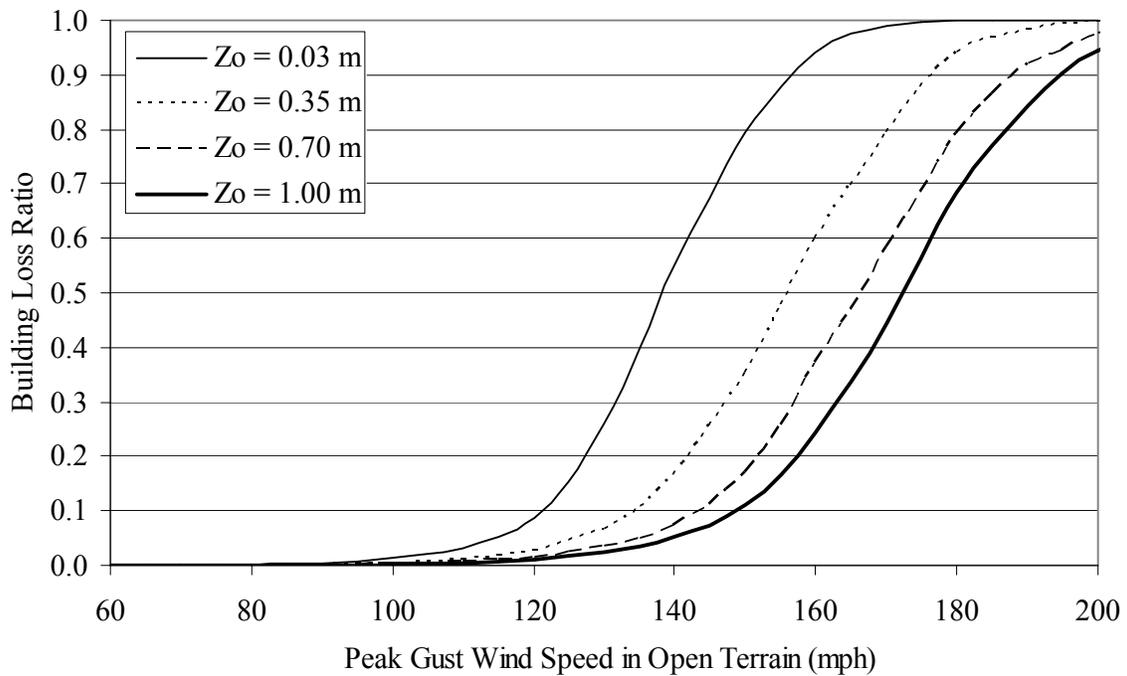
**Figure J.5. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality EPDM.**



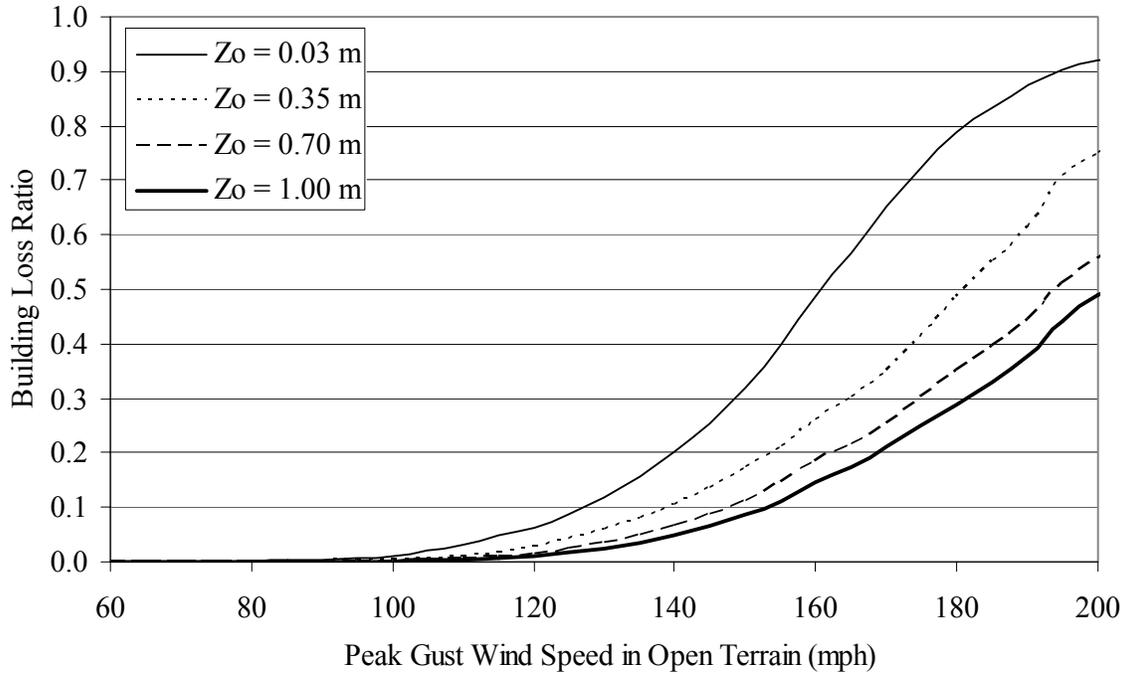
**Figure J.6. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality EPDM.**



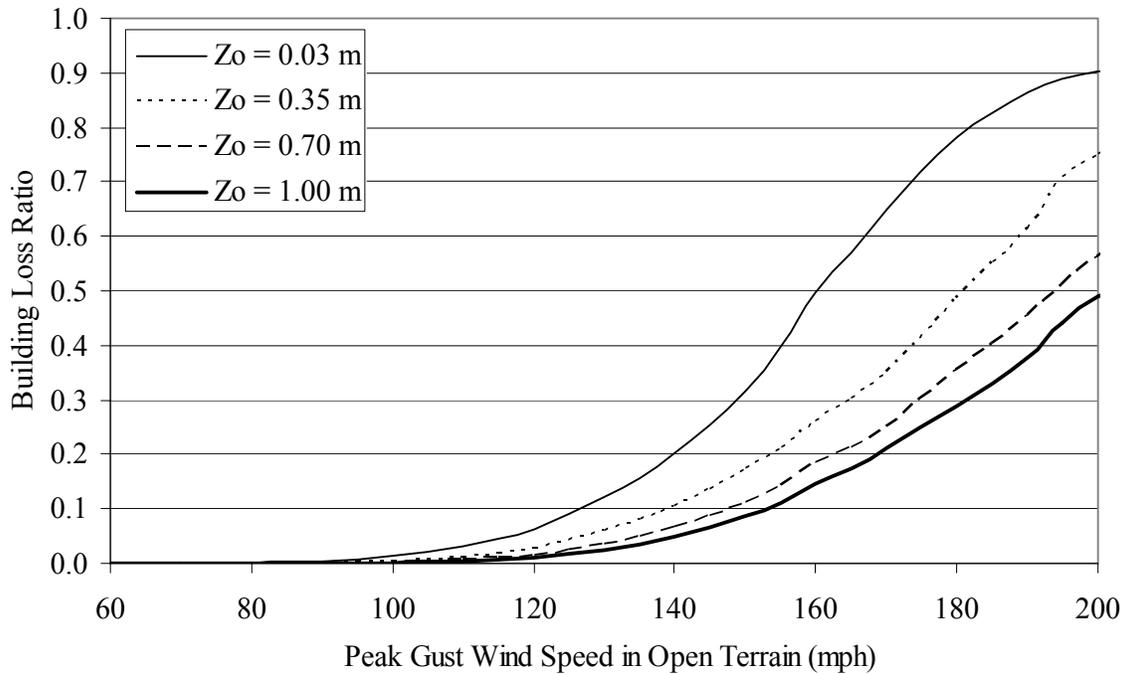
**Figure J.7. Building Loss Function – One-Story, 6d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



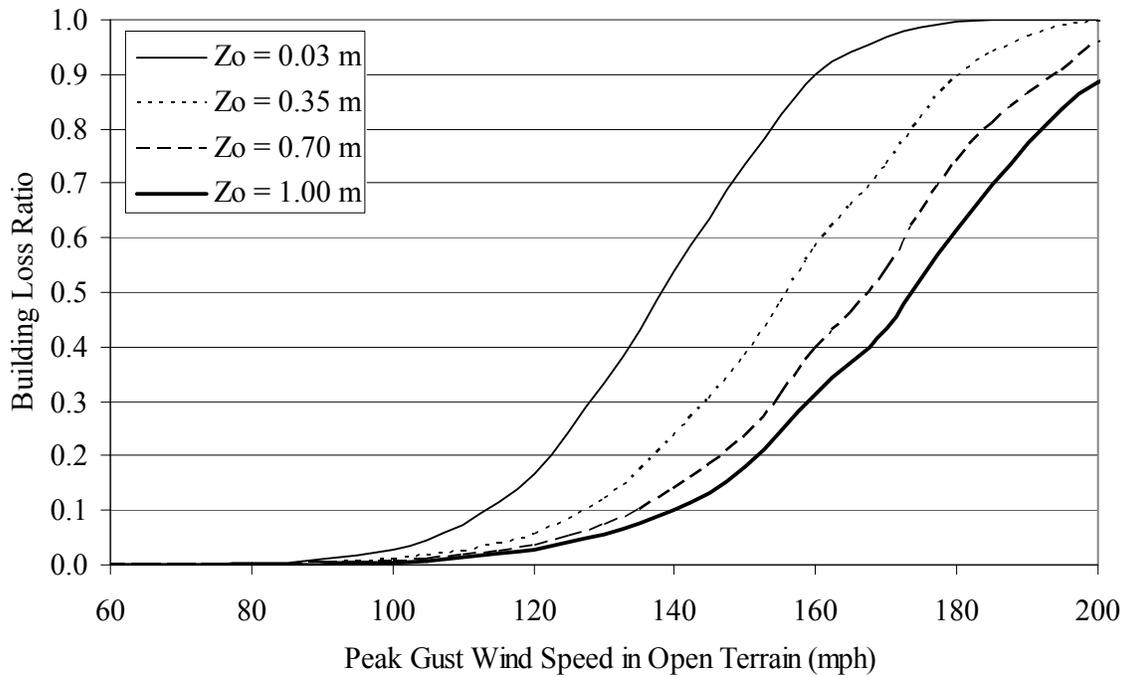
**Figure J.8. Building Loss Function – One-Story, 8d Roof Deck Nails, Toe-Nailed Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



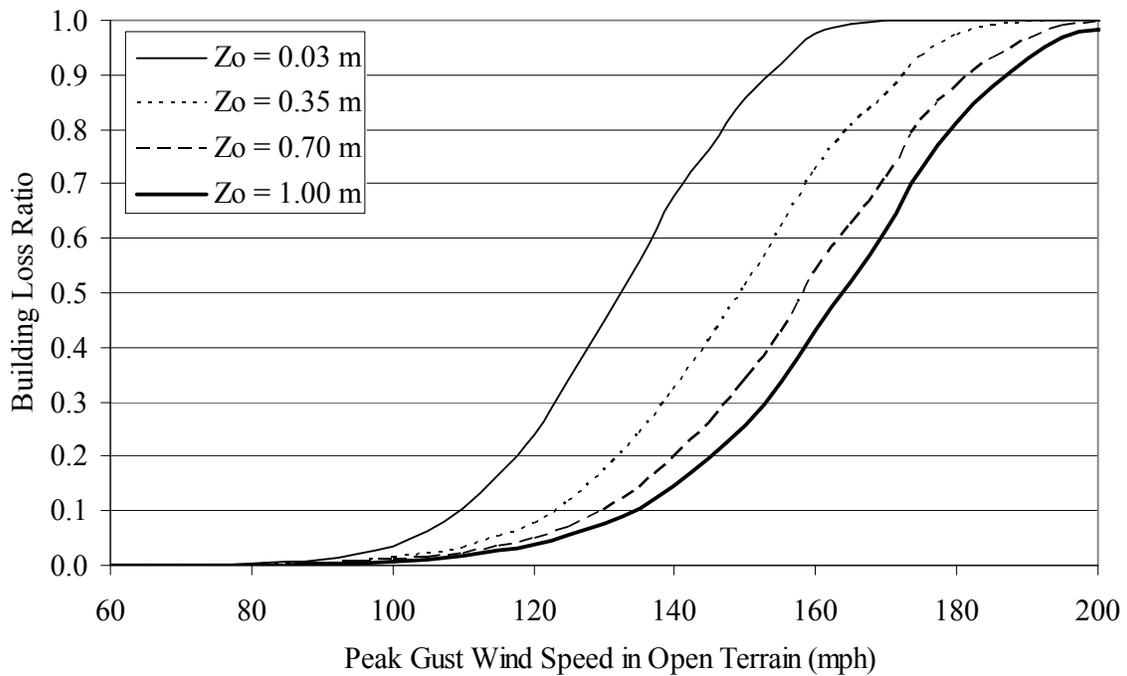
**Figure J.9. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Unreinforced Masonry Walls, Gable Roof with Shingles.**



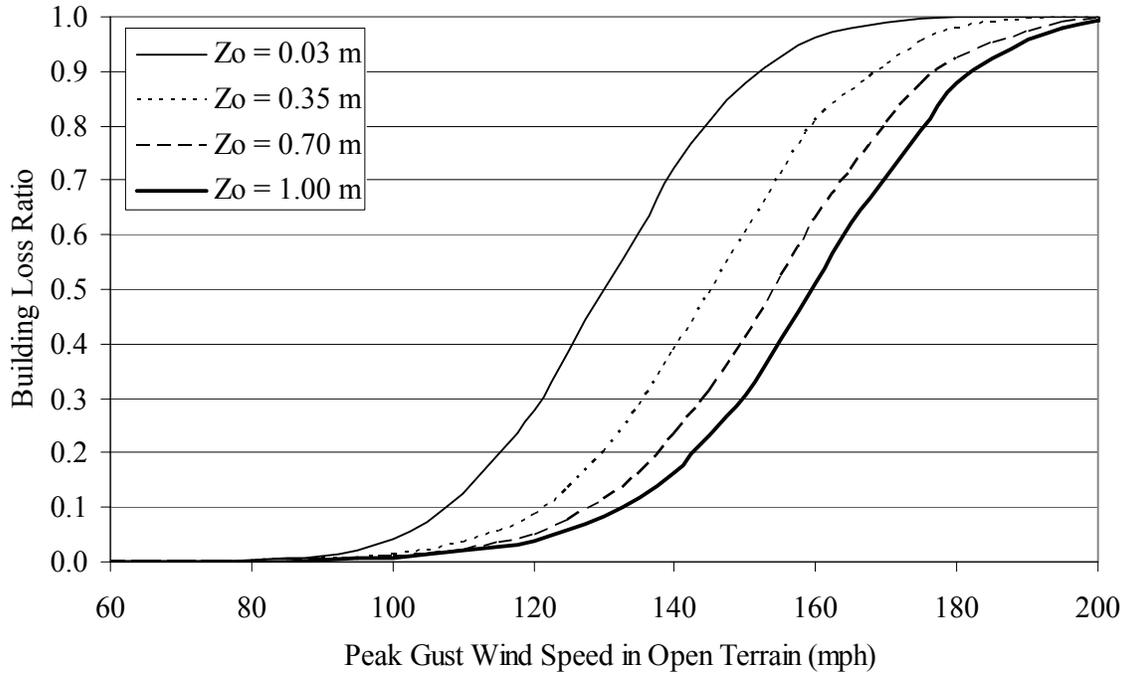
**Figure J.10. Building Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Reinforced Masonry Walls, Gable Roof with Shingles.**



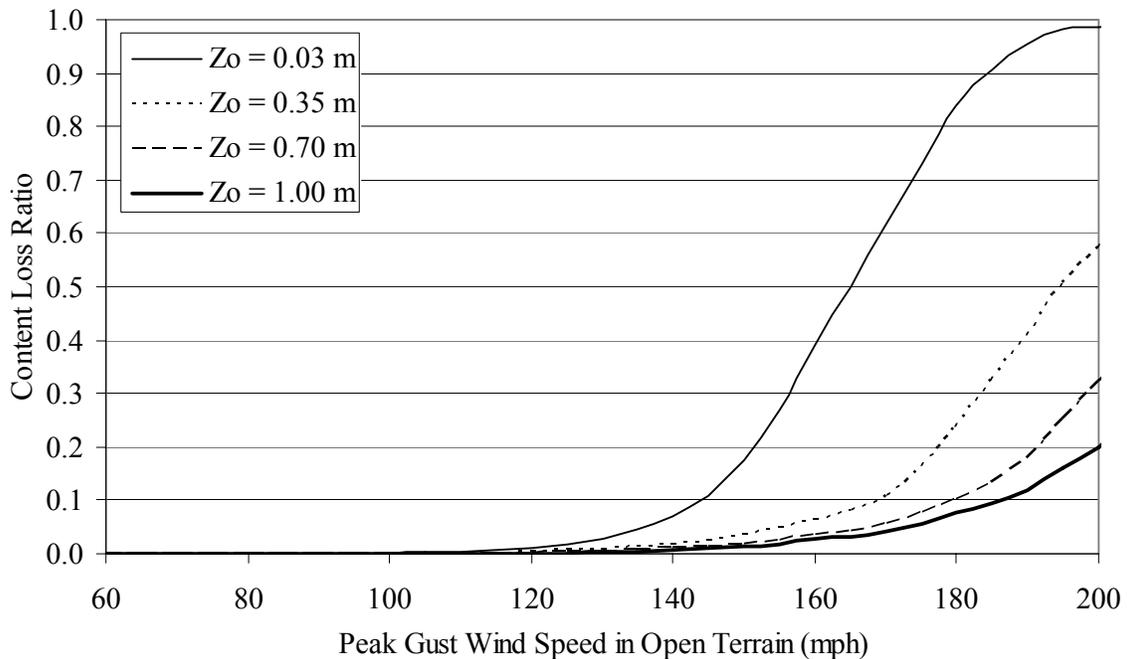
**Figure J.11. Building Loss Function – Two-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



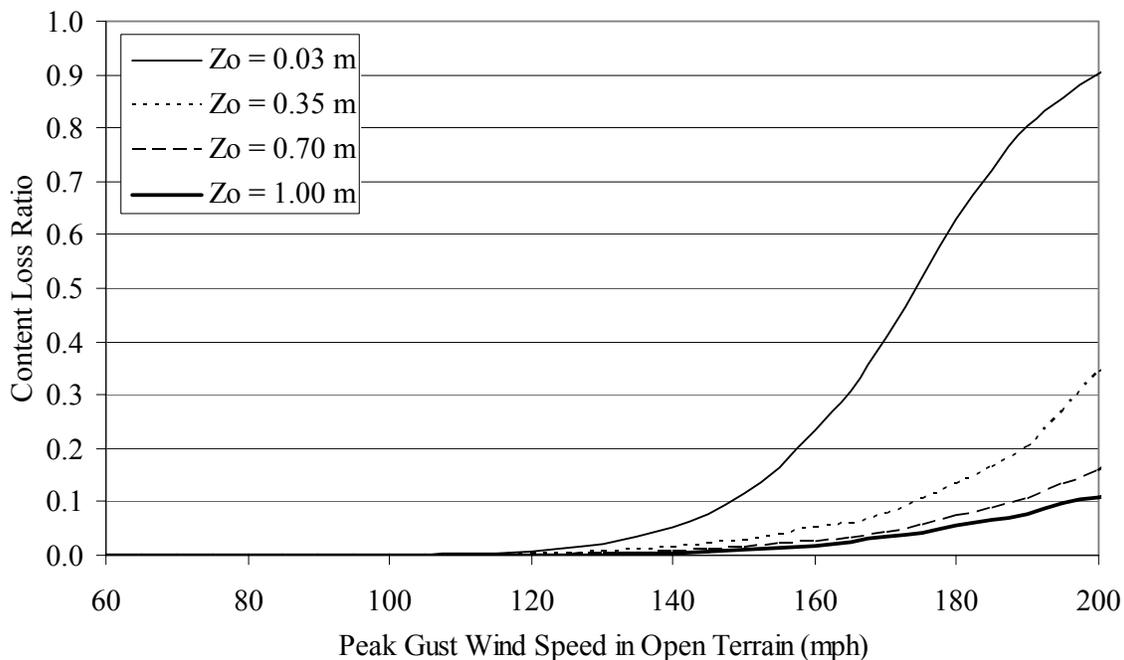
**Figure J.12. Building Loss Function – Three-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



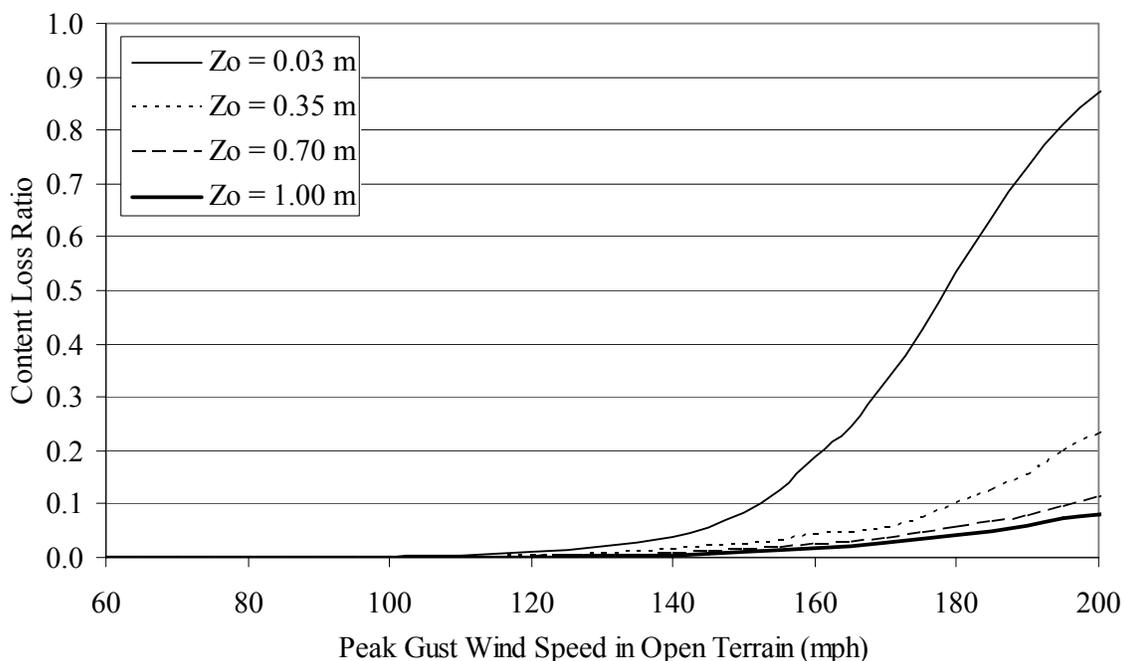
**Figure J.13. Building Loss Function – Four-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



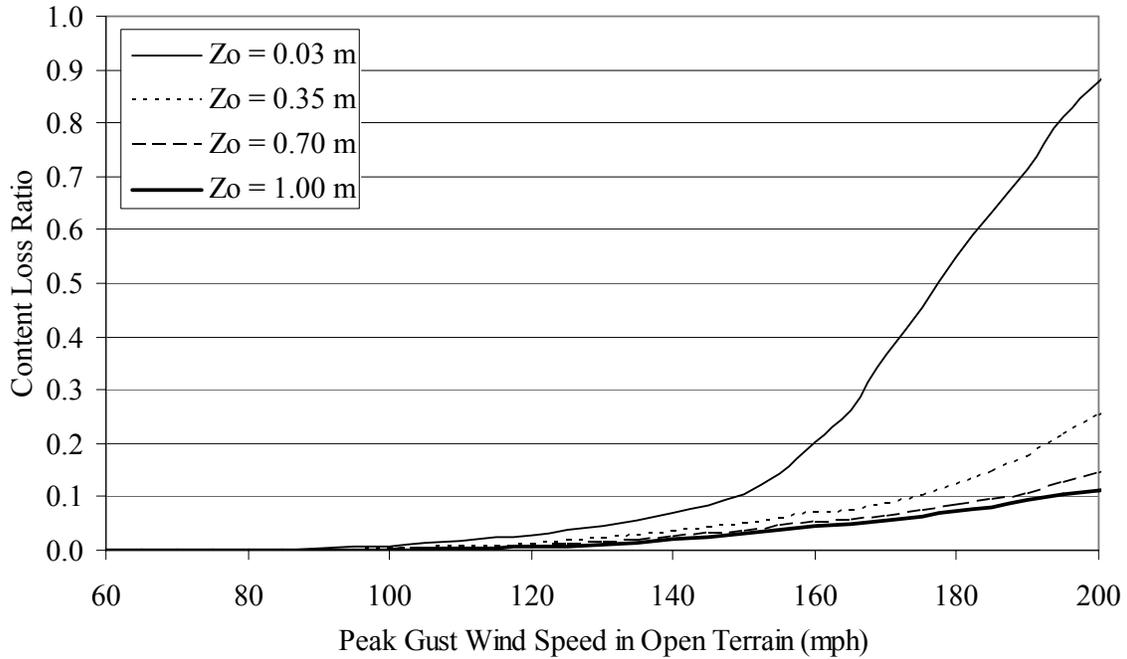
**Figure J.14. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



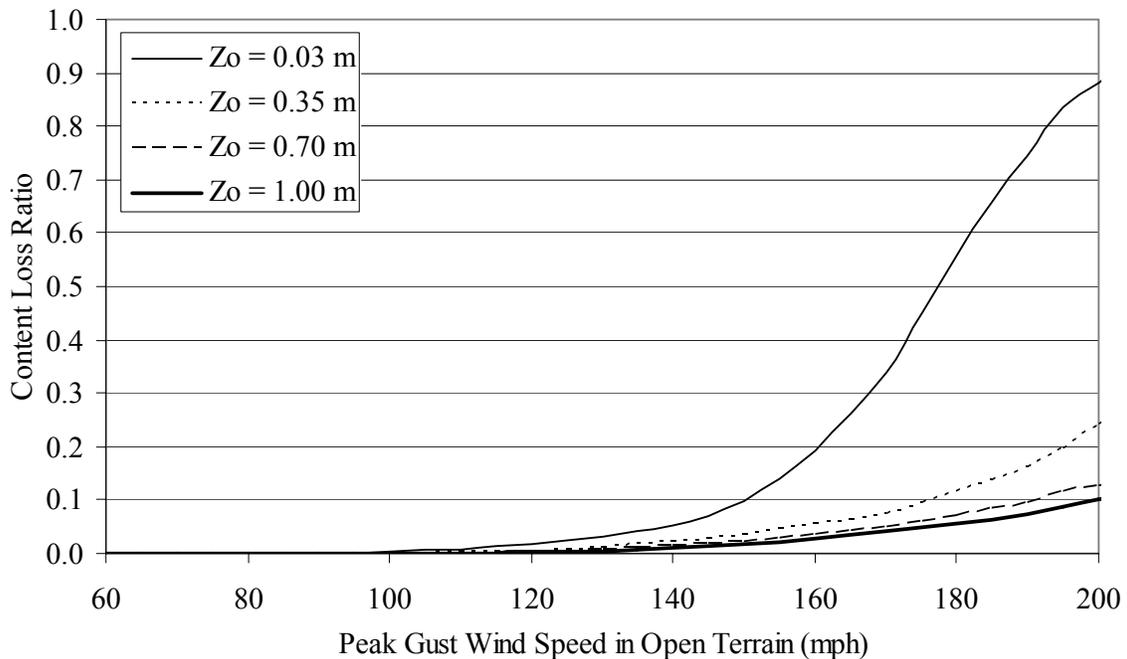
**Figure J.15. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Hip Roof with Shingles.**



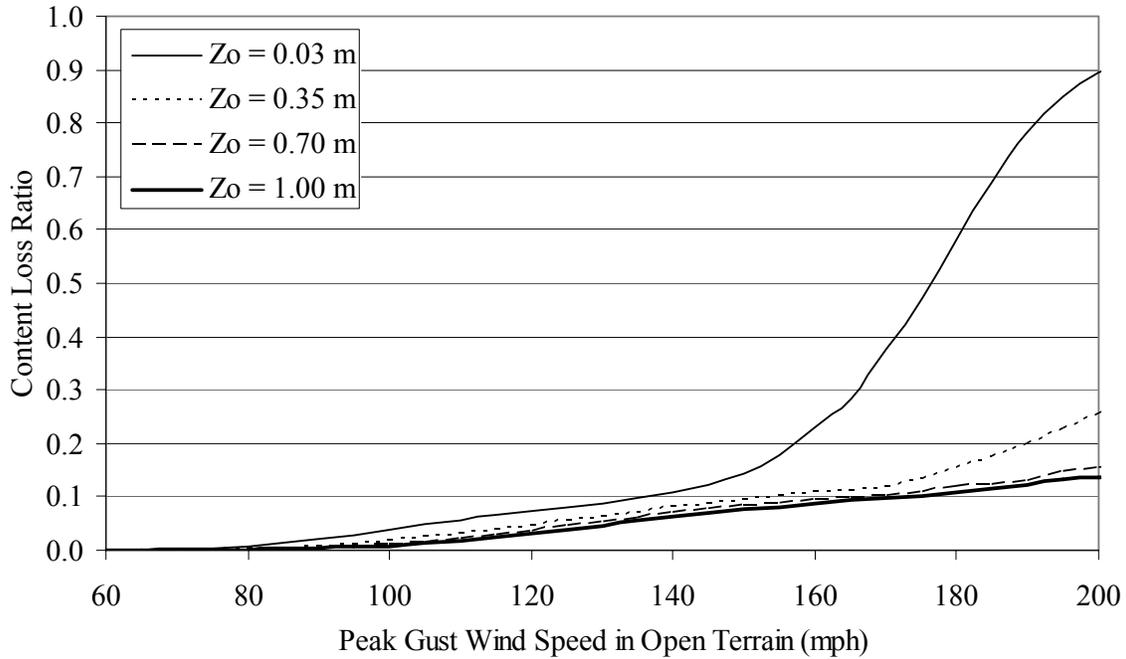
**Figure J.16. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality BUR.**



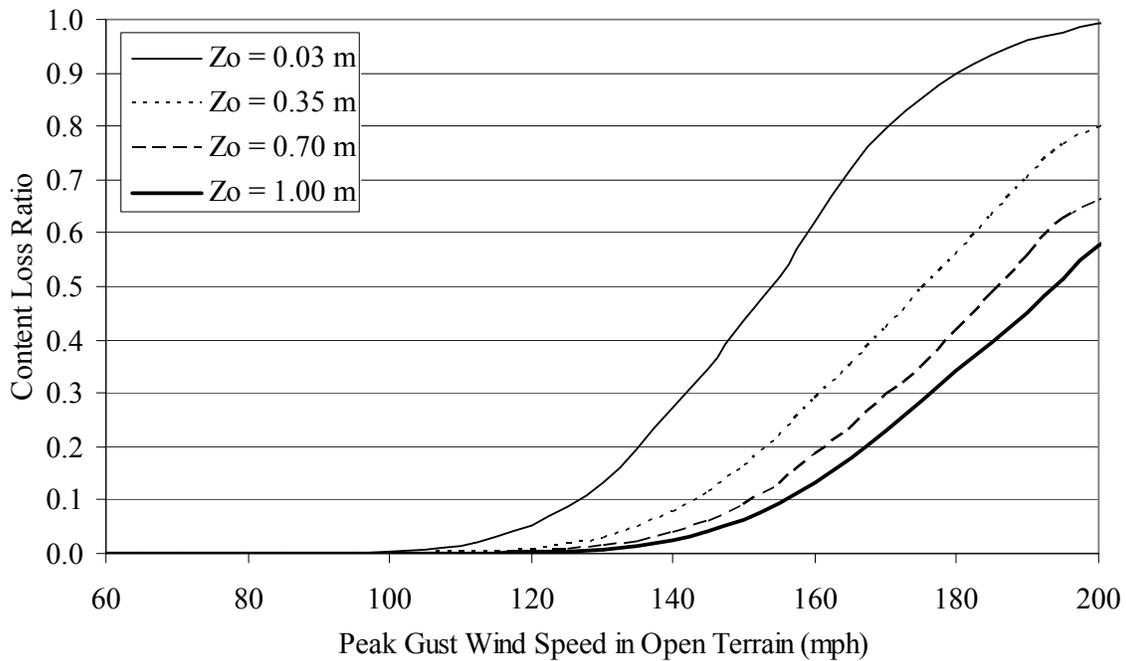
**Figure J.17. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality BUR.**



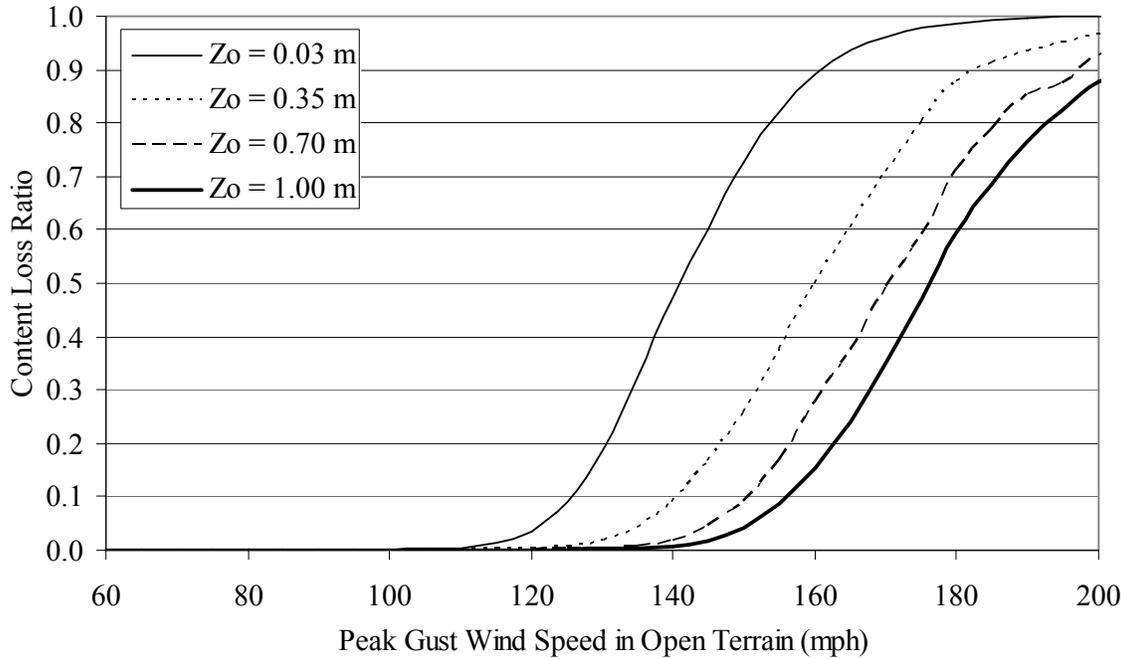
**Figure J.18. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Average Quality EPDM.**



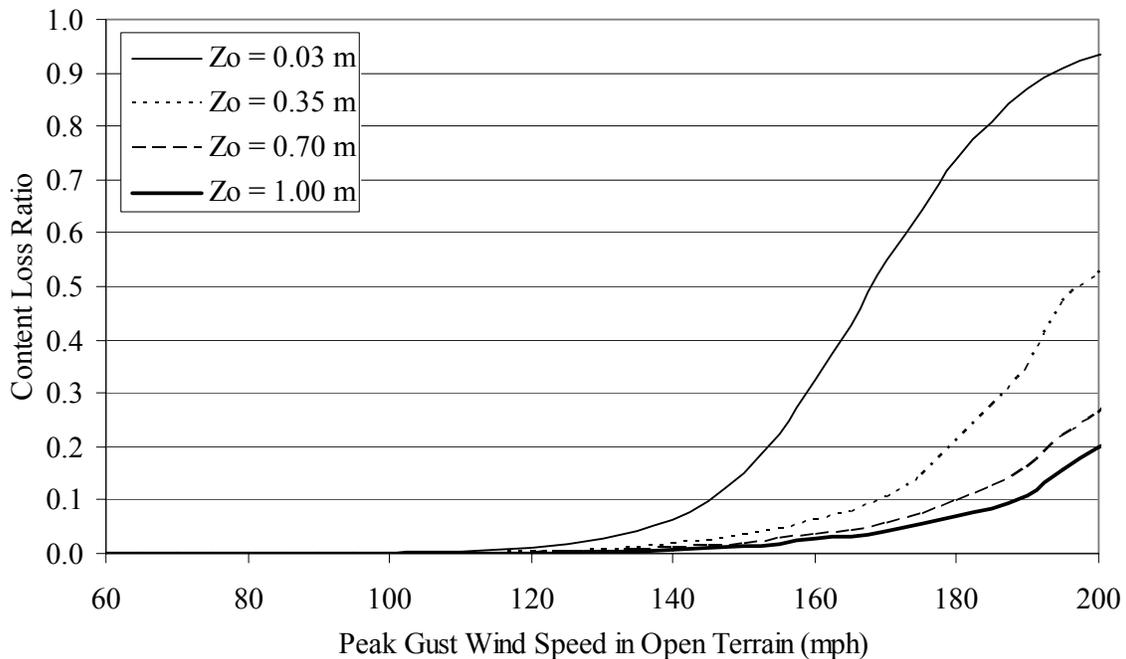
**Figure J.19. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Flat Roof with Poor Quality EPDM.**



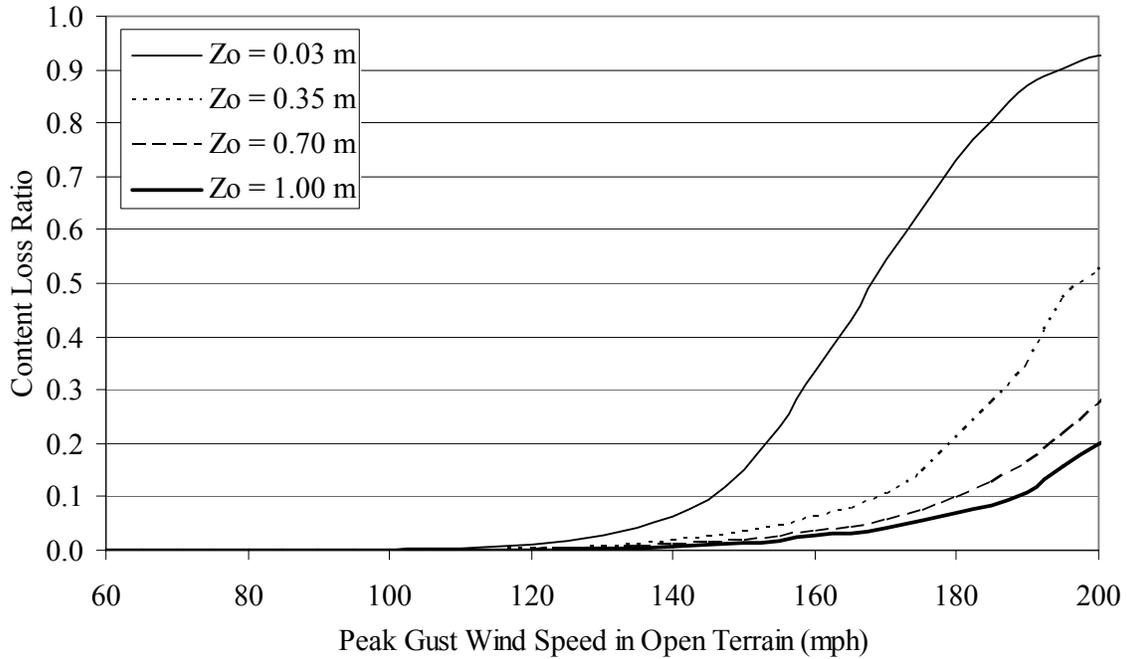
**Figure J.20. Content Loss Function – One-Story, 6d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



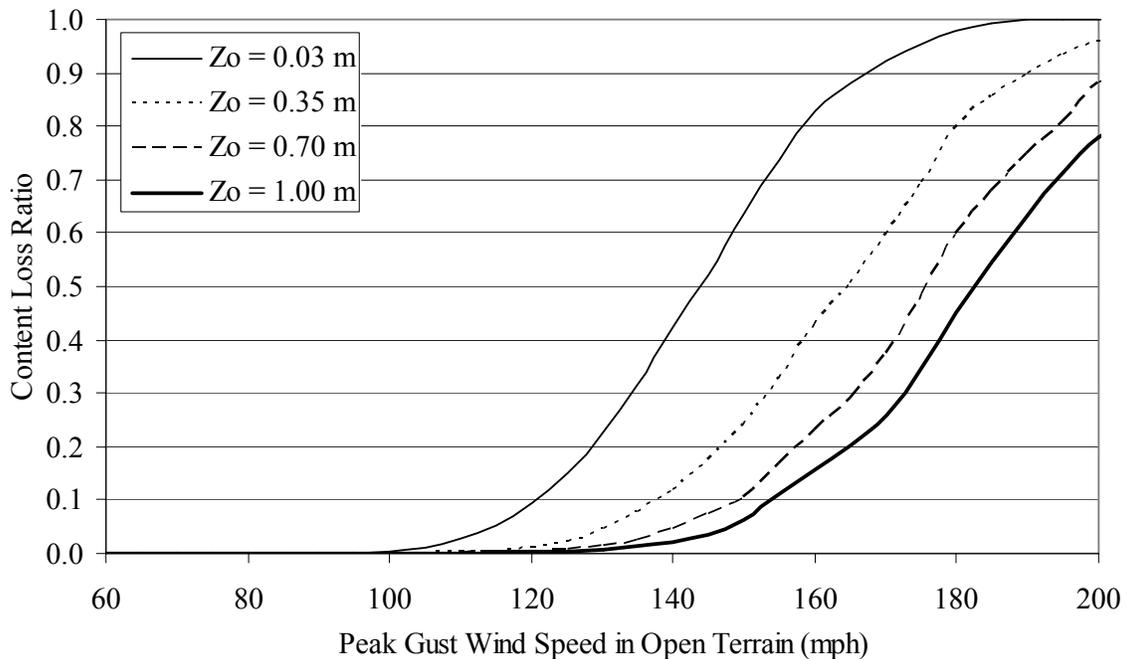
**Figure J.21. Content Loss Function – One-Story, 8d Roof Deck Nails, Toe-Nailed Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



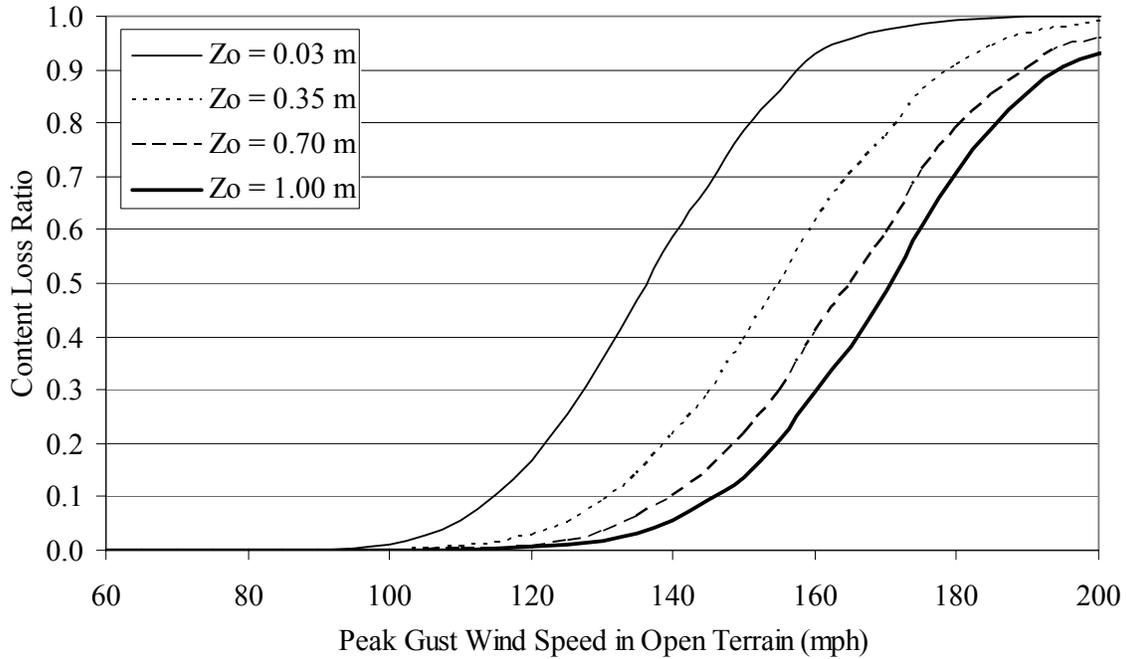
**Figure J.22. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Unreinforced Masonry Walls, Gable Roof with Shingles.**



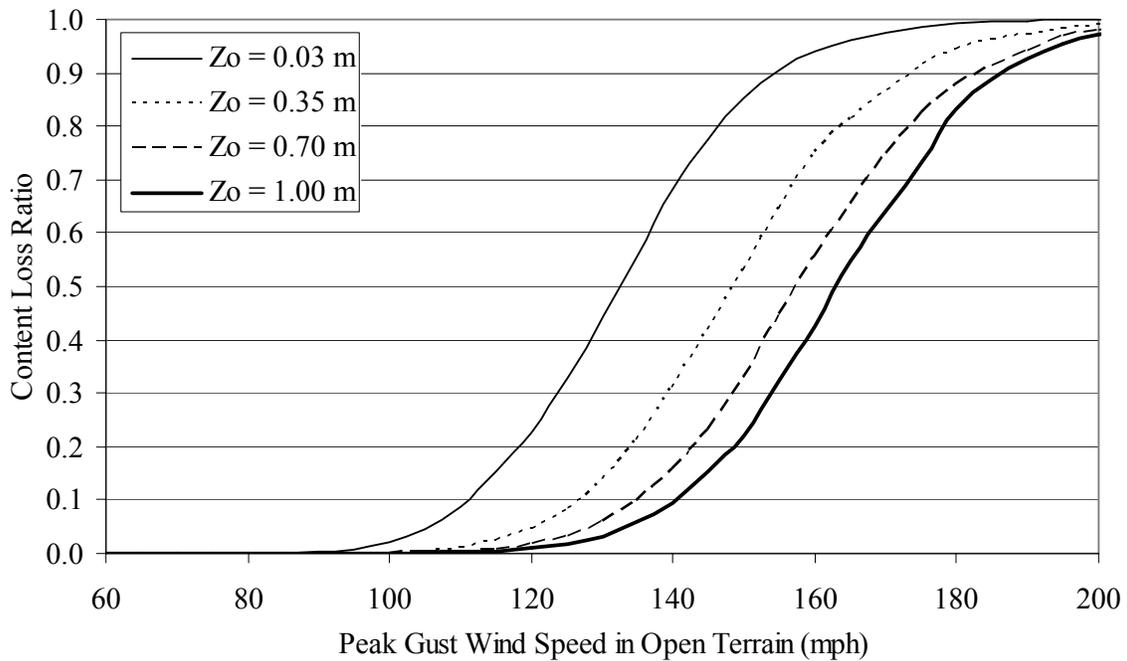
**Figure J.23. Content Loss Function – One-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Reinforced Masonry Walls, Gable Roof with Shingles.**



**Figure J.24. Content Loss Function – Two-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



**Figure J.25. Content Loss Function – Three-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**



**Figure J.26. Content Loss Function – Four-Story, 8d Roof Deck Nails, Strapped Roof Trusses, Wood Frame Walls, Gable Roof with Shingles.**

**Appendix K.**  
**Loss Functions for Low Rise Masonry Strip Mall**  
**Buildings**

## **Appendix K. Loss Functions for Low Rise Masonry Strip Mall Buildings**

This appendix presents loss functions for low rise masonry strip mall buildings (see Section 7.11). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

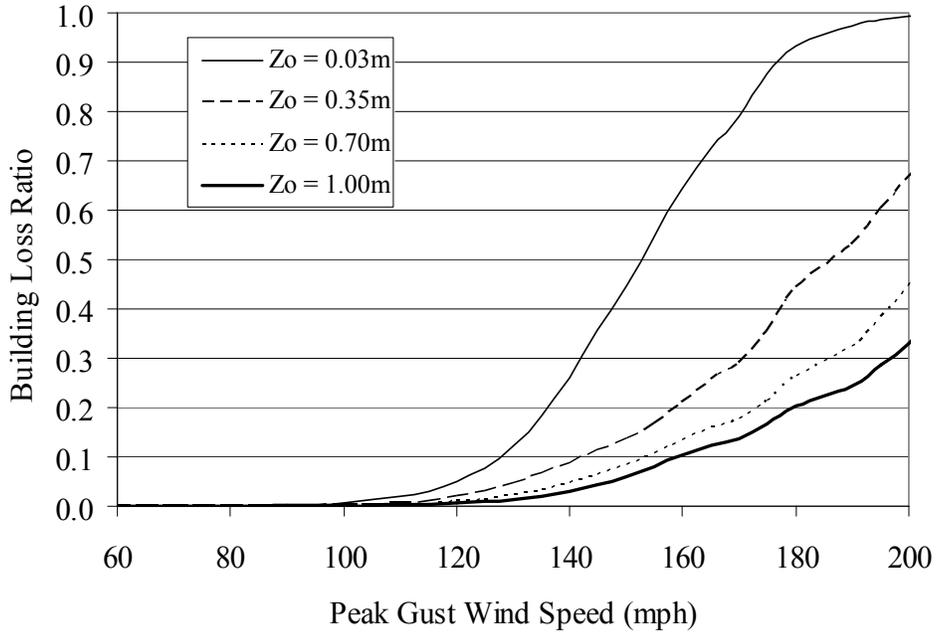
Table K.1 lists the figures provided in this appendix. Figures K.1 through K.18 give example results for the strip mall buildings modeled with a wood roof system. Figures K.19 through K.42 give example results for the strip mall buildings modeled with a steel roof system.

Two sets of nine figures are given for the buildings modeled with a wood roof system. The first set of nine figures (Figures K.1 through K.9) show building loss functions and the second set (Figures K.10 through K.18) show content loss functions. The first figure in each set of nine shows loss results for the 12' high building with 6 units, 8d roof sheathing nails, strapped roof-wall connections, built-up roof cover, unreinforced masonry walls, and situated in Missile Environment A. The remaining eight plots in each set show loss results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

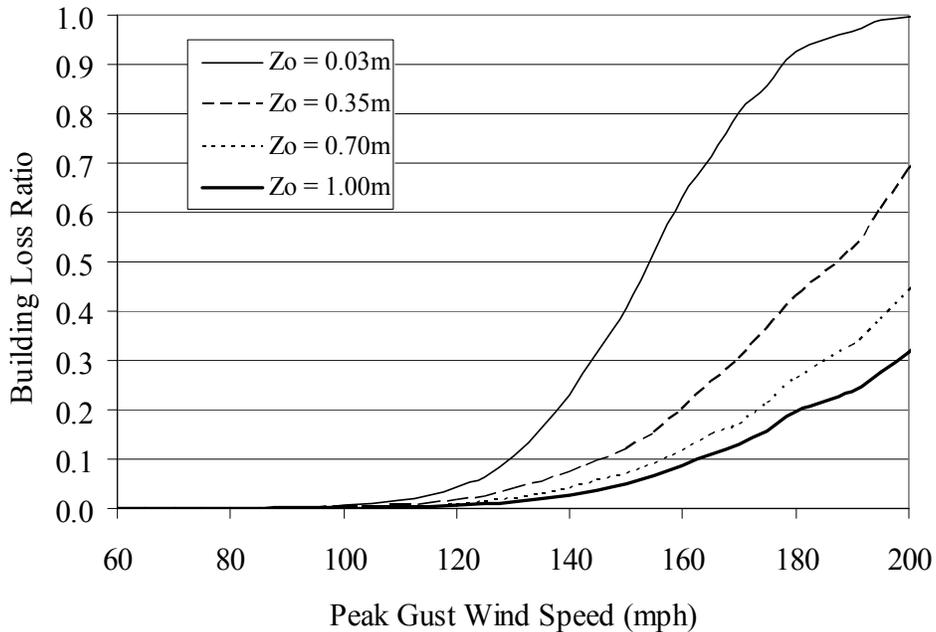
Two sets of twelve figures are given for the buildings modeled with a metal roof system. The first set of twelve figures (Figures K.19 through K.30) show building loss functions and the second set (Figures K.31 through K.42) show content loss functions. The first figure in each set of twelve shows loss results for the 20' high building with 6 units, a joist spacing of 6', metal roof deck fastened with welds, SBCCI roof design criteria, built-up roof cover, unreinforced masonry walls, and situated in Missile Environment A. The remaining eleven plots in each set show loss results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

**Table K.1. Sample Loss Functions for Low Rise Masonry Strip Mall Buildings**

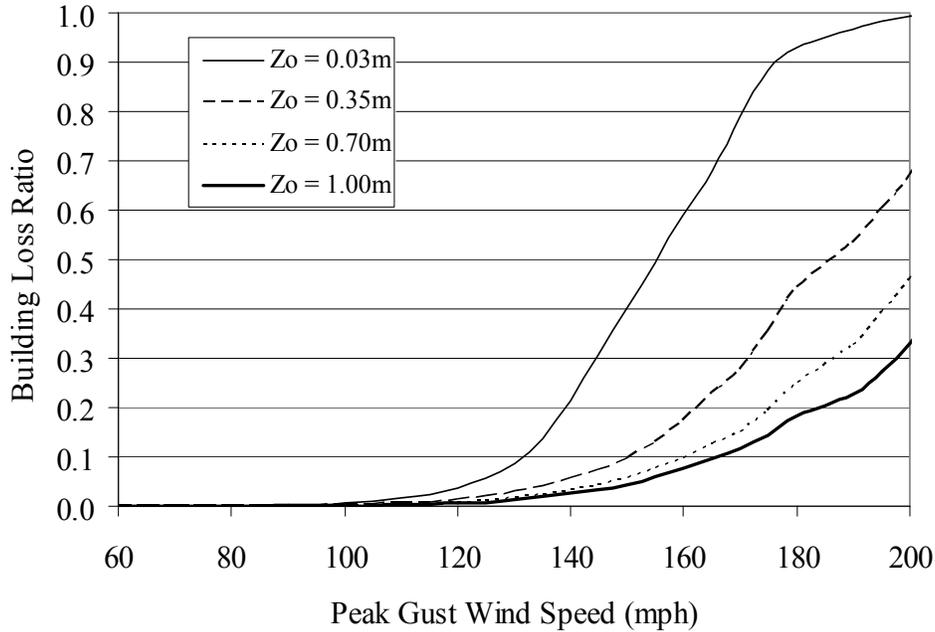
Figure	Loss Type	Walls	Height	Number of Units	Roof Frame	Frame Spacing	Roof/Wall	Deck Mat'l.	Deck Attachment	Design Code	Roof Cover	Missile Environ.
K.1	Building	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.2	Building	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>B</b>
K.3	Building	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>C</b>
K.4	Building	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>D</b>
K.5	Building	URM	12'	6	Wood	2'	Strap	Wood	8d	-	<b>SPM</b>	A
K.6	Building	URM	12'	6	Wood	2'	Strap	Wood	<b>6d</b>	-	BUR	A
K.7	Building	<b>RM</b>	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.8	Building	URM	12'	6	Wood	2'	<b>Toe-Nail</b>	Wood	8d	-	BUR	A
K.9	Building	URM	<b>20'</b>	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.10	Content	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.11	Content	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>B</b>
K.12	Content	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>C</b>
K.13	Content	URM	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	<b>D</b>
K.14	Content	URM	12'	6	Wood	2'	Strap	Wood	8d	-	<b>SPM</b>	A
K.15	Content	URM	12'	6	Wood	2'	Strap	Wood	<b>6d</b>	-	BUR	A
K.16	Content	<b>RM</b>	12'	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.17	Content	URM	12'	6	Wood	2'	<b>Toe-Nail</b>	Wood	8d	-	BUR	A
K.18	Content	URM	<b>20'</b>	6	Wood	2'	Strap	Wood	8d	-	BUR	A
K.19	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A
K.20	Building	URM	20'	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A
K.21	Building	URM	20'	<b>1</b>	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A
K.22	Building	URM	<b>12'</b>	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A
K.23	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>B</b>
K.24	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>C</b>
K.25	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>D</b>
K.26	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	<b>SPM</b>	A
K.27	Building	URM	20'	6	OWSJ	6'	-	Metal	<b>Weld, 50%</b>	SBCCI, 100	BUR	A
K.28	Building	URM	20'	6	OWSJ	6'	-	Metal	<b>Screw</b>	SBCCI, 100	BUR	A
K.29	Building	URM	20'	6	OWSJ	6'	-	Metal	Weld	<b>ASCE, 100</b>	BUR	A
K.30	Building	<b>RM</b>	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A
K.31	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A
K.32	Content	URM	20'	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A
K.33	Content	URM	20'	<b>1</b>	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A
K.34	Content	URM	<b>12'</b>	6	OWSJ	4'	-	Metal	Weld	SBCCI, 100	BUR	A
K.35	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>B</b>
K.36	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>C</b>
K.37	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	<b>D</b>
K.38	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	<b>SPM</b>	A
K.39	Content	URM	20'	6	OWSJ	6'	-	Metal	<b>Weld, 50%</b>	SBCCI, 100	BUR	A
K.40	Content	URM	20'	6	OWSJ	6'	-	Metal	<b>Screw</b>	SBCCI, 100	BUR	A
K.41	Content	URM	20'	6	OWSJ	6'	-	Metal	Weld	<b>ASCE, 100</b>	BUR	A
K.42	Content	<b>RM</b>	20'	6	OWSJ	6'	-	Metal	Weld	SBCCI, 100	BUR	A



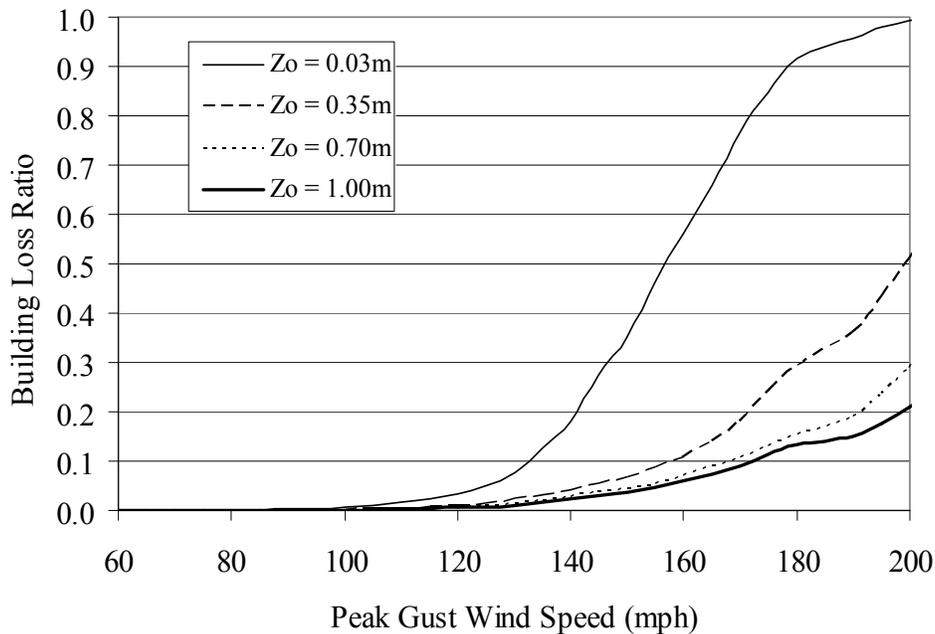
**Figure K.1. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



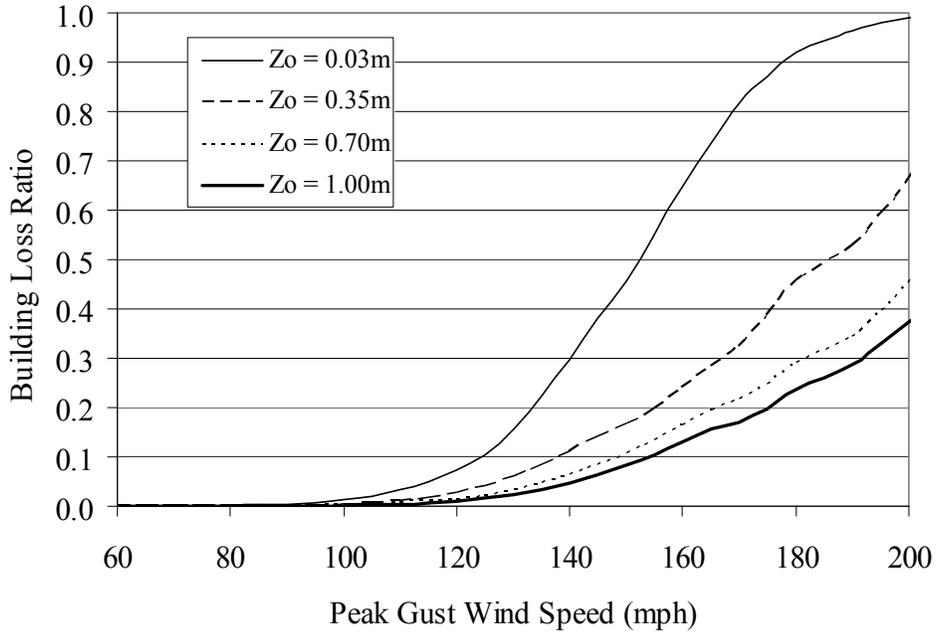
**Figure K.2. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B.**



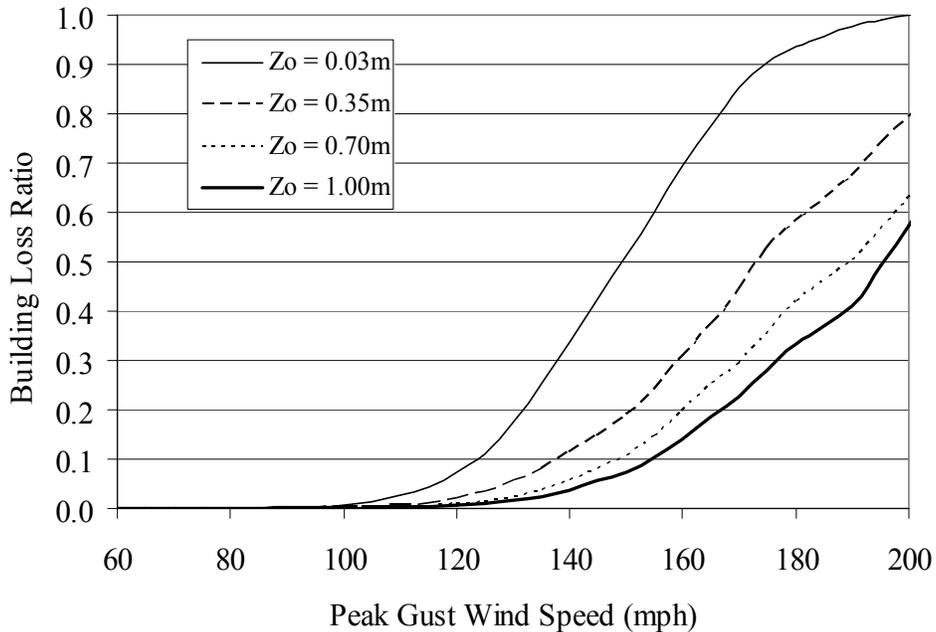
**Figure K.3. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C.**



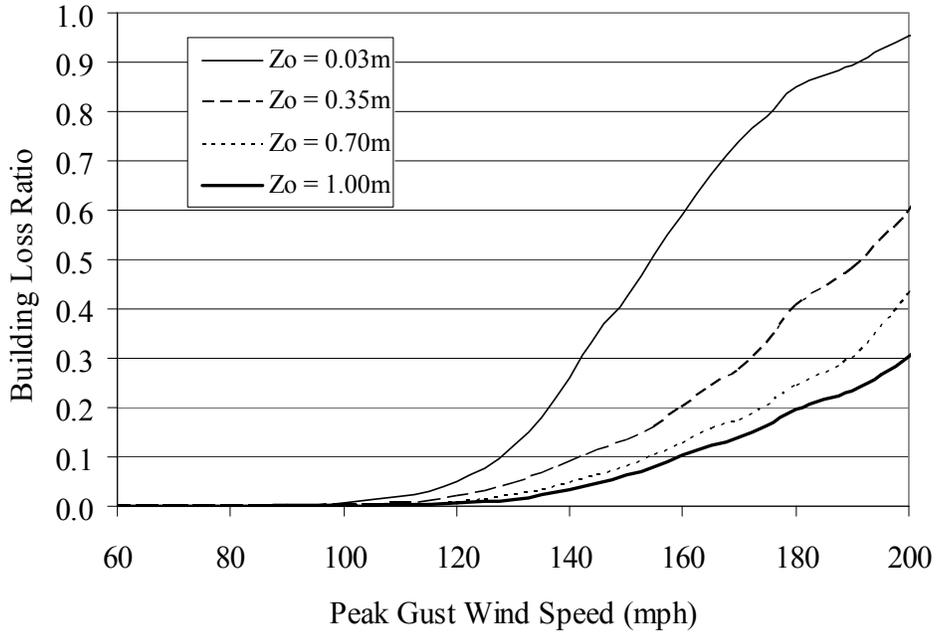
**Figure K.4. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D.**



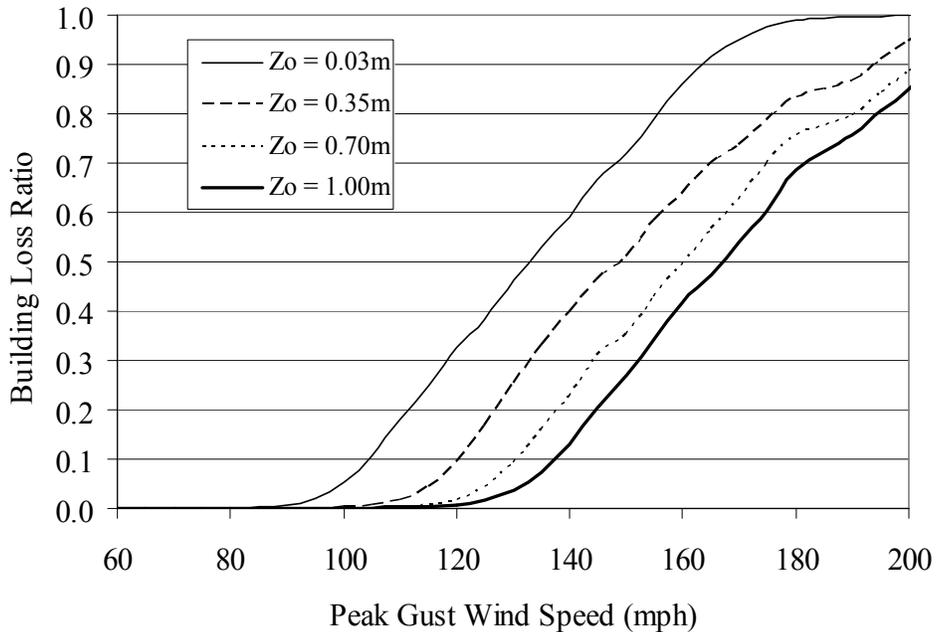
**Figure K.5. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



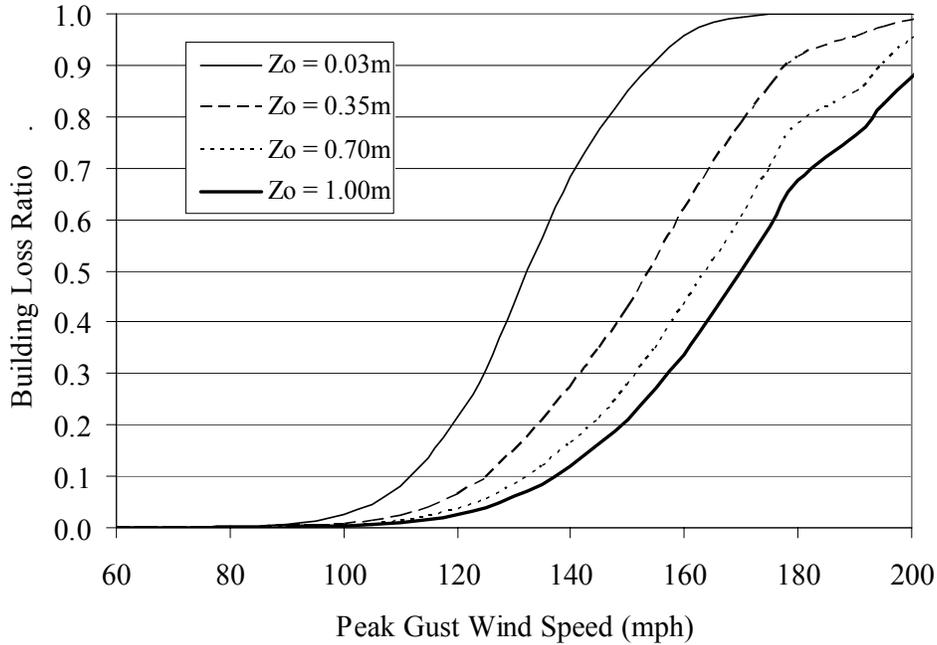
**Figure K.6. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 6d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



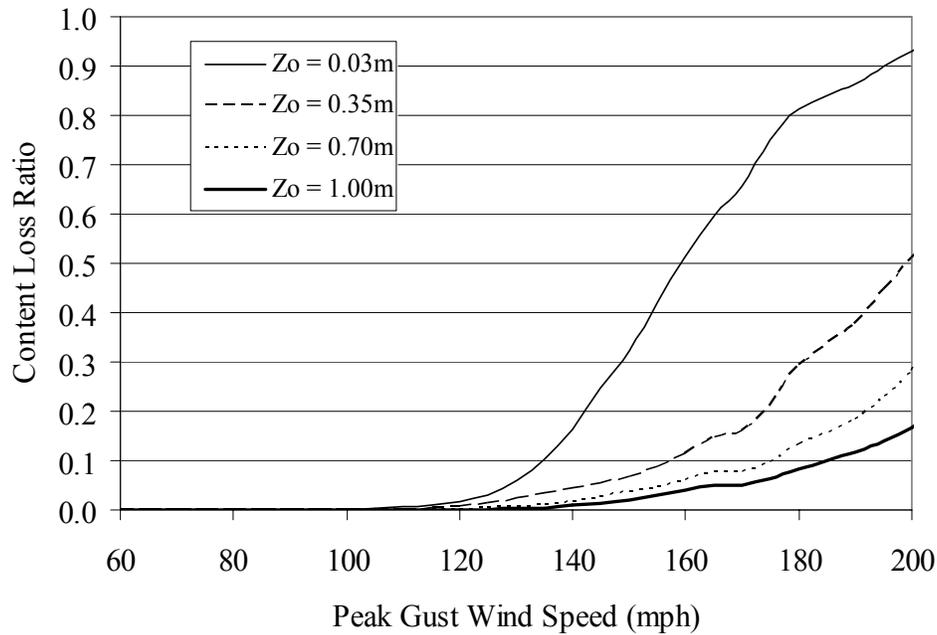
**Figure K.7. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A.**



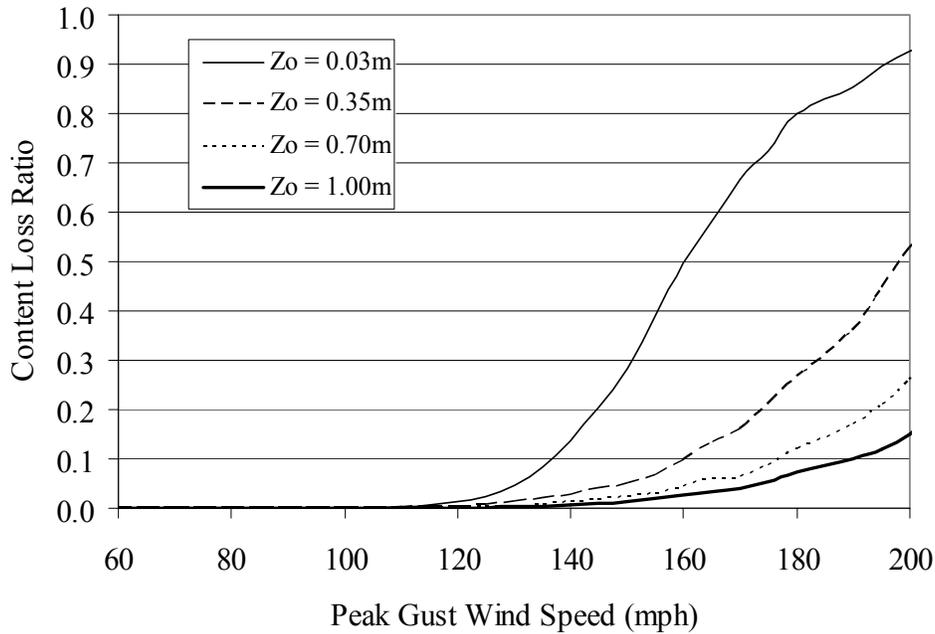
**Figure K.8. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Toe-Nailed Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



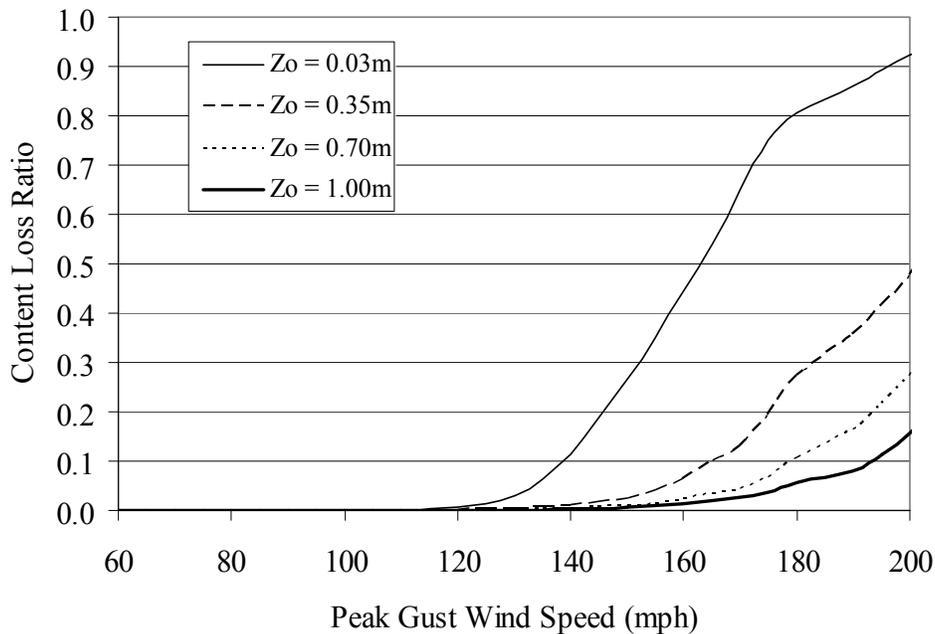
**Figure K.9. Building Loss Function – Strip Mall Building B – Height=20', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



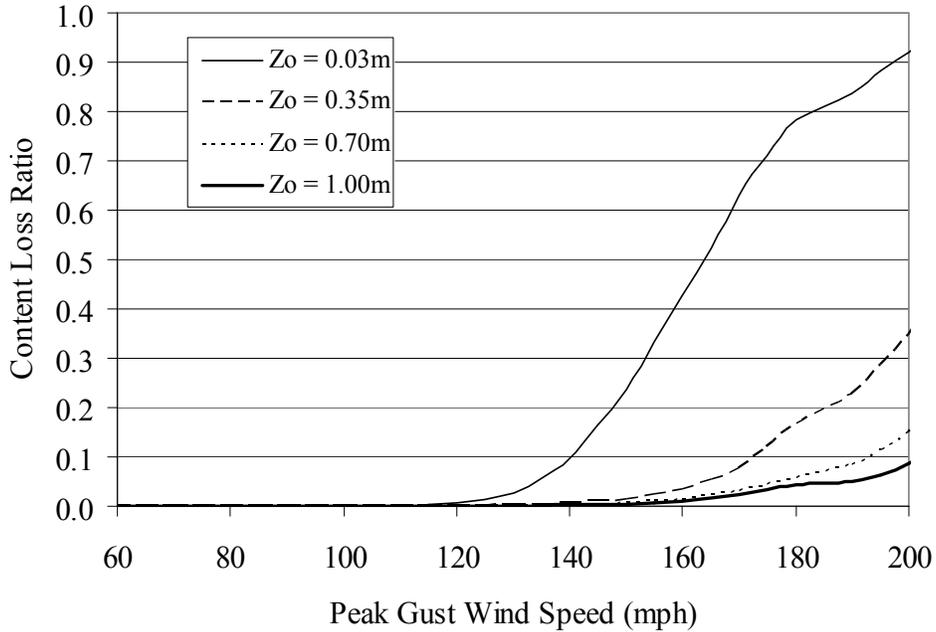
**Figure K.10. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



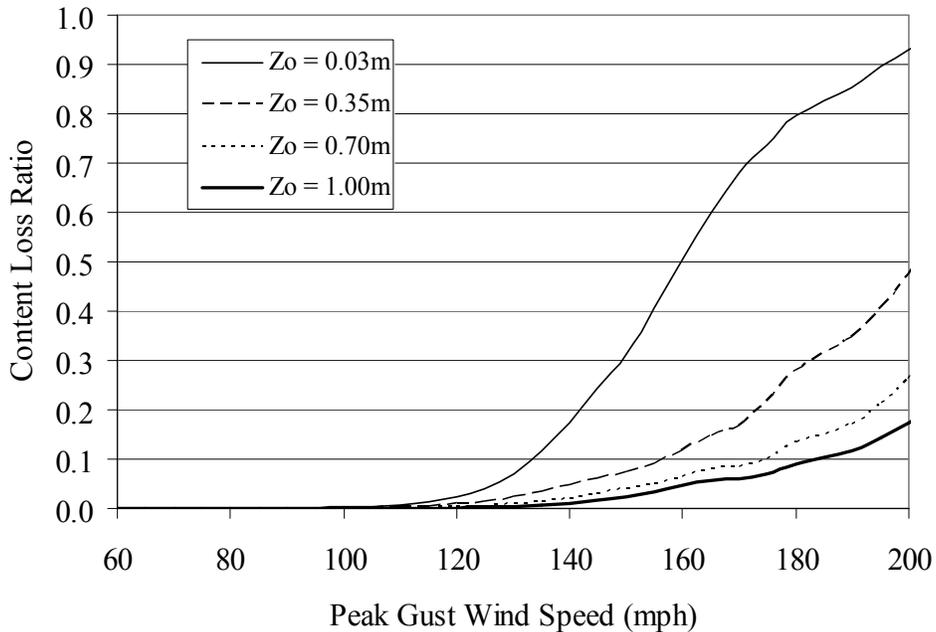
**Figure K.11. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B.**



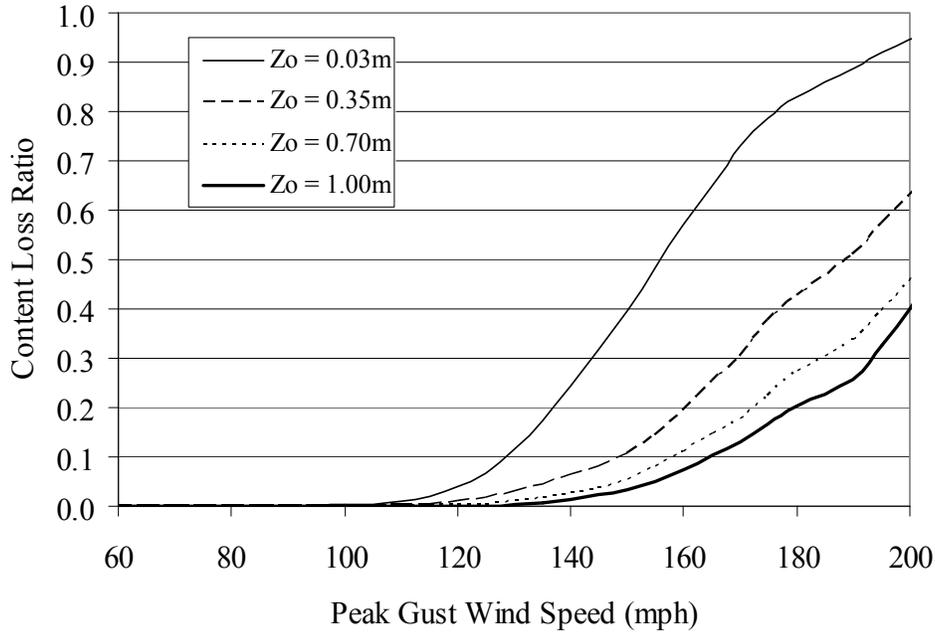
**Figure K.12. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C.**



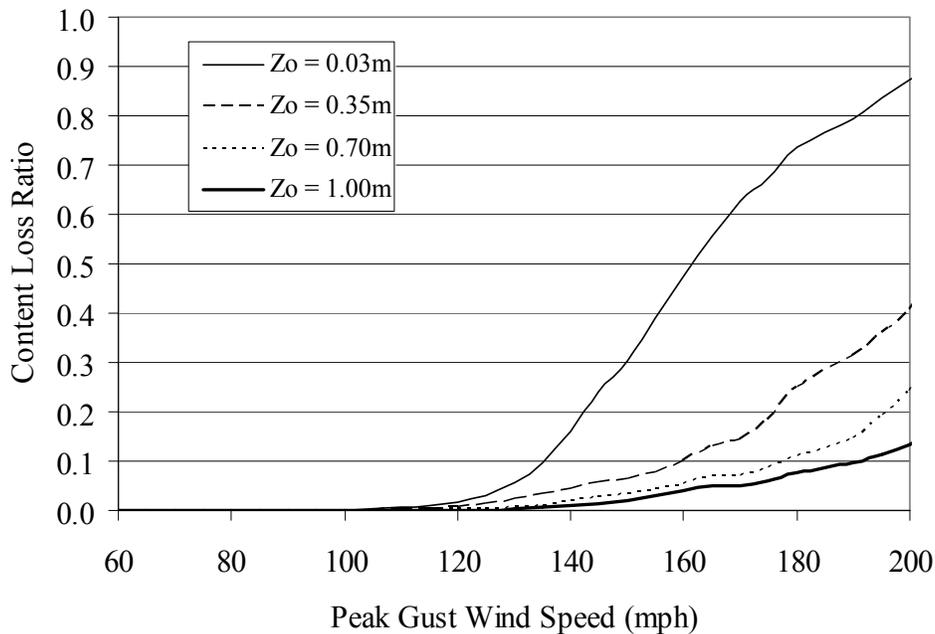
**Figure K.13. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D.**



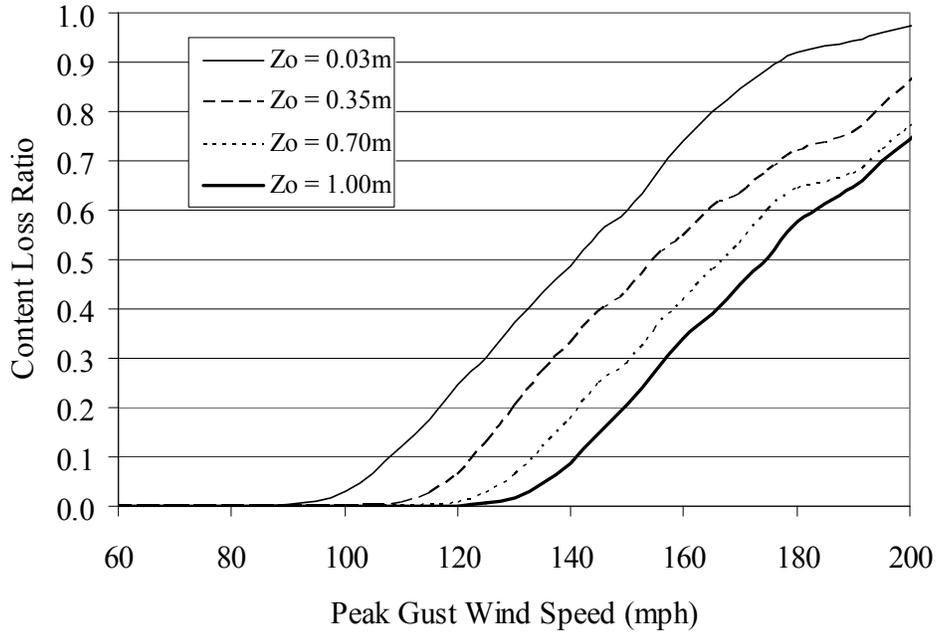
**Figure K.14. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



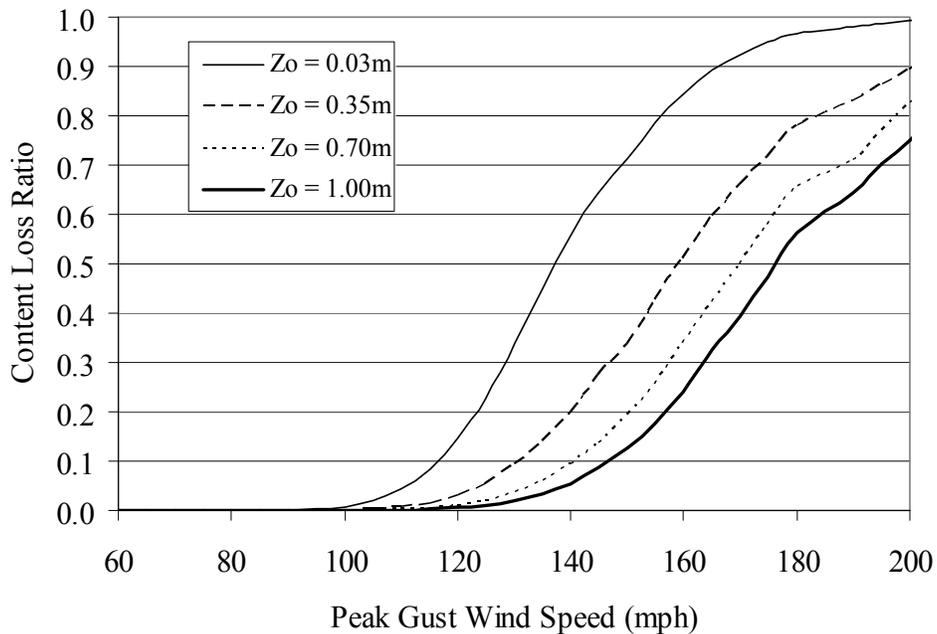
**Figure K.15. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 6d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



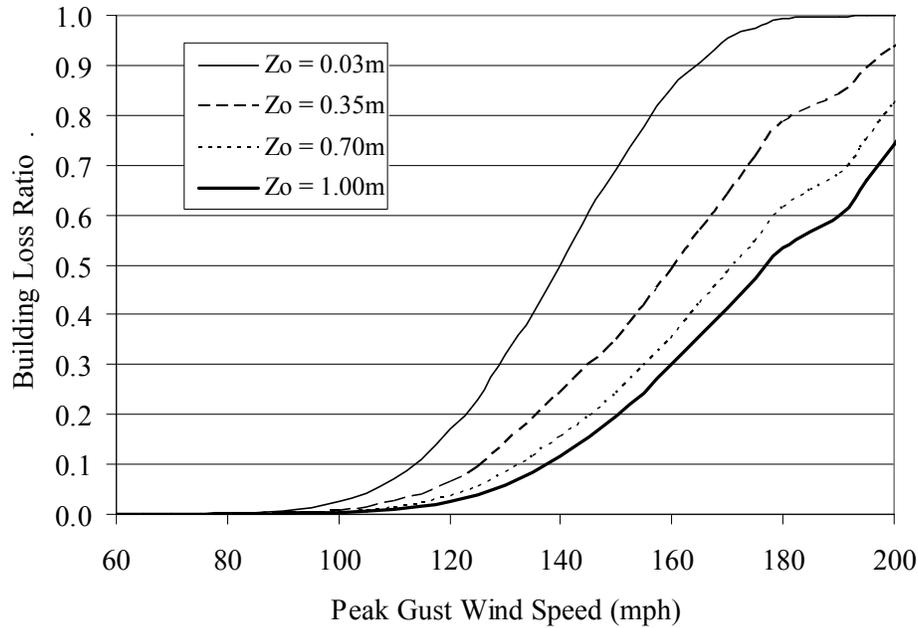
**Figure K.16. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A.**



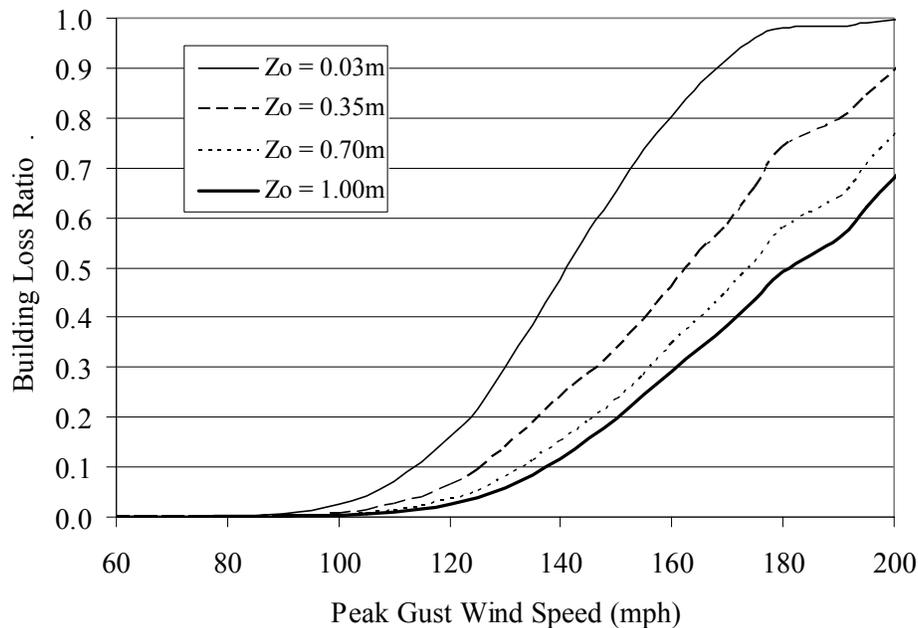
**Figure K.17. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Wood Deck with 8d Nails, Toe-Nailed Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



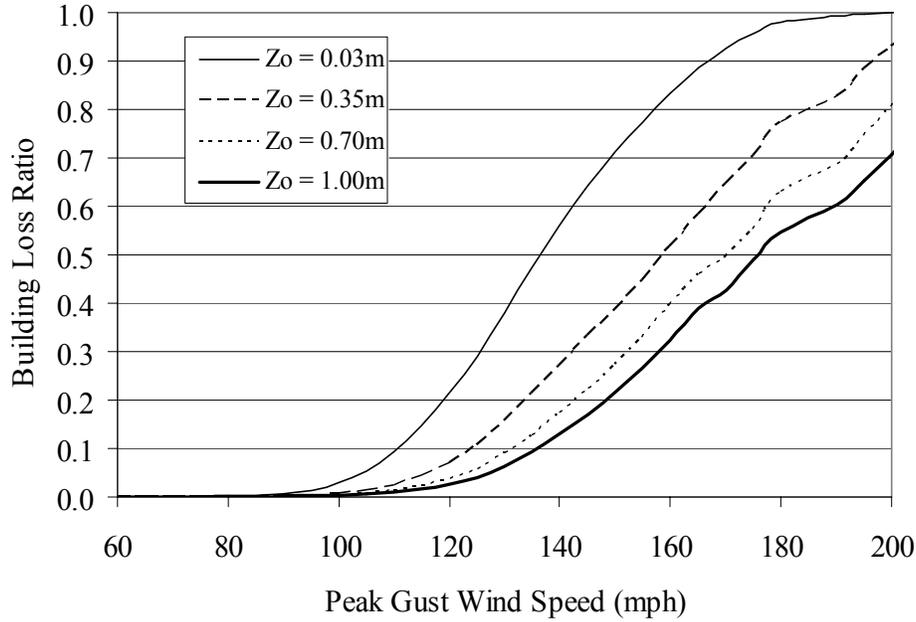
**Figure K.18. Content Loss Function – Strip Mall Building B – Height=20', No. of Units=6, Wood Deck with 8d Nails, Strapped Roof-Wall Connections, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



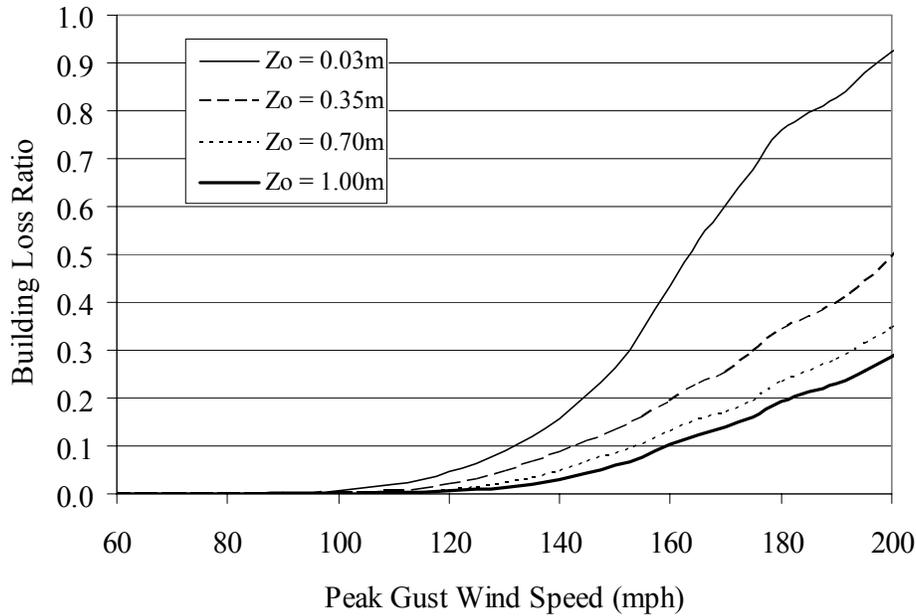
**Figure K.19. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



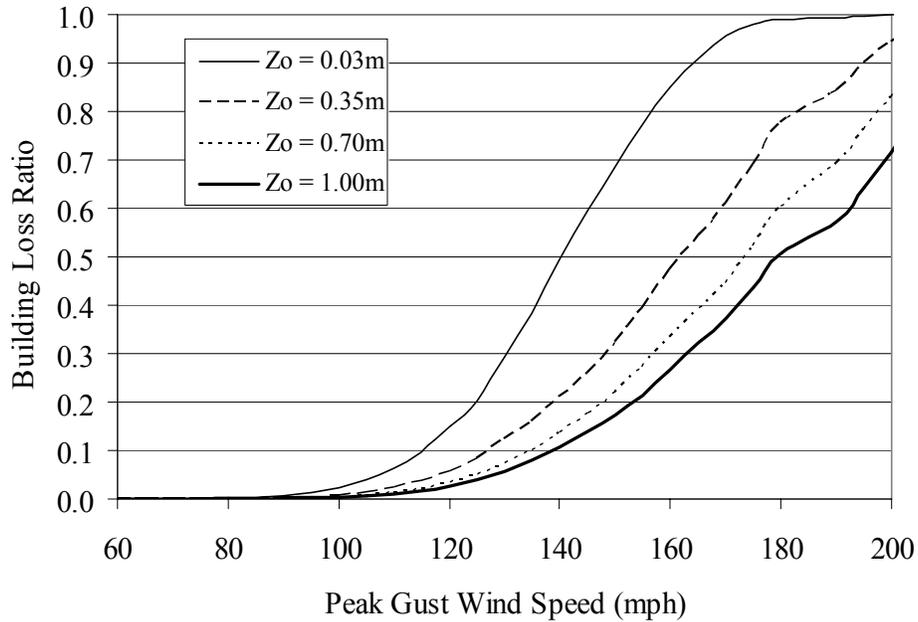
**Figure K.20. Building Loss Function – Strip Mall Building B – Height=20', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



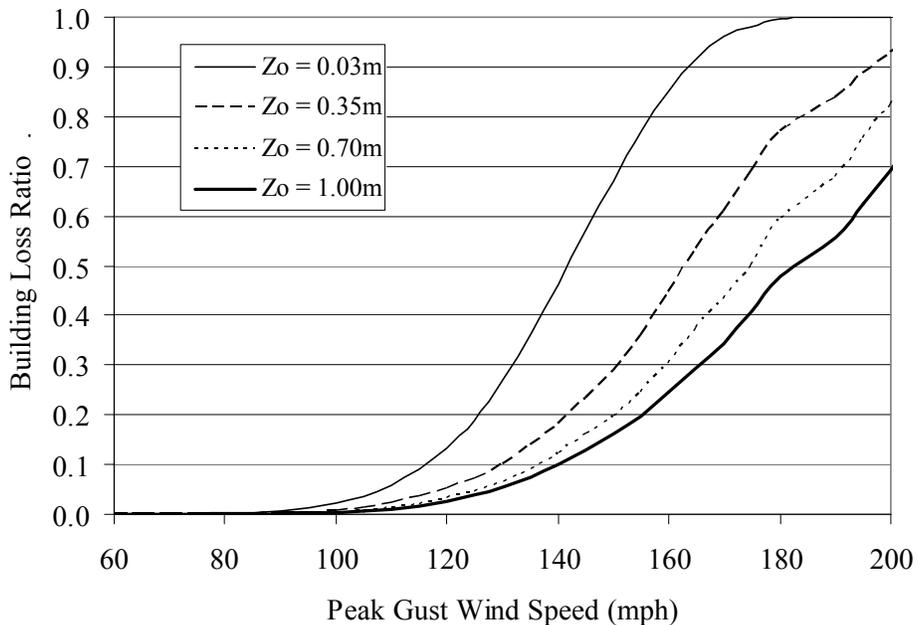
**Figure K.21. Building Loss Function – Strip Mall Building D – Height=20', No. of Units=1, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



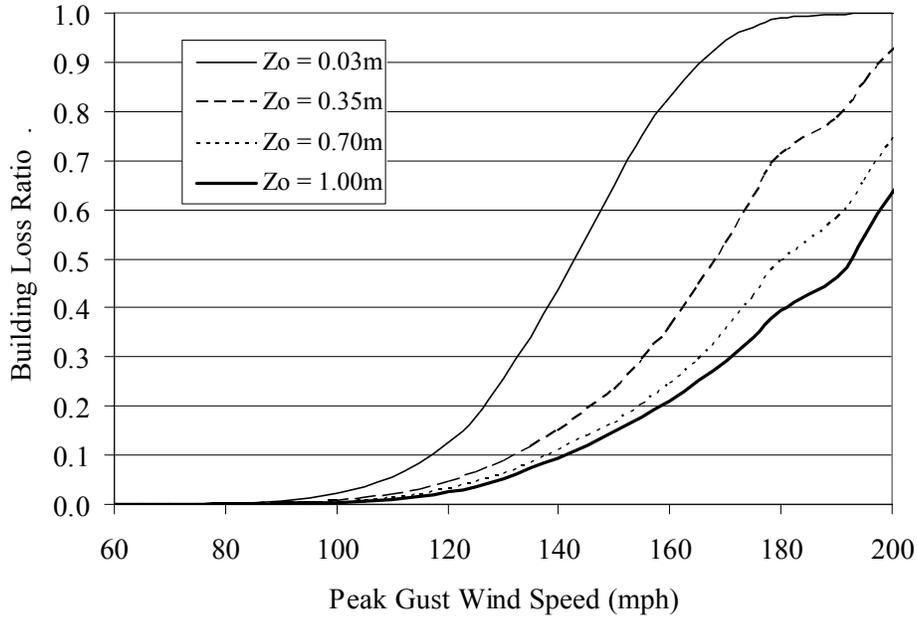
**Figure K.22. Building Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



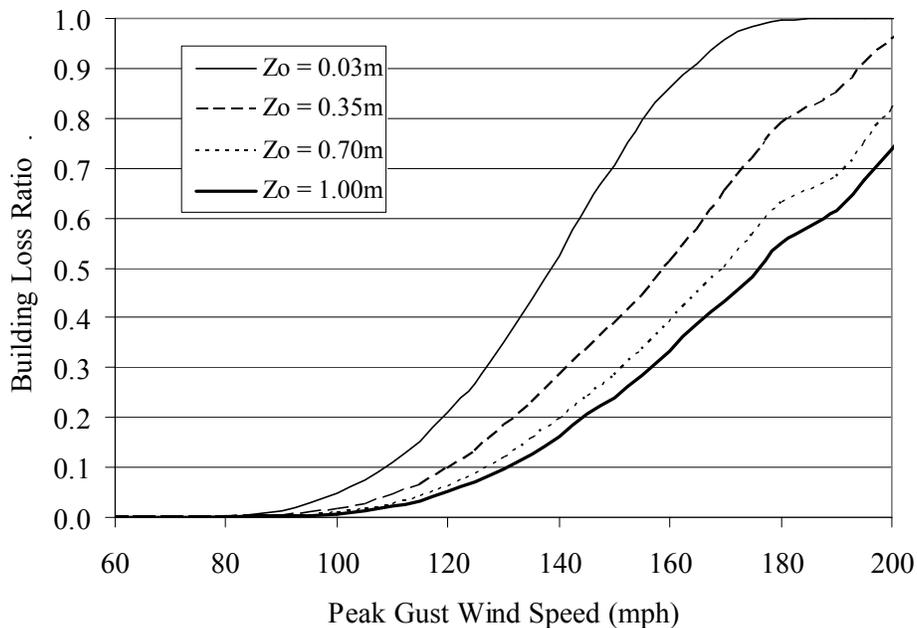
**Figure K.23. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B.**



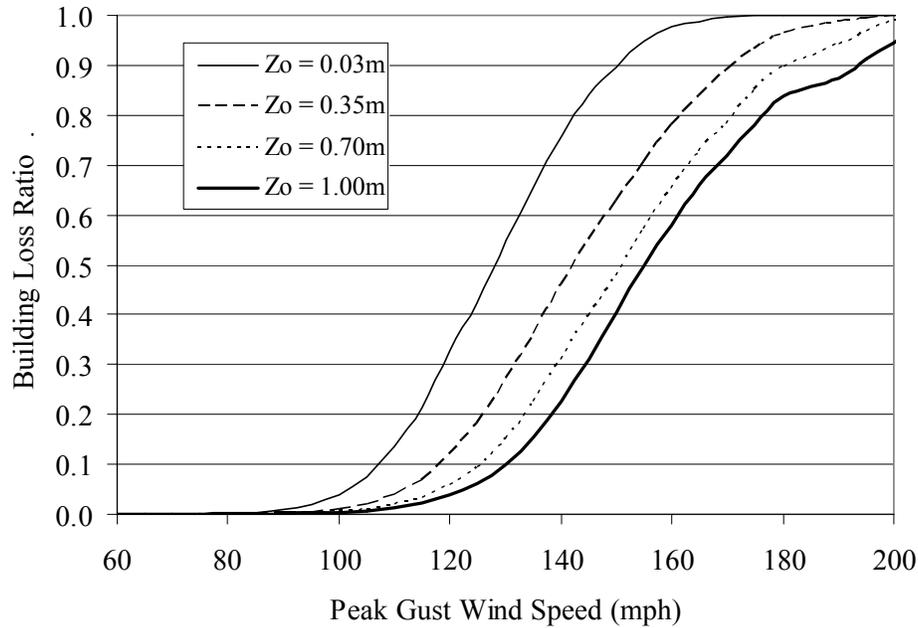
**Figure K.24. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C.**



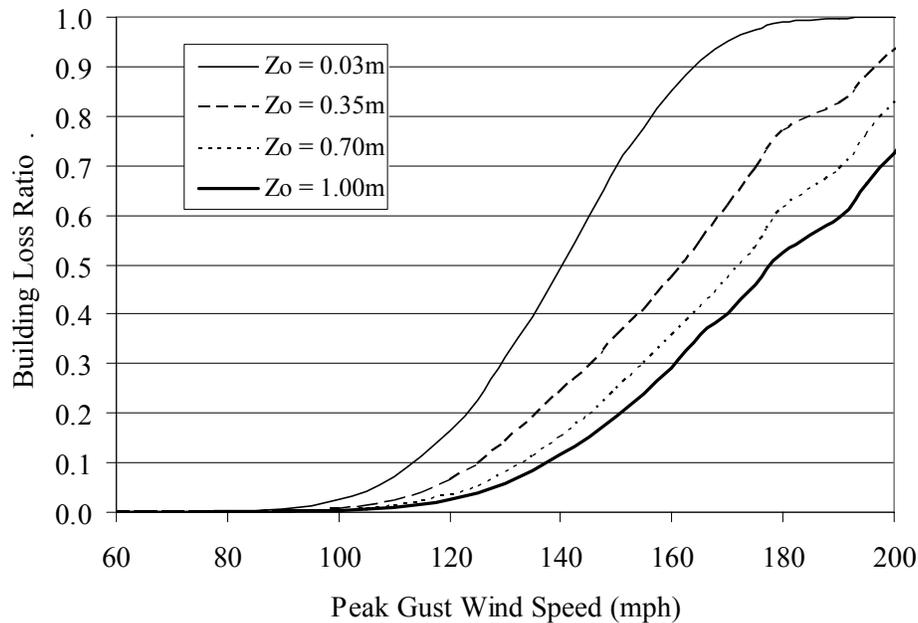
**Figure K.25. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D.**



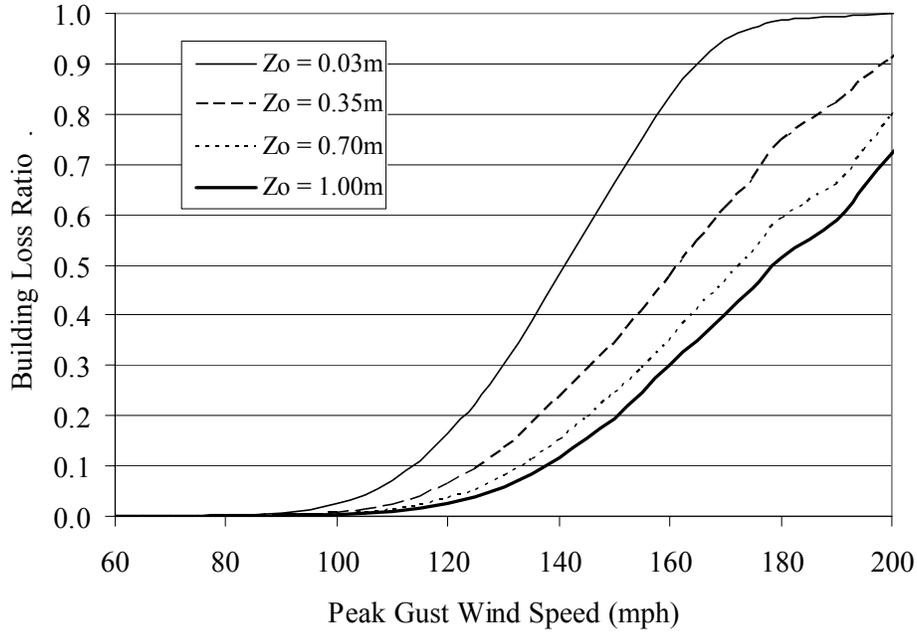
**Figure K.26. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



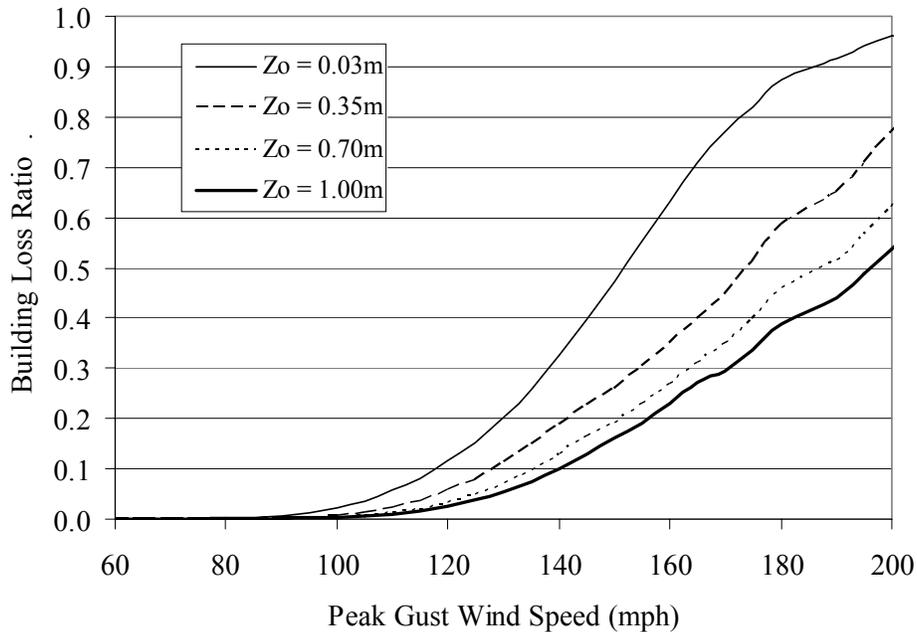
**Figure K.27. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists with 50% Reduction in Resistance, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



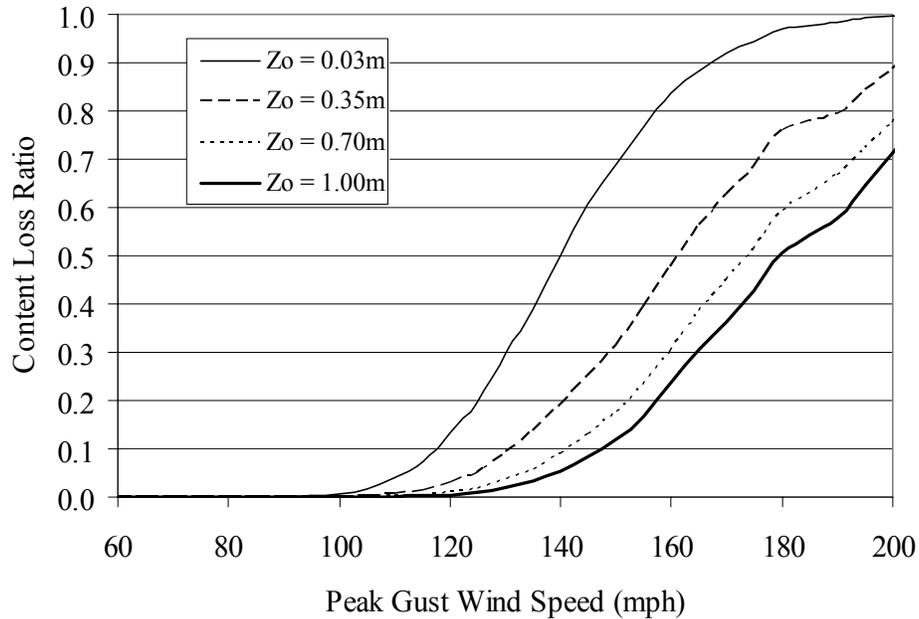
**Figure K.28. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Screwed to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



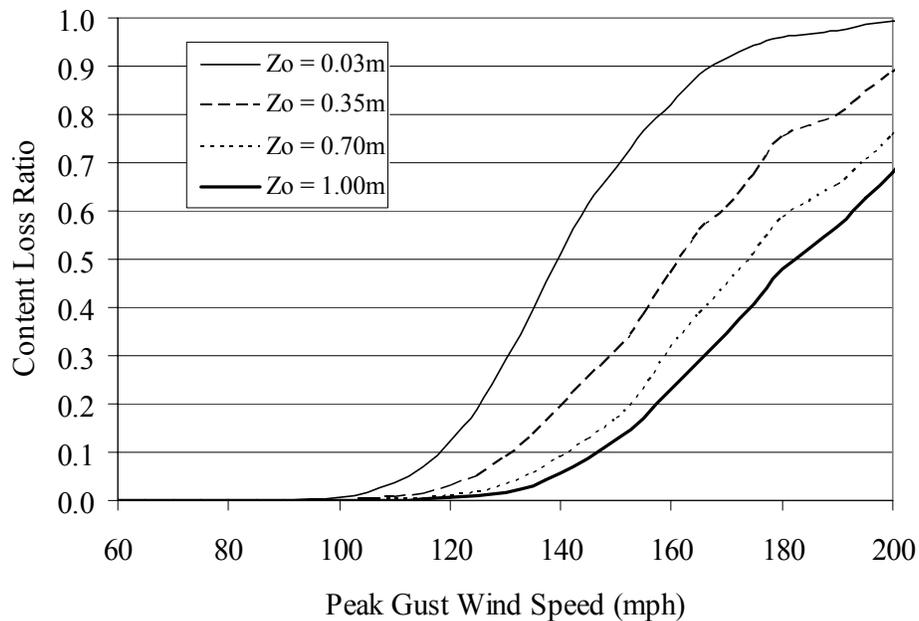
**Figure K.29. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, ASCE 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



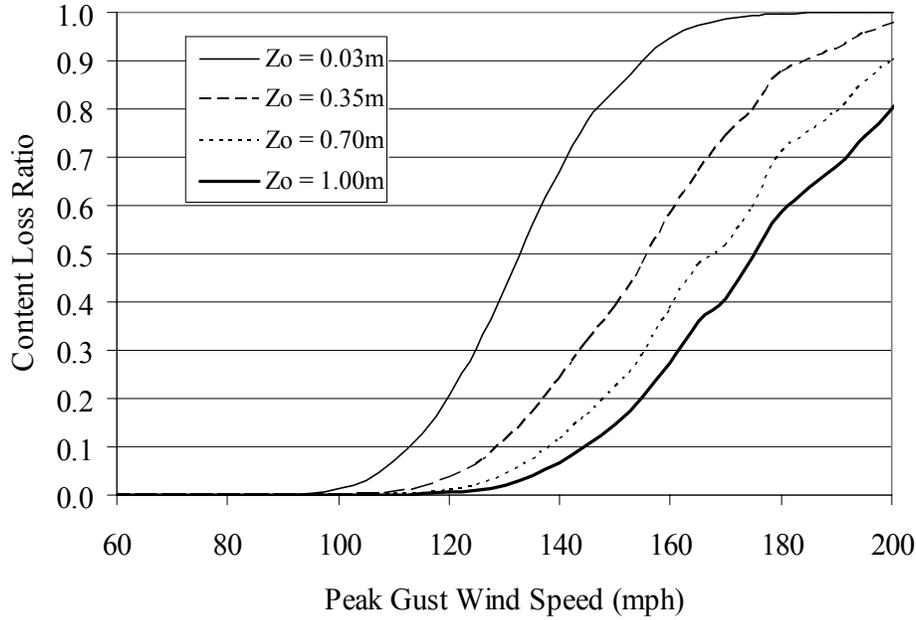
**Figure K.30. Building Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A.**



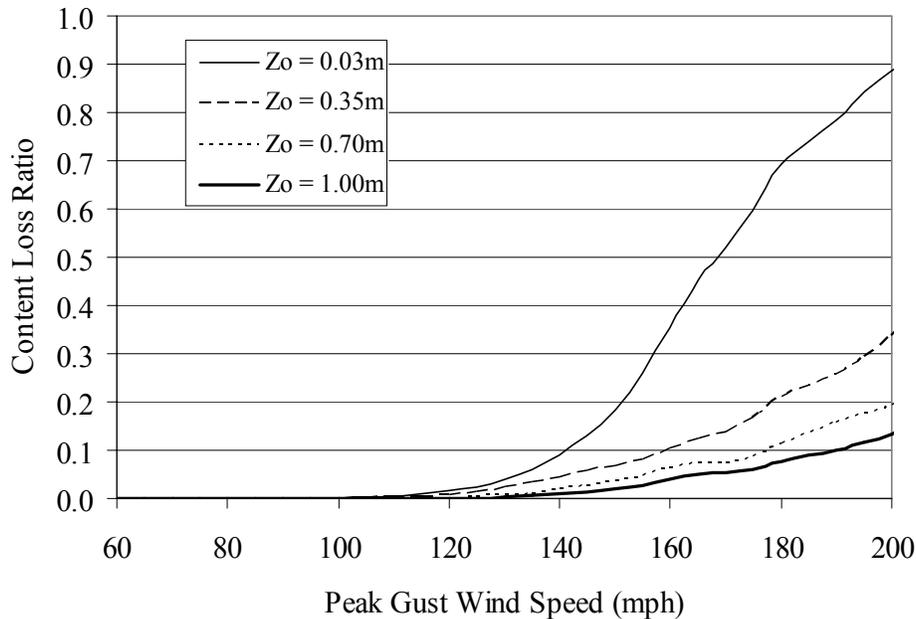
**Figure K.31. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



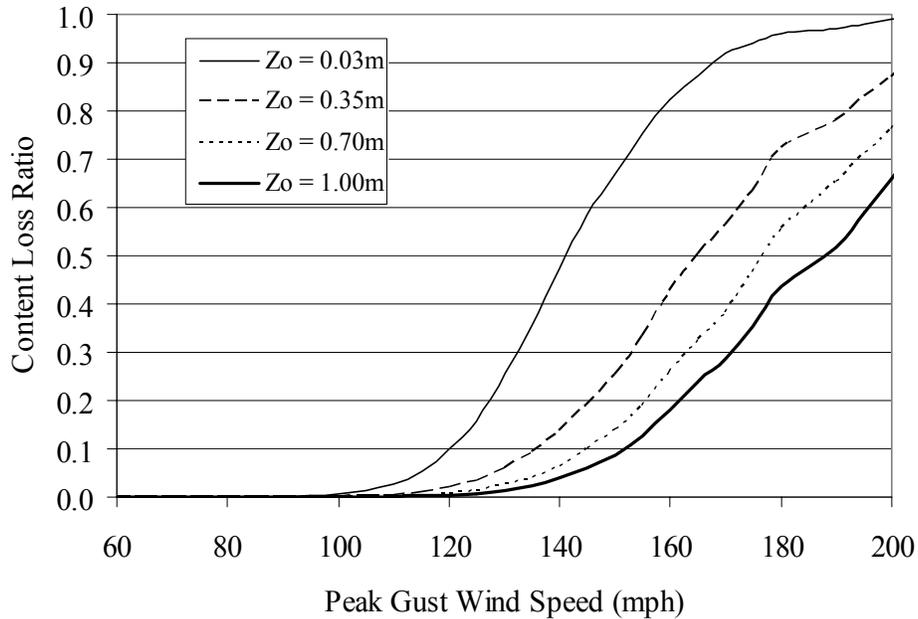
**Figure K.32. Content Loss Function – Strip Mall Building B – Height=20', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



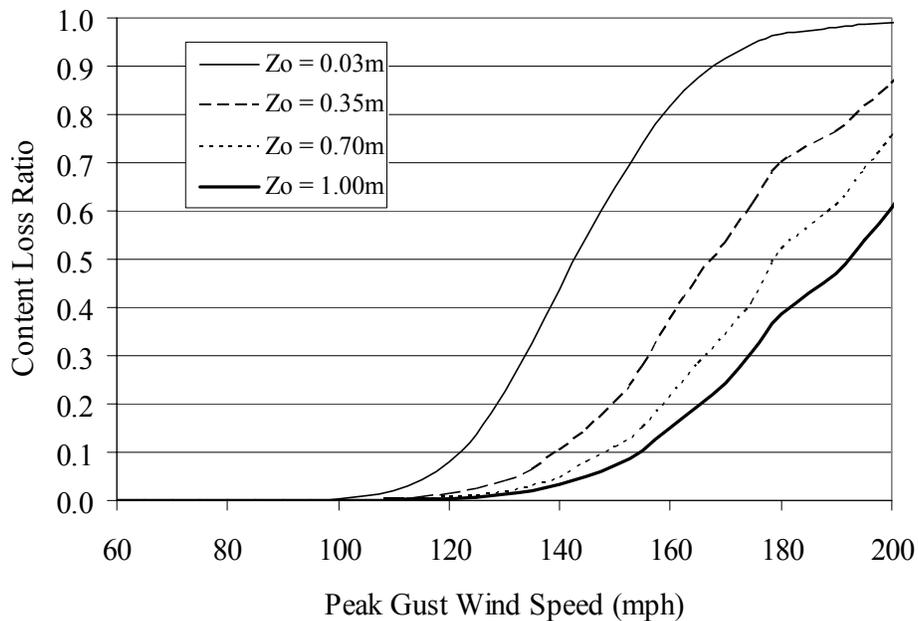
**Figure K.33. Content Loss Function – Strip Mall Building D – Height=20', No. of Units=1, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



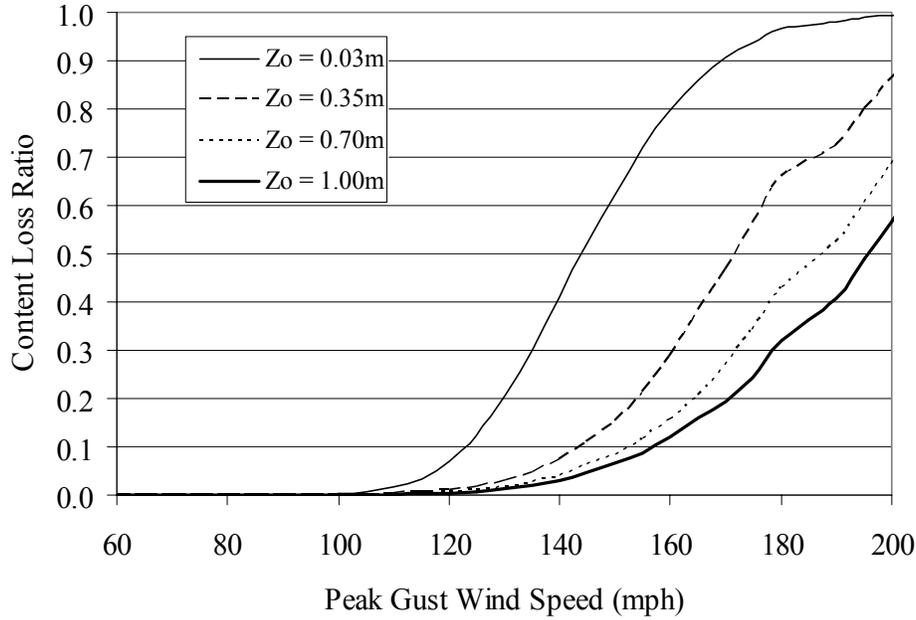
**Figure K.34. Content Loss Function – Strip Mall Building A – Height=12', No. of Units=6, Joist Spacing=4', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



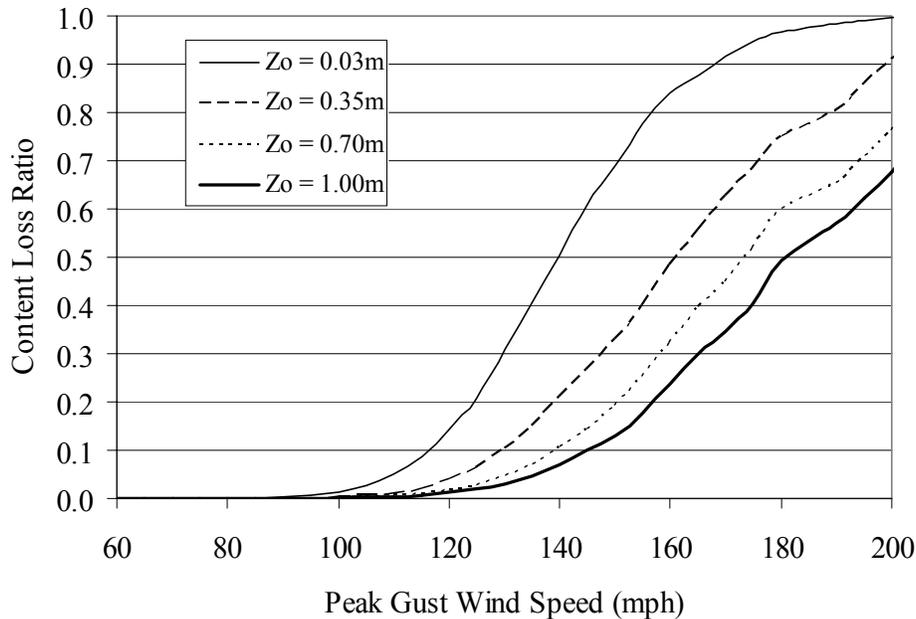
**Figure K.35. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment B.**



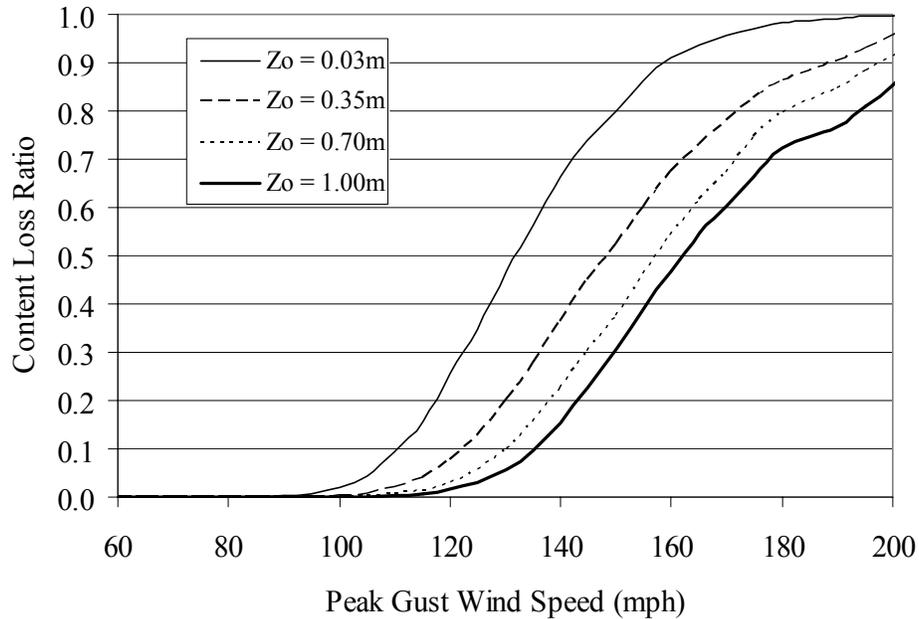
**Figure K.36. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment C.**



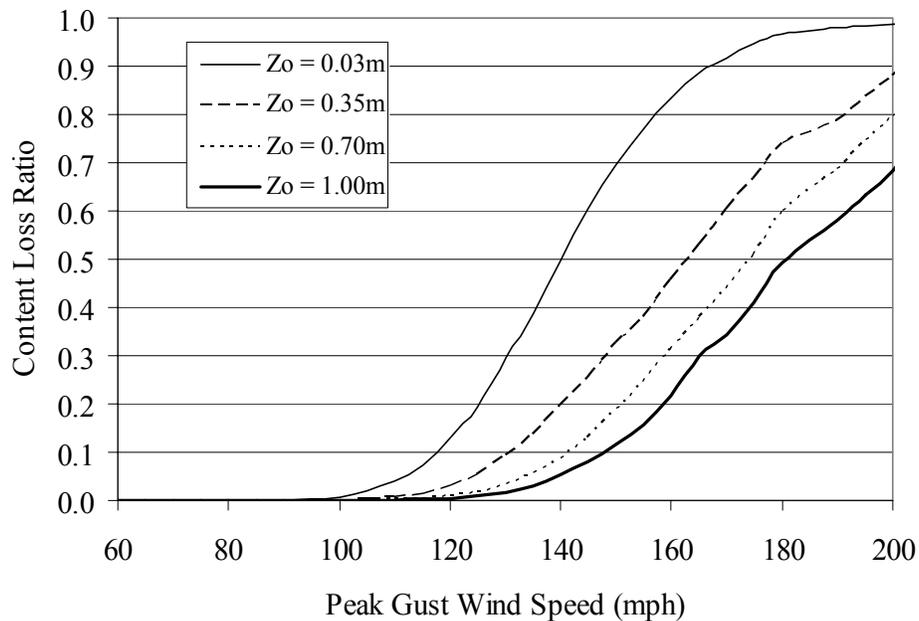
**Figure K.37. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment D.**



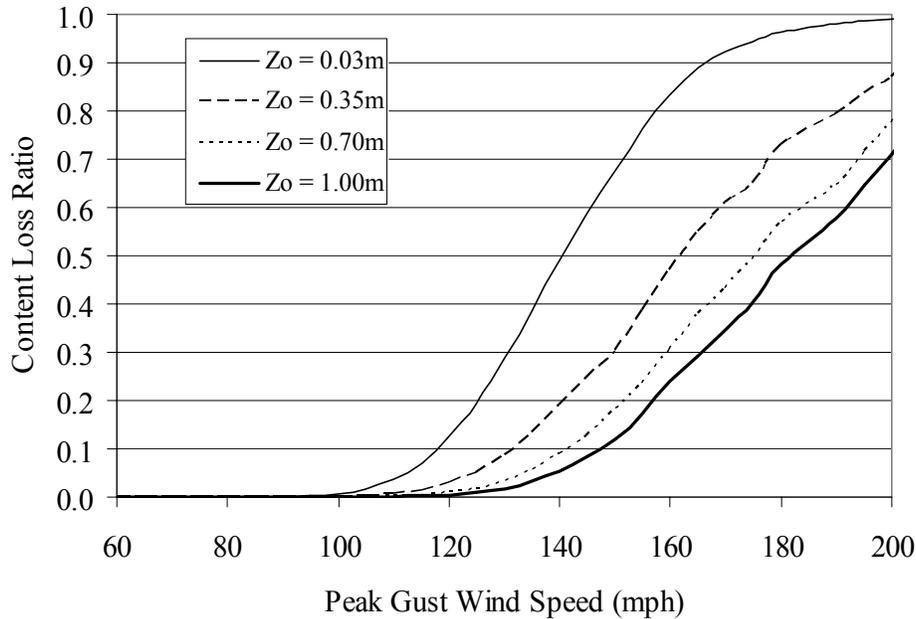
**Figure K.38. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Single Ply Membrane Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



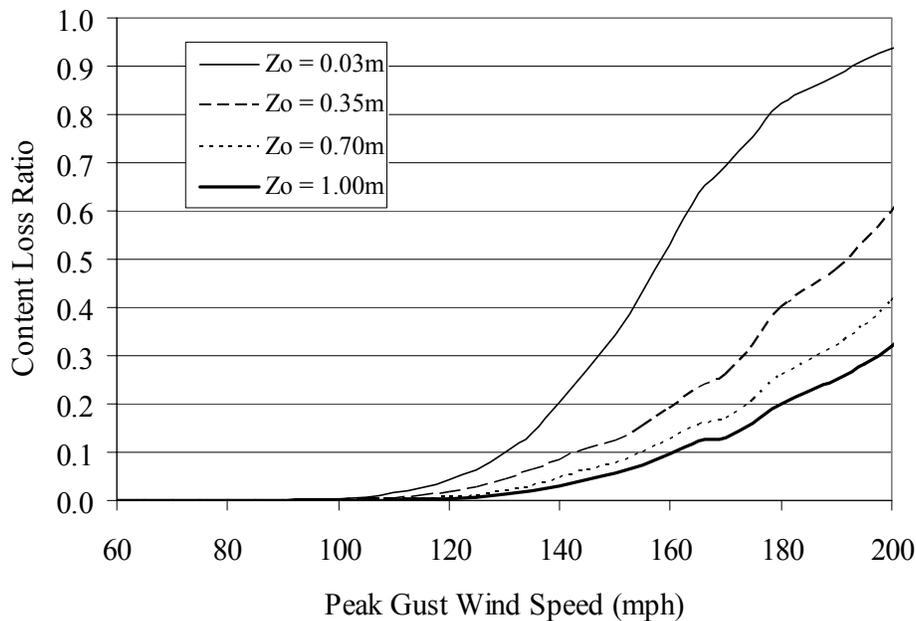
**Figure K.39. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists with 50% Reduction in Resistance, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



**Figure K.40. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Screwed to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



**Figure K.41. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, ASCE 100 mph Design Criteria, Built-up Roof Cover, Unreinforced Masonry Walls, Missile Environment A.**



**Figure K.42. Content Loss Function – Strip Mall Building C – Height=20', No. of Units=6, Joist Spacing=6', Metal Deck Welded to Joists, SBCCI 100 mph Design Criteria, Built-up Roof Cover, Reinforced Masonry Walls, Missile Environment A.**

**Appendix L.**  
**Loss Functions for Pre-Engineered Metal Buildings**

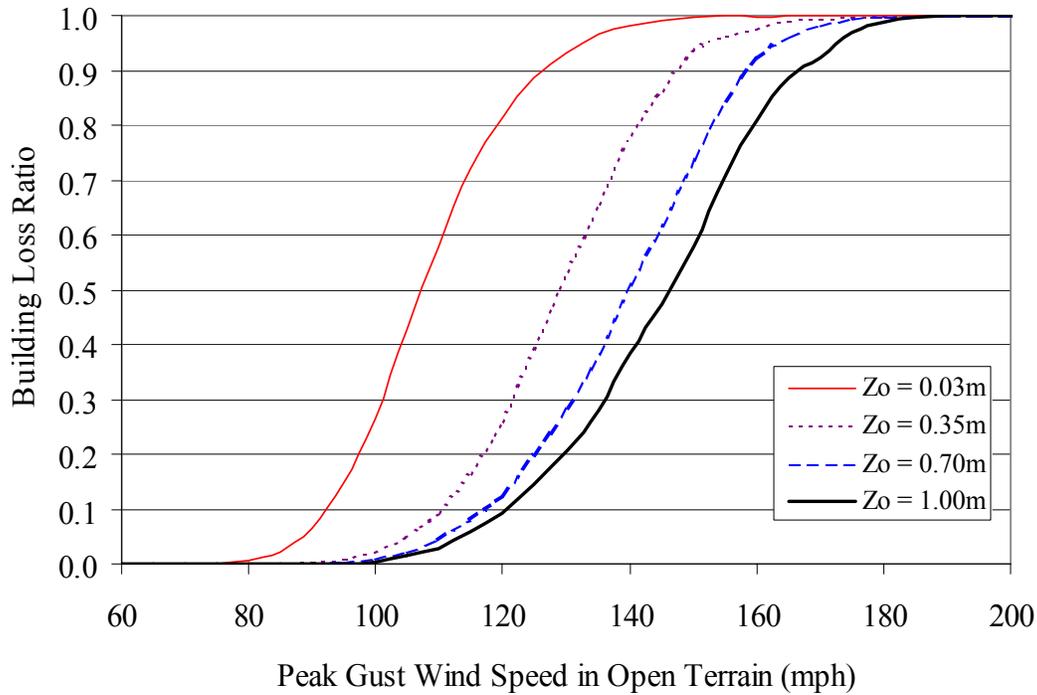
## Appendix L. Loss Functions for Pre-Engineered Metal Buildings

This appendix presents loss functions for pre-engineered metal buildings (see Chapter 7.12). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

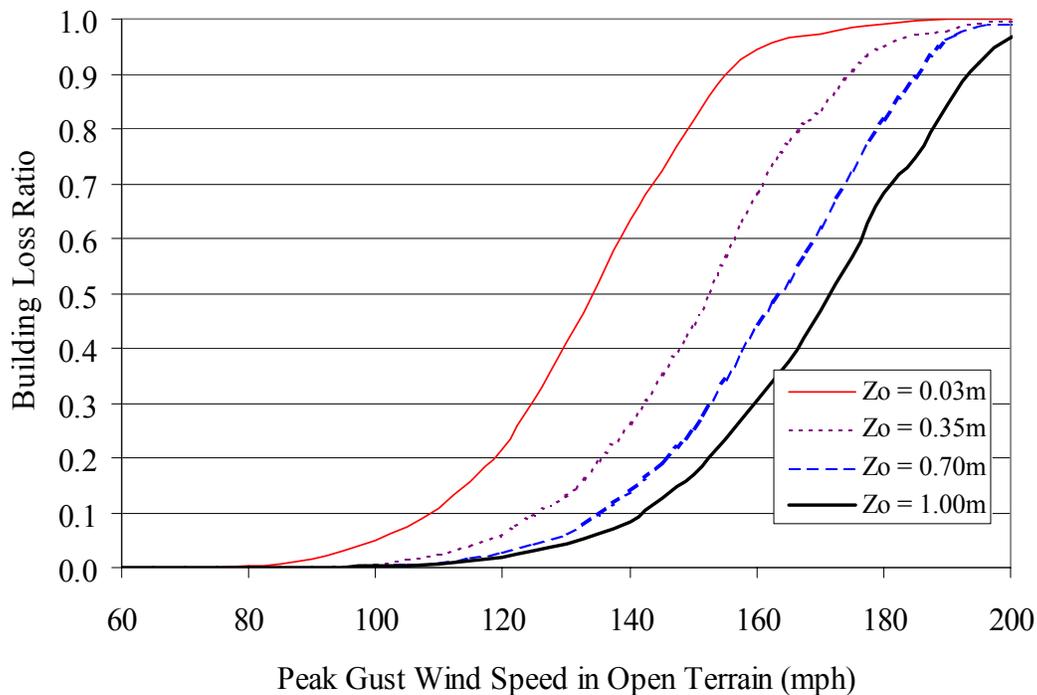
Table L.1 lists the figures provided in this appendix. Two sets of five figures are given for the metal buildings. The first set of five figures (Figures L.1 through L.5) show building loss functions and the second set (Figures L.6 through L.10) show content loss functions. The first figure in each set of five shows loss results for the small metal building designed using a 100 mph design speed and with no reduction in the metal roof panel capacity. The remaining four plots in each set show loss results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

**Table L.1. Sample Loss Functions for Pre-Engineered Metal Buildings**

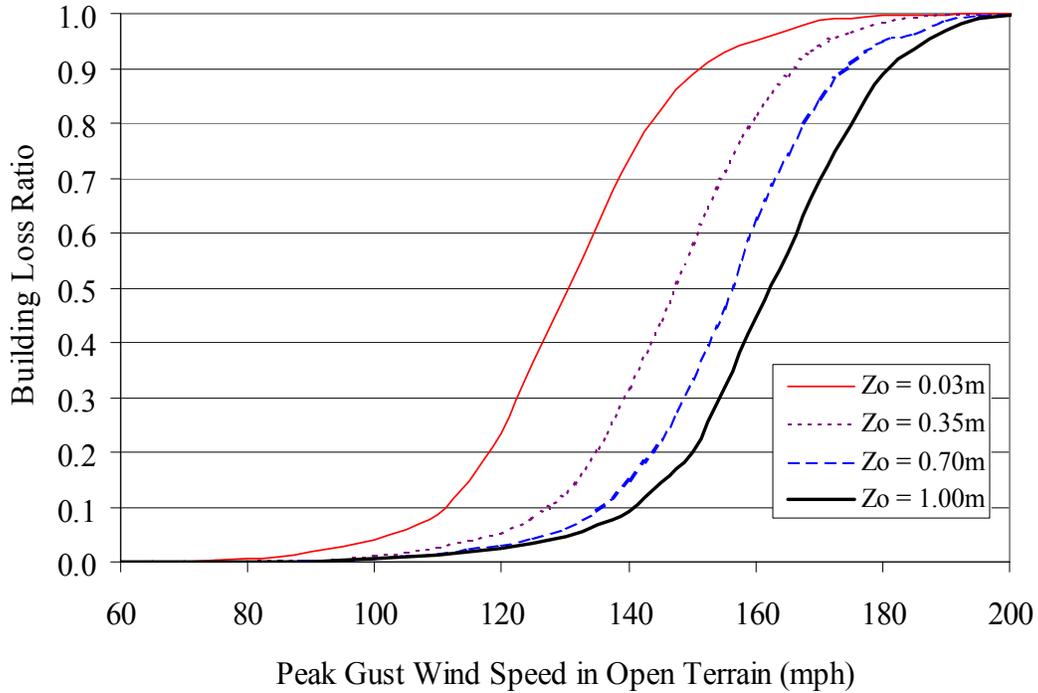
Figure	Loss Type	Model Building	Design Wind Speed	Metal Panel Capacity
L.1	Building	Small	100 mph	Full
L.2	Building	<b>Medium</b>	100 mph	Full
L.3	Building	<b>Large</b>	100 mph	Full
L.4	Building	Small	<b>90 mph</b>	Full
L.5	Building	Small	100 mph	<b>50%</b>
L.6	Content	Small	100 mph	Full
L.7	Content	<b>Medium</b>	100 mph	Full
L.8	Content	<b>Large</b>	100 mph	Full
L.9	Content	Small	<b>90 mph</b>	Full
L.10	Content	Small	100 mph	<b>50%</b>



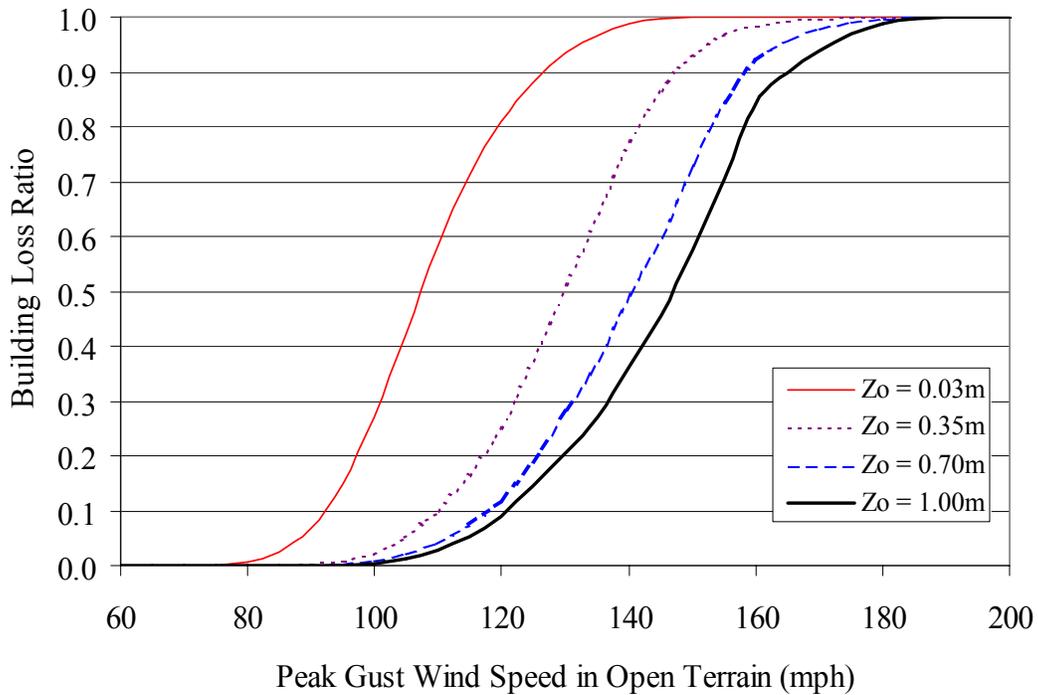
**Figure L.1. Building Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



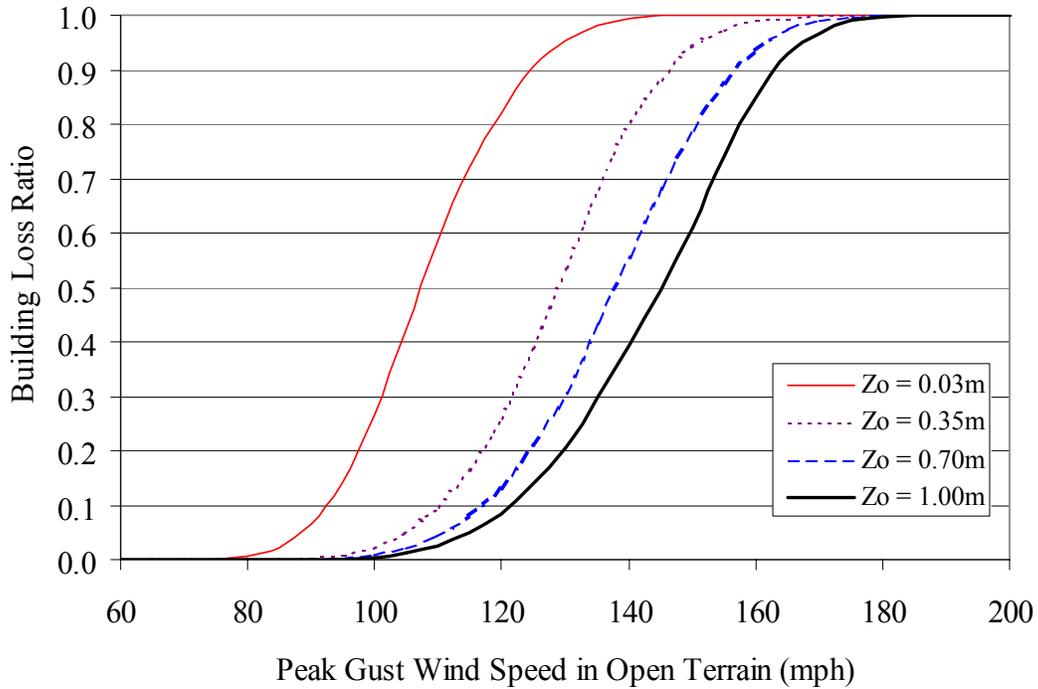
**Figure L.2. Building Loss Ratios versus Peak Gust Wind Speed – Medium Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



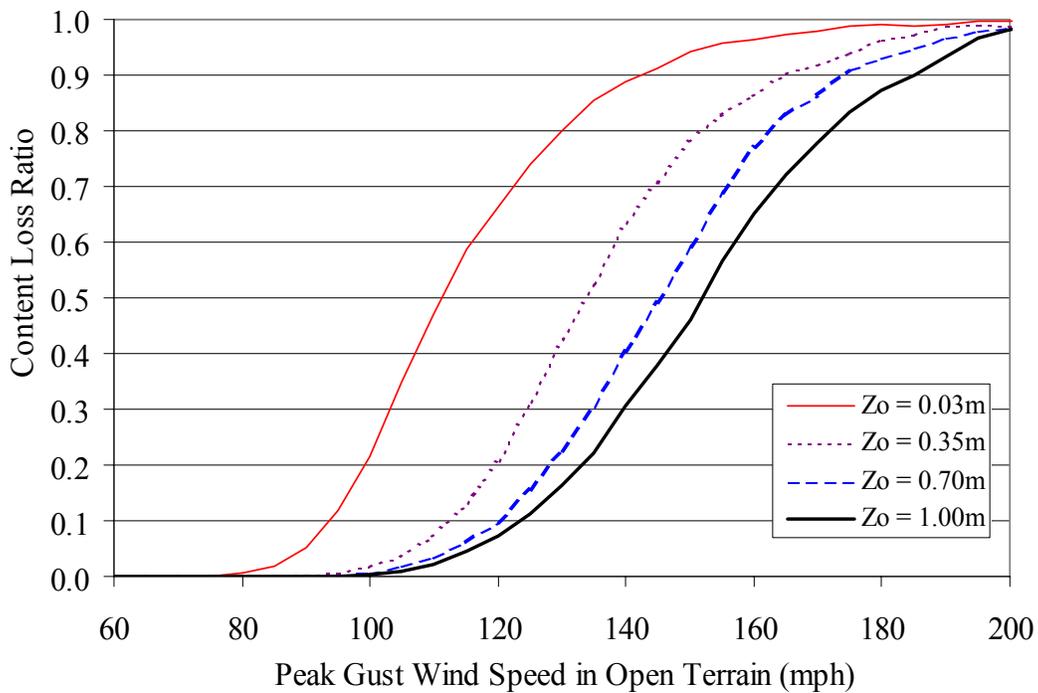
**Figure L.3. Building Loss Ratios versus Peak Gust Wind Speed – Large Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



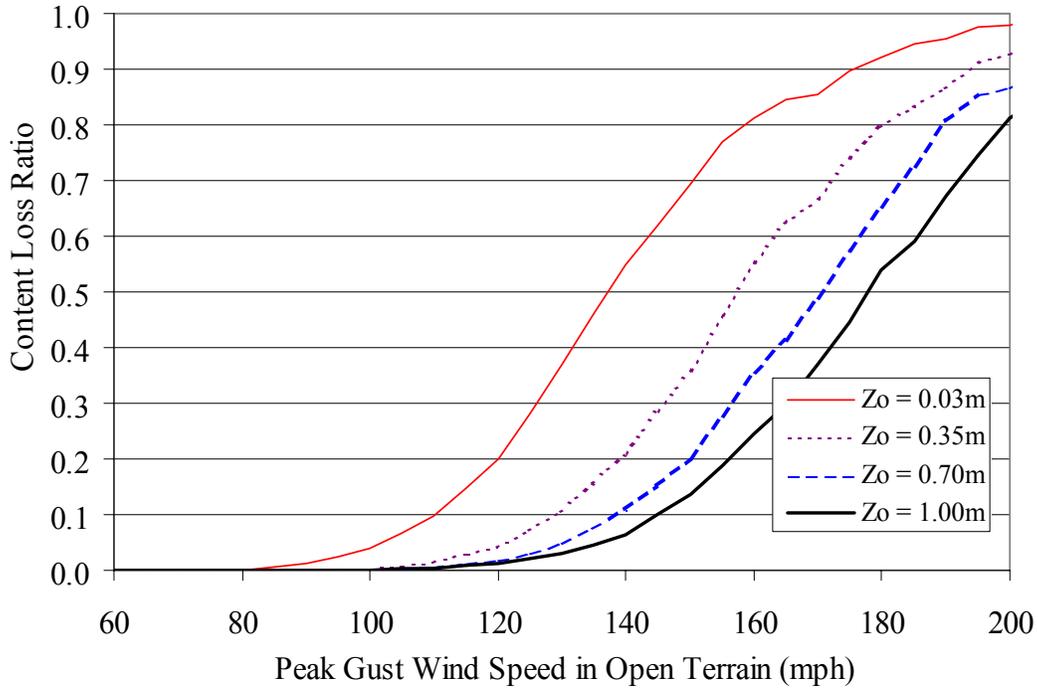
**Figure L.4. Building Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 90 mph Design Speed, No Reduction in Metal Panel Capacity.**



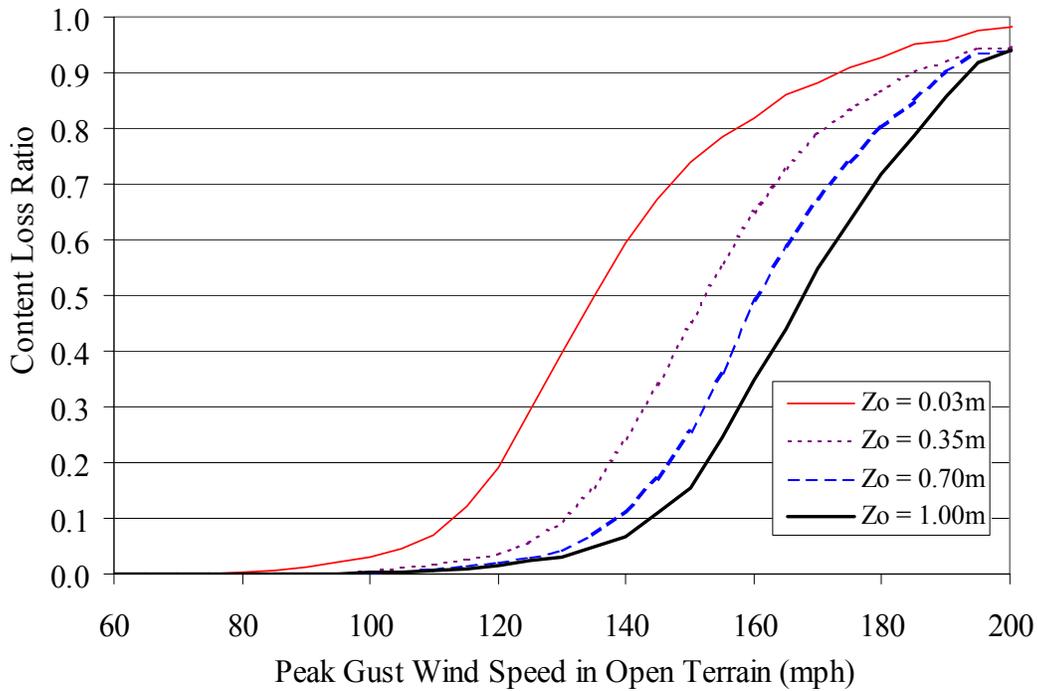
**Figure L.5. Building Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed, 50% Reduction in Metal Panel Capacity.**



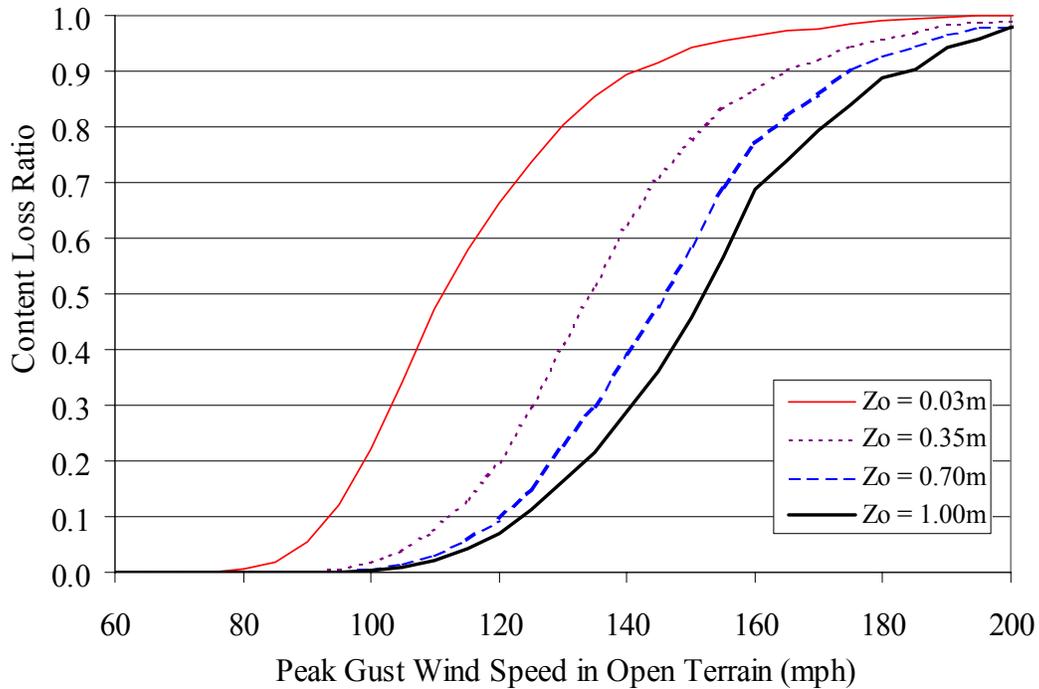
**Figure L.6. Content Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



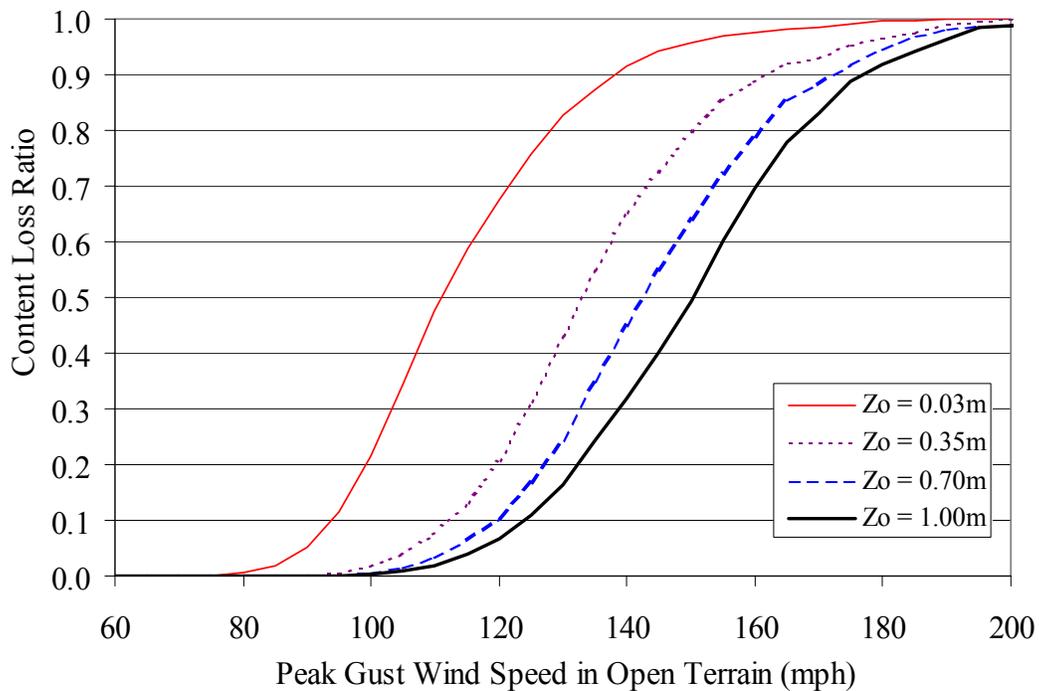
**Figure L.7. Content Loss Ratios versus Peak Gust Wind Speed – Medium Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



**Figure L.8. Content Loss Ratios versus Peak Gust Wind Speed – Large Metal Building, 100 mph Design Speed, No Reduction in Metal Panel Capacity.**



**Figure L.9. Content Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 90 mph Design Speed, No Reduction in Metal Panel Capacity.**



**Figure L.10. Content Loss Ratios versus Peak Gust Wind Speed – Small Metal Building, 100 mph Design Speed, 50% Reduction in Metal Panel Capacity.**



**Appendix M.**  
**Loss Functions for Engineered Residential and**  
**Commercial Buildings**

## Appendix M. Loss Functions for Engineered Residential and Commercial Buildings

This appendix presents loss functions for engineered residential and commercial buildings (see Section 7.13). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

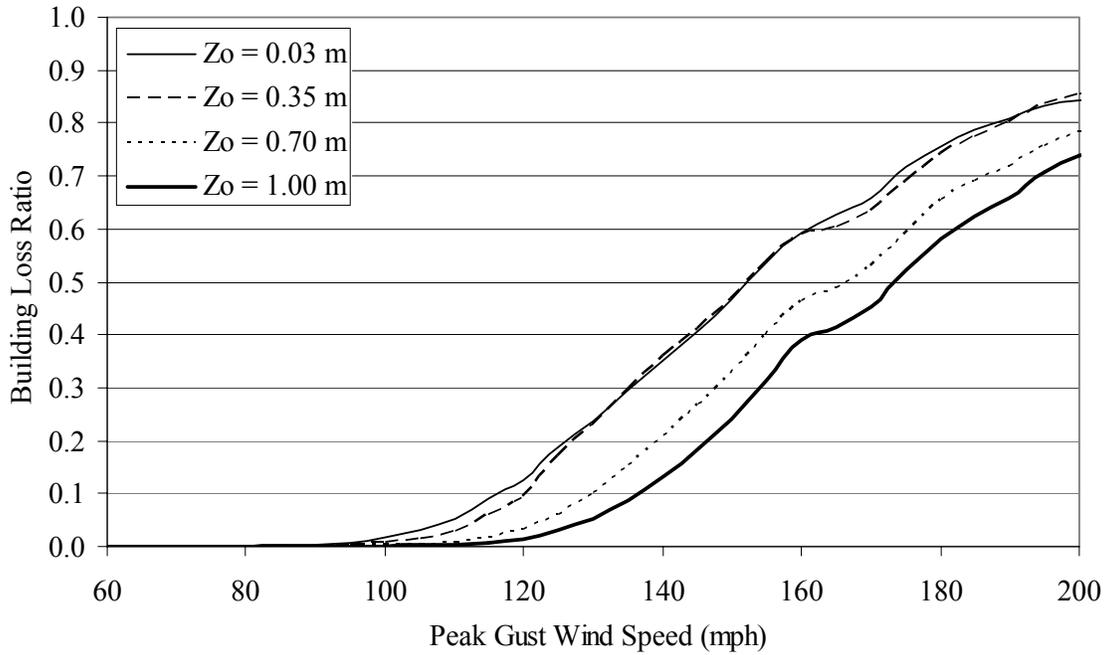
Table M.1 lists the figures provided in this appendix. Loss functions for the two-, five- and eight-story engineered buildings are given in Figures M.1 through M.18, M.19 through M.36 and M.37 through M.54, respectively. Two sets of nine figures are given for each of the two-, five- and eight-story engineered buildings. The first set of nine figures shows building loss functions and the second set shows content loss functions. The first figure in each set of nine shows loss results for the engineered residential building having 33% glazing coverage, a built-up roof cover and situated in Missile Environment A. The remaining eight plots in each set show loss results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

**Table M.1. Sample Loss Functions for Engineered Residential and Commercial Buildings**

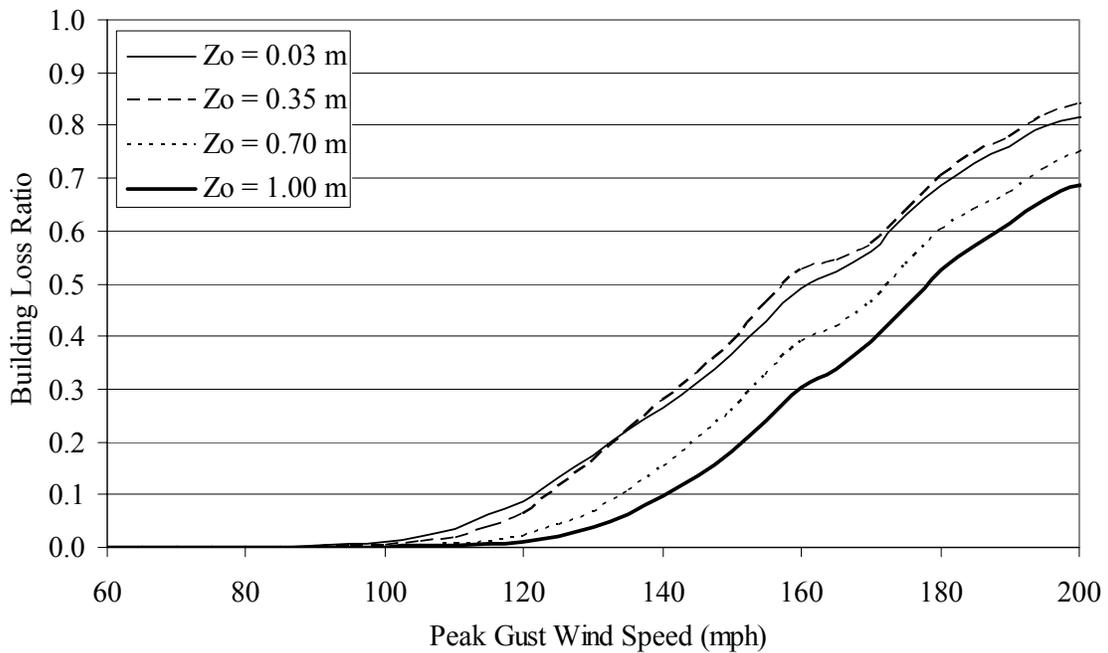
Figure	Loss Type	Stories	Occupancy	Roof Deck	Roof Cover	Glazing	Missile Environ.
M.1	Building	2	Residential	Metal	BUR	33%	A
M.2	Building	2	Residential	Metal	BUR	<b>20%</b>	A
M.3	Building	2	Residential	Metal	BUR	<b>50%</b>	A
M.4	Building	2	Residential	Metal	<b>SPM</b>	33%	A
M.5	Building	2	Residential	Metal	BUR	33%	<b>B</b>
M.6	Building	2	Residential	Metal	BUR	33%	<b>C</b>
M.7	Building	2	Residential	Metal	BUR	33%	<b>D</b>
M.8	Building	2	<b>Commercial</b>	Metal	BUR	33%	A
M.9	Building	2	Residential	<b>Concrete</b>	BUR	33%	A
M.10	Content	2	Residential	Metal	BUR	33%	A
M.11	Content	2	Residential	Metal	BUR	<b>20%</b>	A
M.12	Content	2	Residential	Metal	BUR	<b>50%</b>	A
M.13	Content	2	Residential	Metal	<b>SPM</b>	33%	A
M.14	Content	2	Residential	Metal	BUR	33%	<b>B</b>

**Table M.1. Sample Loss Functions for Engineered Residential and Commercial Buildings (concluded)**

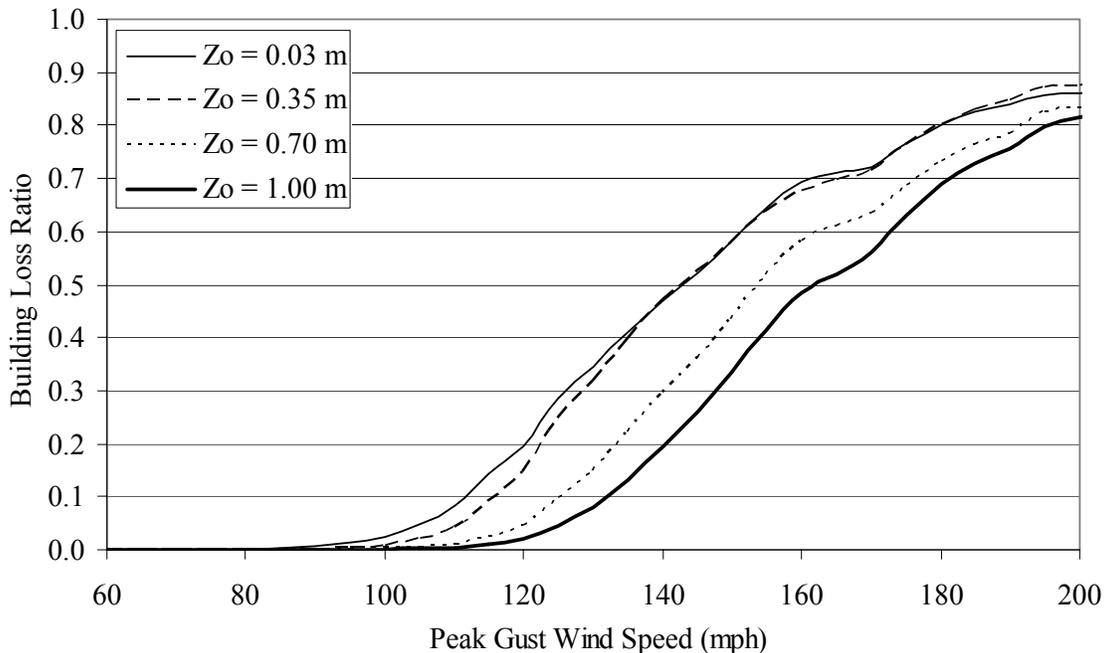
Figure	Loss Type	Stories	Occupancy	Roof Deck	Roof Cover	Glazing	Missile Environ.
M.15	Content	2	Residential	Metal	BUR	33%	<b>C</b>
M.16	Content	2	Residential	Metal	BUR	33%	<b>D</b>
M.17	Content	2	<b>Commercial</b>	Metal	BUR	33%	A
M.18	Content	2	Residential	<b>Concrete</b>	BUR	33%	A
M.19	Building	<b>5</b>	Residential	Metal	BUR	33%	A
M.20	Building	5	Residential	Metal	BUR	<b>20%</b>	A
M.21	Building	5	Residential	Metal	BUR	<b>50%</b>	A
M.22	Building	5	Residential	Metal	<b>SPM</b>	33%	A
M.23	Building	5	Residential	Metal	BUR	33%	<b>B</b>
M.24	Building	5	Residential	Metal	BUR	33%	<b>C</b>
M.25	Building	5	Residential	Metal	BUR	33%	<b>D</b>
M.26	Building	5	<b>Commercial</b>	Metal	BUR	33%	A
M.27	Building	5	Residential	<b>Concrete</b>	BUR	33%	A
M.28	Content	5	Residential	Metal	BUR	33%	A
M.29	Content	5	Residential	Metal	BUR	<b>20%</b>	A
M.30	Content	5	Residential	Metal	BUR	<b>50%</b>	A
M.31	Content	5	Residential	Metal	<b>SPM</b>	33%	A
M.32	Content	5	Residential	Metal	BUR	33%	<b>B</b>
M.33	Content	5	Residential	Metal	BUR	33%	<b>C</b>
M.34	Content	5	Residential	Metal	BUR	33%	<b>D</b>
M.35	Content	5	<b>Commercial</b>	Metal	BUR	33%	A
M.36	Content	5	Residential	<b>Concrete</b>	BUR	33%	A
M.37	Building	<b>8</b>	Residential	Metal	BUR	33%	A
M.38	Building	8	Residential	Metal	BUR	<b>20%</b>	A
M.39	Building	8	Residential	Metal	BUR	<b>50%</b>	A
M.40	Building	8	Residential	Metal	<b>SPM</b>	33%	A
M.41	Building	8	Residential	Metal	BUR	33%	<b>B</b>
M.42	Building	8	Residential	Metal	BUR	33%	<b>C</b>
M.43	Building	8	Residential	Metal	BUR	33%	<b>D</b>
M.44	Building	8	<b>Commercial</b>	Metal	BUR	33%	A
M.45	Building	8	Residential	<b>Concrete</b>	BUR	33%	A
M.46	Content	8	Residential	Metal	BUR	33%	A
M.47	Content	8	Residential	Metal	BUR	<b>20%</b>	A
M.48	Content	8	Residential	Metal	BUR	<b>50%</b>	A
M.49	Content	8	Residential	Metal	<b>SPM</b>	33%	A
M.50	Content	8	Residential	Metal	BUR	33%	<b>B</b>
M.51	Content	8	Residential	Metal	BUR	33%	<b>C</b>
M.52	Content	8	Residential	Metal	BUR	33%	<b>D</b>
M.53	Content	8	<b>Commercial</b>	Metal	BUR	33%	A
M.54	Content	8	Residential	<b>Concrete</b>	BUR	33%	A



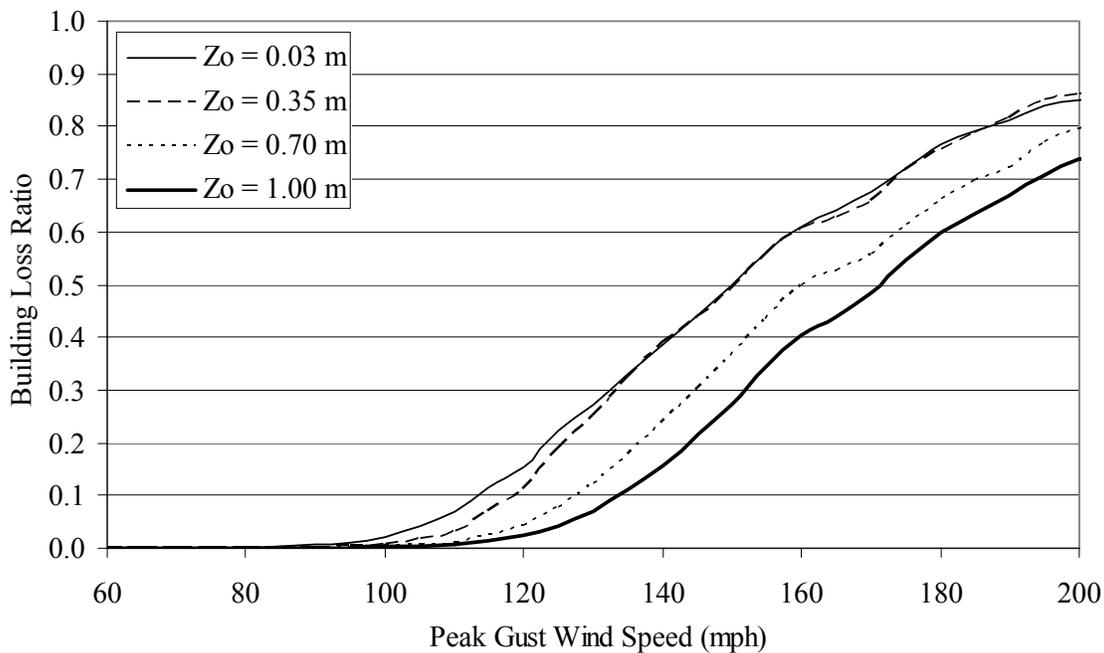
**Figure M.1. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



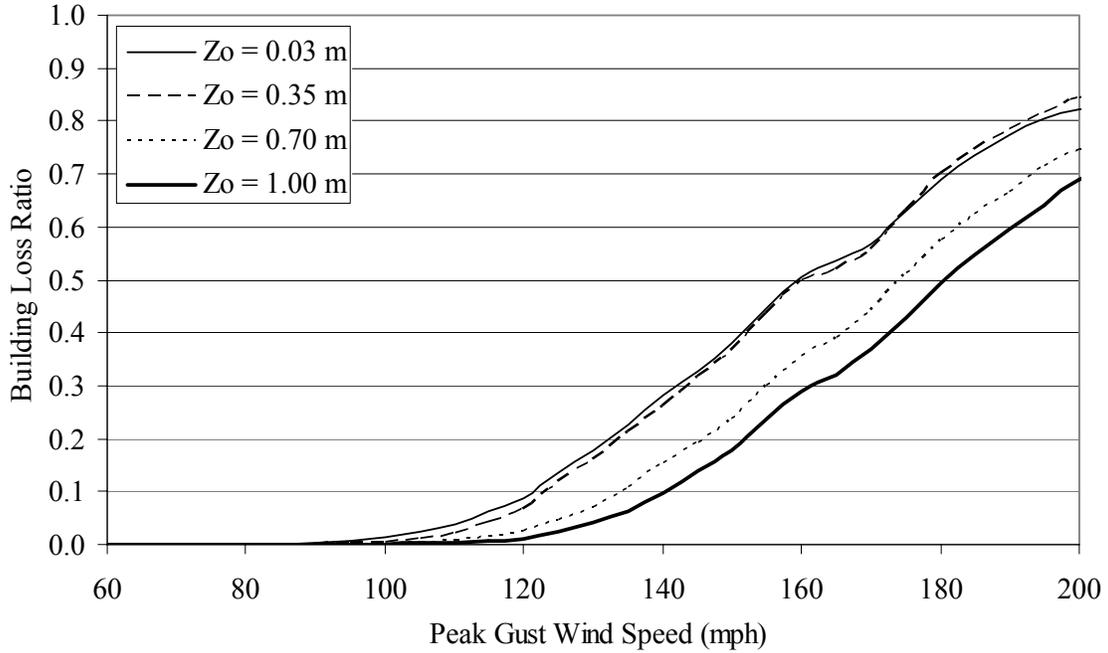
**Figure M.2. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



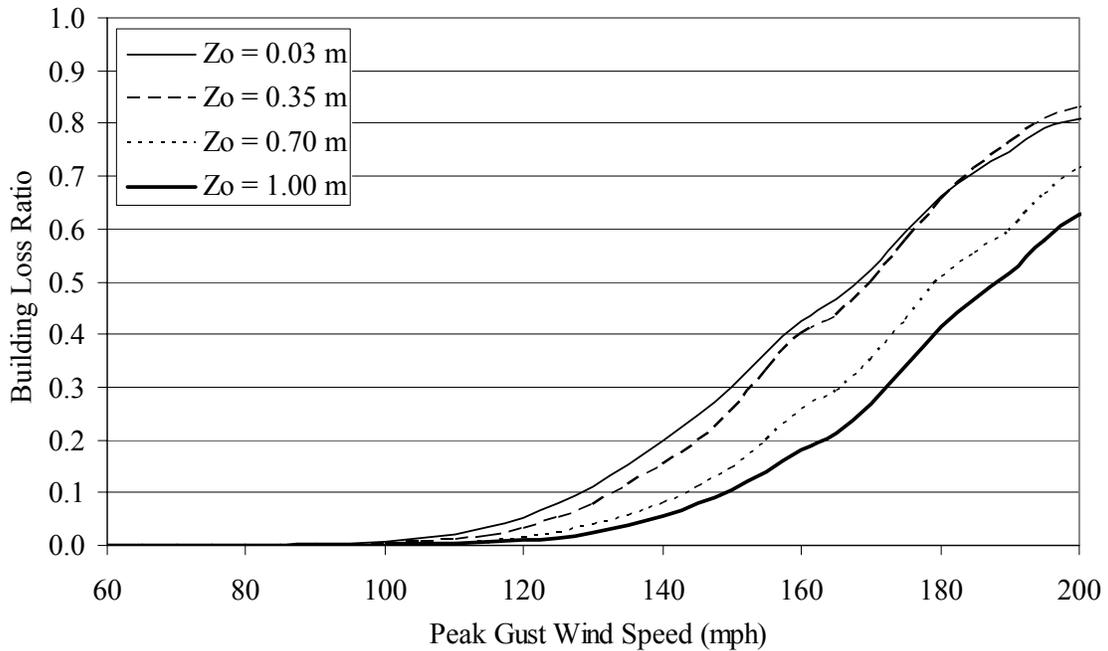
**Figure M.3. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



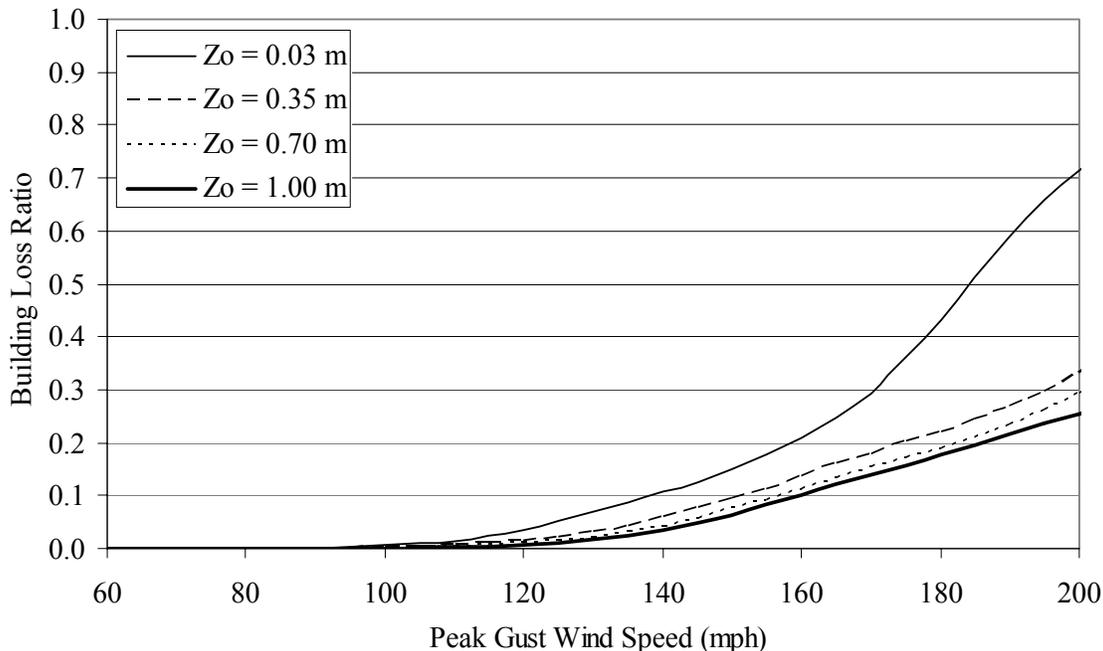
**Figure M.4. Building Loss Function – Two-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



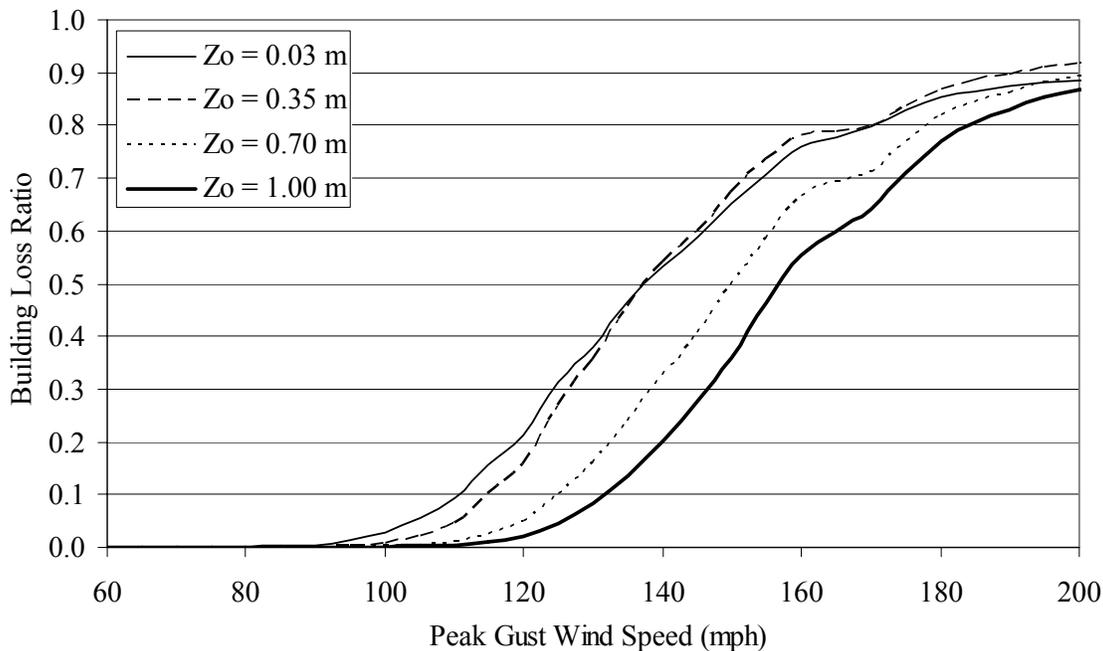
**Figure M.5. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



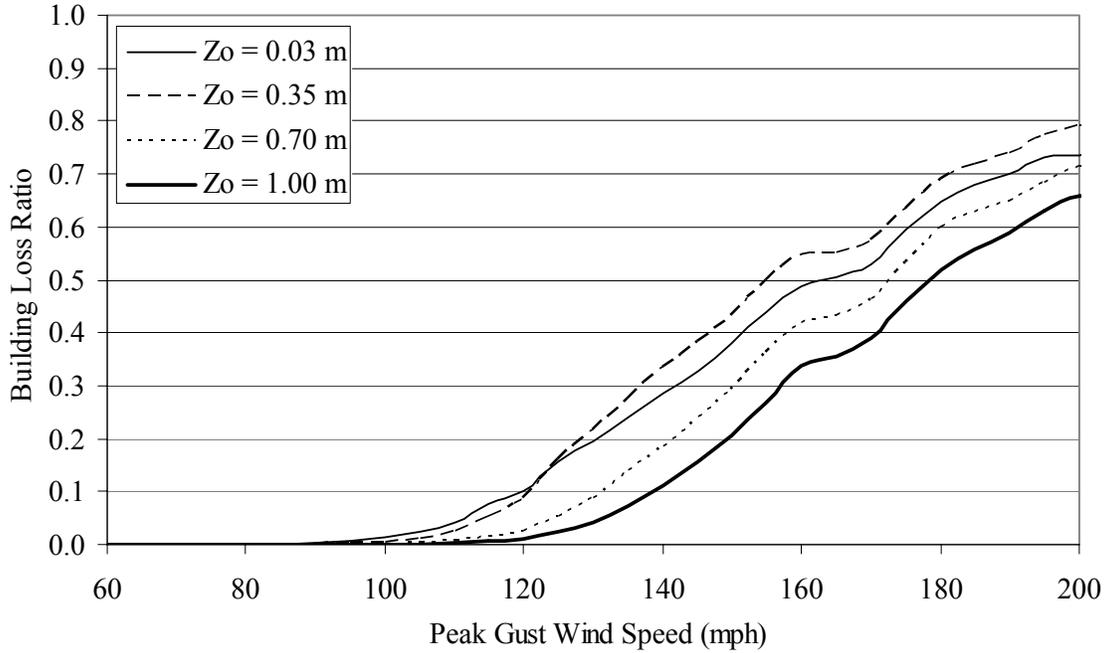
**Figure M.6. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



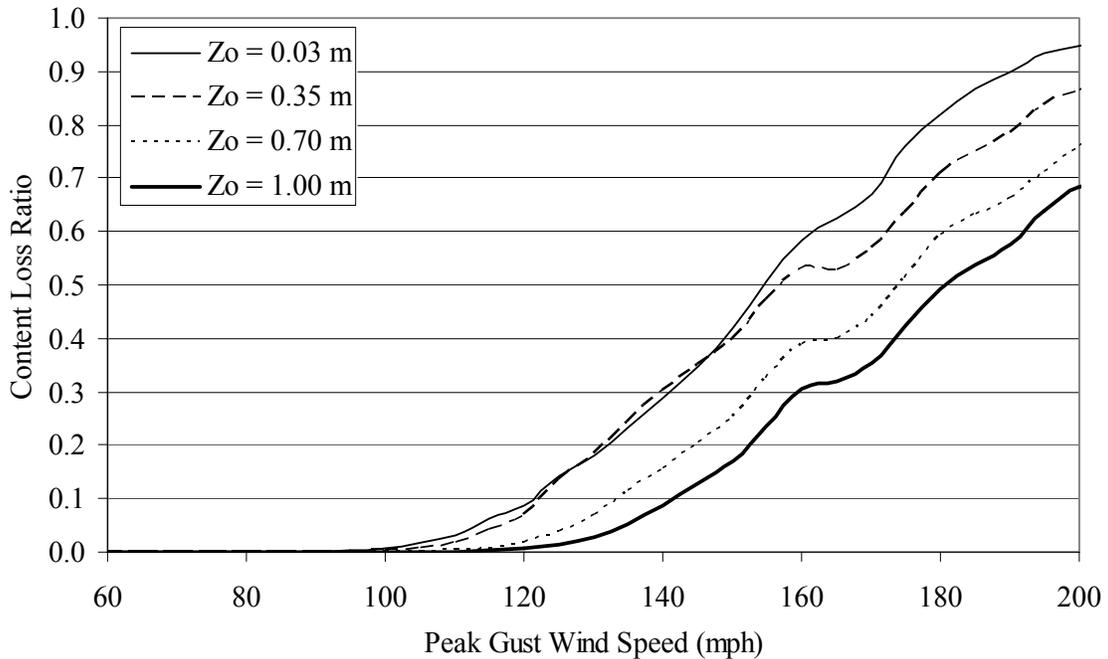
**Figure M.7. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



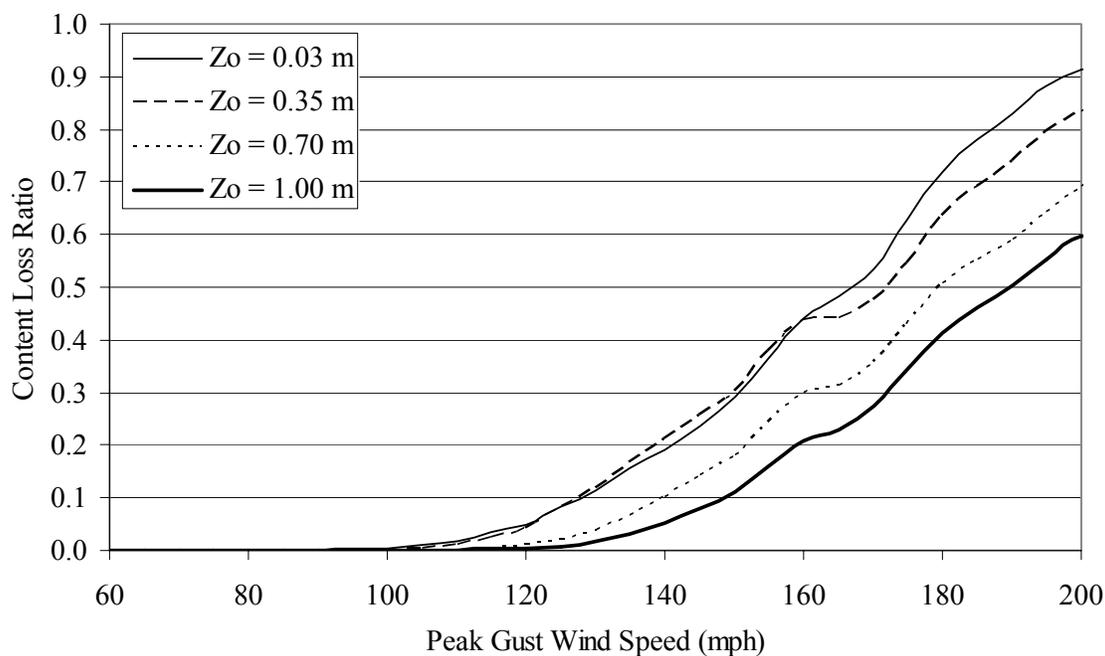
**Figure M.8. Building Loss Function – Two-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



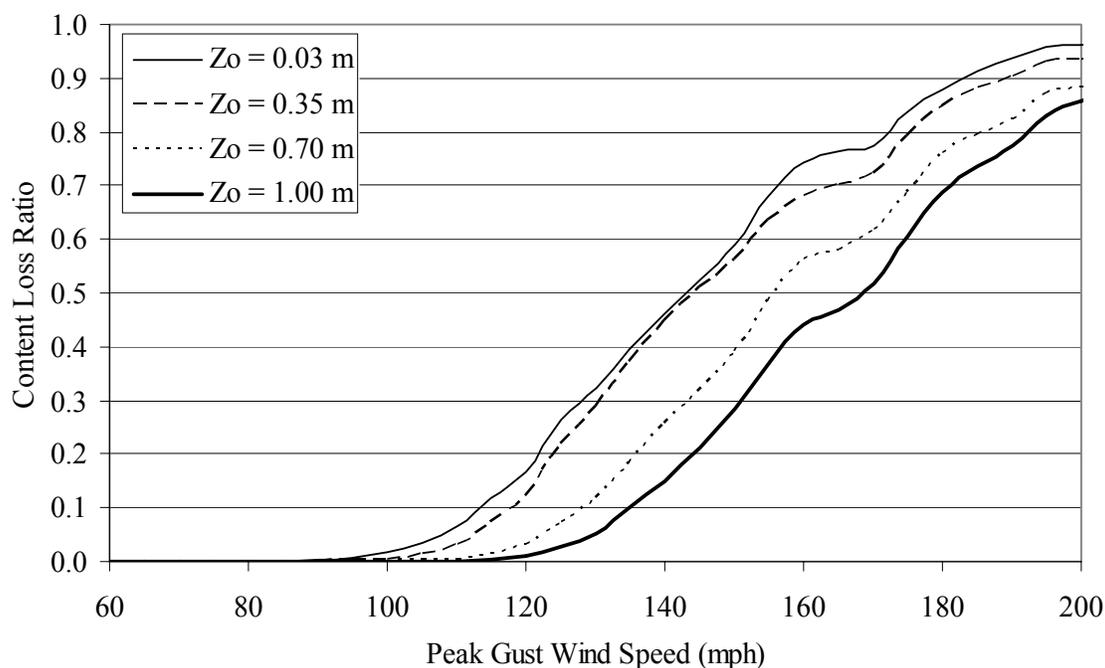
**Figure M.9. Building Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**



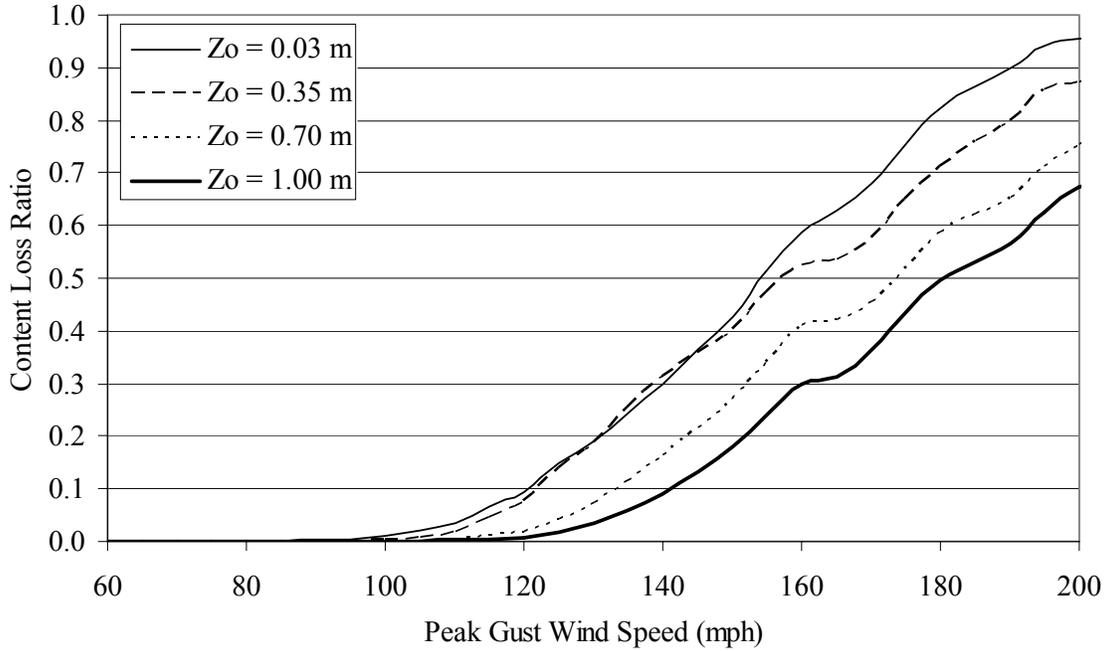
**Figure M.10. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



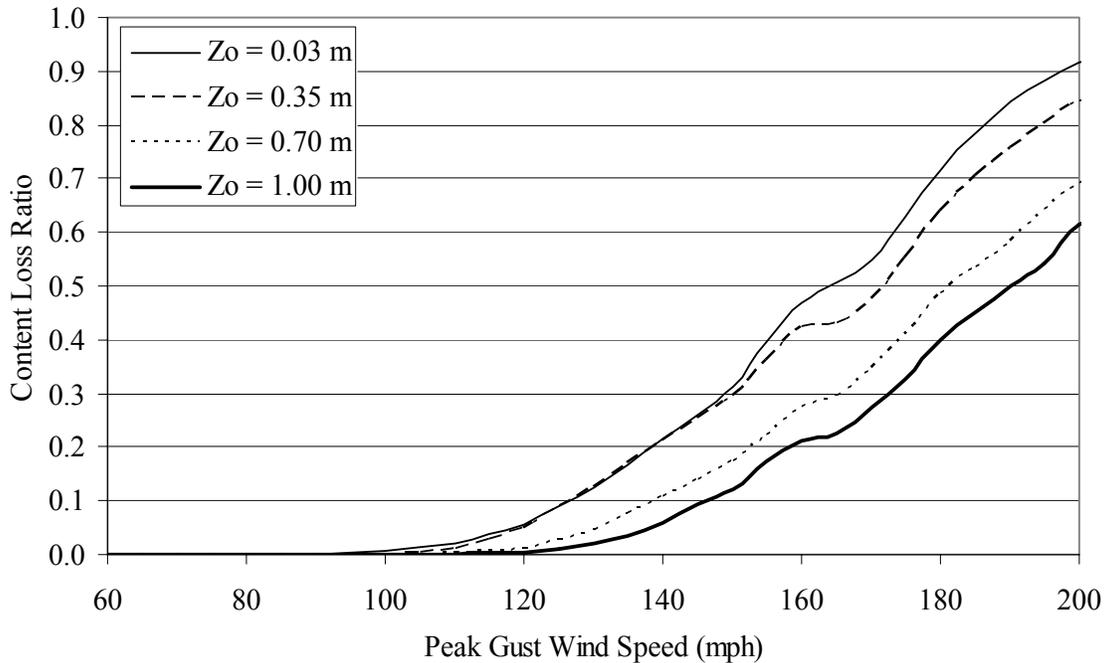
**Figure M.11. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



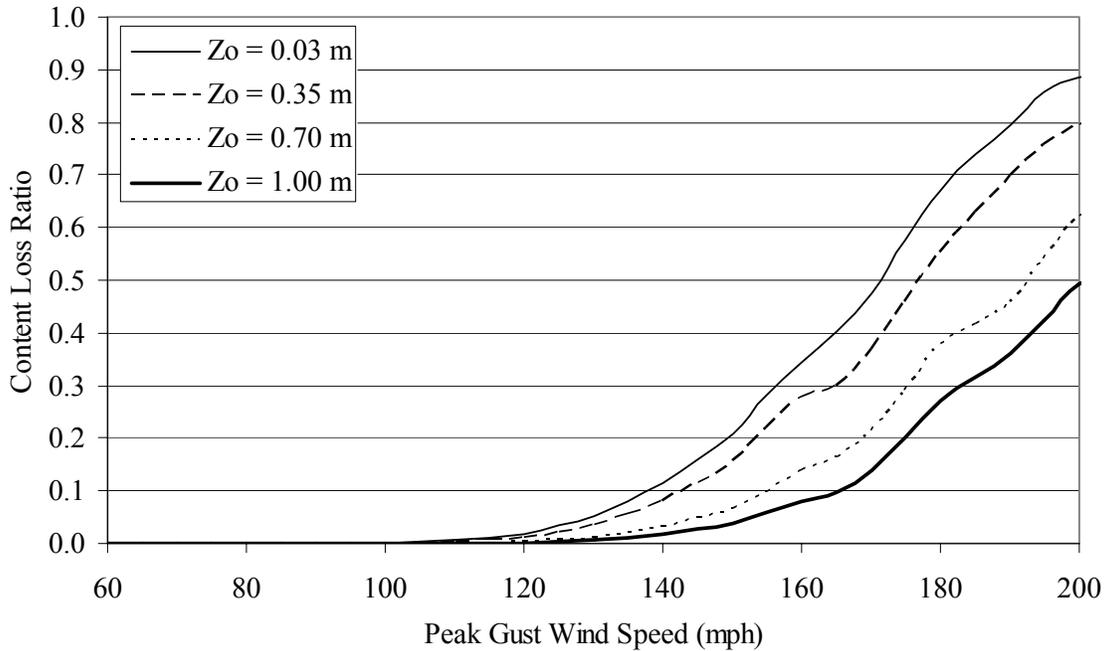
**Figure M.12. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



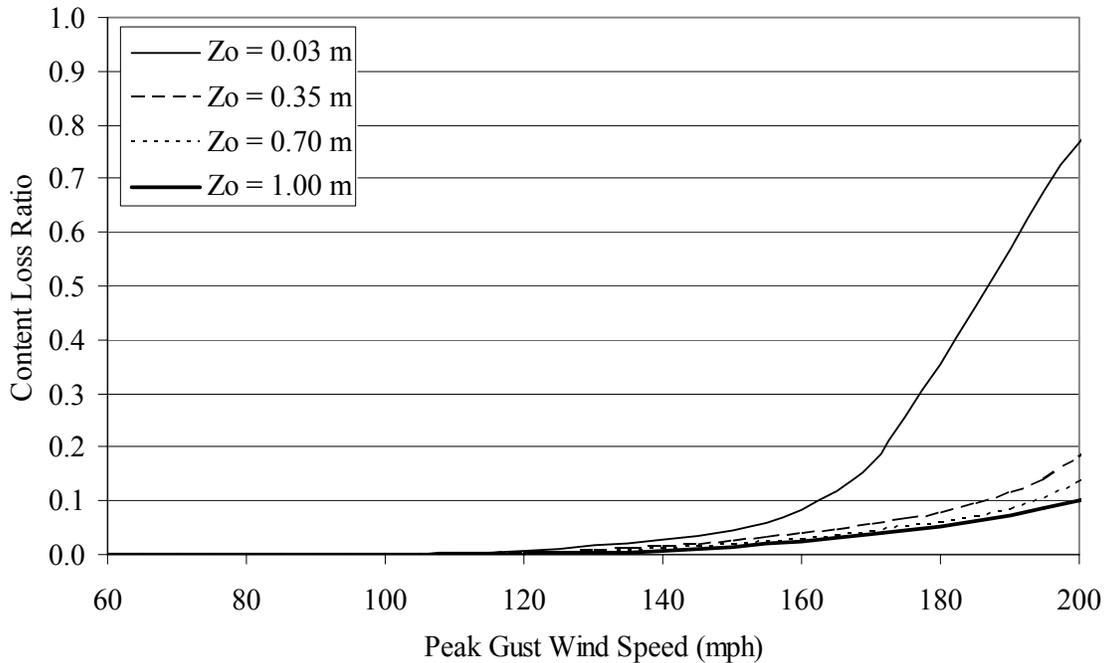
**Figure M.13. Content Loss Function – Two-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



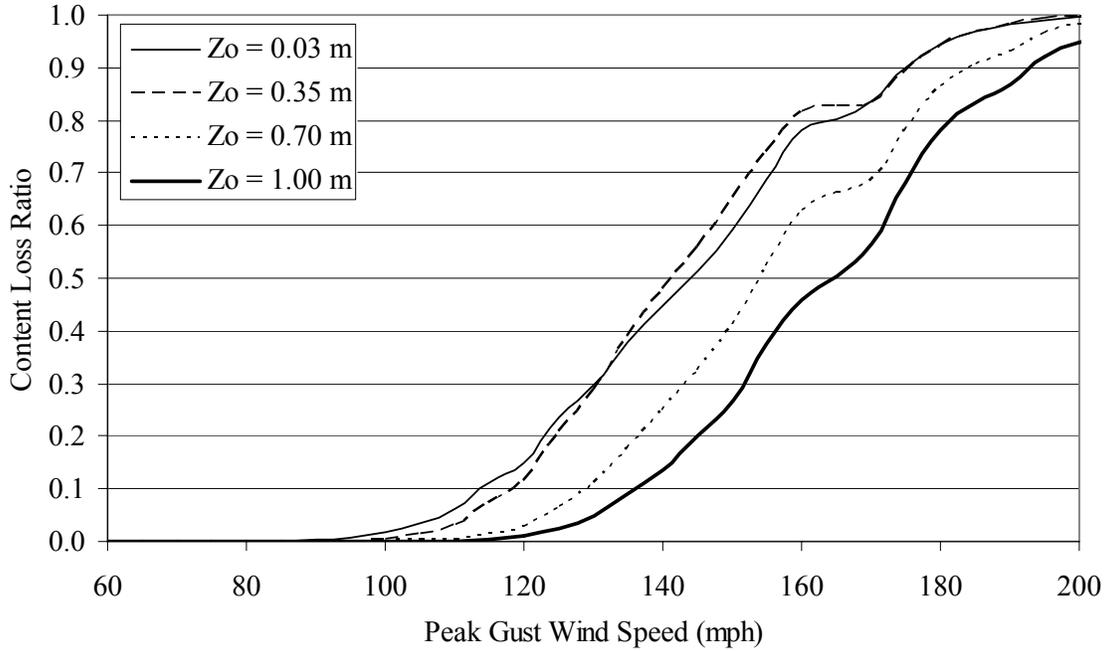
**Figure M.14. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



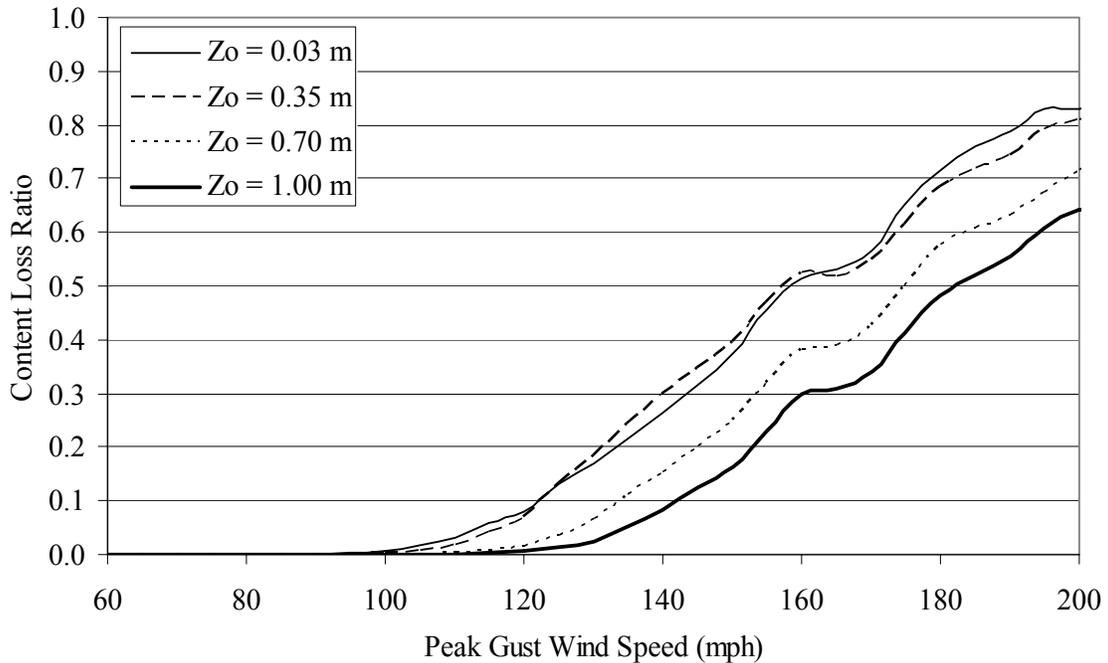
**Figure M.15. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



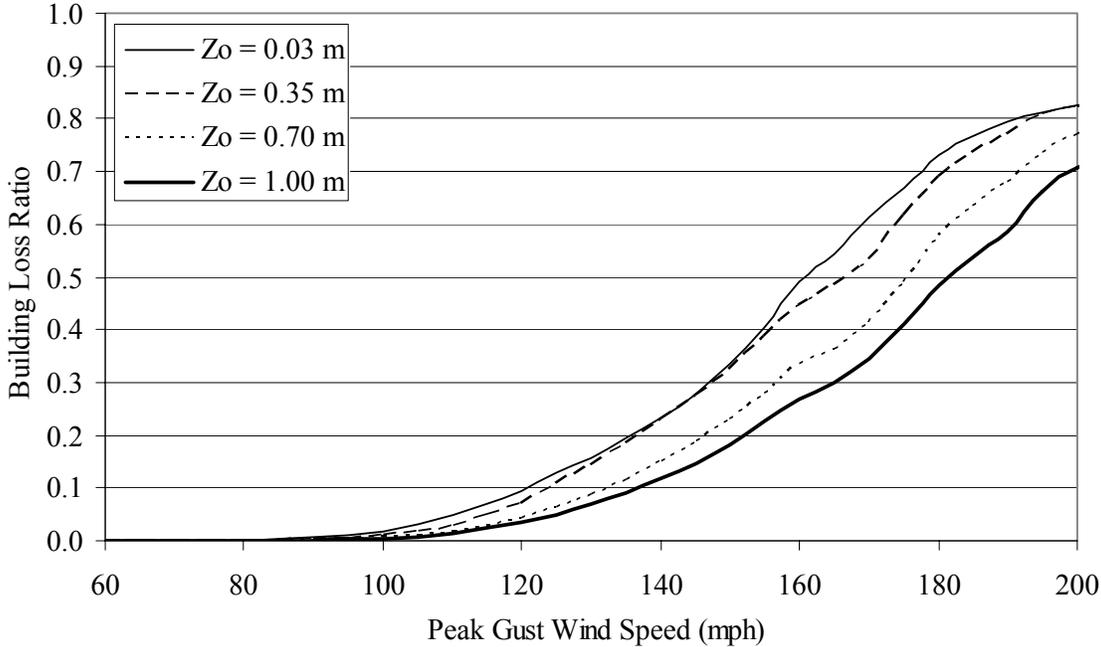
**Figure M.16. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



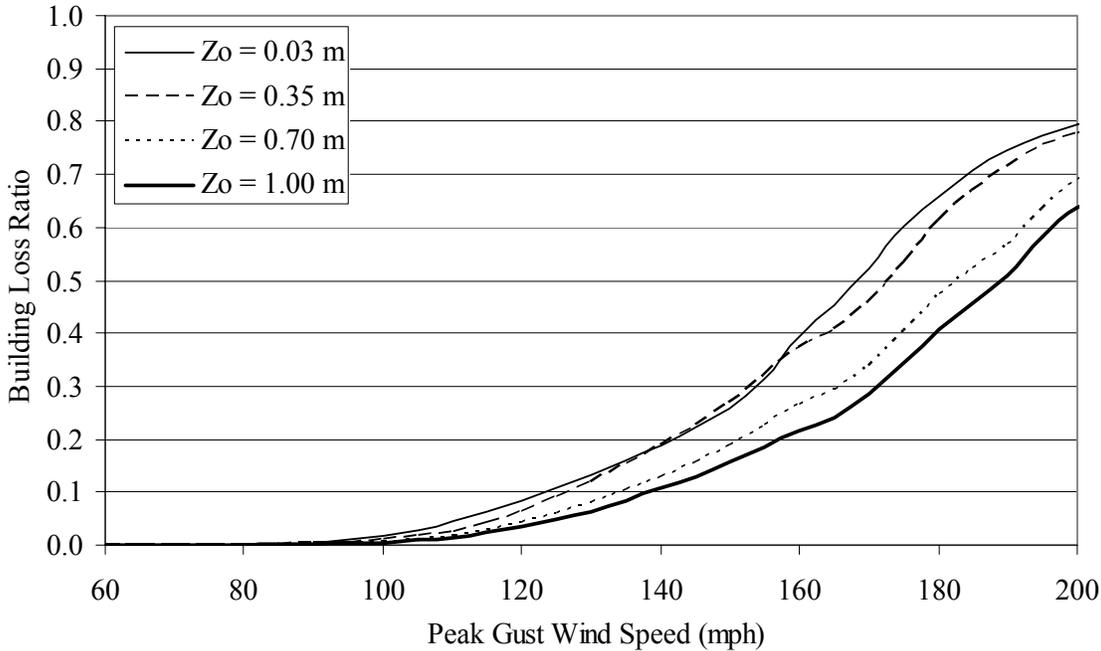
**Figure M.17. Content Loss Function – Two-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



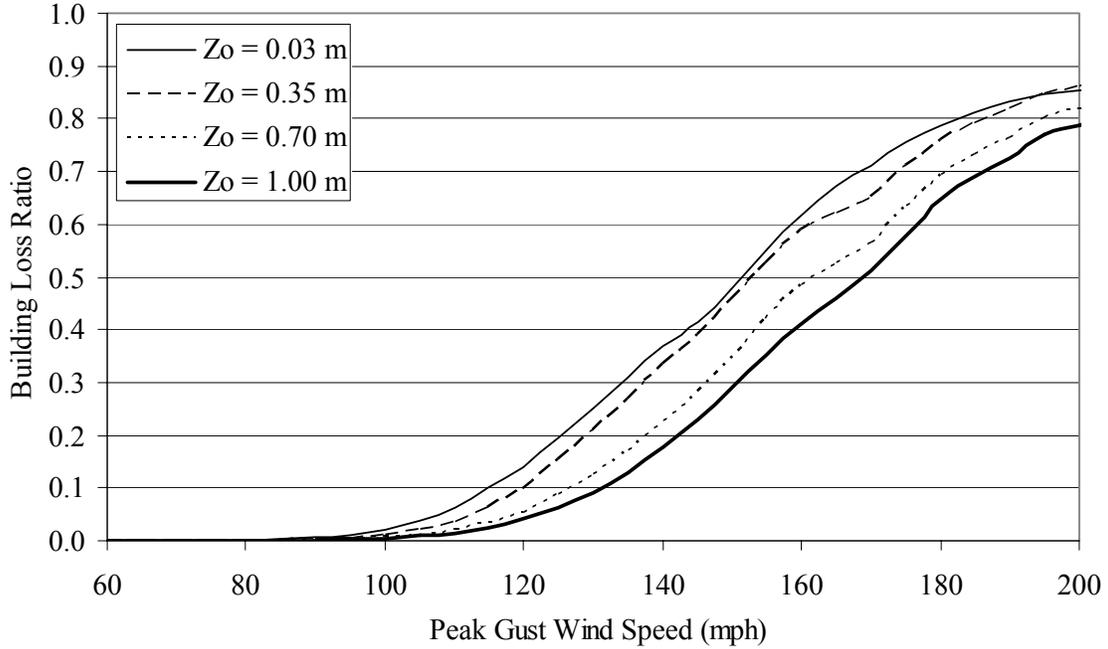
**Figure M.18. Content Loss Function – Two-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**



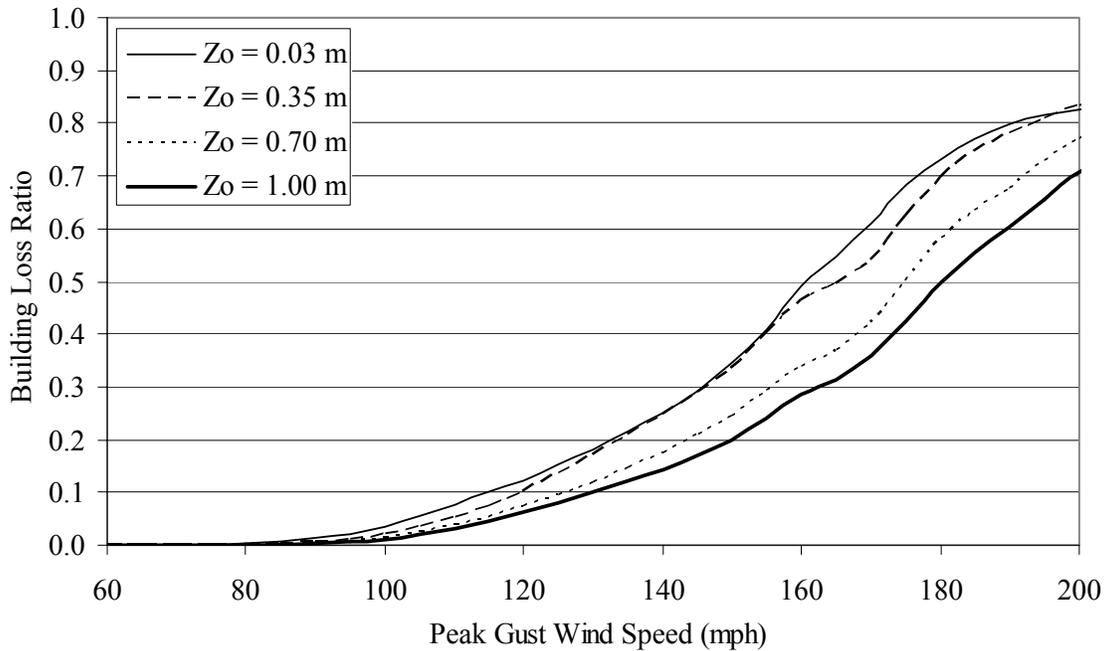
**Figure M.19. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



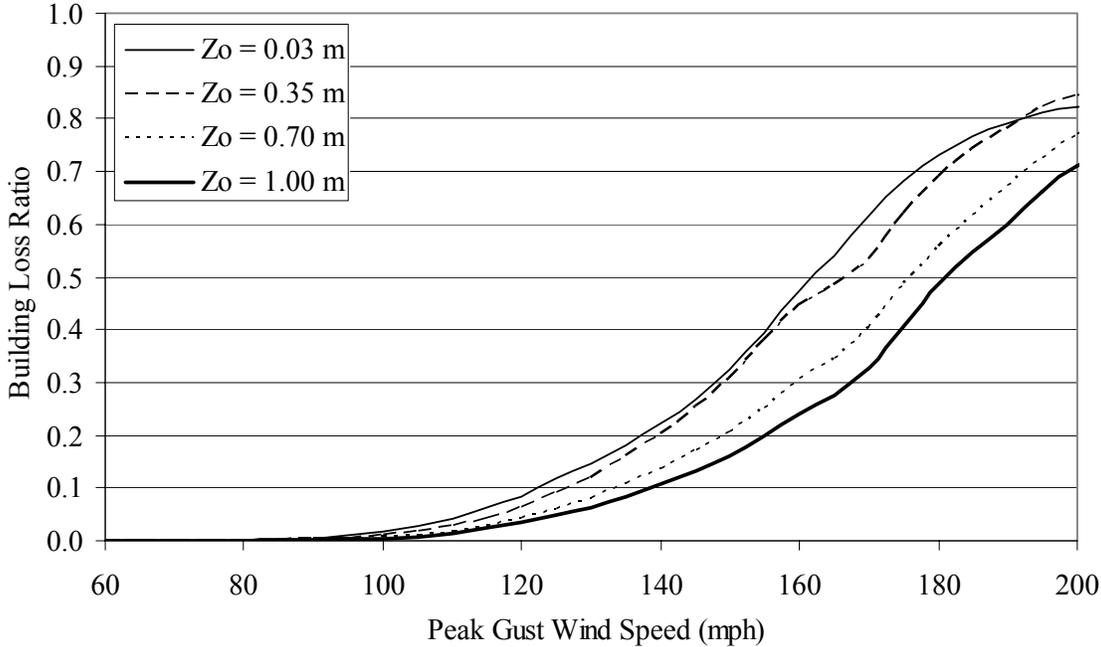
**Figure M.20. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



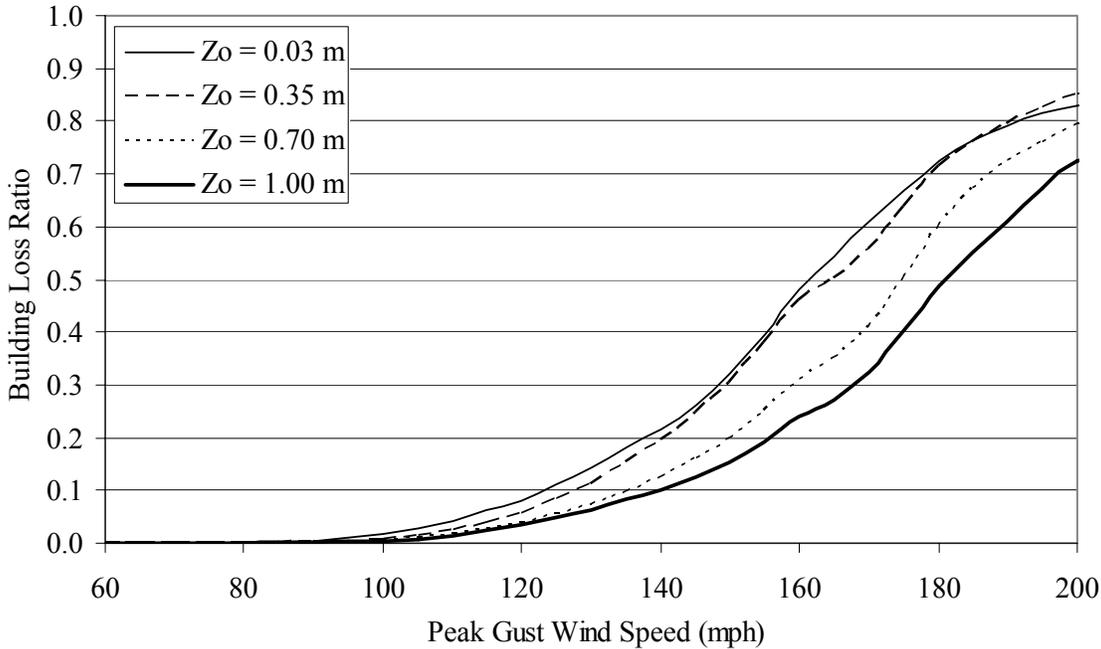
**Figure M.21. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



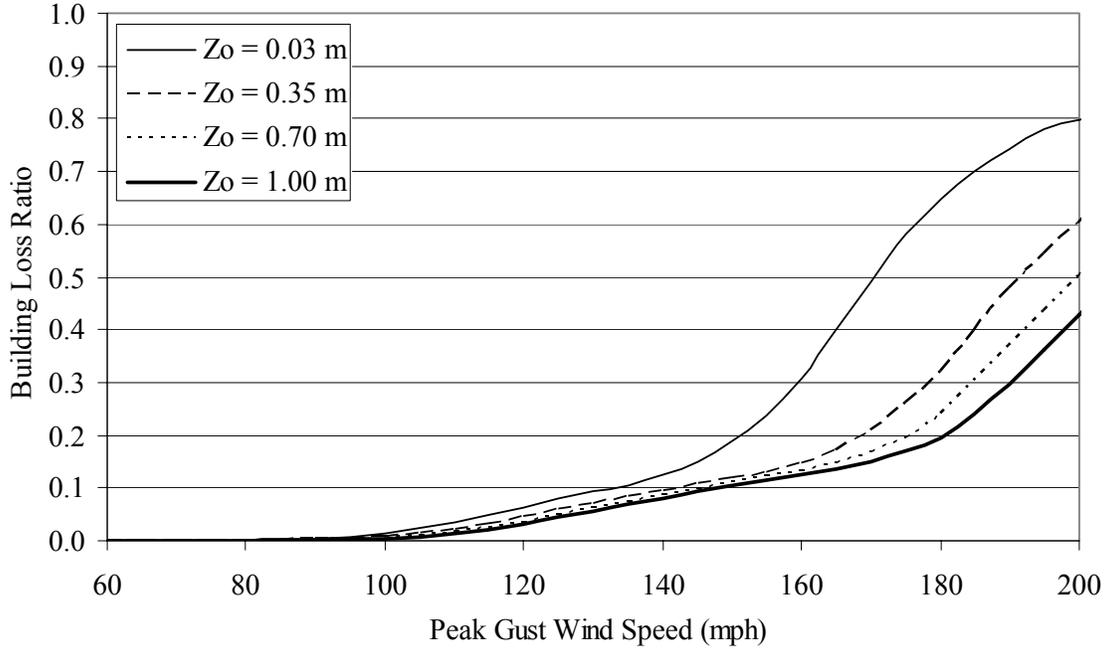
**Figure M.22. Building Loss Function – Five-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



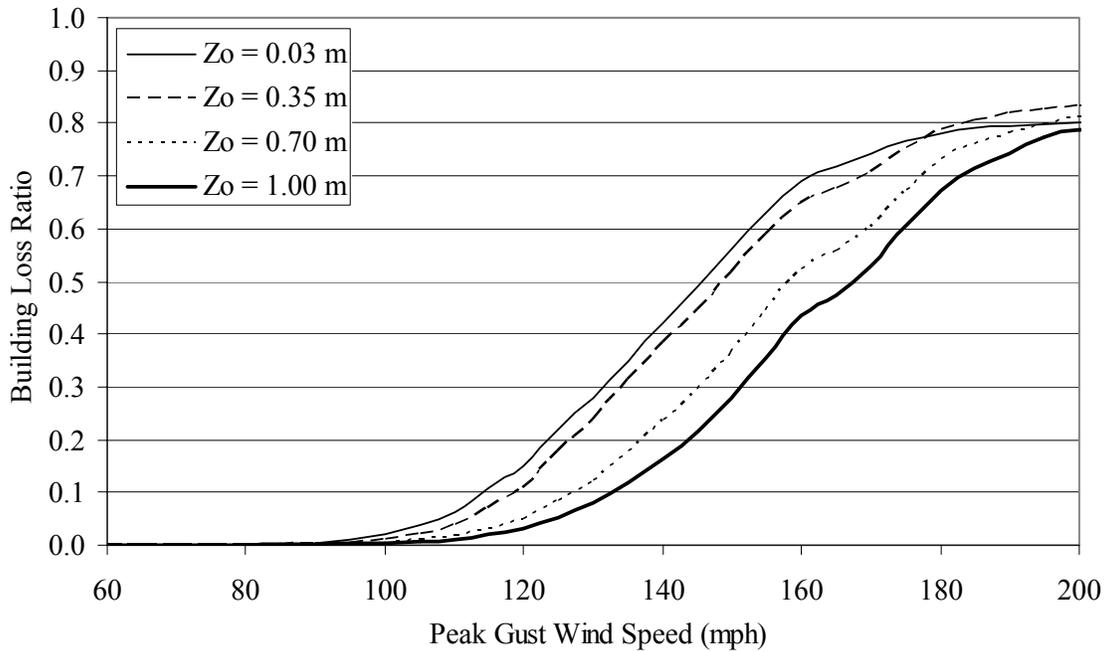
**Figure M.23. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



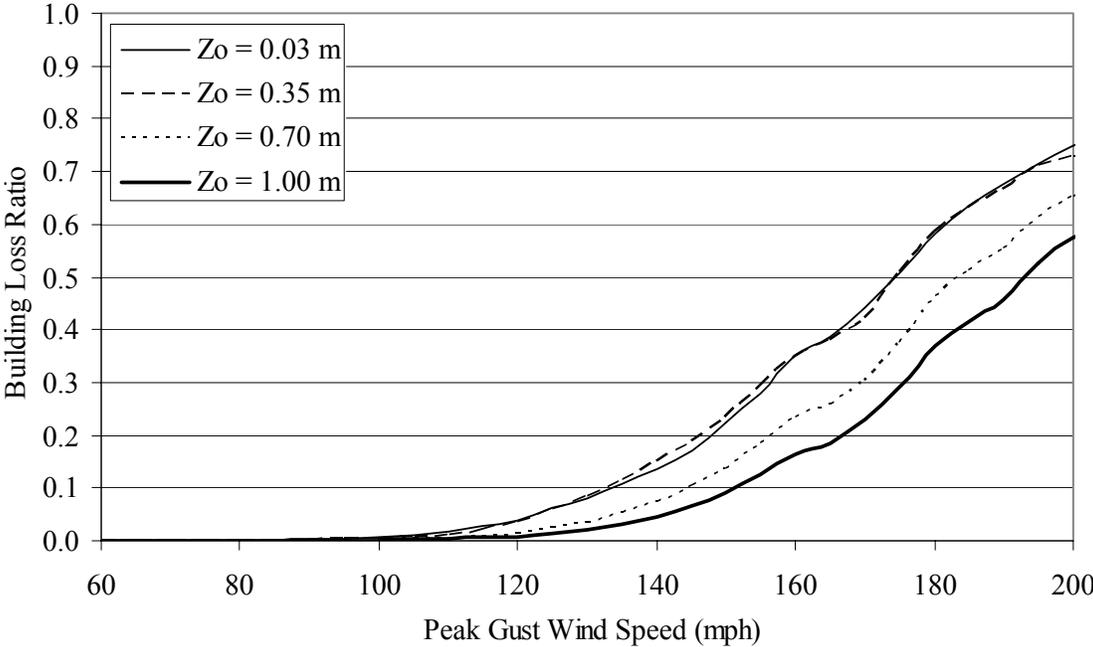
**Figure M.24. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



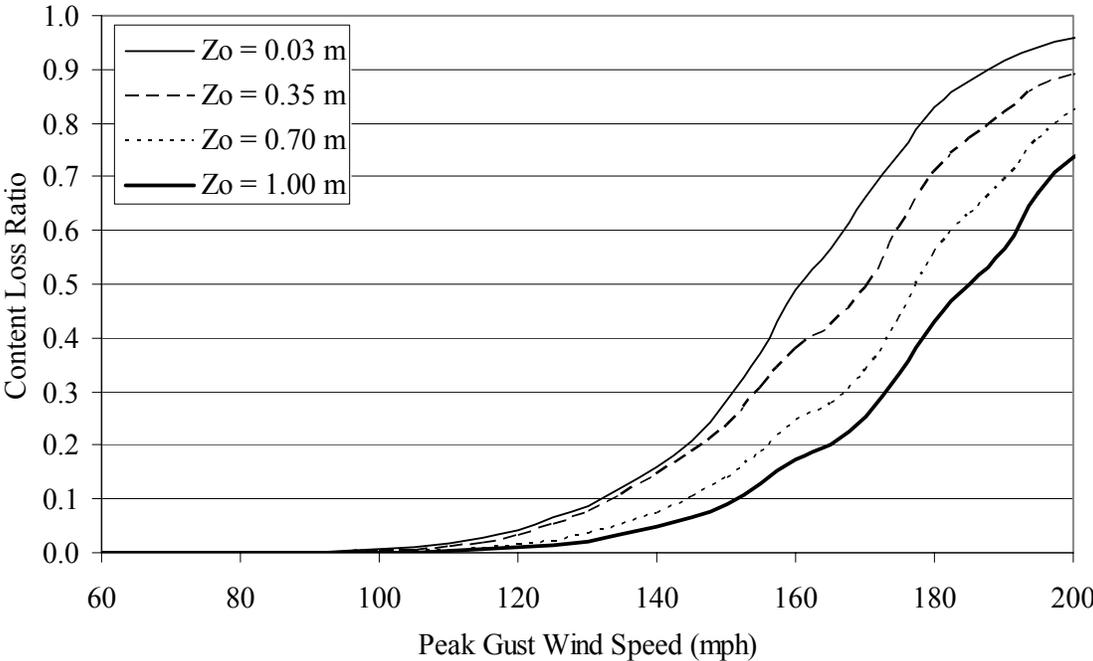
**Figure M.25. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



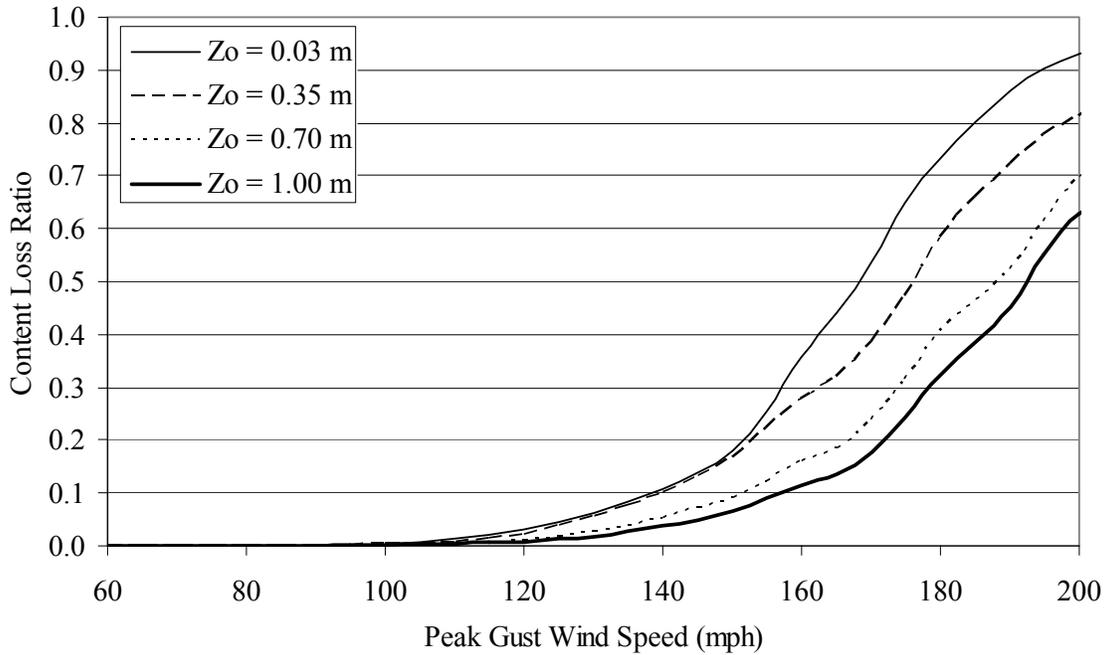
**Figure M.26. Building Loss Function – Five-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



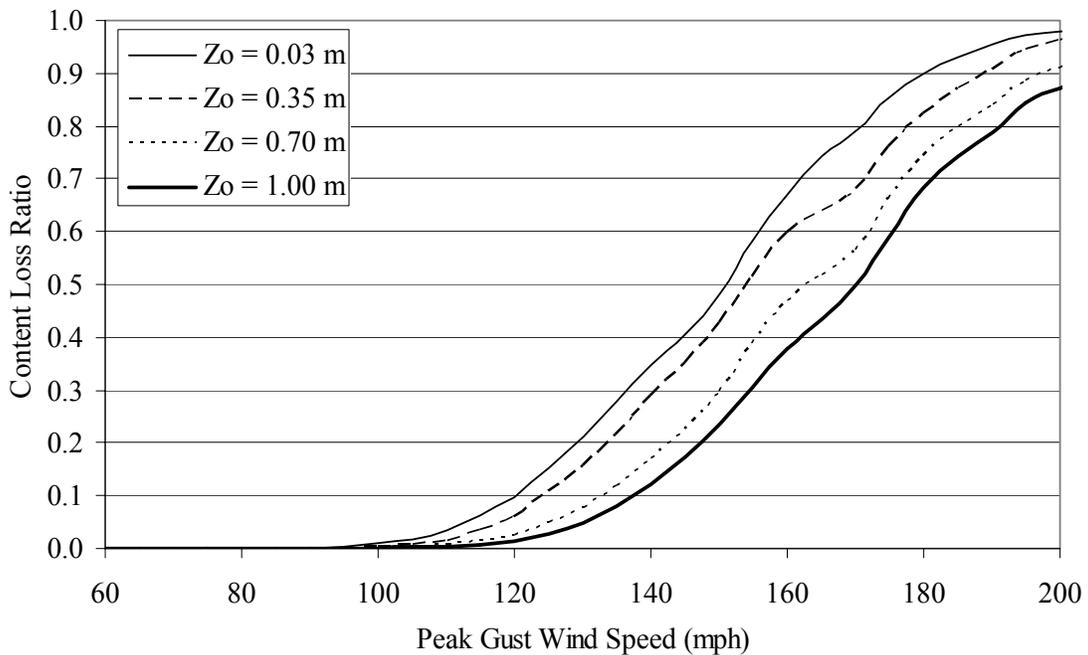
**Figure M.27. Building Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**



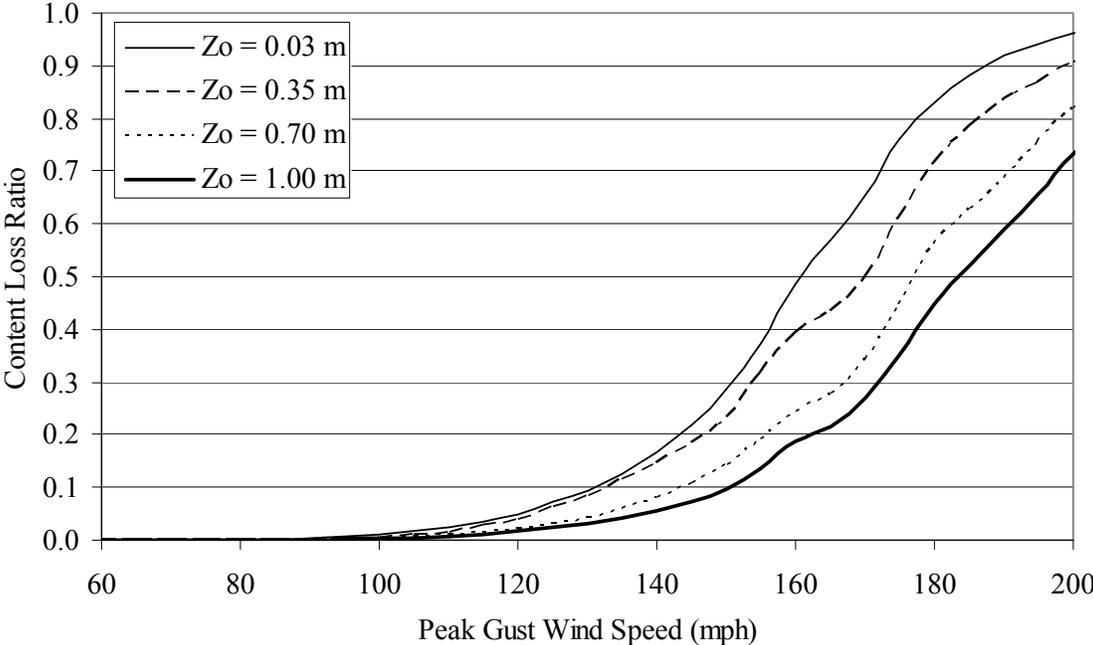
**Figure M.28. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



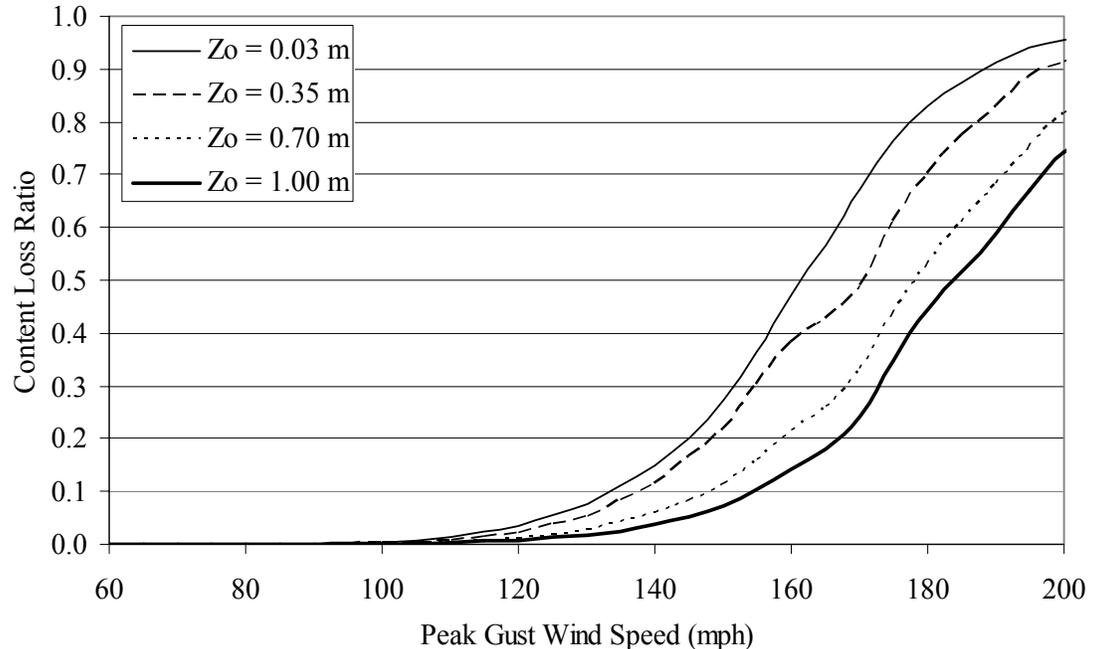
**Figure M.29. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



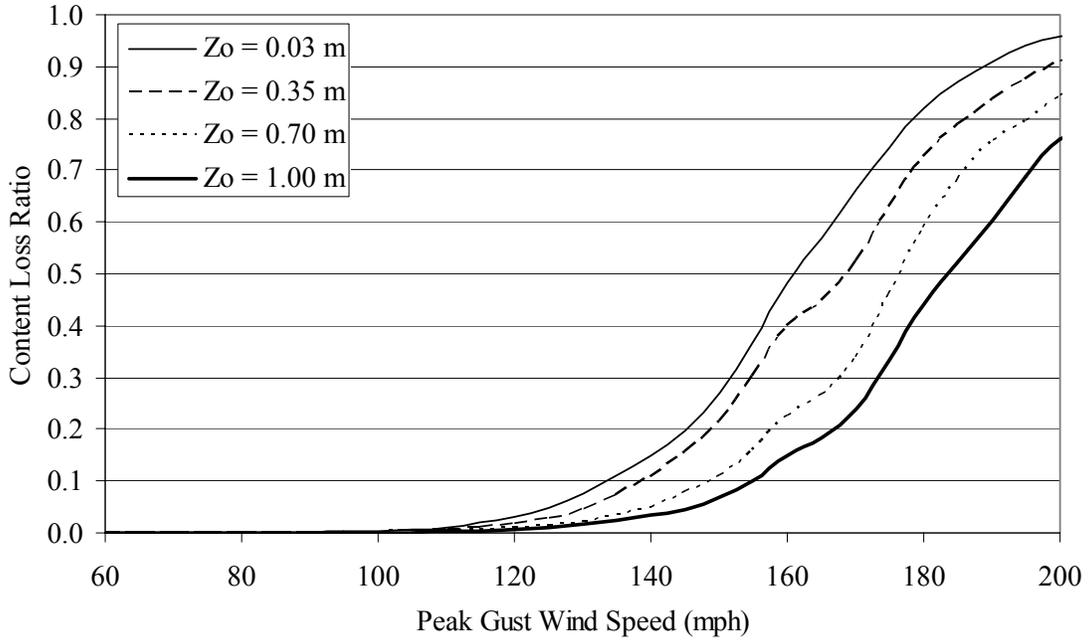
**Figure M.30. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



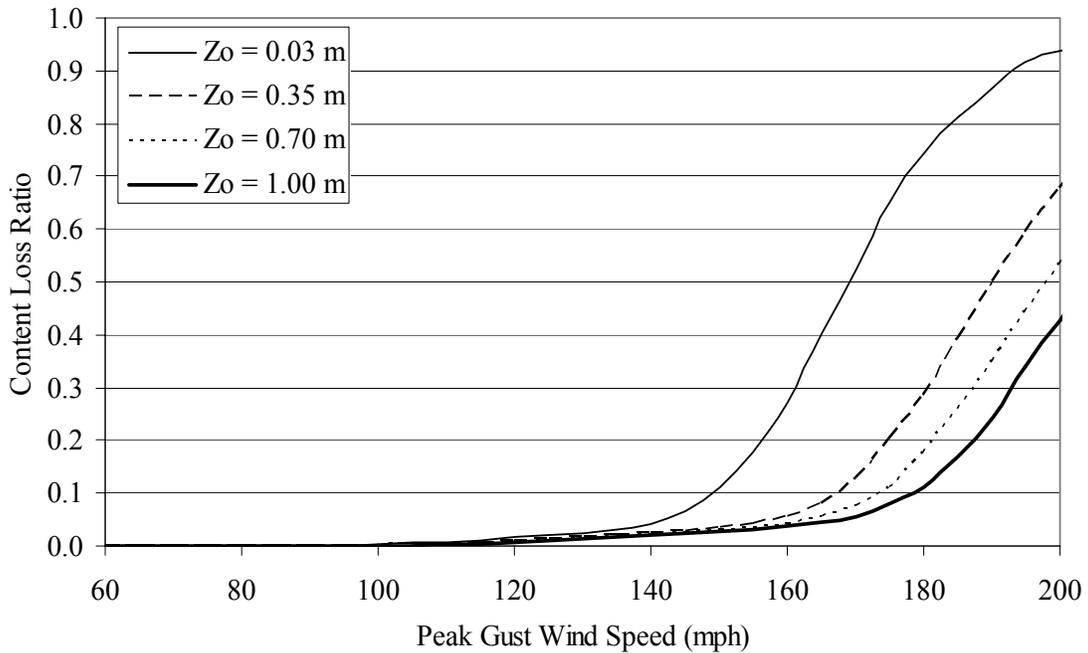
**Figure M.31. Content Loss Function – Five-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



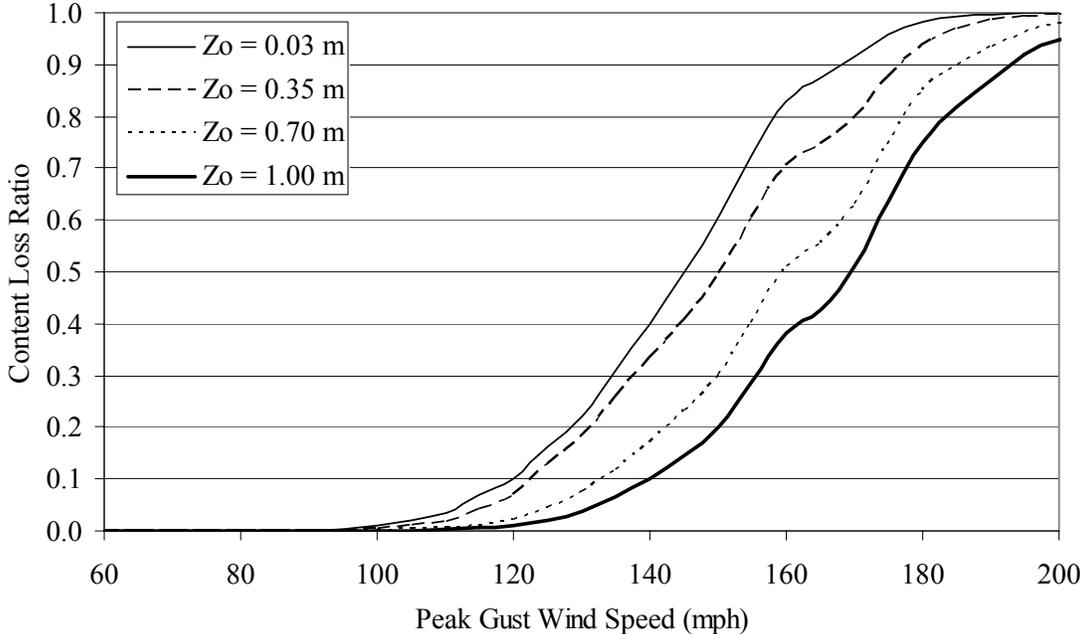
**Figure M.31. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



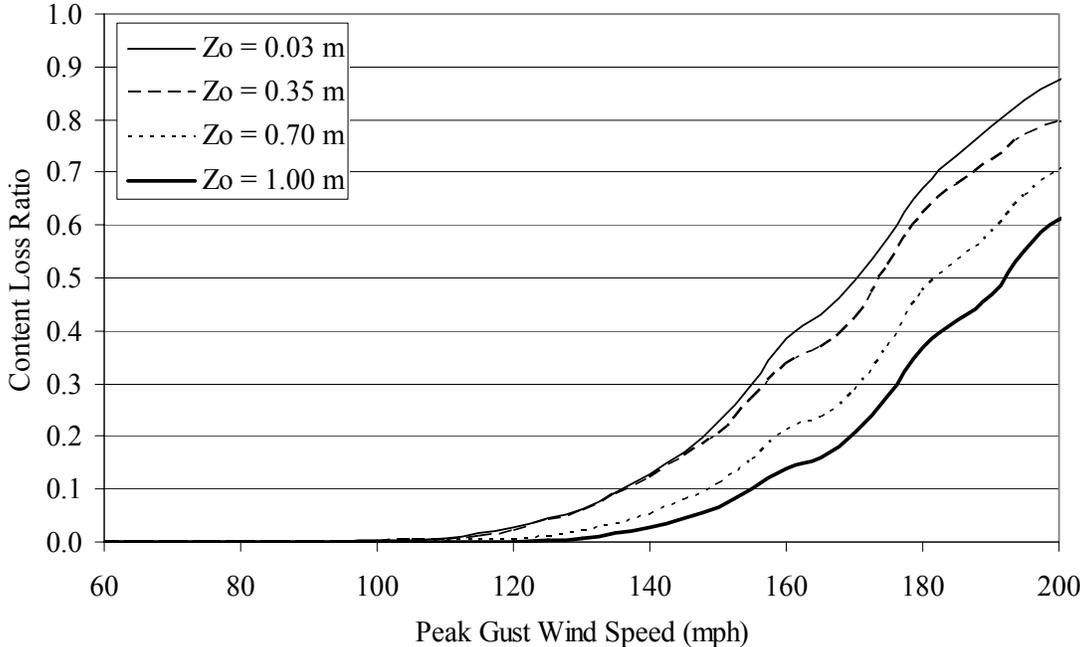
**Figure M.33. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



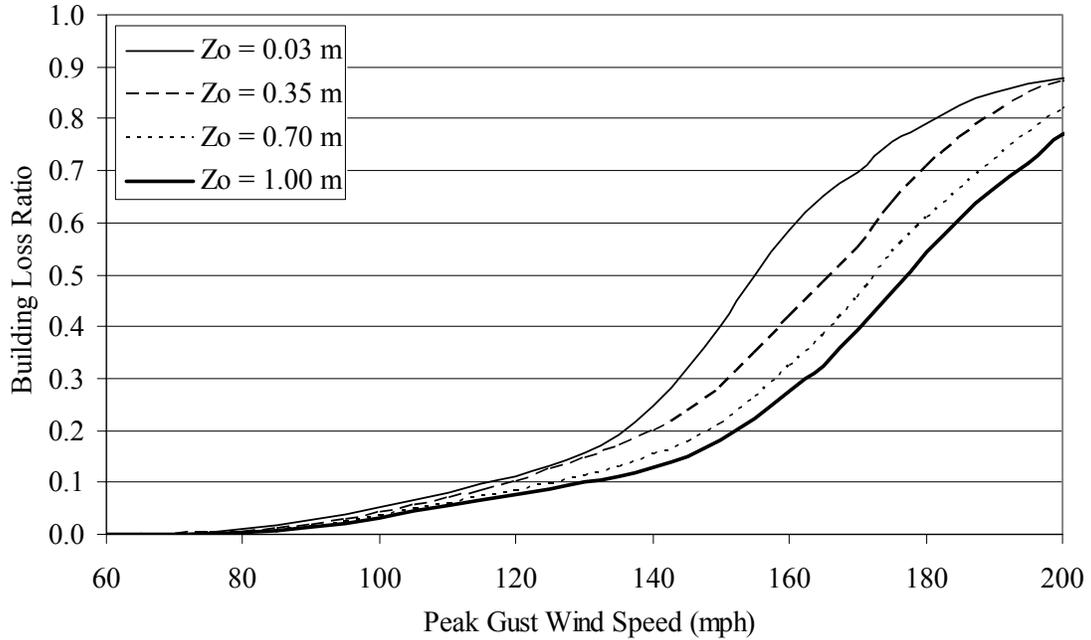
**Figure M.34. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



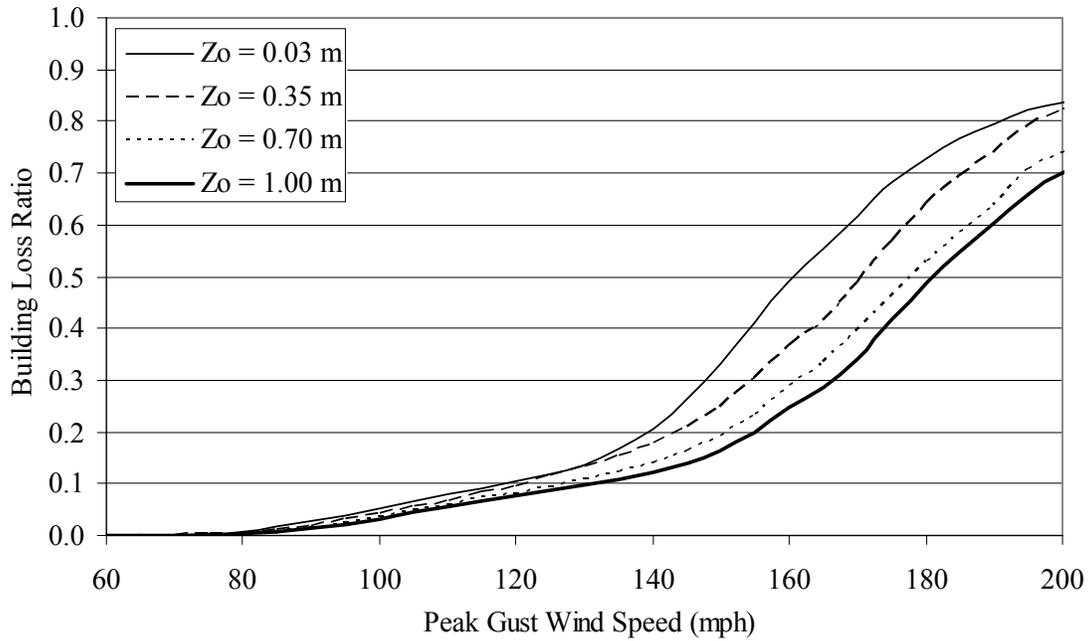
**Figure M.35. Content Loss Function – Five-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



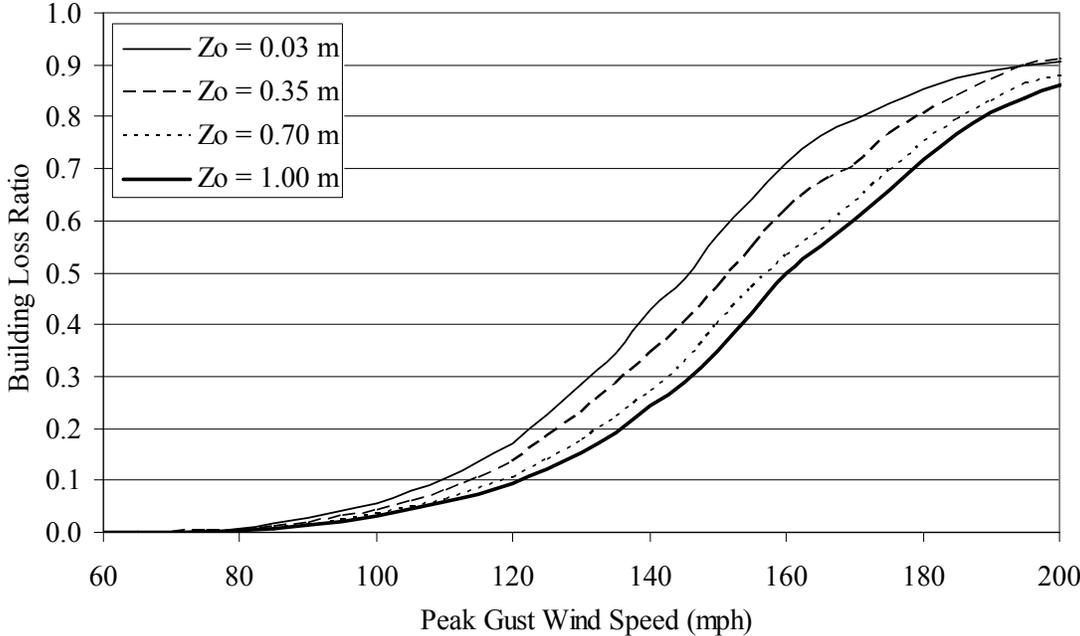
**Figure M.36. Content Loss Function – Five-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**



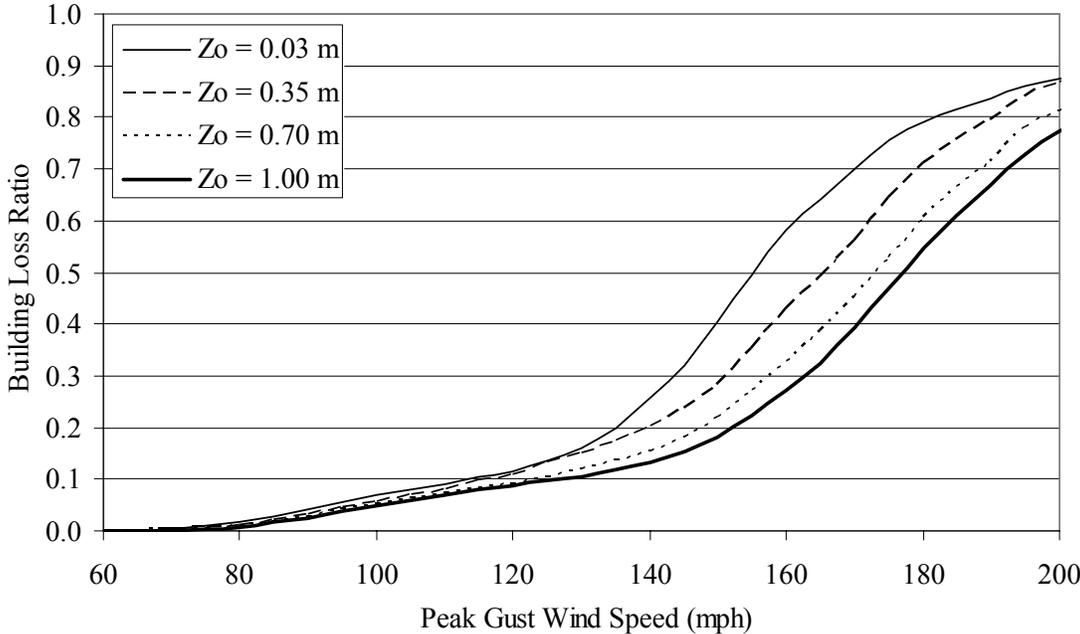
**Figure M.37. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



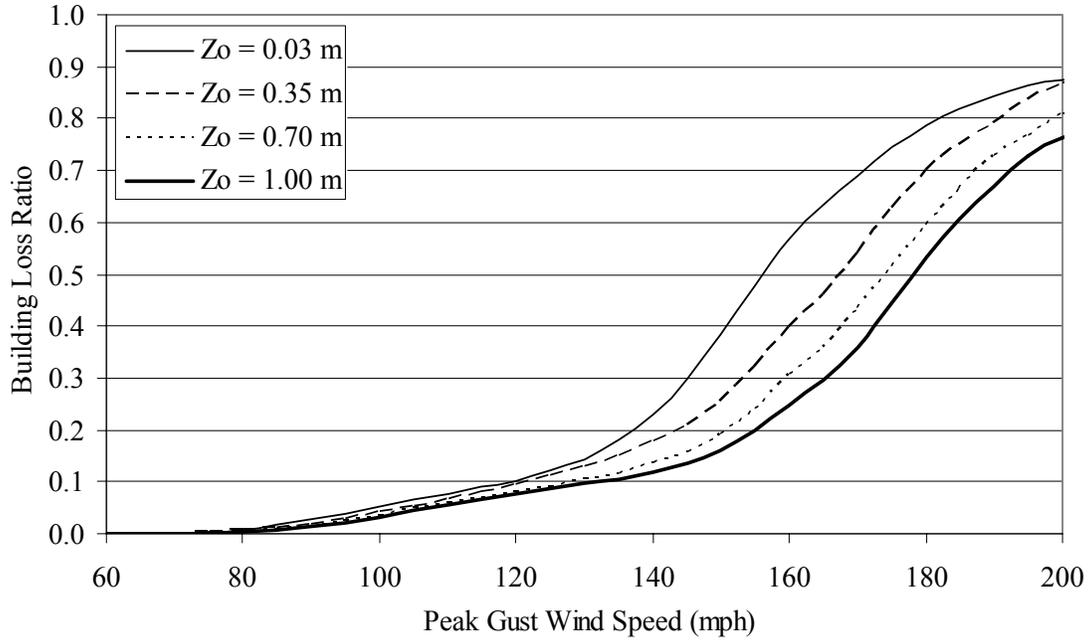
**Figure M.38. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



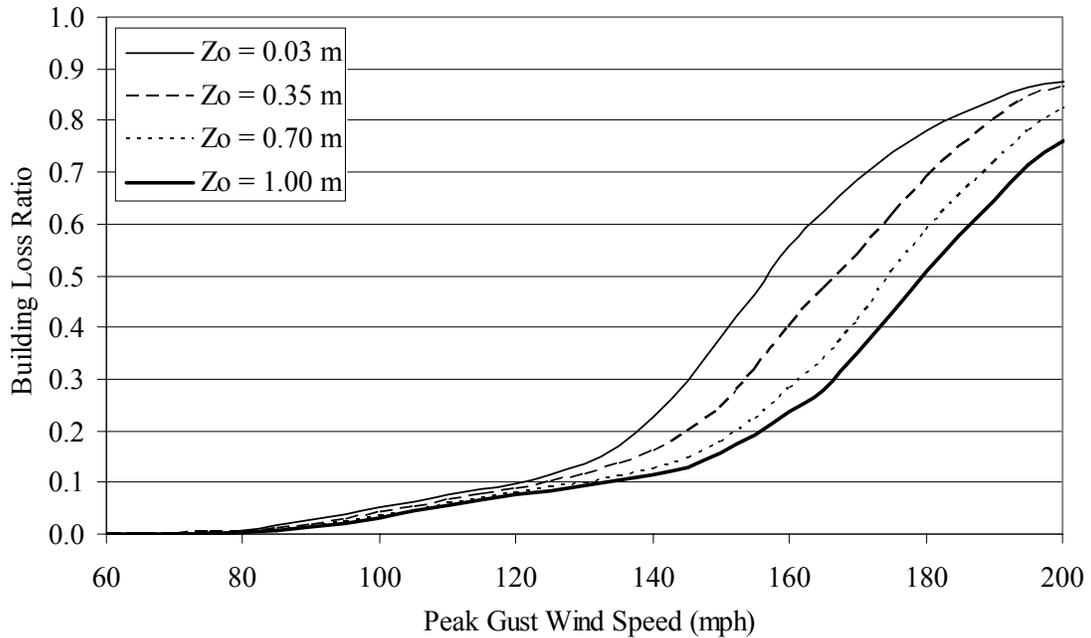
**Figure M.39. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



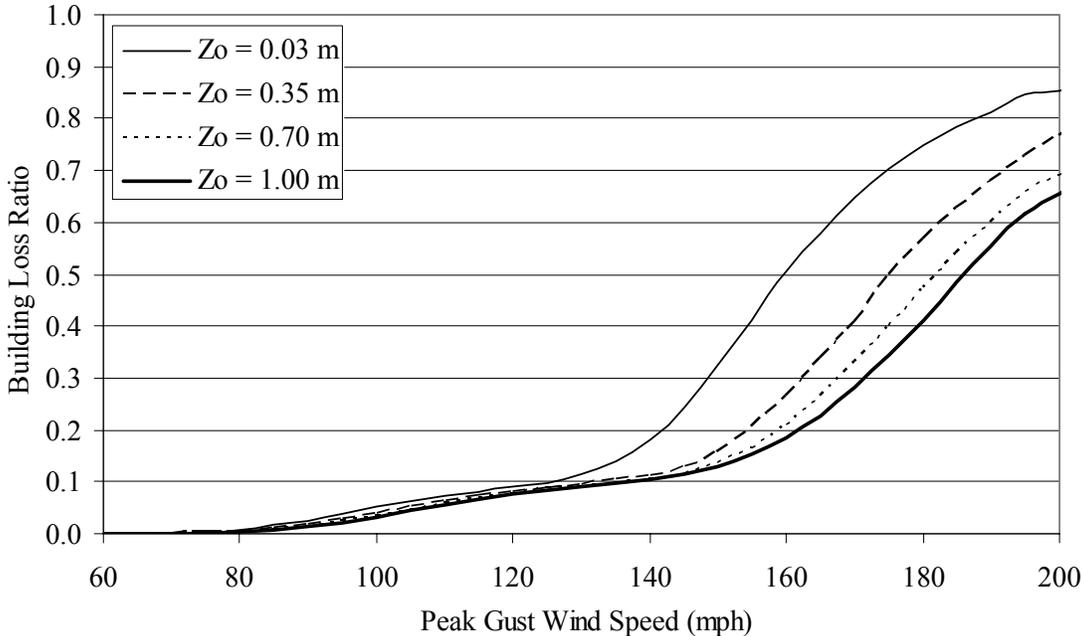
**Figure M.40. Building Loss Function – Eight-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



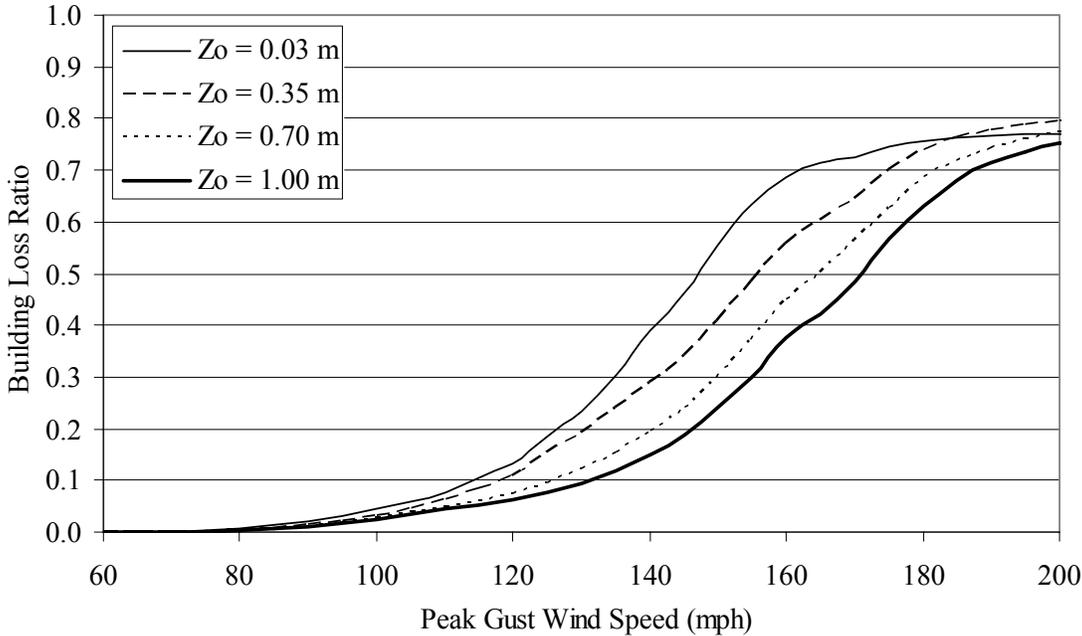
**Figure M.41. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



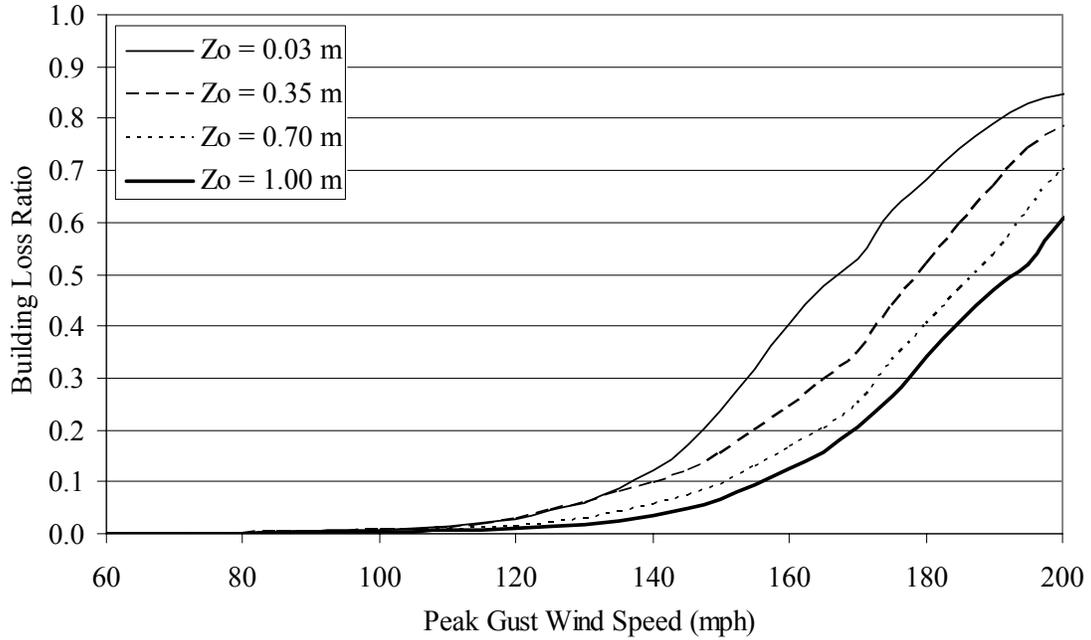
**Figure M.42. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



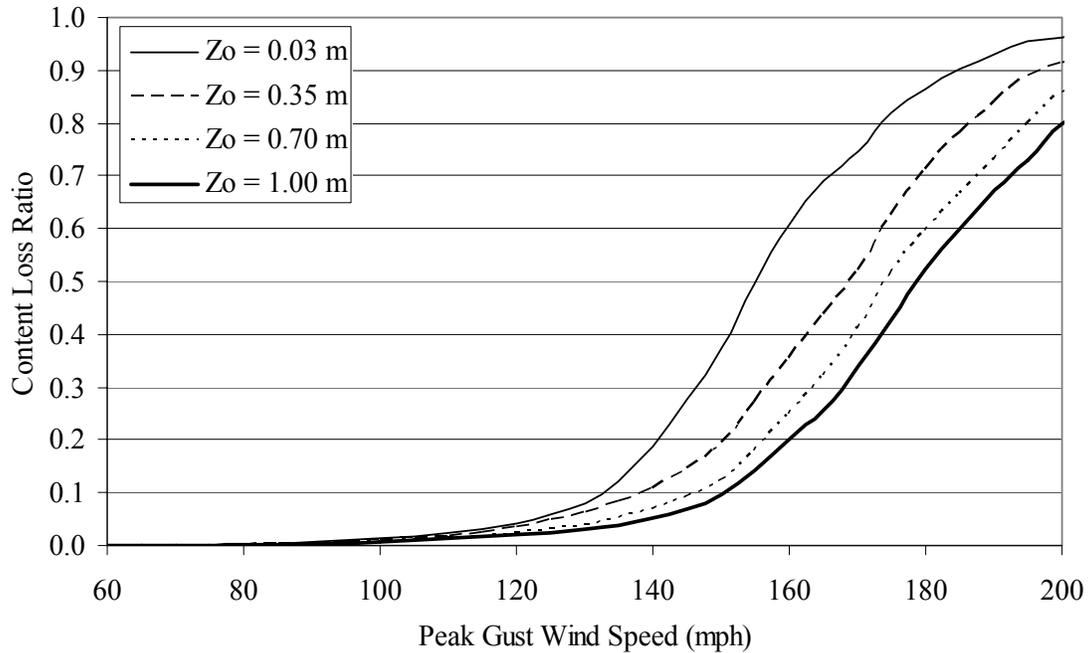
**Figure M.43. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



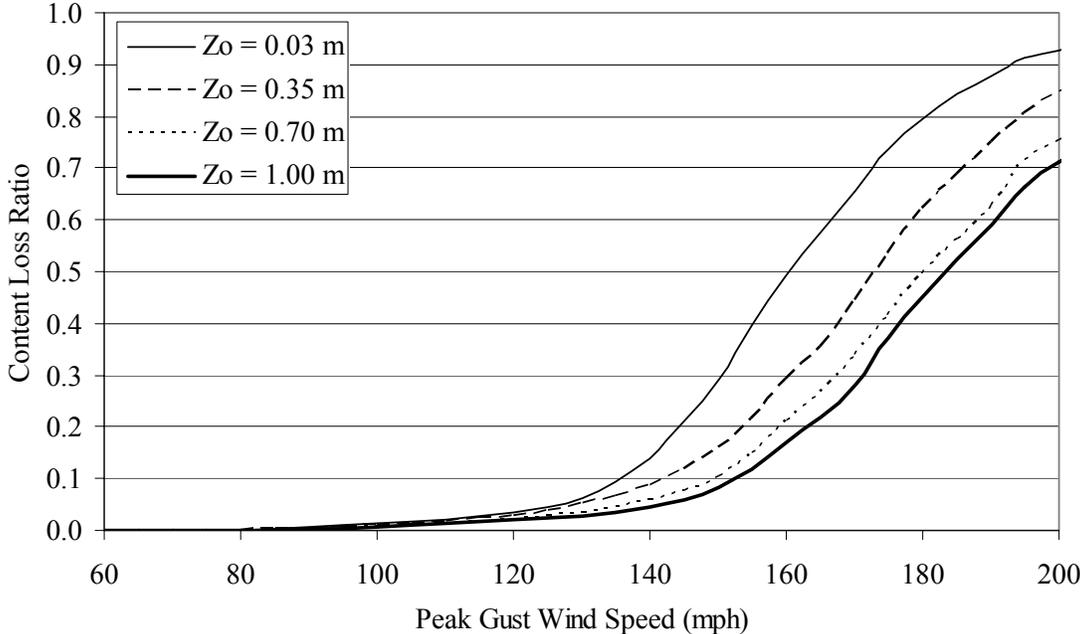
**Figure M.44. Building Loss Function – Eight-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



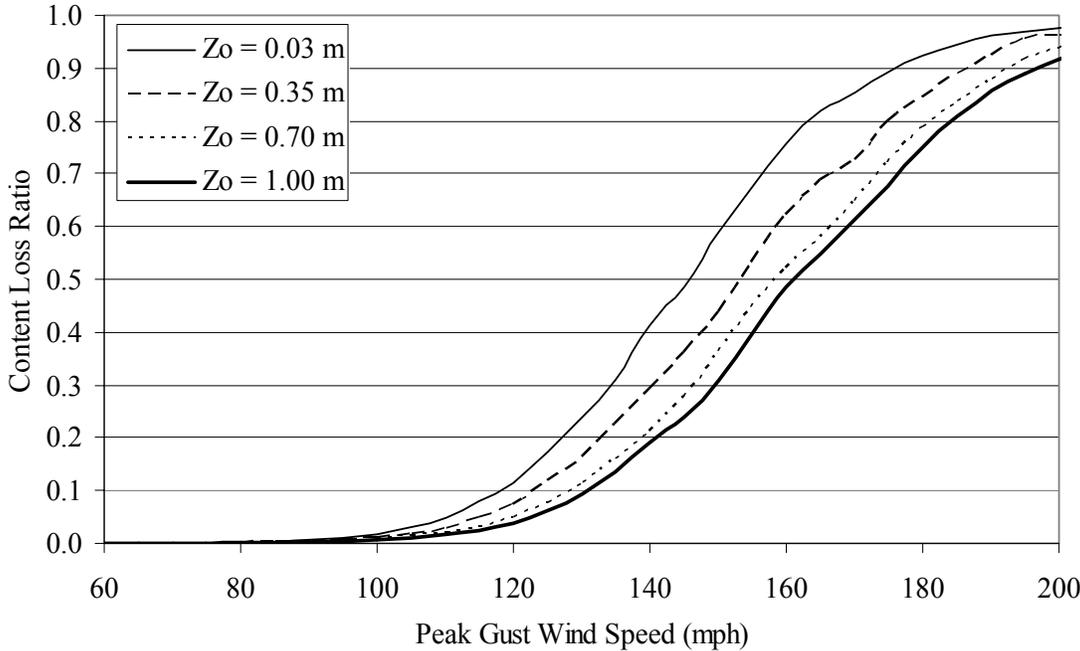
**Figure M.45. Building Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**



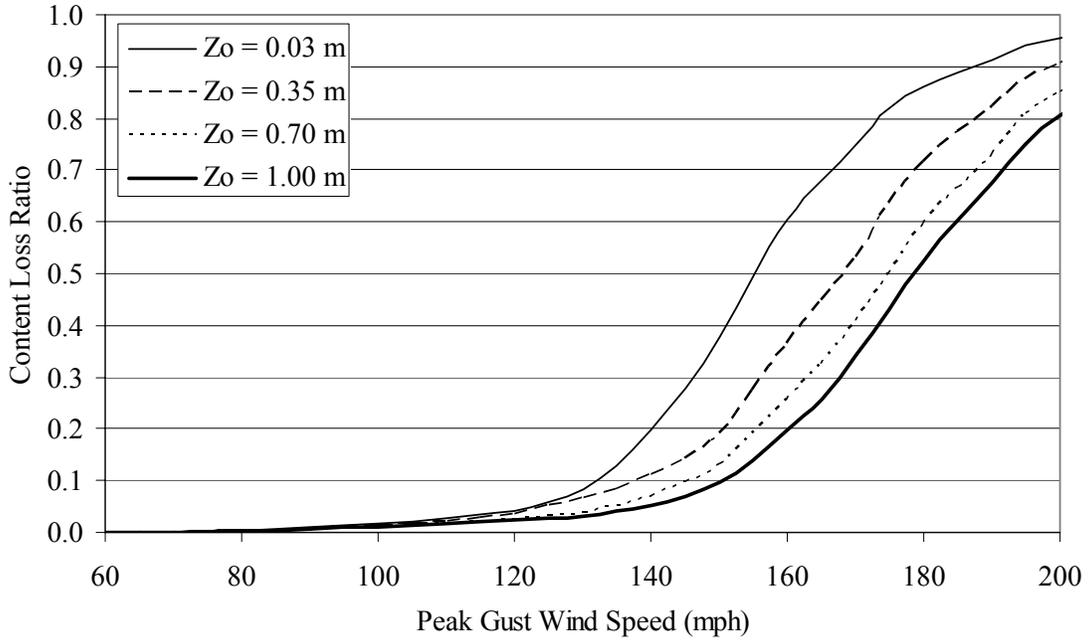
**Figure M.46. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



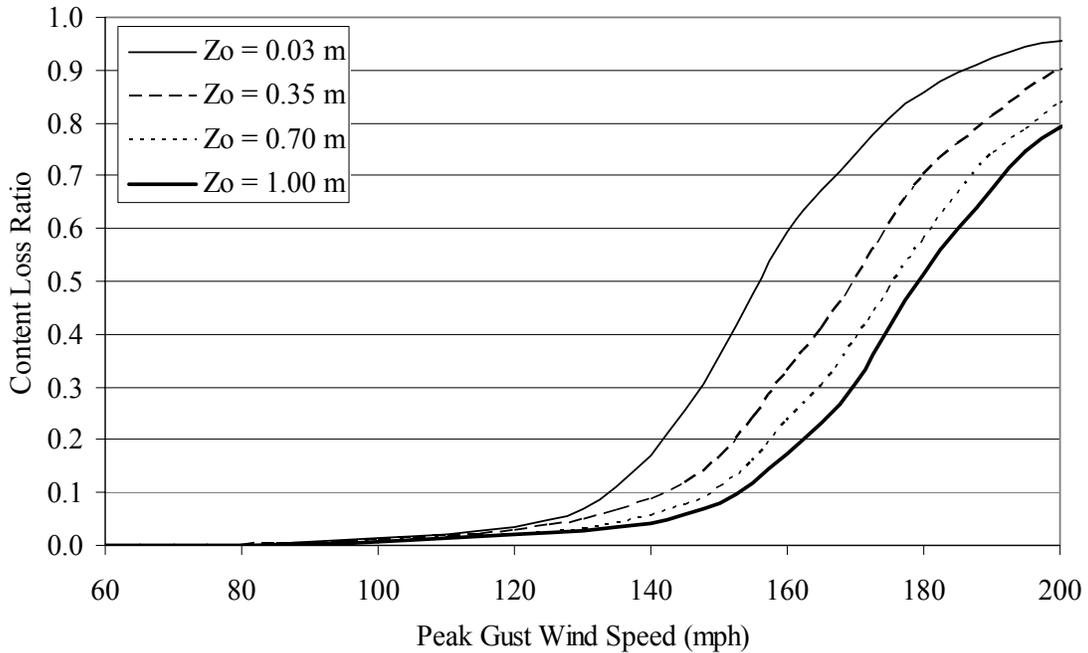
**Figure M.47. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 20% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



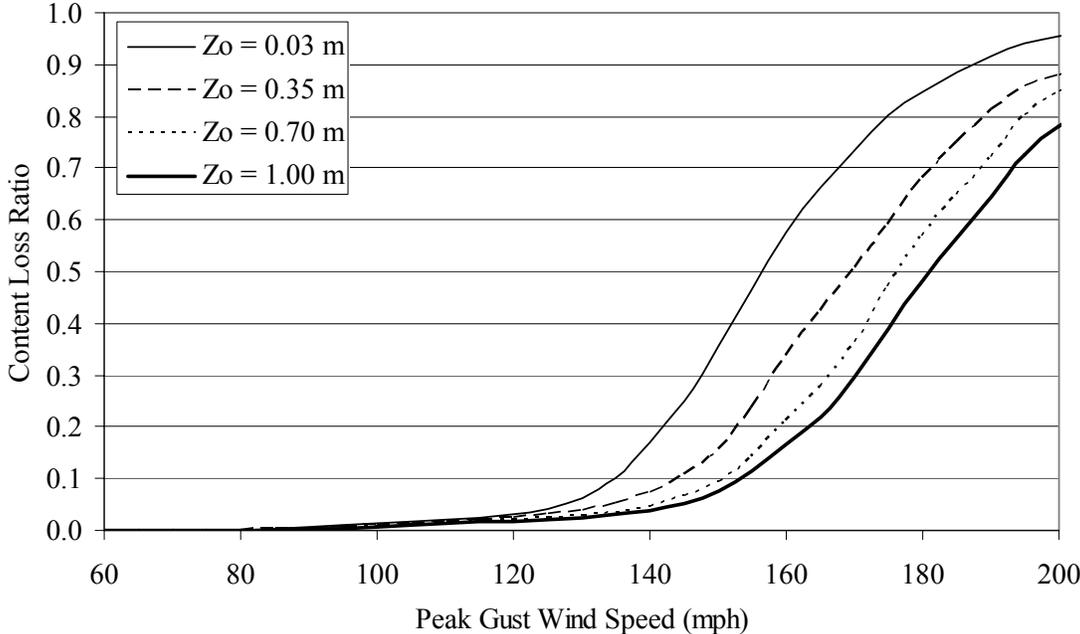
**Figure M.48. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 50% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



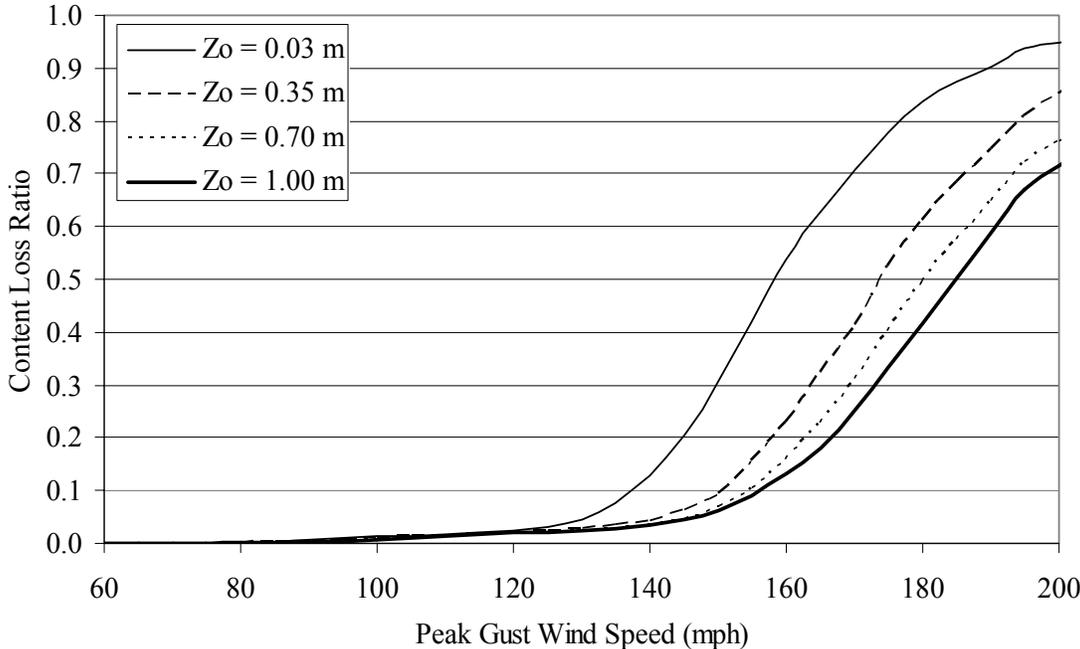
**Figure M.49. Content Loss Function – Eight-Story Engineered Residential Building – Single Ply Membrane Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



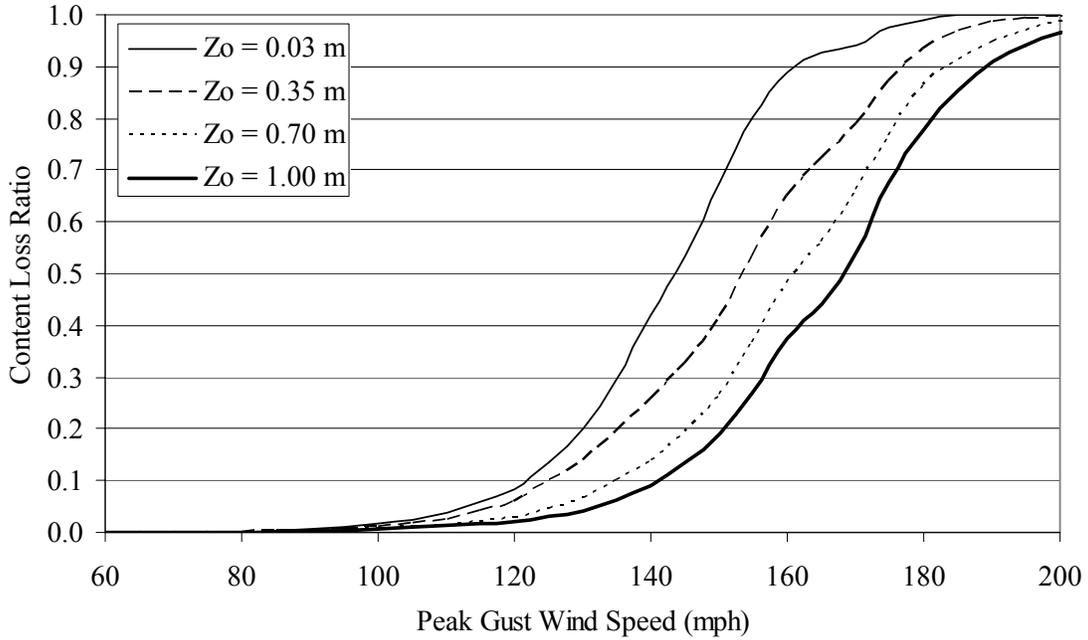
**Figure M.50. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment B.**



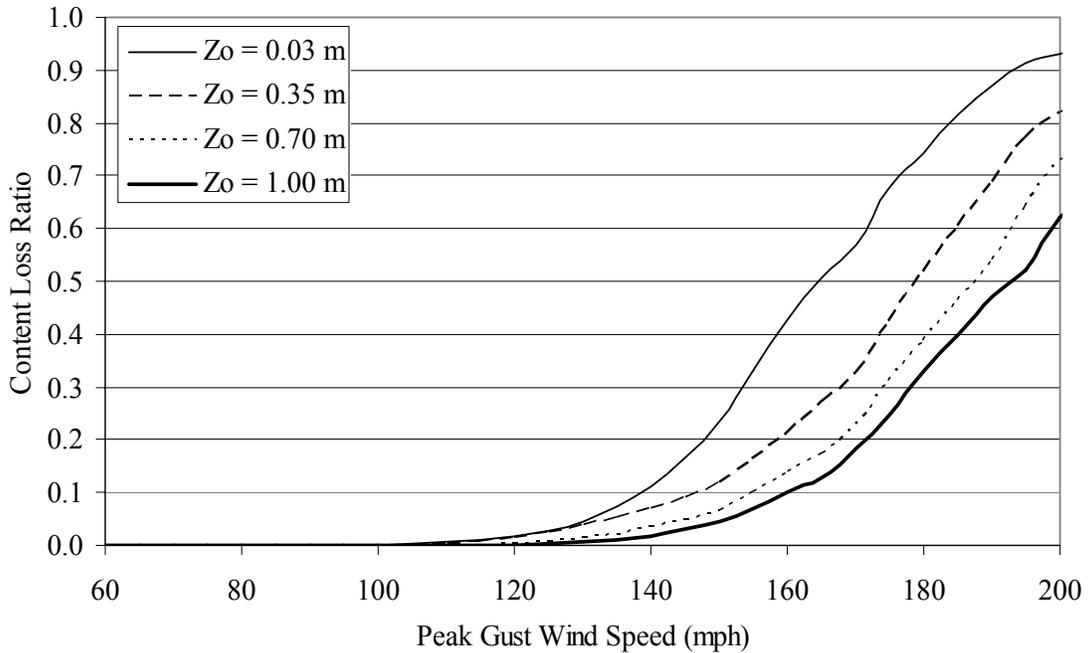
**Figure M.51. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment C.**



**Figure M.52. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment D.**



**Figure M.53. Content Loss Function – Eight-Story Engineered Commercial Building – Built-up Roof Cover, 33% Glazing Coverage, Metal Roof Deck, Missile Environment A.**



**Figure M.54. Content Loss Function – Eight-Story Engineered Residential Building – Built-up Roof Cover, 33% Glazing Coverage, Concrete Roof Deck, Missile Environment A.**

**Appendix N.**  
**Loss Functions for Industrial Buildings**

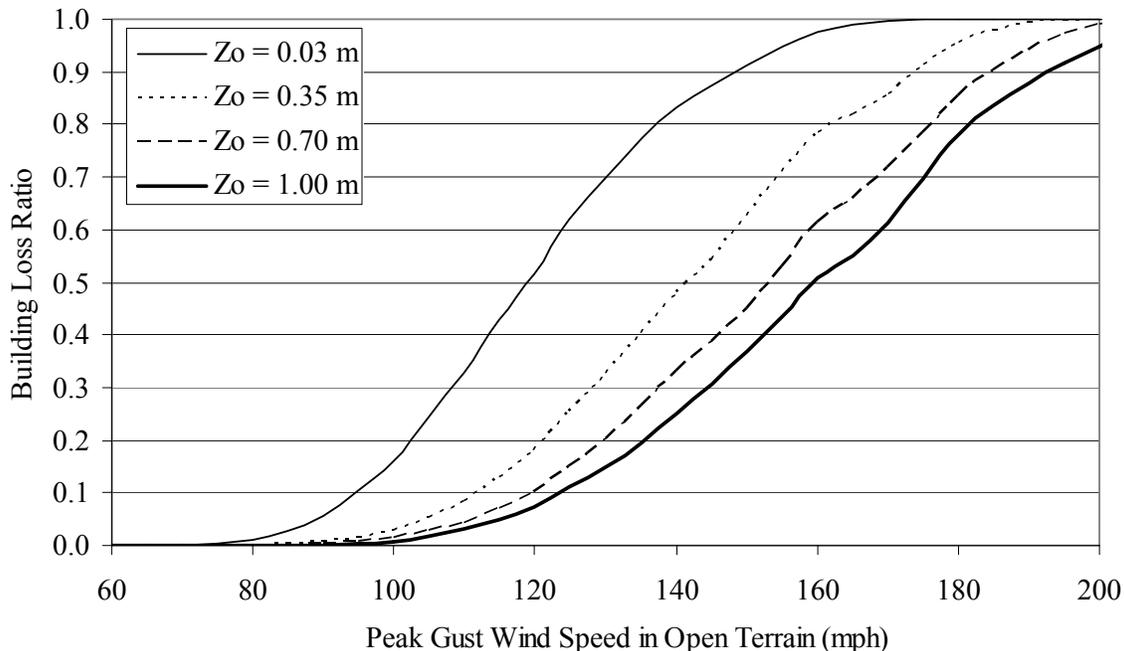
## Appendix N. Loss Functions for Industrial Buildings

This appendix presents loss functions for industrial buildings (see Section 7.14). The loss functions represent either average building loss normalized by building value or average content loss normalized by content value. Therefore, the loss ratios range between 0 and 1 in both cases. Note that the content value is set to 50% of the building value. For a given simulated storm, the building loss ratio and content loss ratio are estimated based on the modeled damage and the largest gust speed over the entire duration of the simulated storm is saved. The loss functions are then computed by averaging the loss ratios associated with the storms producing a maximum gust speed within 5 mph ranges. The average loss ratios (content or building loss) associated with each 5 mph gust speed range are then plotted at the center of that range. Note that the wind speeds are representative of open terrain at 10 m above ground.

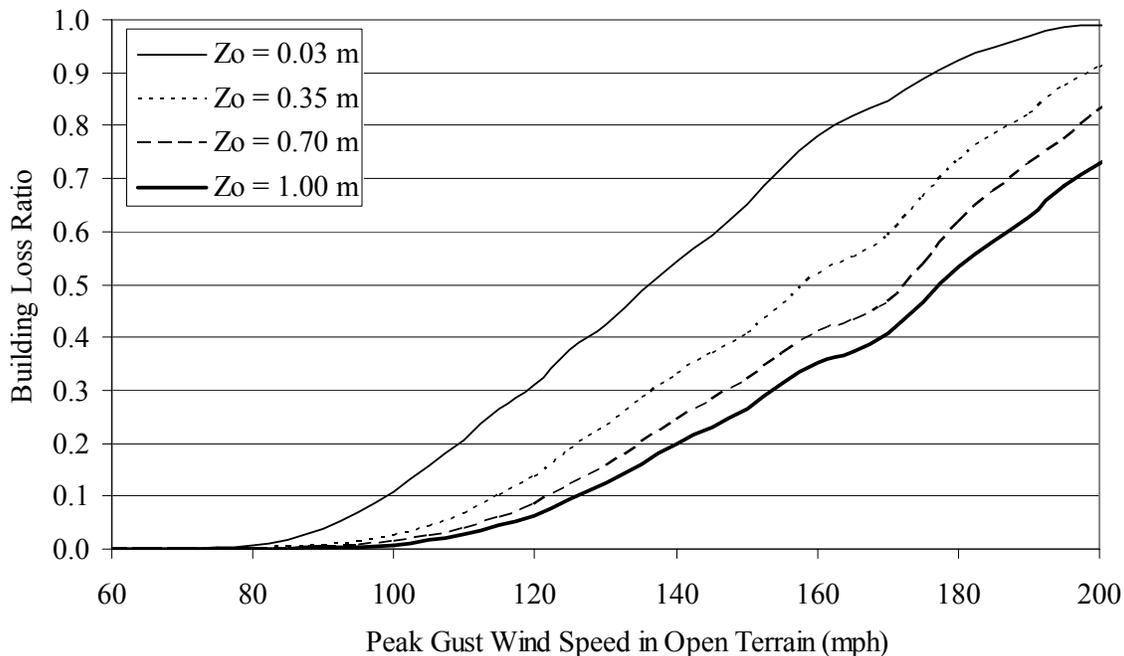
Table N.1 lists the figures provided in this appendix. Two sets of three figures are given for the industrial buildings. The first set of three figures (Figures N.1 through N.3) show building loss functions and the second set (Figures N.4 through N.6) show content loss functions. The first figure in each set of three shows loss results for the industrial building constructed with unreinforced masonry walls, having no reduction in the metal roof deck capacity and situated in Missile Environment A. The remaining two plots in each set show damage state results for buildings which are different by a single variable in comparison to the reference building (note that the changed variable is underlined in the figure titles).

**Table N.1. Sample Loss Functions for Industrial Buildings**

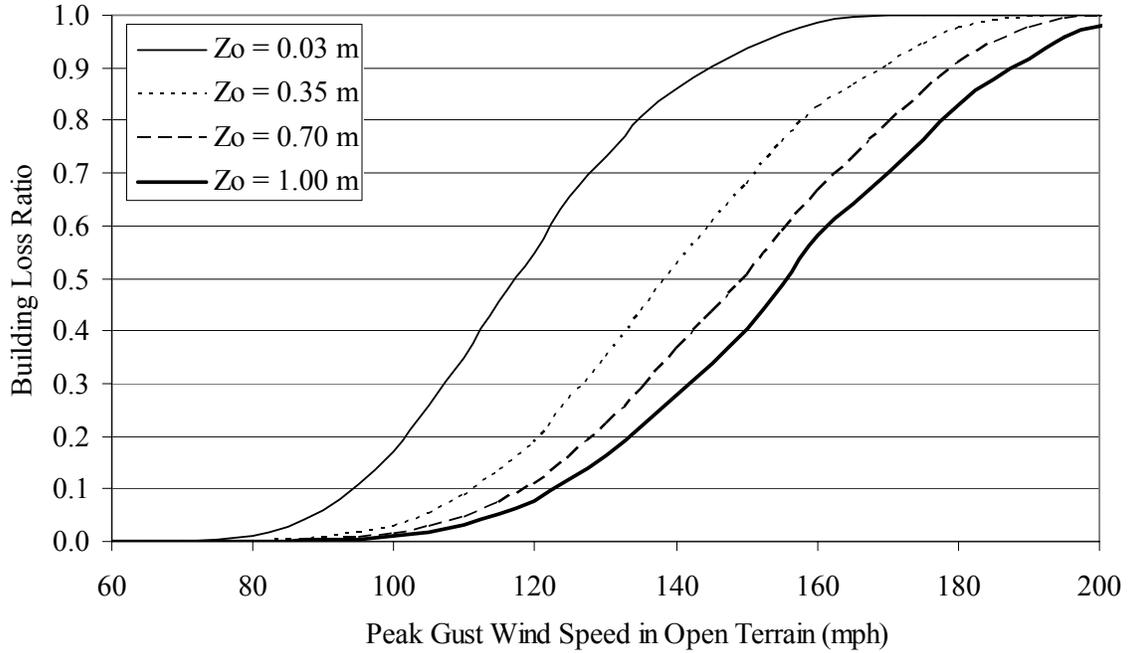
Figure	Loss Type	Walls	Metal Deck Capacity	Missile Environ.
N.1	Building	URM	Full	A
N.2	Building	<b>RM</b>	Full	A
N.3	Building	URM	<b>50%</b>	A
N.4	Content	URM	Full	A
N.5	Content	<b>RM</b>	Full	A
N.6	Content	URM	<b>50%</b>	A



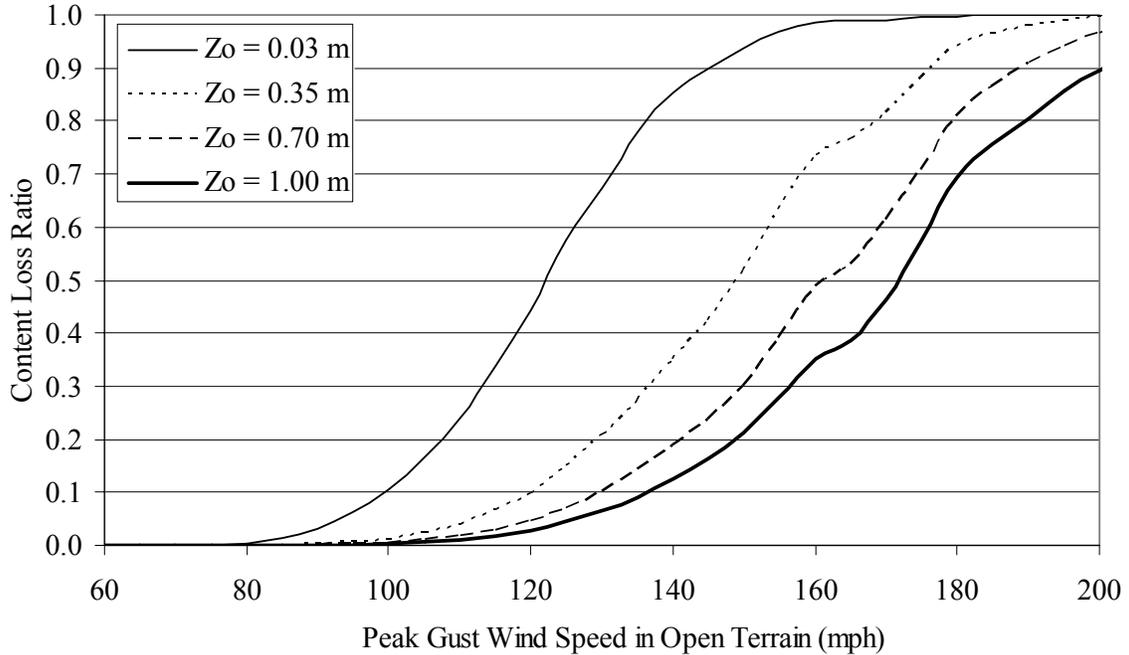
**Figure N.1. Building Loss Function – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A.**



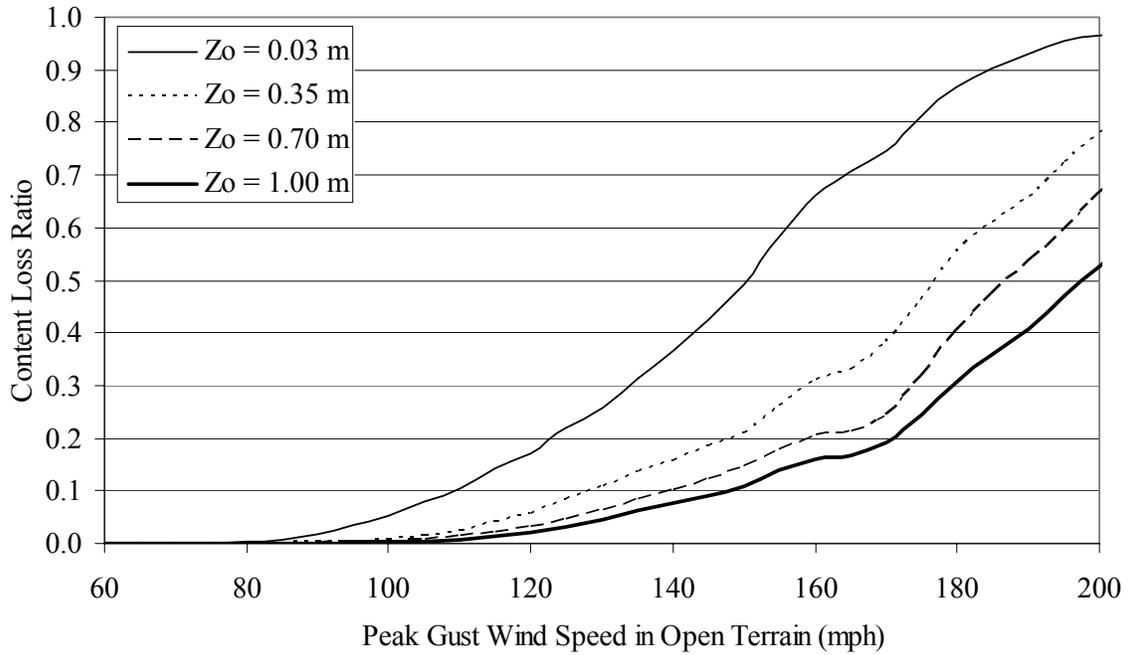
**Figure N.2. Building Loss Function – Industrial Building – No Reduction in Metal Deck Capacity, Reinforced Masonry Walls, Missile Environment A.**



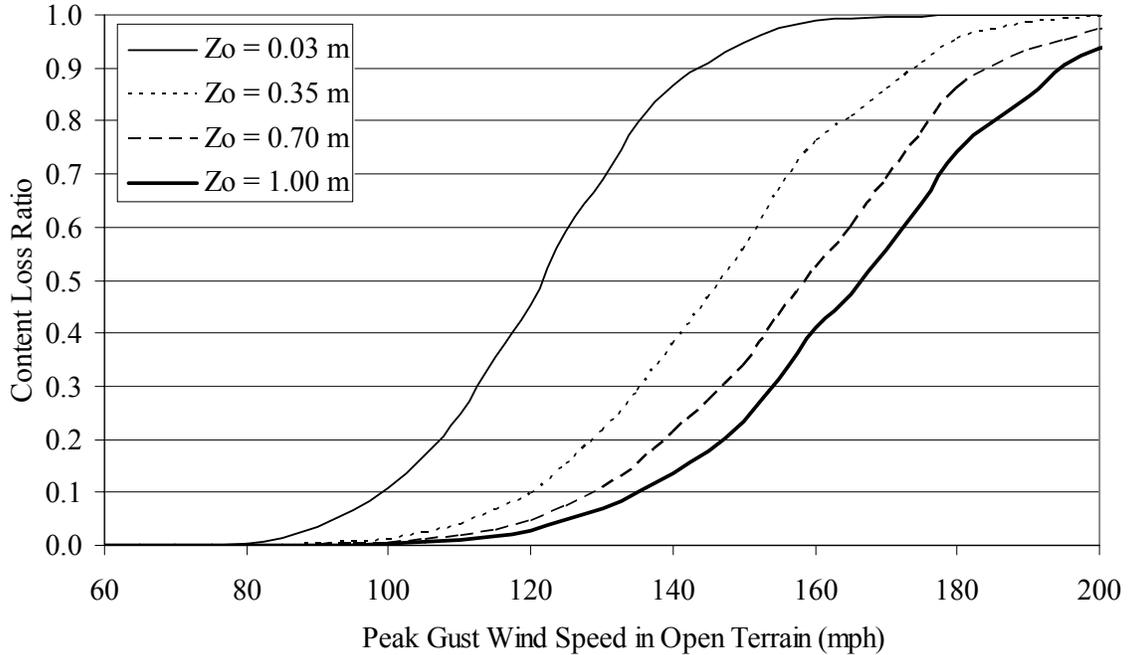
**Figure N.3. Building Loss Function – Industrial Building – 50% Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A.**



**Figure N.4. Content Loss Function – Industrial Building – No Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A.**



**Figure N.5. Content Loss Function – Industrial Building – No Reduction in Metal Deck Capacity, Reinforced Masonry Walls, Missile Environment A.**



**Figure N.6. Content Loss Function – Industrial Building – 50% Reduction in Metal Deck Capacity, Unreinforced Masonry Walls, Missile Environment A.**

