# EXHIBIT 1

## BUILDING PERFORMANCE ASSESSMENT TEAM MEMBERS

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| John Gambel | Federal Emergency Management Agency, Federal Insurance Administration, Washington, D.C., Team Leader |
| Clifford E. Oliver | Federal Emergency Management Agency, Federal Insurance Administration, Washington, D.C., Team Coordinator |
| Michael G. Mahoney | Federal Emergency Management Agency, Office of Earthquakes and Natural Hazards, Washington, D.C. |
| Mark A. Vieira | Federal Emergency Management Agency, Region IV, Atlanta, GA |
| Charles Danger | Metro-Dade County Office of the County Manager, Miami, FL |
| Christopher S. Hanson | Greenhorne & O'Mara, Inc., Consulting Engineers, Greenbelt, MD |
| John C. Pistorino | Pistorino & Alam, Consulting Engineers, Inc., Miami, FL |
| Douglas B. Timmons | Riva, Klein & Timmons, Structural Engineers, Miami, FL |

## BUILDING PERFORMANCE ASSESSMENT TEAM ADVISOR

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| Rodney Cross | National Flood Insurance Program, General Adjustor, Landover, MD, Technical Advisor on Insurance and Claims |

# APPENDIX A

## BUILDING PERFORMANCE ASSESSMENT, DAMAGE ASSESSMENT, AND HAZARD MITIGATION REPORTS

The following is a summary of the reports that FIA has issued, or that FIA staff have participated in preparing, to date to document damages and propose mitigation measures to reduce future damages.

Building Performance Assessment Team Report: Hurricane Andrew, 12/92

Building Performance Assessment Team Report: Hurricane Iniki, 12/92

Building Performance Assessment Team Report: Noreaster, Delaware and Maryland, 1/92

Flood Damage Assessment Report: Noreaster, New York and Massachusetts, 10/91

Flood Damage Assessment Report: Hurricane Bob, 8/91

Guidance Document on Post-Disaster Assessment of Building Flood Damage

Damage Assessment of Flooded Buildings 1985-1990, 6/91

Flood Damage Assessment Report: Hurricane Hugo, 8/91

Hazard Mitigation Team Report: Hurricane Hugo, 10/89

Follow-Up Investigation Report: 9 Months After Hurricane Hugo, 8/91

Flood Damage Assessment Report: Tropical Storm Allison, 6/90

Flood Damage Assessment Report: Noreaster of April 1990, 6/90

Flood Damage Assessment Report: Riverine Flooding in Central Kentucky, 2/90

Flood Damage Assessment Report: Texas, 6/89

Flood Damage Assessment Report: Noreaster, Mid-Atlantic Coast, 3/89

Flood Damage Assessment Report: Noreaster, Mid-Atlantic Coast, 4/88

Flood Damage Assessment Report: Riverine Flooding in the Minneapolis Area

Flood Damage Assessment Report: Riverine Flooding in Maine, 6/88

Flood Damage Assessment Report: Riverine Flooding in Clive, Iowa, 9/86

Flood Damage Assessment Report: Riverine Flooding in Allegheny County, Pennsylvania, 1/87

Flood Damage Assessment Report: Riverine Flooding in Central Michigan, 5/87

Flood Damage Assessment Report: Hurricane Gloria, 2/86

Improving Resistance of Buildings to Wind Damage: Hurricane Elena, 9/85

Hazard Mitigation Team: Hurricane Diana, 1984

Proposed Changes to Building Codes in Response to Hurricane Alica, 8/83

Hazard Mitigation Report: Noreaster, Outer Banks, North Carolina, 10/82

Hazard Mitigation Team Report: Hurricane Frederick, 9/79

# APPENDIX B

## MANUFACTURED HOUSING

A nationwide standard for manufactured home construction was established when Congress passed the Manufactured Home Construction and Safety Standards Act of 1974. This Act directed the Department of Housing and Urban Development (HUD) to develop and administer standards for all components of manufactured home construction, including body and frame construction requirements, and support and anchoring systems to resist specific design wind loads.

HUD's regulation of the manufactured housing industry is based on an enforcement program that consists of three principal components: pre-production design approval, production inspection, and post-production consumer protection.

Manufacturers are required to hire a HUD-approved independent third party Design Approval Primary Inspection Agency to review and approve the manufacturer's design, calculations, and testing for compliance with HUD standards. The manufacturers are also required to hire a HUD-approved Production Inspection Primary Inspection Agency to inspect homes for adherence to the approved design specification and HUD standards. Post-production enforcement processes focus on correcting nonconformances with HUD standards that are usually identified through consumer complaints. These activities are carried out through State Administrative Agencies or directly by HUD.

Under the auspices of the NFIP, localities must require that manufactured homes be elevated and anchored so that they are able to withstand flotation, collapse, and lateral movement as a result of wind and flood forces. Specifically, the NFIP requires manufactured homes to be elevated and secured to an adequately anchored foundation system so that the home itself is not displaced due to flood forces. It is expected that in addition to meeting NFIP requirements, manufactured homes are anchored against wind forces in accordance with State or local regulations.

An exception is manufactured homes in existing manufactured home parks that have been substantially damaged by wind. Here, the NFIP requires that all new replacement homes either be elevated so that their lowest floors are at or above the BFE or be elevated on reinforced piers or other foundation elements of equivalent strength that are at least 36 inches above grade, whichever is lower. In addition, the replacement homes must be securely anchored to withstand floatation, collapse, and lateral movement that could be caused by both flood and wind forces. An existing manufactured home park is defined as a park for which construction of the facilities for servicing the lots on which the homes are installed was completed prior to the effective date of the floodplain management regulations adopted by the community.

# APPENDIX C

## COMMENTS FROM REVIEWERS

Numerous solicited and unsolicited comments were received concerning both the preliminary and the draft versions of the report.

Comments were solicited from the following:

Building Performance Assessment Team Members

FIA

FEMA Region IV, Atlanta, Georgia

- Natural Hazards Branch staff
- Hazard Mitigation Officer

FEMA State and Local Programs and Support Directorate

- Office of Earthquakes and Natural Hazards
- Office of Disaster Assistance Programs

Florida Department of Community Affairs

Unsolicited comments were received from the following:

National Roofing Contractors Association, Rosemont, Illinois

Glazing Consultants, Inc., North Palm Beach, Florida

Following is a list of the substantive comments received and their disposition:

COMMENT: The Dade County GIS played a major role in supporting the assessment team's efforts to identify areas that were damaged. It has shown to be an effective tool in the mitigation and reconstruction effort after the storm. Therfore, the use of GIS should be further discussed in the report.

DISPOSITION: A discussion of the role of GIS and a recommendation concerning its future role in mitigation were added.

COMMENT: The discussion of the actual wind speeds needs to be clarified and expanded.

DISPOSITION: The intent of the report is not to focus on the actual wind speeds. Rather, the focus is based on the premise that buildings built in compliance with the Code should have performed better during Hurricane Andrew. The National Weather Service is producing a document that will identify "official wind speeds" for Hurricane Andrew.

COMMENT: The discussion of the methods used to measure wind speeds, and their differences, should be expanded.

DISPOSITION: Wind speeds are measured differently for meteorological and building code purposes. While the National Weather Service uses terms such as "sustained gust" and "highest gust," building codes prescribe the use of the "fastest mile" wind standard. Though it is possible to convert between the two, the issue is confusing to the general public. This report addresses the differences between the various terms. However, it is beyond the scope of the report to resolve the this complex, long-standing issue.

COMMENT: The report states that wood-frame gable ends failed because of a lack of a defined load transfer path. Instead, failure was due to an over-reliance on plywood roof sheathing, rather than gable and roof truss bracing, to act a load transfer mechanism.

DISPOSITION: The report language was revised to address this issue.

COMMENT: Why is the widespread failure of manufactured homes not discussed in greater detail?

DISPOSITION: The team did not focus on the failure mode of manufactured homes. HUD is the Federal agency responsible for oversight of the manufacured housing industry and is the more appropriate group to address this issue. HUD staff are knowledgeable about the design, construction, and installation practices of the manufactured housing industry. HUD has the resident capability to identify future improvements needed in this technology.

COMMENT: The discussion of the failure mode of composition roof shingles needs further explanation.

DISPOSITION: The report language was revised to address this issue.

COMMENT: The report language implies that the team observed universally poor-quality workmanship.

DISPOSITION: The report language was revised to remove this implication. The team observed numerous examples of quality workmanship that resulted in successful performance of buildings during the storm.

COMMENT: Due to the importance of roof system failure, roofs should be discussed in a separate subsection within the "Observations" section of the report.

DISPOSITION: The revised report includes a separate section on roofing systems.

COMMENT: The limited extent of storm surge damage was a result not only of the forward speed of the storm but also the compact size of the storm.

DISPOSITION: The report language was revised to address this issue.

COMMENT: The recommendation for a "hot-mopped" layer of tar underneath composition shingles may be overly conservative. Investing in better methods of shingle and roofing paper attachment may be more cost-effective.

DISPOSITION: The failure mode of composition roof shingles is complex. Even if the attachment mode were to be improved, material failure will continue to pose problems during high winds. Furthermore, accelerated deterioration of roof shingles in the subtropical climate of southern Florida is a problem. The recommendation for a tar layer, secondary roof membrane beneath composition roof shingles was therefore retained.

COMMENT: Though improved workmanship in the installation of roof tiles will improve the survivability of these roofs, continued debris impact will still result in damages.

DISPOSITION: The report language was revised to address this issue

COMMENT: Proper venting of buildings may act to relieve induced internal air pressure. However, vents can also provide access for uncontrolled air flow if not designed and installed properly.

DISPOSITION: The report language was revised to address this issue.

COMMENT: The failure mode of composition shingles is a complex problem. Further discussion of the team's observations is needed to justify the recommendation concerning composition shingles contained in the report.

DISPOSITION: The report language was revised to address this issue.

COMMENT: Further explanation of the failure mode of concrete and clay roof tiles is needed to support the recommendations contained in the report.

DISPOSITION: The report language was revised to address this issue.

COMMENT: Is there evidence to support the observation that flat roof tiles performed better than roof tiles of other shapes?

DISPOSITION: Changes have been made to the report text to clarify that this was an interpretation based on the team's observations.