Codes, Standards, and Permitting

Mitigation Assessment Team Summary Report and Recommendations
Commonwealth of the Northern Mariana Islands
Super Typhoon Yutu

FEMA P-2177

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1. Executive Summary

In October 2018, Super Typhoon Yutu broke several records by becoming the strongest typhoon ever recorded to impact the Commonwealth of the Northern Mariana Islands (CNMI). Yutu killed two people and injured 133 more, while also destroying homes and damaging infrastructure throughout the populated areas. Most damage to commercial and public buildings in southern Saipan had roof coverings blown off their roof decks; for residential buildings, the damage was more extensive, with roof coverings and roof decks being removed from roof frames or the loss of the entire roof structure. Multi-story concrete and steel frame buildings generally performed well, though some of these buildings experienced heavy roof covering and cladding (wall, door, and window) damage, with only a few buildings considered destroyed. Many buildings that did not have extensive, visible exterior damage were observed to have experienced significant water intrusion causing damage throughout building interiors. Vegetation was uprooted and mixed with other wind-borne debris, such as doors and storm shutters, contributing to the wind damage. Saipan's and Tinian's critical infrastructure—including hospitals, schools, airports, power, water supply, and roadways—all suffered major damage. The damage caused by Typhoon Yutu is not unique to that storm, but rather something that the CNMI will likely face again in the future.

In November 2020, FEMA's Building Science Branch, in conjunction with FEMA Region 9 and supported by the Strategic Alliance for Risk Reduction (STARR II), provided specialized architectural and engineering expertise through the Mitigation Assessment Team (MAT) program to assess building performance; develop customized Recovery Advisories and Fact Sheets; provide tailored training and subject matter expertise; and document observations, conclusions, and recommendations. These products and trainings are meant to support the CNMI in ongoing recovery from Super Typhoon Yutu and to support preparedness for and resiliency in the face of future similar storms.

The team worked with local agencies to assess damage to many types of buildings, including the hospital, police and fire stations, schools, government offices, and homes. The goal was to learn how buildings performed during the typhoon and why they withstood or did not withstand the strain caused by wind and flood hazards. Upon conclusion of the field investigation, specialists worked as a team to analyze the field data, as well as other damage reports and studies conducted by government agencies or private firms. Finally, the team prepared conclusions and developed recommendations based on these findings. This information is presented in three targeted reports:

- Codes, Standards, and Permitting (FEMA P-2177)
- Performance of One- and Two-Family Dwellings (FEMA P-2178)
- Performance of Public Buildings and Critical Facilities (FEMA P-2179)

This report (FEMA P-2177) focuses on the use of hazard-resistant provisions of building codes and standards. The recommendations resulting from building performance and forensic assessments help FEMA coordinate with agencies and organizations to assess the hazard-resistant provisions of the adopted building codes and standards. In addition, recommendations support community

development of long-term strategies to reduce future damage and impacts from storms and improve community resilience.

The recommendations are provided to help the CNMI outline a path forward for building code adoption with enforcement that promotes the resilient construction, repair, and alteration of buildings. The CNMI also can use these recommendations to help guide and better prepare communities, property owners, and other stakeholders for future storms and encourage them to take action with specificity, where possible. Table 1 briefly summarizes the detailed recommendations found in Section 4 of this document and recommends a leader to implement each suggested action.

Table 1: MAT Summary of Recommendations

#	Recommendation	Leader for Implementation
Codes and Standards		
1	Adopt the latest International Codes® (I-Codes) on a recurring three-year basis, with amendments that are specific to the Territory.	Building Safety Code Division (BSCD)
2a	Consider establishing a Building Code Council of balanced membership responsible for studying, evaluating, and making recommendations for the adoption of I-Codes with local amendments for adoption by BSCD.	Dept. of Public Works (DPW)
2b	Establish a formal process for stakeholders to suggest amendments and comment on proposed amendments to the Commonwealth Building Safety Code.	Building Code Council
3	Identify the specific edition, year, amendments, and code volumes when the codes are adopted in the Commonwealth Building Safety Code and use multiple types of media (print, website, etc.) to communicate the information to the public.	DPW and BSCD
4	Update the CNMI Building Safety Code Rules and Regulations (Sec. 155-10.1-615) to remove the earthquake and typhoon amendments, which conflict with adopted I-Codes. Adopt the FEMA 2020 CNMI Special Wind Region maps for all buildings in Risk Categories I, II, III, and IV.	DPW
5	Update the CNMI Flood Damage Prevention Regulations and integrate the regulations with the flood provisions of the I-Codes using the FEMA model code-coordinated ordinance.	DPW and BSCD

#	Recommendation	Leader for Implementation
Permitting and Code Enforcement		
6a	Share with the people of the CNMI the CNMI MAT-prepared fact sheet titled, *Permitting and Inspection Process for Disaster-Resilient Residential Homes, 2021*.	BSCD
6b	Develop a BSCD webpage that provides public access to all appropriate building code adoptions, amendments, and application forms.	DPW
7	Perform quality audits of the building permit and inspection documentation twice a year to ensure standards are being maintained.	DPW
8	Train new and existing staff on the requirements of the adopted building codes and standards. Work with ICC and FEMA to provide and access training on the 2018 I-Codes.	BSCD
9a	Require that permit applications and construction documents include the contents required by the codes, especially critical design information such as all wind, seismic, and flood design data and design parameters.	BSCD
9b	Require that building construction documents show details of load path connections and for design professionals to attest, using a signed form, that continuous load paths are provided in designs.	BSCD
10	Issue permits for temporary structures and track and monitor the use of all temporary structures.	BSCD
11	Develop a contractor license program and require contractors to obtain licenses to ensure awareness of the latest codes.	CNMI Dept. of Commerce
12	Consider developing and maintaining a list of known hazard-resistant building products appropriate for the CNMI, which have been tested for compliance with the IBC, such as impact-resistant systems (e.g., shutters), wind and debris impact-rated doors and windows, etc.	BSCD
13	Work with local hardware stores and construction material suppliers to stock tested and approved materials, which should be used at all times and not just after damaging events. Have a plan in place to quickly order and receive materials after a disaster.	CNMI Recovery Administrator

2. Acronyms and Abbreviations

ASCE	American Society of Civil Engineers
BSCD	CNMI Building Safety Code Division
CMC	Commonwealth Mariana Code
CNMI	Commonwealth of the Northern Mariana Islands
DPW	Department of Public Works
FEMA	Federal Emergency Management Agency
I-Codes	International Codes®
IBC	International Building Code®
ICC	International Code Council®
IRC	International Residential Code®
MAT	Mitigation Assessment Team
mph	Miles per hour
NFIP	National Flood Insurance Program
SEI	Structural Engineering Institute
SWR	Special Wind Region

3. Event Description and Purpose of Study

In October 2018, Super Typhoon Yutu broke several records by becoming the strongest typhoon ever recorded to impact the Commonwealth of the Northern Mariana Islands (CNMI), the most powerful tropical cyclone of 2018 worldwide, and the strongest storm to hit the United States since 1935. For this commonwealth situated far from the continental U.S., evacuation is not a viable option. Help and supplies cannot reach the area for days following major storms. It is important to understand the event and the purpose of this study, as it serves to help the CNMI make sound decisions for disaster preparedness and recovery to best protect its citizens against future storms.

3.1. Event Description

Super Typhoon Yutu began as a tropical depression in the Pacific Ocean and grew rapidly in a short period of time, producing 90 mile-per-hour (mph) winds on October 23, 2018, that doubled the next day to 180 mph (Figure 1). On October 25, 2018, Yutu made landfall in the CNMI, with maximum sustained winds of 180 mph and torrential rainfall, according to the U.S. Navy Joint Typhoon Warning Center.[1]

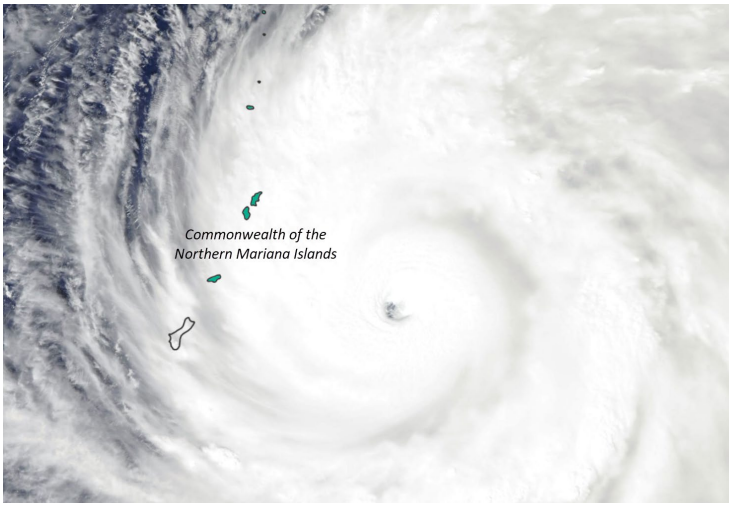

Figure 1. Super Typhoon Yutu crossed over CNMI in October 2018. [Image credit: NASA]

Yutu killed two people and injured 133 more, while also destroying homes and infrastructure throughout populated areas. Most commercial and public buildings in southern Saipan had roof coverings blown off their roof decks. For residential buildings, the damage was more extensive, with roof coverings and roof decks being removed from roof frames or the loss of the entire roof structure. Multi-story concrete and steel frame buildings generally performed better, though some of these buildings experienced heavy roof covering and cladding (wall, door, and window) damage, though only a few buildings were considered destroyed. Many buildings that did not have extensive, visible exterior damage were observed to have experienced significant water intrusion, causing damage throughout building interiors. Vegetation was uprooted and mixed with other wind-borne

[1] Wind speed reference data obtained from https://weather.com/storms/typhoon/news/2018-10-28-super-typhoon-yutu-philippines-china-saipan

debris, such as doors and storm shutters, contributing to the wind damage. Saipan's and Tinian's critical infrastructure—including hospitals, schools, airports, power, water supply, and roadways—all suffered damage. The CNMI was using the 2009 International Building Code® (IBC) and 2009 International Residential Code® (IRC) for building construction when Yutu hit.

3.2. Purpose of the Study

In 2020, FEMA's Building Science Branch, in conjunction with FEMA Region 9 and supported by the Strategic Alliance for Risk Reduction (STARR II), was asked to engage the Mitigation Assessment Team (MAT) to support long-term recovery efforts in the CNMI. Though the MAT typically deploys immediately following a major disaster, providing support even two years after Super Typhoon Yutu still can help steer long-term recovery and resilience efforts for these high-risk islands.

In November 2020, the MAT deployed to Saipan and Tinian to assess building performance; develop customized Recovery Advisories and Fact Sheets; provide tailored training and subject matter expertise; and document observations, conclusions, and recommendations. The team worked with local agencies to assess damage to many types of buildings, including the hospital, police and fire stations, schools, government offices, and homes. The goal was to learn how buildings performed during the typhoon and why they withstood, or did not withstand, the strain caused by wind and flood hazards. The MAT also studied the adequacy of current building codes and floodplain management regulations, local practices, and building materials based on the damage observed after the disaster. Upon conclusion of the field investigation, specialists worked as a team to analyze the field data, as well as other damage reports and studies conducted by government agencies or private firms. Finally, the team prepared conclusions and developed recommendations based on these findings.

The recommendations resulting from this building performance report help FEMA coordinate with agencies and organizations to assess the hazard-resistant provisions of building codes and standards. In addition, recommendations support community development of long-term strategies to reduce future damage and impacts from hazard events and improve community resilience.

The recommendations are provided to help the CNMI outline a path forward for building code adoption with enforcement that promotes the resilient construction, repair, and alteration of buildings. The CNMI also can use these recommendations to help guide and better prepare design professionals, contractors, and property owners for future storms through clear and wide-reaching communication.

The likelihood of experiencing a storm of the magnitude of Super Typhoon Yutu in the CNMI has always existed and the threat remains still. Storms like Typhoon Soudelor and Super Typhoon Yutu have served as demonstrations of the need to take the proper steps to be prepared when the next disaster occurs

4. Observations, Conclusions, and Recommendations

The MAT visited the CNMI in November 2020 and made numerous observations related to codes, standards, and permitting functions. The conclusions and recommendations presented in this report are based on the MAT's observations in the areas studied; evaluation of relevant codes, standards, and regulations; and meetings with territory and local officials and other interested parties. The recommendations are intended to assist the government of the CNMI in establishing processes and requirements that continue to support the Territory in the recovery process and help reduce future damage and impacts from design-level flood and wind events similar to Super Typhoon Yutu.

The recommendations are presented as guidance to the Territory and those who are involved with the design, construction, and maintenance of the built environment across the islands. The government of the CNMI and the entities involved in reconstruction and mitigation efforts will need to consider these recommendations in conjunction with their existing priorities and resources when determining how they can or will be implemented.

Many of the conclusions and recommendations center on encouraging the CNMI to assess its code development and enforcement and implement a robust code and standards program that will withstand the test of time and the forces of nature.

The 2018 *Guidance Manual for Smart, Safe Growth in the CNMI* is a set of development strategies focused on improving the resiliency of the built environment. This document introduces smart, safe growth and discusses adaptation measures, recommendations for government action, planning resources, regulatory instruments, and tools to work toward smart, safe growth in the communities of the CNMI. It is foremost intended for regulatory authorities and government planning officials to assist them in their work.

Several of the strategies and recommendations within the *Guidance Manual* overlap with the recommendations found in this summary report, such as updating regulations and the permitting process, hazard mitigation supported by long-term mitigation planning, and continued efforts to identify and incorporate "better building" principles and practices.

Using the *Guidance Manual* in tandem with this summary report can help break the conventional cycle of disaster-recovery-repeated damage. https://opd.gov.mp/library/reports/opd-safe-smart-growth-guidance-for-cnmi/

4.1. Codes and Standards

One of the most effective ways to safeguard the CNMI against natural disasters is to adopt and enforce the latest hazard-resistant building codes and referenced standards. Modern building codes address many concerns, including public health, safety, and resiliency. As the CNMI recovers from Super Typhoon Yutu, the rebuilding of damaged and vulnerable buildings in accordance with the latest adopted building codes offers one of the greatest opportunities for long-term resilience. The CNMI can help break the cycle of storm destruction by continually adopting and implementing modern, hazard-resistant building codes.

For better building construction and greater public safety, the Twenty-First Northern Marianas Commonwealth Legislature adopted the 2018 International Building Code® (IBC) through Public Law No. 21-14, as signed by the governor on December 19, 2019. Soon afterward, the Department of Public Works (DPW) updated the Building Safety Code Rules and Regulations (Sec. 155-10.1-601) to use the 2018 IBC and 2018 International Residential Code® (IRC). This was a positive step toward long-term resilience as these codes were the latest available at the time and presented a significant upgrade from the previously adopted 2009 IBC and 2009 IRC.

The Building Safety Code Division (BSCD), a unit in the DPW, is dedicated to upholding CNMI Public Law No. 21-14 to ensure that buildings meet the minimum safety standards of the IBC and IRC. The 2018 IBC and 2018 IRC currently govern the design and construction of buildings in the CNMI, which include requirements to address earthquakes, flooding, and high winds that help buildings resist damage. The BSCD also enforces the CNMI's floodplain management regulations to minimize flood damage in accordance with CNMI Public Law No. 8-7. The Division's Mission Statement provides for and promotes:

> *"… the health, safety, and general welfare for the people of the Commonwealth of the Northern Mariana Islands in the built environment, through professional services in the plan review and inspection of all commercial and residential structures constructed and occupied in the commonwealth."*

4.1.1. OBSERVATIONS

Beginning in 2019, after the widespread damage of Super Typhoon Yutu, the CNMI government, with the support of FEMA, updated from the 2009 editions to the adoption of the 2018 editions of the IBC and IRC as the official building codes. In the process, the Legislature said,

> *"… it is critical for the proper development of local infrastructure to ensure the building code remains up to date with national standards."*[2]

[2] Commonwealth Law Revision Commission. 2019. Public Law 21-14. https://cnmilaw.org/pdf/public_laws/21/pl21-14.pdf

The Legislature's charging language promotes keeping current with the adoption of national consensus model building codes, such as the IBC and IRC, which are updated in three-year cycles. The Legislature also gave authority to BSCD to adopt new editions of building codes. However, the CNMI does not have a regularly scheduled process to adopt the latest national consensus model building codes in the same recurring three-year time frame:

> *"The Building Safety Official may adopt by regulation updates to, and new editions of, the International Building Code pursuant to the Administrative Procedures Act."*

The CNMI appropriately updated Section 155-10.1-601 of the Building Safety Code Rules and Regulations to specify the adoption of the 2018 IBC and 2018 IRC. However, the public is not currently provided with sufficient detail to determine from this section the other International Codes® (I-Codes) and their editions being adopted. Section 601 provides two examples of the other I-Codes being adopted along with the IBC, but it does not list each of the I-Codes adopted as part of the Commonwealth Building Safety Code.

> *"The International Building Code ('IBC') of 2018, which includes its ICC Family of codes such as the International Residential Code and energy codes, as adopted by the International Code Council, is hereby adapted [sic] as the Commonwealth Building Safety Code."*

The Commonwealth Building Safety Code includes a section dedicated to earthquake and typhoon standards. The initial portion of this section recognizes that proper earthquake and typhoon standards are a matter of life and death for the citizens of and visitors to the CNMI. The emphasis on these particular hazards provides an opportunity for the CNMI to clarify the language within this section to agree with the most recent adoption of the I-Codes. The adoption of the 2018 IBC and 2018 IRC created a conflict between a seismic provision in the Commonwealth Building Safety Code amendments[3] and the seismic requirements in the adopted I-Codes. The existing amendments found in Section 155-10.1-615 specify:

> *"All structures which are required to meet earthquake construction requirements shall be designed and constructed to Seismic Zone 4 standards."*

However, the 2018 IBC and 2018 IRC no longer use the term "Seismic Zone," which is a legacy term used in the Uniform Building Code. This term is not consistent with the I-Codes. The corresponding term used in the I-Codes is "Seismic Design Category."

Later, in Section 155.10.1-615, the code amendments go on to specify that:

[3] Northern Mariana Islands Administrative Code. 2020. Section 155-10.1-601. https://cnmilaw.org/pdf/admincode/T155/T155-10.1.pdf

> *"the minimum design strength of every building and structure and every portion thereof to which the Building Safety Code applies shall be designed and constructed to withstand the minimum horizontal and uplift pressure of wind velocity of at least 175 miles per hour."*

In that section, the code amendments do well to specify a "minimum design strength." However, the statement does not match the I-Code terminology. This code amendment was in place when the CNMI adopted the 2009 IBC and 2009 IRC. Since that time, the I-Codes have transitioned to an updated wind design methodology. For example, a basic (design) wind speed of 175 miles per hour (mph) in the 2009 IBC is now equivalent to a basic wind speed of 225 mph in the 2018 IBC.[4]

In support of applying the appropriate design wind speed for the CNMI, FEMA developed the 2020 CNMI Special Wind Region (SWR) maps to simplify the process of determining the design wind speeds for design professionals. FEMA produced four sets of SWR maps for each of the islands of Saipan, Tinian, and Rota, for a total of 12 SWR maps. The SWR maps include the effects of island topography and provide an alternative method to the guidance found in *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (American Society of Civil Engineers [ASCE]/Structural Engineering Institute [SEI] 7-16), which is referenced by the adopted 2018 IBC and 2018 IRC. Figure 2, below, shows an example for one of the 12 SWR maps. It displays the wind speeds associated with the topography of Saipan for Risk Category II buildings, which include one- and two-family dwellings, office buildings, and retail buildings. These SWR maps and the associated design wind speeds enable design professionals to simply select a design wind speed for a building at a site from the SWR maps. This will provide results similar to those of ASCE/SEI 7-16's methodology, yet without performing the additional, complex calculations it requires. Using the SWR maps for the design of buildings and structures helps optimize designs and avoids unnecessary costs. These efforts have culminated in the opportunity for these SWR maps to be adopted into the Commonwealth Building Safety Code as an alternative method for calculating design wind pressures on buildings and structures.

Building code councils are used by many states to help make amendments that are necessary to address local conditions, reflect local laws, and make recommendations that strengthen the resiliency of buildings. The CNMI currently does not have a professional oversight council designated with the responsibility of proposing amendments to the I-Codes that are appropriate for the CNMI. DPW has been given the authority to employ staff as required to assist it in performing its duties,[5] which would include the designation of a Building Code Council with the responsibility of studying, evaluating, and making recommendations for building code amendments.

[4] To convert from basic wind speed (V_{asd}) in the 2009 IBC to the basic wind speed (V) equivalent in the 2018 IBC, the following equation is used: $V = V_{asd} / 0.6^{1/2}$.

[5] Commonwealth Mariana Code (CMC). 2021. Title 1: Government, Section 2405 Department of Public Works: Staff. https://cnmilaw.org/pdf/cmc_section/T1/2405.pdf

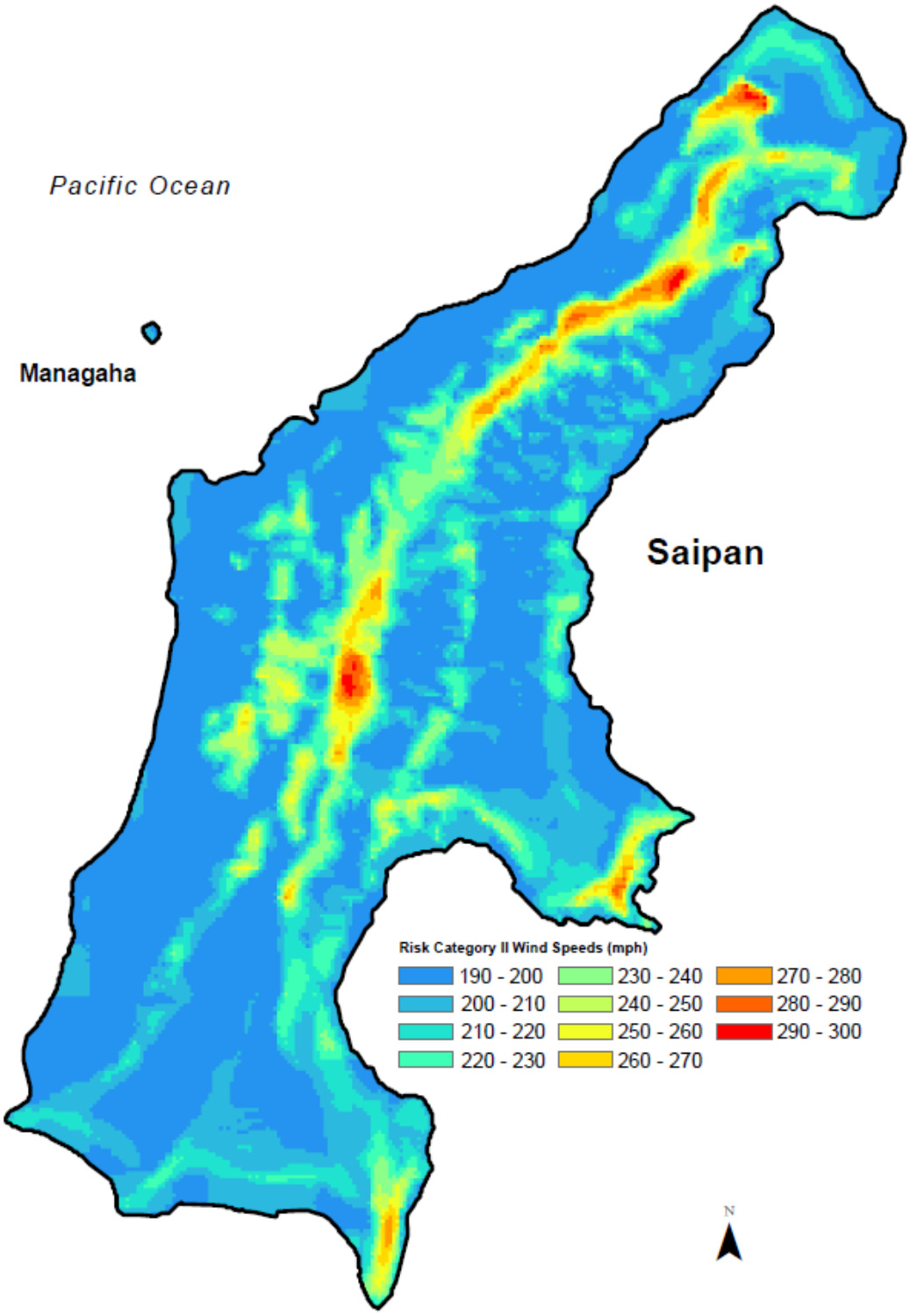

Figure 2. Risk Category II (appropriate for buildings such as 1- and 2-family dwellings, office buildings, and retail buildings) color-coded SWR map of Saipan in mph displaying colors assigned to a range of design wind speeds, which all exceed 175 mph.

The CNMI does not have a document summarizing for the public the full extent of amendments made to the 2018 I-Codes. This summary, especially useful for design professionals and contractors, can clarify which provisions of the I-Codes are not appropriate for local conditions, and how some local requirements exceed the 2018 IBC and 2018 IRC because of historical knowledge and past disaster experience.

The BSCD serves a vital role in helping the public understand and adhere to the building codes. The Division holds responsibility for reviewing permit applications and conducting inspections before issuing occupancy permits. However, the public does not have access to a BSCD website that shares building code adoption with amendments, permit applications, fee requirements, links to publications useful for contractors and property owners, and answers to frequently asked questions.

The National Flood Insurance Program (NFIP) is based on the premise that the federal government will make flood insurance available to communities that adopt and enforce floodplain management requirements that meet or exceed the minimum NFIP requirements. The NFIP minimum requirements for buildings and structures are the basis for the flood-resistant design and construction requirements in the I-Codes and the referenced standard ASCE 24, *Flood Resistant Design and Construction*. When decisions result in development within flood hazard areas, application of NFIP criteria is intended to minimize exposure to floods and flood-related damage. The Flood Damage Prevention Regulations in Subchapter 155-10.2 of the Northern Mariana Islands Administrative Code have not been updated since 1993[6], even as the building code has been updated to the 2009 I-Codes and then, more recently, the 2018 I-Codes.

4.1.2. CONCLUSIONS AND RECOMMENDATIONS

Conclusion 1

The CNMI does not regularly adopt the most recent edition of the I-Codes, which leaves the infrastructure of the CNMI lagging behind national standards. The hazard-resistant provisions of the latest I-Codes and standards referenced by the I-Codes enable new and existing buildings to better resist the impacts of typhoons, floods, and seismic events. *Building Codes Save: A Nationwide Study,* published by FEMA in November 2020, concluded that state, local, tribal, and territorial governments that have adopted the I-Codes and continue to adopt the latest updated editions can avoid billions of dollars in annual losses. Without a formal adoption cycle by BSCD, many years may pass between adoptions without the latest hazard-resistant building code provisions being in effect.

Recommendation 1:

BSCD should adopt the latest I-Codes on a recurring three-year basis, with amendments that are specific to the Territory.

[6] Northern Mariana Islands Administrative Code. 2017. Section 155-10.1-601. https://cnmilaw.org/pdf/admincode/T155/T155-10.2.pdf

Conclusion 2

Creation of a CNMI Building Code Council would establish a formal process that considers CNMI-specific amendments to the I-Codes. A Building Code Council can identify opportunities to strengthen building construction and propose local amendments.

Recommendation 2a:

DPW should consider establishing a Building Code Council of balanced membership with representation by local engineers, architects, contractors, and appropriate government professionals. The council would be responsible for studying, evaluating, and making recommendations for the adoption of I-Codes with local amendments for adoption by BSCD.

Recommendation 2b:

The Building Code Council should establish a formal process for stakeholders to suggest amendments and comment on proposed amendments to the Commonwealth Building Safety Code.

The International Code Council® (ICC) can serve as a consultant and has online customizable platforms to help establish the code adoption and amendment process.
https://www.iccsafe.org/products-and-services/consulting/

Conclusion 3

The current Commonwealth Building Safety Code (Sec. 155-10.1-601) does not clearly identify the code, edition, and year of all the adopted building codes with local amendments. The Commonwealth Building Safety Code amendments, such as those for fire protection and snow loads, are not summarized in a document nor made available for distribution via print, website, or other media. This lack of documentation makes it difficult for owners, design professionals, and contractors to review and comply with the local building code provisions.

Recommendation 3:

DPW and BSCD should ensure the specific edition, year, amendments, and code volumes are identified when the codes are adopted in the Commonwealth Building Safety Code and use multiple types of media (print, website, etc.) to communicate the information to the public.

Conclusion 4

The CNMI Building Safety Code Rules and Regulations (Sec. 155-10.1-615) have earthquake and typhoon amendments that conflict with the adopted I-Codes and referenced standards. The CNMI would benefit from the removal of references to Seismic Zone 4, which is an outdated specification that is not consistent with the 2018 IBC and 2018 IRC. The SWR maps prepared for the CNMI by FEMA are more suitable for adoption than the single design wind speed listed in the Commonwealth

Building Safety Code. The SWR maps display more specific and appropriate design wind speeds that vary based on the location and one of the four Risk Categories. The Risk Category number increases from I to IV to provide higher performance of more important buildings and structures.

Recommendation 4:

DPW should update the CNMI Building Safety Code Rules and Regulations (Sec. 155-10.1-615) to remove the earthquake and typhoon amendments, which conflict with adopted I-Codes. In keeping with the latest seismic design knowledge, it would be beneficial to either reference the seismic provisions of the adopted I-Codes or specify the minimum Seismic Design Category per the IBC and IRC. DPW should adopt the FEMA 2020 CNMI Special Wind Region maps for all buildings in Risk Categories I, II, III, and IV.

The Special Wind Region maps for the CNMI are captured in a user-friendly interface on the Applied Technology Council website, ATC Hazards by Location: https://hazards.atcouncil.org/.

Conclusion 5

The CNMI Flood Damage Prevention Regulations are not consistent with the flood provisions in the 2018 IBC and 2018 IRC. By enactment of Public Law No. 8-7 in 1992, the CNMI Legislature vested the Director of Public Works with the authority to bring the CNMI into full compliance with the provisions of the NFIP and to make the CNMI a participating NFIP community. On October 15, 1993, DPW adopted Subchapter 155-10.2, Flood Damage Prevention Regulations, within the Northern Mariana Islands Administrative Code. The regulations have not changed for many years. FEMA provides a model code-coordinated ordinance that can be used with the adoption of the I-Codes and IBC Appendix G Flood-Resistant Construction.

Recommendation 5:

DPW and BSCD should update the CNMI Flood Damage Prevention Regulations and integrate the regulations with the flood provisions of the I-Codes using the FEMA model code-coordinated ordinance.

4.2. Permitting and Code Enforcement

The catastrophic damage from Super Typhoon Yutu to CNMI has affected thousands of existing buildings and structures throughout the islands. Many buildings and structures have yet to be fully repaired. This results in numerous building permits being requested and inspections being performed by the BSCD. Permitting and inspection are the enforcement tools to implement the building code and floodplain management regulations. Adherence to the permitting, inspection, and enforcement processes helps produce more sustainable and resilient buildings.

4.2.1. OBSERVATIONS

The CNMI's history of typhoons demonstrates the need for proper inspection and enforcement of construction to protect the health and welfare of the public. Many poor construction practices of the past resulted in building failures during Super Typhoon Yutu.

Although it is commendable for many homeowners to take the initiative to repair their homes, it is in violation of Building Safety Code Section 155-10.1-501 to not comply with the CNMI building permitting and construction requirements. The CNMI faces the challenge of breaking a cycle of improper repair and construction practices by homeowners. These improper practices occur when building permit applications are not submitted. It would benefit the communities of the CNMI for the BSCD to increase public awareness and have mechanisms that provide instruction about how to adhere to the building permit and construction requirements.

Contractors who assist homeowners and building owners with new construction and repairs are not required to be licensed in the CNMI. Licensure provides a method of oversight to determine whether building contractors have the knowledge to properly serve the CNMI community. Contractors who are knowledgeable about proper construction practices and current building codes and good practices promote code-compliant construction.

In some cases, the construction of resilient buildings is limited by the availability of hazard-resistant materials and products that are tested and approved to meet the IBC and IRC hazard requirements. Approved materials and products such as shutters, structural connectors, windows, and doors are critical elements that help protect buildings from wind loads and wind-borne debris. Without the use of proper approved materials and products, these building elements are more likely to fail when exposed to hazardous conditions.

The "load path" is the route by which building loads are transferred through the members and connections. The loads may be dead loads such as the building's own weight; live loads such as the weight of occupants or furniture; or environmental loads such as those caused by wind, floods, and earthquakes. The load path begins where a load is applied, moves through the building, and ends where the load is transferred to the ground. A design professional will evaluate and specify load path connectors of the appropriate type, number, size, and corrosion protection to resist all the imposed building loads that occur during extreme weather. The current building permit applications do not require identification of load path connectors on the construction design documents, leaving contractors to select the number and type of connectors. Lightly constructed buildings with weak points or incomplete load paths performed poorly under high winds during Yutu.

Building permit applications submitted to the BSCD sometimes lack documentation of design criteria for hazards such as high winds, earthquakes, and floods. The building code requires this information to be supplied in permit applications and construction documents. Some building permit files lack plan review and inspection reports. Accessing ICC training on building codes and code administration is one way to educate BSCD staff as new building code editions are adopted. Regular audits of building permit files promote accountability and a consistent approach.

The MAT observed many temporary facilities still in existence more than two years after Super Typhoon Yutu (see Figure 3). The IBC and IRC require permits for temporary structures, which are allowed for no more than 180 days of service. It is critical that temporary buildings be tracked during the permitted time of service. Temporary buildings are not required to adhere to all the typical building requirements, which puts these structures more at risk than permanent structures during hazard events.

Figure 3. Temporary structure built more than 15 years ago is no longer in service but has not been removed. In the event of a future disaster, it creates a danger to the Tinian Health Center, which is only 100 feet away.

4.2.2. CONCLUSIONS AND RECOMMENDATIONS

Conclusion 6

Homeowners with limited awareness and understanding of the building permit process are less likely to submit permit applications for new home construction and home repairs. The absence of a building permit website creates an obstacle to homeowners who may not be aware of the steps and requirements for obtaining building permits. Providing clear and easily accessible information about the building permit process informs homeowners about the building code requirements. This also aligns with the *Guidance Manual for Smart, Safe Growth*, which recommends the development of post-disaster code compliance and build-back requirements.

Recommendation 6a:

BSCD should widely share with the people of the CNMI the CNMI MAT-prepared fact sheet titled, *Permitting and Inspection Process for Disaster-Resilient Residential Homes, 2021*. This fact sheet provides homeowners with a clear written explanation of the permit application, permit review, and inspection processes to make them aware of their responsibilities and the building code requirements. This information can be distributed at local permitting offices.

Recommendation 6b:

DPW should develop a BSCD webpage that provides public access to all appropriate building code adoptions, amendments, and application forms. The webpage should describe the application process, inspections that will be conducted, and the importance of obtaining certificates of occupancy. A specific section should be dedicated to homeowners.

Conclusion 7

Regular quality audits of plan reviews and permit records and training can improve the filing of BSCD permitting and inspection documentation. This will support a consistent method and improve the quality of record keeping.

Recommendation 7:

Twice a year, DPW should perform quality audits of the building permit and inspection documentation to ensure standards are being maintained. Based on the results, BSCD should implement periodic training on lessons learned from the audits and update internal documentation to clarify the roles and responsibilities of BSCD staff.

The ICC has a recognition program for local building departments to demonstrate a commitment to service, safety, and continuous improvement performed through the International Accreditation Service Building Department Recognition Program. The program involves an independent verification to ensure that building departments meet nationally recognized standards. For more information, go to https://www.iasonline.org/services/building-department-recognition/

Conclusion 8

Training is needed for BSCD staff to be familiar with the adopted 2018 I-Codes. Training staff on relevant code changes compared to the previous code prepares them to administer the current building code. This training is for effective implementation and enforcement of the Commonwealth Building Safety Code.

Recommendation 8:

BSCD should train new and existing staff on the requirements of the adopted building codes and standards. BSCD should work with ICC and FEMA to provide and access training on the 2018 I-Codes. All code enforcement staff should be adequately trained on changes to the building codes, standards, and local amendments. In the future, staff training should take place in advance of the next edition of the codes being implemented.

Conclusion 9

BSCD's Requirements for Plan Review Checklist, which lists the minimum building plan and specification submittal requirements associated with permit applications, does not match the submittal and construction document requirements specified in the 2018 IBC and 2018 IRC. See 2018 IBC Sec. 107 and Sec. 1603; and 2018 IRC Sec. 105.3 and Sec. 106. The 2018 IBC and 2018 IRC provide some guidance for minimal design information that should be included on construction documents. However, many jurisdictions in high wind-prone areas require additional design information beyond the minimum guidance.

Recommendation 9a:

BSCD should require that permit applications and construction documents include the information required by the codes, especially critical design information such as all wind, seismic, and flood design data and design parameters.

Recommendation 9b:

BSCD should require that building construction documents show details of load path connections. It also should require design professionals to attest, using a signed form, that continuous load paths are provided for by designs. Describing and identifying load path connections in the construction documents should apply to both new construction and existing construction that is being repaired, added to or renovated. During inspections, BSCD must verify that continuous load path connections have been constructed as designed and special inspections should be performed as required by the code.

The ICC has Plan Review Records available, which can serve as thorough checklists of requirements for code sections within the I-Codes. It also helps prepare detailed and consistent plan reviews. For more information, go to https://shop.iccsafe.org/topics/building-departments/plan-review-records-and-checklist.html.

Conclusion 10

The use of many temporary buildings far exceeds the 180-day time of service specified in the IBC and IRC.

Recommendation 10:

BSCD should issue permits for temporary structures and track and monitor the use of all temporary structures, especially those that were allowed during the Yutu recovery efforts. BSCD should require removal of temporary buildings after 180 days or enforce the building code requirements for buildings constructed or installed as temporary that will transition into permanent-use structures. If the expected time of service is uncertain, BSCD can require temporary structures to be constructed or installed in accordance with the building code.

Conclusion 11

Construction contractors are not required to be licensed to operate, which may lead to unfamiliarity with the latest building code requirements and poor construction practices. Certification of contractors provides a higher likelihood of competency.

Recommendation 11:

The CNMI Department of Commerce, working with DPW, should develop a contractor license program and require contractors to obtain licenses to ensure awareness of the latest codes. This

also will aid the CNMI in tracking and enforcing code compliance. All construction contractors should be required to be licensed.

Conclusion 12

BSCD does not have a list of tested and approved hazard-resistant materials and products appropriate for high-wind-resistant construction. A list would assist design professionals, contractors, plan reviewers, and code enforcement staff in identifying products and materials that comply with hazard-resistant codes and standards. Some specific items appropriate for the list include shutters, impact-resistant glazing, other window assemblies rated for high-wind pressures, and various connectors used to establish a continuous load path. Jurisdictions with similar hazard risks have already developed certifications or ratings for many products that could be appropriate for the CNMI.

Recommendation 12:

BSCD should consider developing and maintaining a list of known hazard-resistant building products appropriate for the CNMI, which have been tested in accordance with the IBC, such as impact-resistant systems (e.g., shutters) and wind and debris impact-rated doors and windows.

Jurisdictions with lists of tested and approved hazard-resistant materials for consideration:

- Miami-Dade product control requirement: http://www.miamidade.gov/building/pc-search_app.asp
- The Florida product approval system: https://www.floridabuilding.org/pr/pr_app_srch.aspx
- Many jurisdictions rely on ICC-Evaluation Services (ES) reports as the basis for hazard-resistant products: http://www.icc-es.org/reports/index.cfm?search=search
- The Texas Department of Insurance has a list of approved products: http://www.tdi.texas.gov/wind/prod/index.html.

Conclusion 13

Many types of hazard-resistant materials are not available for purchase by contractors, homeowners, and building owners. This makes it more difficult for building construction and repairs to be completed in accordance with the codes and standards.

Recommendation 13:

The CNMI Recovery Administrator should work with local hardware stores and construction material suppliers to stock tested and approved materials, which should be used at all times and not just after damaging events. In addition, the Recovery Administrator should have a plan in place to quickly order and receive materials after a disaster. This ensures that contractors and owners can rebuild with hazard-resistant materials immediately after an event instead of waiting for stores to obtain adequate stock.

5. References and Resources

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