HAZUS Building Attribute Rulesets - Wind - HUEFFS-HUEFSS			
Note: Defaults should be assigned to all HUEFFS-HUEFSS Buildings as defined below; then rulesets should be applied to override those defaults as informed by available data.			
Essential Facility Classes:	Fire Stations (HUEFFS), Elementary Schools (HUEFSS)		
Typology Assumption:	Modeled after 12' strip malls with 4' joist spacing.		
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			*Source of Wind Borne Debris*
Valid Entries	A, B, C, D	**Input Variable**	YearBuiltNJDEP
Default	A	**Input Variable Source**	
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
All YearBuiltNJDEP	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. All essential facilities are assumed to be residential/commercial hybrid	Note essential facilities 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

RDage			*Roof Deck Age*
Valid Entries	good, poor	**Input Variable**	YearBuiltNJDEP
Default	good	**Input Variable Source**	
Years Ruleset Applies	**Ruleset**	**Notes**	**Possible Extensions**
YearBuiltNJDEP >= (Current Year - 50)	RDage = good	Average lifespan of a steel joist roof is roughly 50 years according to the source below. Therefore, if constructed 50 years before the current year, the roof deck should be considered old. https://www.metalroofing.systems/metal-roofing-pros-cons/	
YearBuiltNJDEP < (Current Year - 50)	RDage = poor	Average lifespan of a steel joist roof is roughly 50 years according to the source below. Therefore, if constructed 50 years before the current year, the roof deck should be considered old. https://www.metalroofing.systems/metal-roofing-pros-cons/	Any information on roof replacements on individual homes should be used to specify further

Metal-RDA			*Metal Roof Deck Attachment*
Valid Entries	standard, superior	**Input Variable**	YearBuiltNJDEP, DSWII
Default	standard	**Input Variable Source**	
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.	