HAZUS Building Attribute Rulesets - Wind - HUEFPS-HUEFEO			
Note: Defaults should be assigned to all HUEFPS-HUEFEO Buildings as defined below; then rulesets should be applied to override those defaults as informed by available data.			
Essential Facility Classes:	Police Stations (HUEFPS), Emergency Operation Centers (HUEFEO)		
Typology Assumption:	None stated in Hazus documentation, but based on fields, small, medium, and large commercial steel buildings offers a good starting point		
RoofCvr			*Roof Cover*
Valid Entries	BUR, SPM	**Input Variable**	YearBuiltNJDEP
Default	SPM	**Input Variable Source**	Custom Inventory
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
YearBuiltNJDEP >= 1975	RoofCvr = SPM	NJ Building Code Section 1507 (in particular 1507.10 and 1507.12) address Built Up Roofs and Single Ply Membranes. However, the NJ Building Code only addresses installation and material standards of different roof covers, but not in what circumstance each must be used. SPMs started being used in the 1960s, but different types continued to be developed through the 1980s. Today, single ply membrane roofing is the most popular flat roof option. BURs have been used for over 100 years, and although they are still used today, they are used less than SPMs. Since there is no available ruleset to be taken from the NJ Building Code, the ruleset is based off this information. Sources: https://www.spri.org/2019/01/singe-ply-roofing-101/, https://continuingeducation.bnpmedia.com/courses/johns-manville/understanding-single-ply-roofing-systems/ Assumptions of the Ruleset: All flat roofs built before 1975 are BURs. SPMs were developed in the 1960s, and considering that there is a time lag to start consistently using new methods, SPMs rose in importance through the 1970s, becoming more popular. This ruleset assumes that all roofs built after 1975 are SPMs.	Any data from NJ on practices around BUR, SPM should be incorporated; trends presently inferred from when a technology entered the market
YearBuiltNJDEP < 1975	RoofCvr = BUR	NJ Building Code Section 1507 (in particular 1507.10 and 1507.12) address Built Up Roofs and Single Ply Membranes. However, the NJ Building Code only addresses installation and material standards of different roof covers, but not in what circumstance each must be used. SPMs started being used in the 1960s, but different types continued to be developed through the 1980s. Today, single ply membrane roofing is the most popular flat roof option. BURs have been used for over 100 years, and although they are still used today, they are used less than SPMs. Since there is no available ruleset to be taken from the NJ Building Code, the ruleset is based off this information. Sources: https://www.spri.org/2019/01/singe-ply-roofing-101/, https://continuingeducation.bnpmedia.com/courses/johns-manville/understanding-single-ply-roofing-systems/ Assumptions of the Ruleset: All flat roofs built before 1975 are BURs. SPMs were developed in the 1960s, and considering that there is a time lag to start consistently using new methods, SPMs rose in importance through the 1970s, becoming more popular. This ruleset assumes that all roofs built after 1975 are SPMs.	Any data from NJ on practices around BUR, SPM should be incorporated; trends presently inferred from when a technology entered the market
shutters			
Valid Entries	yes, no	**Input Variable**	YearBuiltNJDEP, WBD

Default	yes	**Input Variable Source**	Custom Inventory
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
All YearBuiltNJDEP	IF WBD = yes, shutters = yes IF WBD = no, shutters = no	Shutters were not required by code until the 2000 IBC. Before 2000, the percentage of commercial buildings that have shutters is assumed to be 46%. This value is based on a study on preparedness of small businesses for hurricane disasters, which says that in Sarasota County, 46% of business owners had taken action to wind-proof or flood-proof their facilities. In addition to that, 46% of business owners reported boarding up their businesses before Hurricane Katrina. However, as essential facilities, it is assumed that shutter use or window protection has greater compliance and will be assumed at 100% Source: https://www.sciencedirect.com/science/article/pii/S2212420916303855	

WindDebris			*wind Debris sources*
Valid Entries	A, B, C, D	**Input Variable**	YearBuiltNJDEP
Default	A	**Input Variable Source**	
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
YearBuiltNJDEP ≤ Current Year	WindDebris=A	If a building is a given class, according to zoning, neighboring buildings are likely of this class. Thus this assignment is made based on OccupancyClass. We cannot assign “varies by direction” because we don’t have specific information. Assume PD and FD are in commercial and residential areas	Note essential faclities attributes were defined as A, B, C, D which are respectively equivalent to the attributes used for non-essential classes as follows: A: Res/Comm B: Varies by Direction C: Residential D: None

Metal-RDA			*Metal Roof Deck Attachment*
Valid Entries	standard, superior	**Input Variable**	YearBuiltNJDEP, DSWII
Default	standard	**Input Variable Source**	Custom Inventory
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**

YearBuiltNJDEP > 2000	IF DSWII ≤ 142 mph, Metal-RDA = standard IF DSWII > 142 mph, Metal-RDA = superior	Present to 2006: 1507.2.8.1 High Wind Attachment. Underlayment applied in areas subject to high winds (Vasd greater than 110 mph as determined in accordance with Section 1609.3.1) shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap not more than 36 inches on center. Underlayment installed where Vasd, in accordance with section 1609.3.1 equals or exceeds 120 mph shall be attached in a grid pattern of 12 inches between side laps with a 6-inch spacing at the side laps. 1507.2.8.1 High Wind Attachment. Underlayment applied in areas subject to high winds (Vasd greater than 110 mph as determined in accordance with Section 1609.3.1) shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap not more than 36 inches on center. Underlayment installed where Vasd, in accordance with section 1609.3.1 equals or exceeds 120 mph shall be attached in a grid pattern of 12 inches between side laps with a 6-inch spacing at the side laps. 1507.2.8.1 High Wind Attachment. Underlayment applied in areas subject to high winds (Vasd greater than 110 mph as determined in accordance with Section 1609.3.1) shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap not more than 36 inches on center.Underlayment installed where Vasd, in accordance with section 1609.3.1 equals or exceeds 120 mph shall be attached in a grid pattern of 12 inches between side laps with a 6-inch spacing at the side laps. 2000-2006: 1507.2.8.1 High Wind Attachment. Underlayment applied in areas subject to high winds (greater than 110 mph) shall be applied with corrosion-resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap not more than 36 inches on center. According to Figure 1609, this is basic wind speed. convert Vasd to Vult using Vasd=sqrt(0.6)Vult --- 110 -> 142	
YearBuiltNJDEP ≤ 2000	Metal-RDA = standard	There is no mention of straps or enhanced tie-downs of any kind in the BOCA codes, and there is no description of these adoptions in IBHS reports or the New Jersey Construction Code Communicator. Although there is no explicit information, it seems that hurricane straps really only came into effect in Florida after Hurricane Andrew (1992), and likely it took several years for these changes to happen. Because Florida is the leader in adopting hurricane protection measures into codes and because there is no mention of shutters or straps in the BOCA codes, it is assumed that New Jersey did not adopt these standards until the 2000 IBC. https://www.insurancejournal.com/news/southeast/2007/05/18/79827.htm https://forum.nachi.org/t/hurricane-straps/4617 http://www.floridaretrofits.com/service/hurricaneStrapsClips Thus, all connections before 2000 are assumed to be standard.	
WWR			*Window Wall Ratios*
Valid Entries	low, medium, high	**Input Variable**	YearBuiltNJDEP, WindowArea

Default	low	**Input Variable Source**	Custom Inventory
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
YearBuiltNJDEP ≤ Current Year	IF 0.2 ≤ WindowArea < 0.33, WWR = Low IF 0.33 ≤ WindowArea < 0.5, WWR = Medium IF 0.5 ≤ WindowArea, WWR = High	HAZUS defines these categories on window to wall ratios (WWR) as follows: Low: 20% ≤ WWR < 33% Medium: 33% ≤ WWR < 50% High: WWR ≥ 50% If WindowArea informaiton avaible in Custom Inventory from street view data, this should be used to determine the Window Area being low, medium, or high. If this information is not available, all engineered residental buildings are assumed to have low window area. This ruleset was created from the information on the Reference Buildings from the Office of Energy Efficiency and Renewable Energy. Baltimore, MD was used as the test city because the climate was the most similar to Atlantic City of the data available. Office buildings (used as a test case for commercial), have 33% WWR and apartments (used as a test case for residential) have 15% WWR. Therefore, commercial is assumed to have medium window area, whereas residential buildings are assumed to have low window area. It is assumed that essential facilities will be more like residential with fewer windows so the defult is set to low Source: https://www.energy.gov/eere/downloads/reference-buildings-building-type-midrise-apartment	