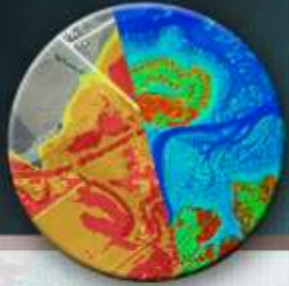


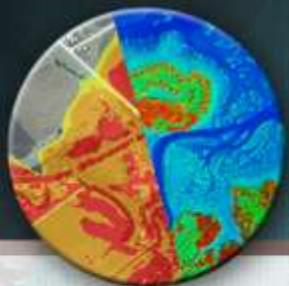
2011 BCAR Re-Engineered Depth-Damage Curves in Hazus

James Mawby, CFM
August 2013



Background

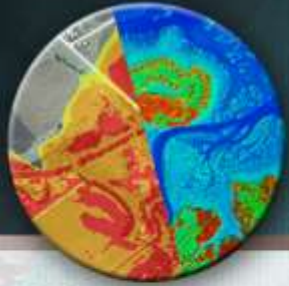
- FEMA's BCA is the tool to determine economic viability of mitigation projects.
- BCA evaluates the future benefits (projected losses avoided) of a project in relation to project cost.
- Hazus, although similar, is not 100% the same. But what benefit might exist to use the same curves?
 - ✓ BCA includes newer curves for coastal residential damages – currently not in Hazus Curve Library.
- Here's an effort to use the new BCA curves in Hazus.
 - ✓ The effort was associated with a project to assist a community post-Hurricane Sandy.



Reference

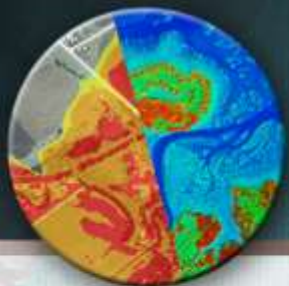
- **The acceptable uses of Hazus information are (see Section 5.1.3.1):**
 - ☐ Depth-damage functions (Flood module)
 - ☐ Contents values (Flood module)
 - ☐ Displacement values (Flood module)
 - ☐ Flood module loss calculations (DFA module)
- **The unacceptable uses of Hazus information are (see Section 5.1.3.2):**
 - ☐ Level 1 analysis
 - ☐ Level 2 and Level 3 analyses for census blocks
 - ☐ Level 2 and Level 3 analyses for user-defined facilities





Reference

- ... fundamental differences between the Hazus and BCA approaches that make the Hazus UDF analysis unacceptable for BCA are as follows:
 - ✓ *Topographic data requirements*
 - ✓ *H&H modeling methods*
 - ✓ *Loss calculation methods*
 - ✓ *Demolition threshold*
- “If a user has data such as detailed structure characteristics, a HEC-RAS analysis, and detailed flood depth and water surface elevations grids, these data could be used for the Flood module rather than trying to make Hazus approximate what the BCA software does by default.”



Reference

- FEMA BCA Software (Version 4.5 – May 2009) did not include functions.
 - Lack of adequate Coastal functions presented core challenges
- Circa October 2010 project initiated to develop updated coastal functions.

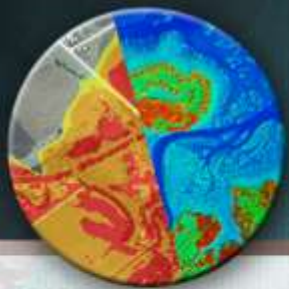
FEMA Benefit-Cost Analysis Re-engineering (BCAR)

Flood Module Revision

Updates to Residential Depth Damage Functions (DDFs) and Guidance for Coastal Flooding

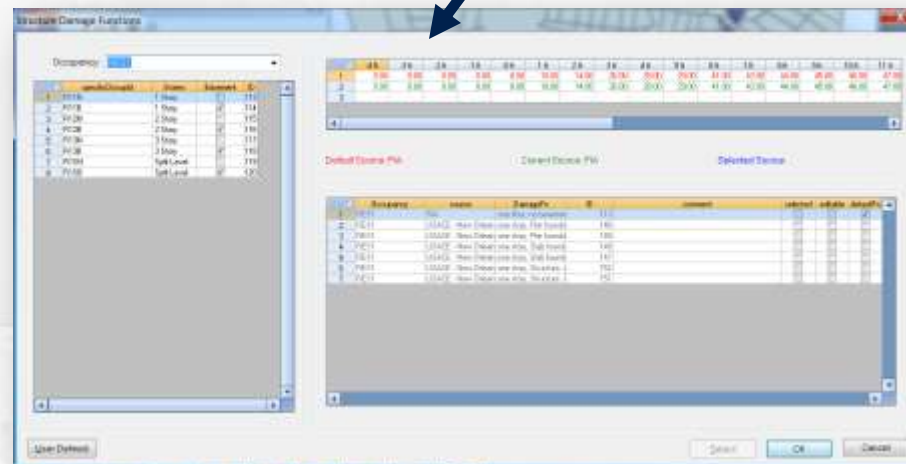
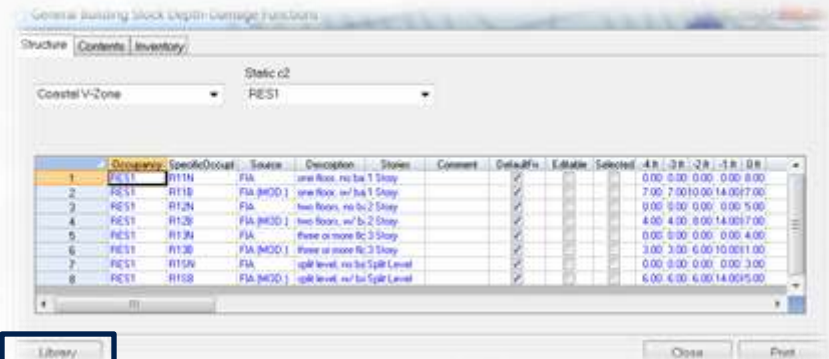
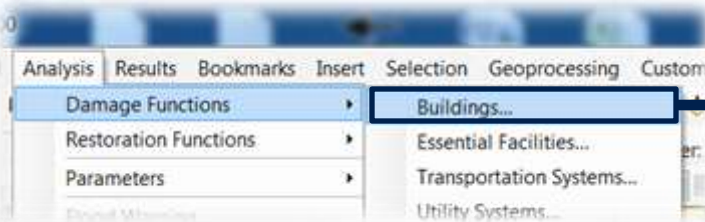
Version 4.5.5

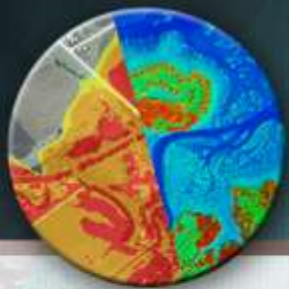
January 2011



Accessing Hazus Curves

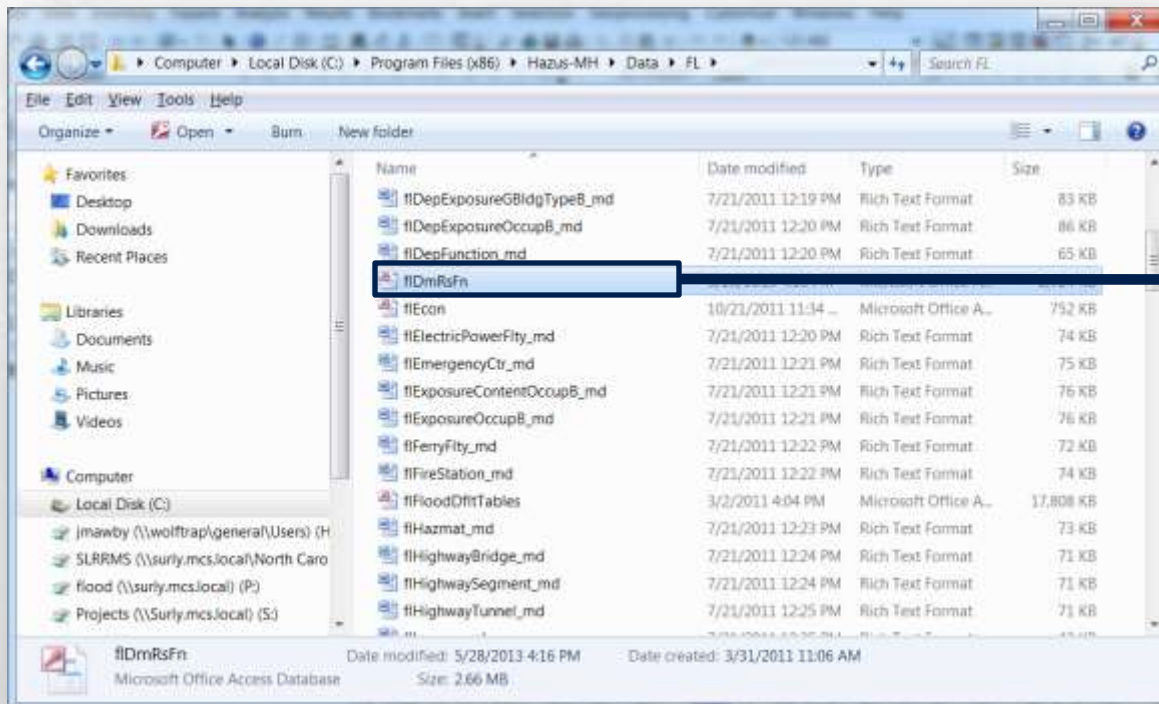
- Where are the Hazus curves?
 - ✓ Front end (Assumption - Beneficial for adding a curve or two)



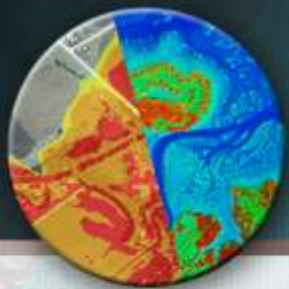


Accessing Hazus Curves

- Where are the Hazus curves?
 - ✓ Back end (Assumption - Beneficial for adding Multiple Curves)



fIDmRsFn

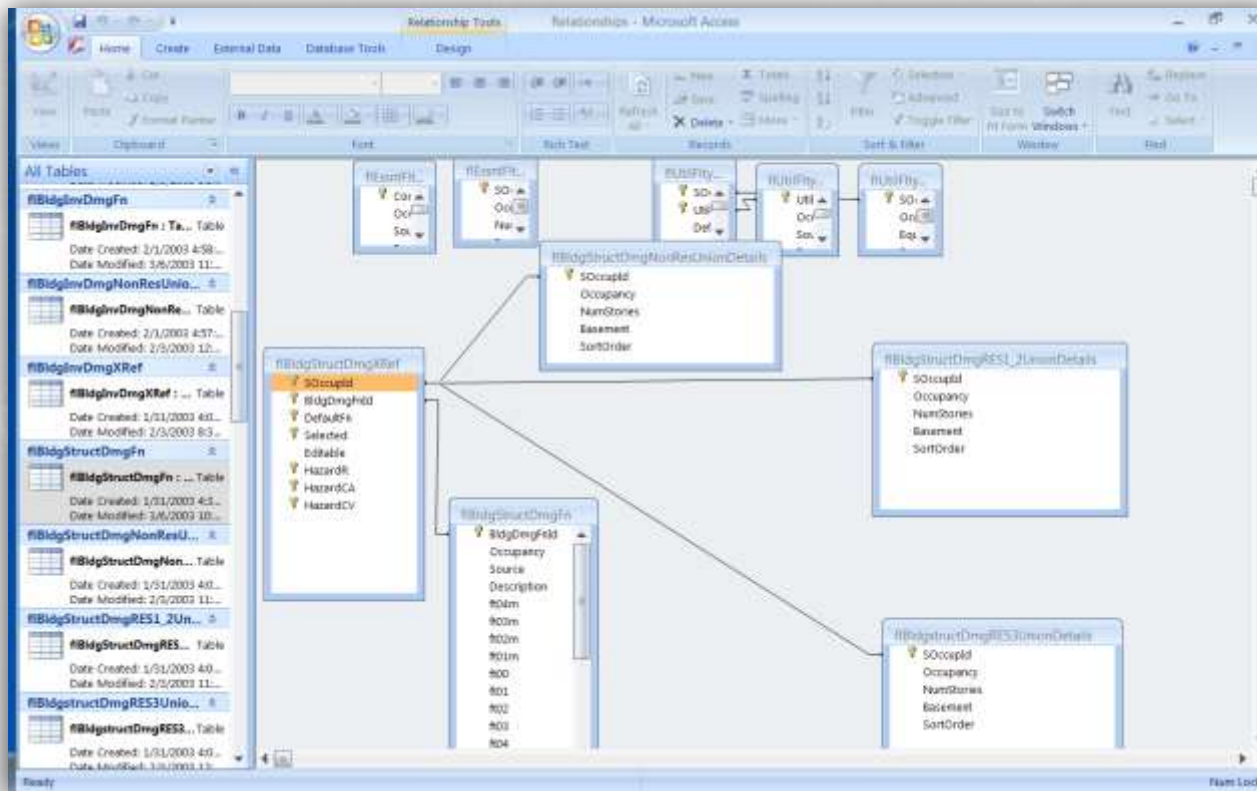


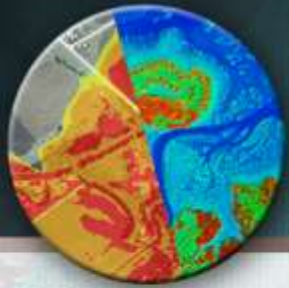
Curve dB Structure

Always wise to
back-up files
before editing



- Review/Understand Curve Tables/Relationships
 - ✓ Structure curves, Contents Curves, Inventory Curves, Other...etc
 - ✓ Identify which tables relate to others





Understand Curve Tables

- Consider Default for... RES1, Two-Story, No Basement

fiBldgStructDmgRES1_2UnionDetails

| SOccupId | Occupancy | NumStories | Basement | SortOrder | Add New Field |
|----------|-----------|------------|--------------------------|-----------|---------------|
| R12N | RES1 | 2 Story | <input type="checkbox"/> | 103 | |

Record: 1 of 1 | Filtered | Search

fiBldgStructDmgXRef

| SOccupId | BldgDmgFnId | DefaultFn | Selected | Editable | HazardR | HazardCA | HazardCV | Add New Field |
|----------|-------------|-------------------------------------|--------------------------|--------------------------|-------------------------------------|-------------------------------------|-------------------------------------|---------------|
| R12N | 107 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | |
| R12N | 115 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | |

Record: 1 of 2 | Filtered | Search

fiBldgStructDmgFn

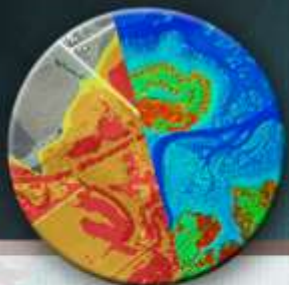
| BldgDmgFnId | Occupancy | Source | Description | ft04 | ft03 | ft02 | ft01 | ft00 | ft01 | ft02 | ft03 | ft04 | ft05 |
|-------------|-----------|--------|--|------|------|------|------|------|------|------|------|------|------|
| 107 | RES1 | FIA | two floors, no basement, Structure, A-Zone | 0 | 0 | 0 | 0 | 11 | 12 | 14 | 18 | 20 | 22 |
| 115 | RES1 | FIA | two floors, no basement, Structure, V-Zone | 0 | 0 | 0 | 0 | 5 | 9 | 13 | 18 | 20 | 22 |

Record: 2 of 2 | Filtered | Search

No Basement



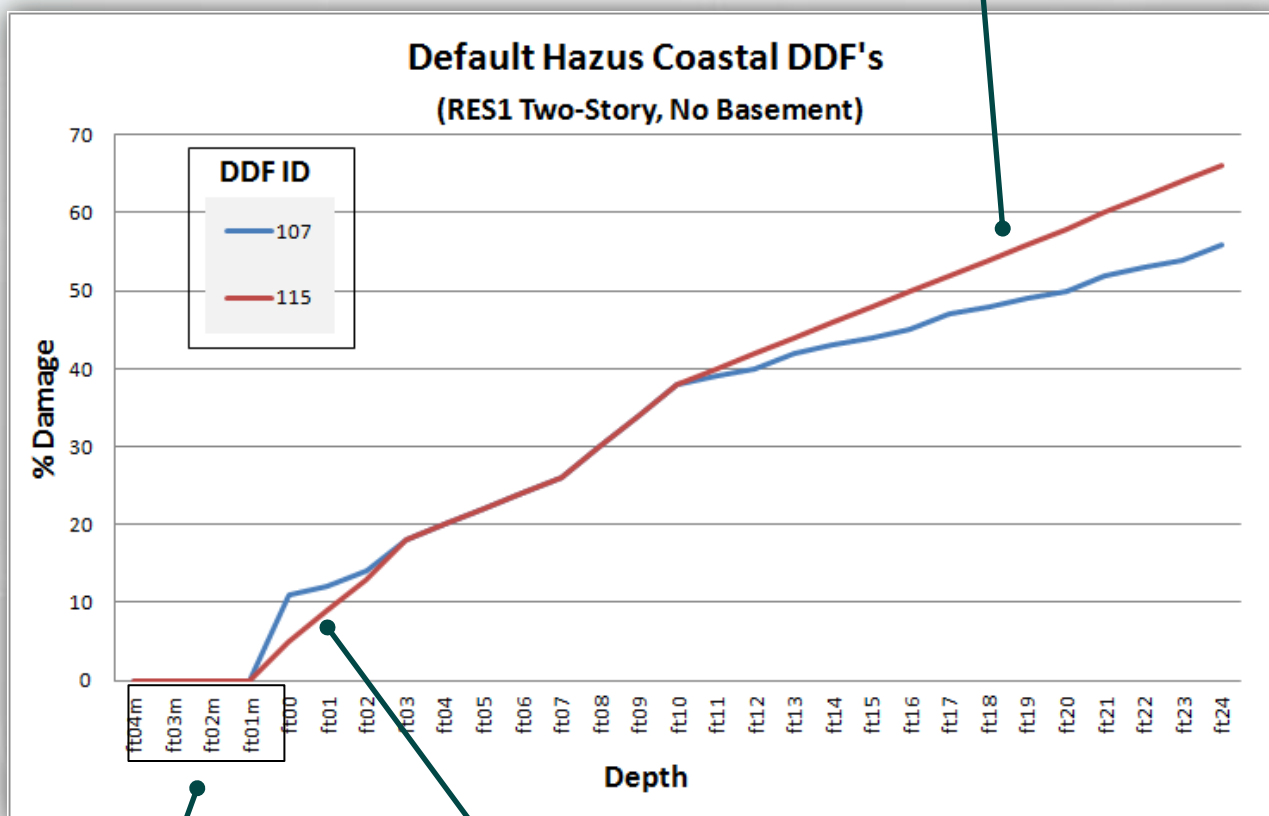
| ft04 | ft03 | ft02 | ft01 | ft00 | ft01 | ft02 |
|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 11 | 12 | 14 |
| 0 | 0 | 0 | 0 | 5 | 9 | 13 |



Understand the Hazus Curves

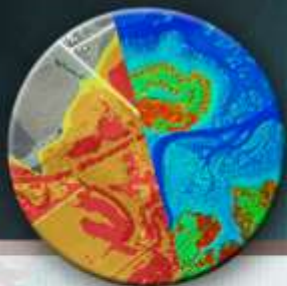
- Riverine & Coastal A Zones (107)
- Coastal V Zones (115)

Coastal V – More Damage
assumes wave effects



No Basement

Coastal V – Less Damage
assumes higher foundations



BCAR Curve Tables

- Consider Default for... RES1, (Two-Story*), (No Basement**)

Updated Coastal Depth-Damage Function Curves

DDF Type: Expert Panel

Flood Zone: Coastal A or V Zone

Structure Type: Slab

FLOOD DEPTH AND WAVE HEIGHT ASSUMPTIONS:

Reference elevation = 0.0 ft above ground surface elevation.

Reference elevation is at the top of slab.

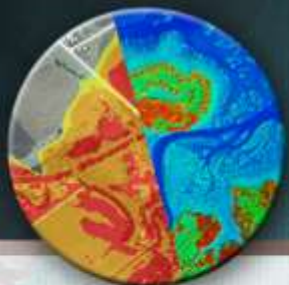
Bottom of lowest horizontal member is 0.5 feet below top of slab.

| Flood Depth (ft) | Stillwater Flood Depth (ft) | Wave Height (ft) | Stillwater Depth with Wave Height | Height above reference elevation | Building DDF (%) | Contents DDF (%) | Displacement DDF (days) | Loss of Function DDF (days) |
|------------------|-----------------------------|------------------|-----------------------------------|----------------------------------|------------------|------------------|-------------------------|-----------------------------|
| -2 | -2.0 | 0.0 | -2.0 | -2.0 | 0.0% | 0.0% | 0 | 0 |
| -1 | -1.0 | 0.0 | -1.0 | -1.0 | 0.0% | 0.0% | 0 | 0 |
| 0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0% | 10.0% | 0 | 30 |
| 1 | 1.0 | 0.8 | 1.6 | 1.6 | 25.0% | 30.0% | 120 | 120 |
| 2 | 2.0 | 1.6 | 3.1 | 3.1 | 50.0% | 45.0% | 360 | 360 |
| 3 | 3.0 | 2.3 | 4.7 | 4.7 | 75.0% | 75.0% | 540 | 540 |
| 4 | 4.0 | 3.1 | 6.2 | 6.2 | 100.0% | 100.0% | 720 | 720 |
| 5 | 5.0 | 3.9 | 7.8 | 7.8 | 100.0% | 100.0% | 720 | 720 |
| 6 | 6.0 | 4.7 | 9.3 | 9.3 | 100.0% | 100.0% | 720 | 720 |
| 7 | 7.0 | 5.5 | 10.9 | 10.9 | 100.0% | 100.0% | 720 | 720 |
| 8 | 8.0 | 6.2 | 12.4 | 12.4 | 100.0% | 100.0% | 720 | 720 |
| 9 | 9.0 | 7.0 | 14.0 | 14.0 | 100.0% | 100.0% | 720 | 720 |
| 10 | 10.0 | 7.8 | 15.5 | 15.5 | 100.0% | 100.0% | 720 | 720 |
| 11 | 11.0 | 8.6 | 17.1 | 17.1 | 100.0% | 100.0% | 720 | 720 |
| 12 | 12.0 | 9.4 | 18.6 | 18.6 | 100.0% | 100.0% | 720 | 720 |
| 13 | 13.0 | 10.1 | 20.2 | 20.2 | 100.0% | 100.0% | 720 | 720 |
| 14 | 14.0 | 10.9 | 21.7 | 21.7 | 100.0% | 100.0% | 720 | 720 |
| 15 | 15.0 | 11.7 | 23.3 | 23.3 | 100.0% | 100.0% | 720 | 720 |
| 16 | 16.0 | 12.5 | 24.8 | 24.8 | 100.0% | 100.0% | 720 | 720 |

* BCAR is impartial to # of stories

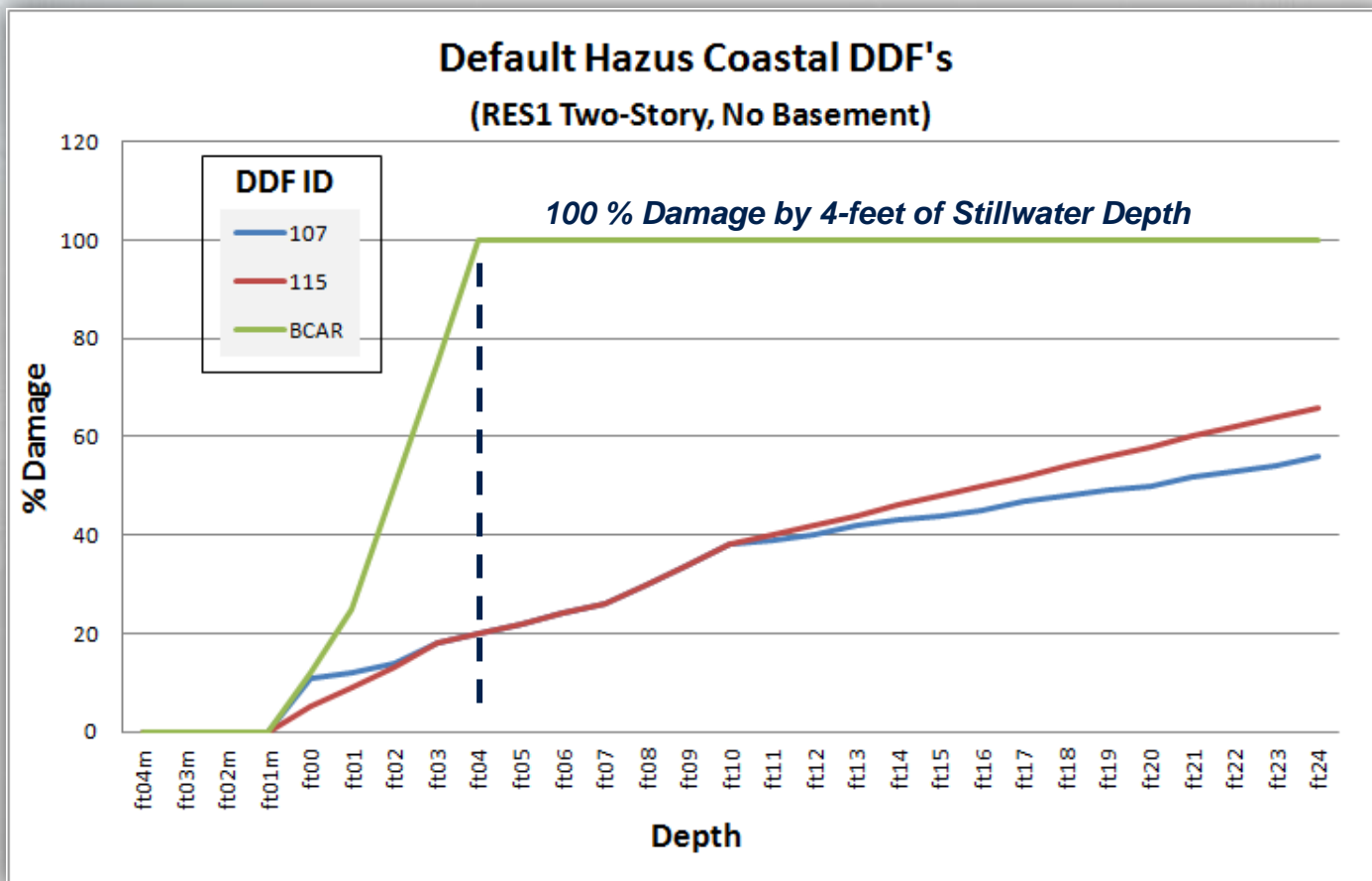
** No Basement is same as Slab-foundation

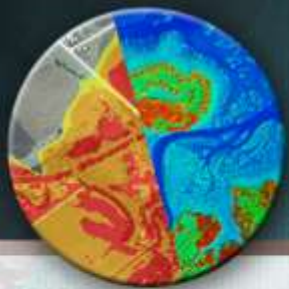
100 % Damage by 4-feet of Stillwater Depth



BCAR Curve vs. Hazus Equivalent

- Riverine & Coastal A Zones (107)
 - Coastal V Zones (115)
- • BCAR – Coastal A or V Zones



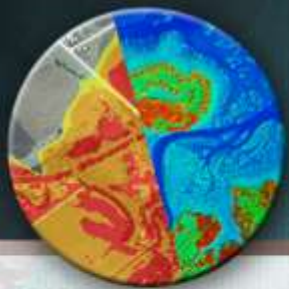


Curve Table Development

- Mass population or addition of curves (Excel)
 - ✓ Drag & Fill to propagate addition of BCAR tabular data

| ID | Structure | Source | Description | 100 | 50 | 25 | 10 | 5 | 2 | 1 | 0.5 | 0.2 | 0.1 |
|-----------|---------------------|---------------------------|---|-----|----|----|----|---|---|---|-----|-----|-----|
| 648 EDU2 | USACE - New Orleans | College, structure | Elementary school, structure, salt water, short duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 649 EDU1 | USACE - New Orleans | College, structure | Elementary school, structure, fresh water, long duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 650 EDU1 | USACE - New Orleans | College, structure | Elementary school, structure, fresh water, short duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 651 EDU1 | USACE - New Orleans | College, structure | Elementary school, structure, composite water & duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 652 EDU2 | USACE - New Orleans | College, structure | Average college/university, structure | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 653 EDU2 | USACE - New Orleans | College, structure | College, structure, salt water, long duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 654 EDU2 | USACE - New Orleans | College, structure | College, structure, salt water, short duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 655 EDU2 | USACE - New Orleans | College, structure | College, structure, fresh water, long duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 656 EDU2 | USACE - New Orleans | College, structure | College, structure, fresh water, short duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 657 EDU2 | USACE - New Orleans | College, structure | College, structure, composite water & duration | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 658 RES1 | BCAR - Jan 2011 | all floors, slab - no | 1to2 Stories, slab - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 659 RES3A | BCAR - Jan 2011 | all floors, slab - no | 1to2 Stories, slab - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 660 RES3B | BCAR - Jan 2011 | all floors, Wall 2ft - no | 1to2 Stories, Wall 2ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 661 RES1 | BCAR - Jan 2011 | all floors, Wall 2ft - no | 1to2 Stories, Wall 2ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 662 RES3A | BCAR - Jan 2011 | all floors, Wall 2ft - no | 1to2 Stories, Wall 2ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 663 RES3B | BCAR - Jan 2011 | all floors, Wall 3ft - no | 1to2 Stories, Wall 3ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 664 RES1 | BCAR - Jan 2011 | all floors, Wall 3ft - no | 1to2 Stories, Wall 3ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 665 RES3A | BCAR - Jan 2011 | all floors, Wall 3ft - no | 1to2 Stories, Wall 3ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 666 RES3B | BCAR - Jan 2011 | all floors, Wall 3ft - no | 1to2 Stories, Wall 3ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 667 RES2 | BCAR - Jan 2011 | all floors, Wall 3ft - no | 1to2 Stories, Wall 3ft - no | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

- **SLAB**
 - **WALL2 & 3**
 - **MH**
 - **ELEV OPEN2-4-6-8-10-12**
 - **ELEV OBSTR2-4-6-8-10-12 added for**
- RES1, RES2, RES3A and RES3B**



Run a Test

- Tested with User-Defined Facilities (UDF)
 - ✓ Where user can define DmgFnID's in UDF table

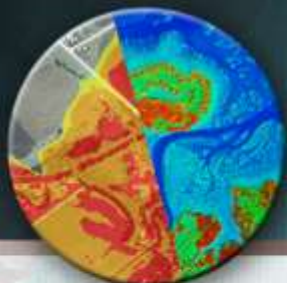
User Defined Facilities

User Defined

| | BldgType | Cost | YearBuilt | Area | NumStorie | DesignLe | Foundatio | FirstFloor | ContentCost | BldgDamageFnId | ContDamageFnId | InvDamageFnId |
|----|----------|--------------|-----------|-----------|-----------|----------|-----------|------------|--------------|----------------|----------------|---------------|
| 1 | Concrete | \$406,286.48 | 1977 | 5,349.39 | 1 | 2 | 7 | 1.00 | \$406,286.48 | | | |
| 2 | Concrete | \$118,378.87 | 1977 | 1,558.64 | 1 | 2 | 7 | 1.00 | \$118,378.87 | | | |
| 3 | Concrete | \$93,728.79 | 1977 | 1,234.09 | 1 | 2 | 7 | 1.00 | \$93,728.79 | | | |
| 4 | Concrete | \$74,646.03 | 1977 | 982.83 | 1 | 2 | 7 | 1.00 | \$74,646.03 | | | |
| 5 | Masonry | \$114,530.74 | 1977 | 1,507.98 | 1 | 2 | 7 | 1.00 | \$114,530.74 | | | |
| 6 | Masonry | \$155,076.96 | 1977 | 2,041.83 | 1 | 2 | 7 | 1.00 | \$155,076.96 | | | |
| 7 | Concrete | \$72,156.02 | 1977 | 950.05 | 1 | 2 | 7 | 1.00 | \$72,156.02 | | | |
| 8 | Concrete | \$108,913.61 | 1977 | 1,318.09 | 1 | 2 | 7 | 1.00 | \$108,913.61 | | | |
| 9 | Concrete | \$406,099.94 | 1977 | 4,914.68 | 1 | 2 | 7 | 1.00 | \$406,099.94 | | | |
| 10 | Concrete | \$124,973.87 | 1960 | 1,512.45 | 1 | 2 | 7 | 1.00 | \$124,973.87 | | | |
| 11 | Masonry | \$96,107.51 | 1977 | 1,163.11 | 1 | 2 | 7 | 1.00 | \$96,107.51 | | | |
| 12 | Concrete | \$347,892.47 | 1977 | 4,210.24 | 1 | 2 | 7 | 1.00 | \$347,892.47 | | | |
| 13 | Concrete | \$171,409.58 | 1977 | 2,074.42 | 1 | 2 | 7 | 1.00 | \$171,409.58 | | | |
| 14 | Steel | \$281,101.65 | 1977 | 15,504.07 | 1 | 2 | 7 | 1.00 | \$281,101.65 | | | |

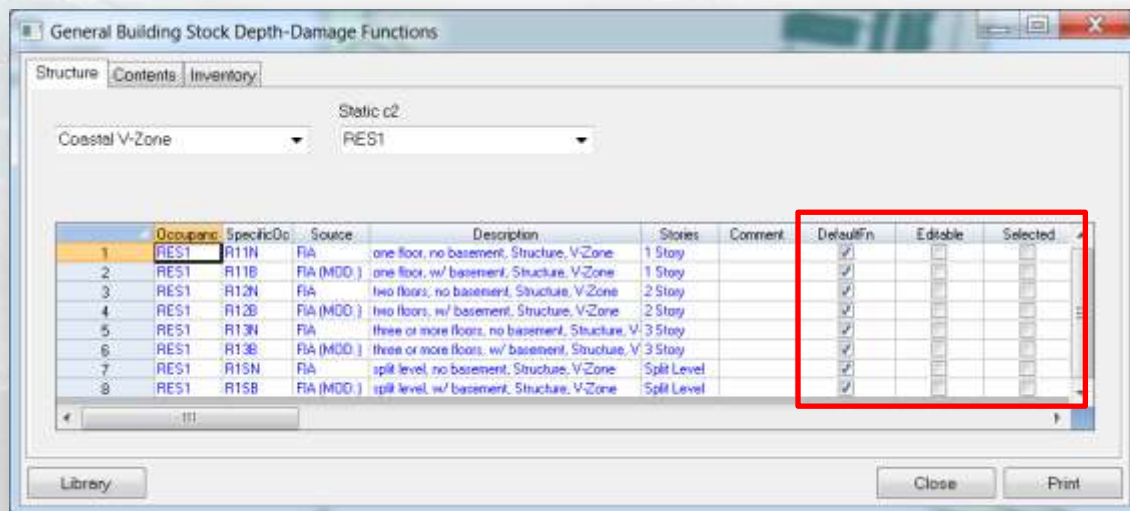
User defines the DmgFnID in these fields

Close Map Print



Test Run Lessons Learned

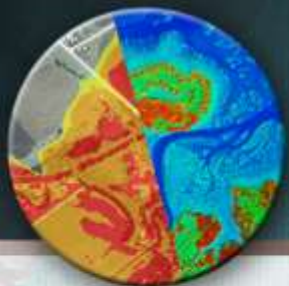
- Initial testing revealed that the TRUE/FALSE values of the XREF Table were not set properly.
 - Assumption: it was initially assumed that if the DmgFnID was defined in the UDF Table, the model would use it. Not so...



The check-boxes are controlled by the TRUE & FALSE values of the Xref Table in flDmRsFn.mdb - Access dB

| | | | |
|-----------------|--|---------|----------------|
| BCAR - Jan 2011 | all floors, Elevated (Obstr)+8ft - no basement | 1 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, Elevated (Obstr)+8ft - no basement | 1 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, slab - no basement, Coastal A or 1 | 1 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, Wall 2ft - no basement, Coastal A | 1 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, Wall 3ft - no basement, Coastal A | 1 Story | RAMPP Inserted |
| FIA | one floor, no basement, Structure, V-Zone | 1 Story | |
| FIA (MOD.) | one floor, w/ basement, Structure, V-Zone | 1 Story | |
| BCAR - Jan 2011 | all floors, Elevated (Obstr)+10ft - no baseme | 2 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, Elevated (Obstr)+2ft - no baseme | 2 Story | RAMPP Inserted |
| BCAR - Jan 2011 | all floors, Elevated (Obstr)+4ft - no baseme | 2 Story | RAMPP Inserted |

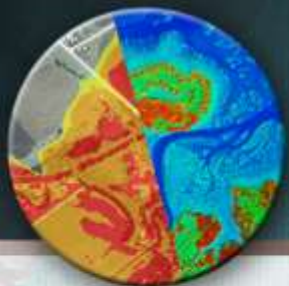
| DefaultFn | Editable | Selected |
|-------------------------------------|--------------------------|-------------------------------------|
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |



Comparative Scenarios

- Focus on 1% Annual Chance
 - ✓ Hurricane Sandy has been described as ~ 1% Event
 - ✓ Worked with a community for:
 - Policy information (95) & Paid claims (199)

| Scenario | Description |
|--|--|
| Field-FFht & Default DDF | FFht from field data collection (first-floor elevations) & LAG Elevation from Airborne LiDAR-based DEM. No DDF assigned; Hazus use default FIA curves. |
| Field-FFht & BCAR | FFht from field data collection (first-floor elevations) & LAG Elevation from Airborne LiDAR-based DEM. BCAR or FIA curves assigned accordingly. |
| Policy-FFht & BCAR | FFht from policy data. BCAR or FIA curves assigned accordingly. |
| Policy-FFht & Default DDF | ONLY 95 structures for which we have policy data, used the fields "POLICY LOWADJ_GRA" and "POLICY LOW_FLOOR" to compute FFht. Used default Hazus DDFs. |
| HzFFht & Default DDF | Assigned default Hazus FFht based on Year Built & Foundation (Table 3.14 Hz Tech Man). Used default Hazus DDFs. |

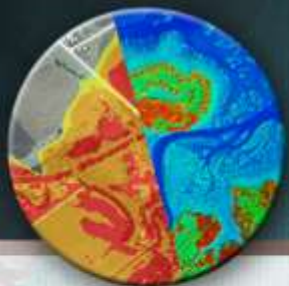


Comparative Results

- Focus on 1% Annual Chance - Paid claims (199)

| Buildings Considered | Field-FFht & Default DDF | Field-FFht & BCAR | Policy-FFht & BCAR | Policy-FFht & Default DDF | HzzFFht & Default DDF | Paid Claim |
|----------------------------------|--------------------------|-------------------|------------------------|---------------------------|-----------------------|------------|
| All Study Area with Payout (199) | \$ 3.38 M | \$ 5.97 M | \$ 9.56 M ¹ | \$ 3.22 M ¹ | \$ 3.91 M | \$ 10.79 M |
| Losses are X% of Payout | 31 % | 55 % | 89 % | 30 % | 36 % | |

¹ - Only includes 95 structures for which policy data was made available



Comparative Results

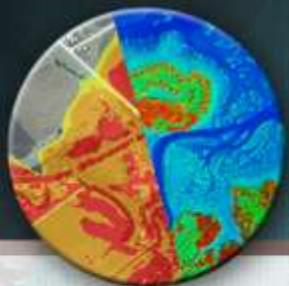
- Focus on 1% Annual Chance – Policy FFht & Claims (95)

| Buildings Considered | Field-FFht & Default DDF | Field-FFht & BCAR | Policy-FFht & BCAR | Policy-FFht & Default DDF | HzzFFht & Default DDF | Paid Claim |
|-------------------------|--------------------------|-------------------|--------------------|---------------------------|-----------------------|------------|
| Policy FFht (95) | \$1.33 M | \$2.51 M | \$9.56 M | \$ 3.22 | \$1.45 M | \$ 4.80 M |
| Losses are X% of Payout | 28 % | 52 % | 199 % | 67 % | 30 % | |

- Deciphering Results...AVG FFht by Method

| Foundation ^A | # of Structures | FieldFFht | PolicyFFht | Default Hazus |
|--------------------------|-----------------|-----------|------------|---------------|
| Basement (Pre/Post) | 10 | 8.5 | 2.0 | 4 |
| Crawlspace (Pre-FIRM) | 26 | 3.3 | 4.6 | 3 |
| Crawlspace (Post-FIRM) | 56 | 3.8 | 3.4 | 4 |
| Pier (Pre-FIRM) | 1 | 6.6 | 0.0 | 5 |
| Pier (Post-FIRM; V-Zone) | 1 | 10.0 | -0.7 | 8 |
| Pile (Pre-FIRM) | 1 | 5.29 | 15 | 7 |

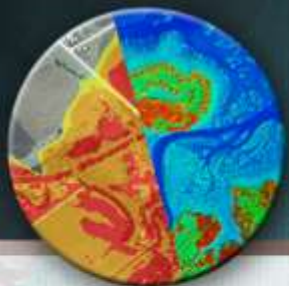
^A - Field Observations



Coastal VE Comparative Results

- Subset of Structures in Coastal VE (12 bldgs)

| OBJECTID * | Foundation Type | 1st-Floor Heights | | | Estimated UDF Loss per Structure by Scenario | | | | | Total_Paid |
|--------------------------------------|--------------------------|-------------------|------------|-------------|--|----------------------|-----------------------|------------------------------|-------------------------|-------------------|
| | | HxFFht | Field-FFht | Policy-FFht | Field-FFht & Default DDF | Field-FFht & BCAR | Policy-FFht & BCAR | Policy-FFht & Default DDF | HxFFht & Default DDF | |
| 18 | Basement (Pre/Post) | 4 | 10.77 | 0.2 | \$ 5,355 | \$ 5,355 | \$ 61,403 | \$ 61,403 | \$ 28,172 | \$ 23,831 |
| 263 | Basement (Pre/Post) | 4 | 9.33 | 0.4 | \$ 7,217 | \$ 7,217 | \$ 73,397 | \$ 73,397 | \$ 25,860 | \$ 4,779 |
| 266 | Basement (Pre/Post) | 4 | 5.02 | 0.2 | \$ 11,184 | \$ 11,184 | \$ 79,826 | \$ 79,826 | \$ 14,798 | \$ 4,328 |
| 278 | Basement (Pre/Post) | 4 | 8.66 | 0.1 | \$ 5,694 | \$ 5,694 | \$ 53,420 | \$ 53,420 | \$ 15,557 | \$ 9,550 |
| 16 | Basement (Pre/Post) | 4 | 9.67 | 9.2 | \$ - | \$ - | \$ 371,668 | \$ 94,281 | \$ - | \$ 4,370 |
| 280 | Crawlspace (Post-FIRM) | 4 | 2.85 | -2.2 | \$ 20,286 | \$ 20,286 | \$ 114,680 | \$ 155,617 | \$ 77,505 | \$ 30,000 |
| 121 | Crawlspace (Post-FIRM) | 4 | 9.43 | 0 | \$ 80,870 | \$ 152,965 | \$ 732,697 | \$ 179,759 | \$ 80,870 | \$ 38,110 |
| 331 | Crawlspace (Post-FIRM) | 4 | 3.79 | 0 | \$ 7,142 | \$ 7,142 | \$ 12,509 | \$ 50,389 | \$ - | \$ 20,429 |
| 341 | Crawlspace (Post-FIRM) | 4 | 2.62 | 0 | \$ 43,351 | \$ 164,162 | \$ 248,724 | \$ 60,502 | \$ 33,392 | \$ 79,062 |
| 351 | Crawlspace (Post-FIRM) | 4 | 2.73 | 0.8 | \$ 85,732 | \$ 393,869 | \$ 435,179 | \$ 105,490 | \$ 75,175 | \$ 77,393 |
| 245 | Crawlspace (Post-FIRM) | 4 | 5.74 | 0.1 | \$ - | \$ - | \$ 608,828 | \$ 190,315 | \$ - | \$ 21,237 |
| 347 | Pier (Post-FIRM; V-Zone) | 8 | 10.04 | -0.7 | \$ - | \$ - | \$ 597,678 | \$ 125,916 | \$ - | \$ 10,000 |
| TOTAL | | | | | \$ 266,832 | \$ 767,874 | \$ 3,390,009 | \$ 1,230,316 | \$ 351,330 | \$ 323,089 |
| Loss Estimate is X Percent of Payout | | | | | 83% | 238% | 1049% | 381% | 109% | |



Takeaways

■ Questioning Results:

✓ Actually means questioning the inputs!

- Policy Elevations Questionable
- 1st Floor Heights from Field Data; FFE & ground from differing sources presents questions

✓ Further understand the nature of the curves

- Curves useable if the input flood depth grid includes wave heights
- Otherwise curve translations would be required

• Potential Hazus Schema Needs

- BCAR curves for elevated structures include depth entries below the current maximums in Hazus schema; negative depths 6, 8, 10 & 12.

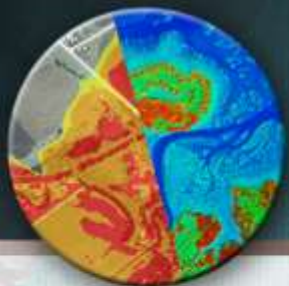
AND WAVE HEIGHTS

Reference elevation = 6.0 ft above ground

Reference elevation is at the top of the floor.

Bottom of floor joist is 1.0 foot below top of floor (feet below top of floor).

| | Flood Depth (ft) | Stillwater Flood Depth (ft) | Wave Height (ft) | Stillwater Depth with Wave Height | Wave Height |
|----|------------------|-----------------------------|------------------|-----------------------------------|-------------|
| 11 | | | | | |
| 12 | | | | | |
| 13 | | | | | |
| 14 | -8 | -2.0 | 0.0 | -2.0 | |
| 15 | -7 | -1.0 | 0.0 | -1.0 | |
| 16 | -6 | 0.0 | 0.0 | 0.0 | |
| 17 | -5 | 1.0 | 0.8 | 1.6 | |
| | -4 | 2.0 | 1.6 | 3.1 | |
| | -3 | 3.0 | 2.3 | 4.7 | |
| | -2 | 4.0 | 3.1 | 6.2 | |
| | | 5.0 | 3.9 | 7.8 | |
| | | 6.0 | 4.7 | | |




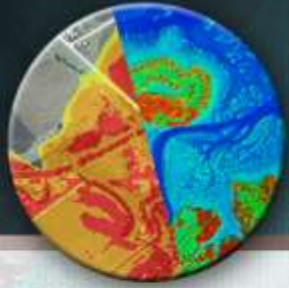
Takeaways

■ Potential Improvements to UDF

- ✓ Simple data loader usability
 - Users express limits on front-end mass loading
- ✓ Mapping of results
 - Tabular data of losses must be joined outside of Hazus

■ Usage with BCA

- ✓ “Triage” an area for BCA Discovery: 
 - Level 1 (2010 Average Annualized Loss Study)
 - Community Feedback (Known and Historic “trouble” Areas)
 - Level 2 (Refined Hazard Analyses - FIRM based hazard)
 - Determine potential BCA candidate properties

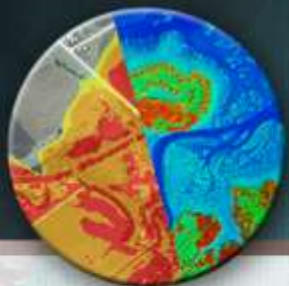


The Future?

- Future or Potential BCA Integration?
 - *Topographic data requirements*
 - *H&H modeling methods*
 - *Loss calculation methods*
 - *Demolition threshold*

- Push the Limits!





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