



# NC Department of Public Safety

## EMERGENCY MANAGEMENT

Josh Stein, Governor

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### Fiscal Note for Proposed North Carolina Emergency Management's Rules on Foot Conversion Standards

<b>Agency:</b>	North Carolina Department of Public Safety
<b>Division:</b>	North Carolina Emergency Management
<b>Rule Citation(s):</b>	14B NCAC 03 .0601 PURPOSE 14B NCAC 03. 0602 REQUIRED FOOT CONVERSION
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<b>Rulemaking Authority:</b>	G.S. § 102-1.1; G.S. § 102-1.2; G.S. § 102-1.3; G.S. § 102-2; G.S. § 102-8; G.S. § 102-9; G.S. § 102-11
<b>Impact Summary:</b>	State Government: Yes Local Government: Yes Private Entities: Yes Substantial Impact: No

### INTRODUCTION

This fiscal note evaluates the expected fiscal and operational impact of the proposed North Carolina Emergency Management (NCEM) rules that codify standards for the conversion of measurement units between feet and meters based on the coordinate system.

### PURPOSE OF PROPOSED RULES

The purpose of the proposed rules is to clarify the appropriate usage of the U.S. Survey Foot and International Foot. This change is in accordance with the decision by the National Institute of Standards and Technology (NIST) and the National Geodetic Survey (NGS) to phase



out the U.S. Survey Foot. It also aligns with recent amendments to North Carolina General Statute 102-1.2, which adopted the International Foot as the state standard. The clarification provided by the proposed rules should reduce confusion arising from having multiple measurement standards, helping to prevent costly errors and improve consistency in project execution.

## **DEPRECATION OF THE U.S. SURVEY FOOT and ADOPTION OF THE INTERNATIONAL FOOT IN NORTH CAROLINA**

The National Institute of Standards and Technology (NIST) and the National Geodetic Survey (NGS) posted a [notice](#) in the Federal Register announcing the decision to deprecate the use of the U.S. Survey Foot beginning January 1, 2023. In its place, the recommended form of measurement is the International Foot. By shifting toward a singular measuring unit (the International Foot), government, construction, engineering, surveying, mapping, agriculture, and other impacted industries will have clearer guidance and a standardized process.

A U.S. Survey Foot is expressed as a fraction — 1200/3937 meters — while an International Foot is expressed as a decimal – 0.3048 meters. That’s a difference of only one one-hundredth of a foot per mile<sup>1</sup>. The importance of this difference is explained by NIST:

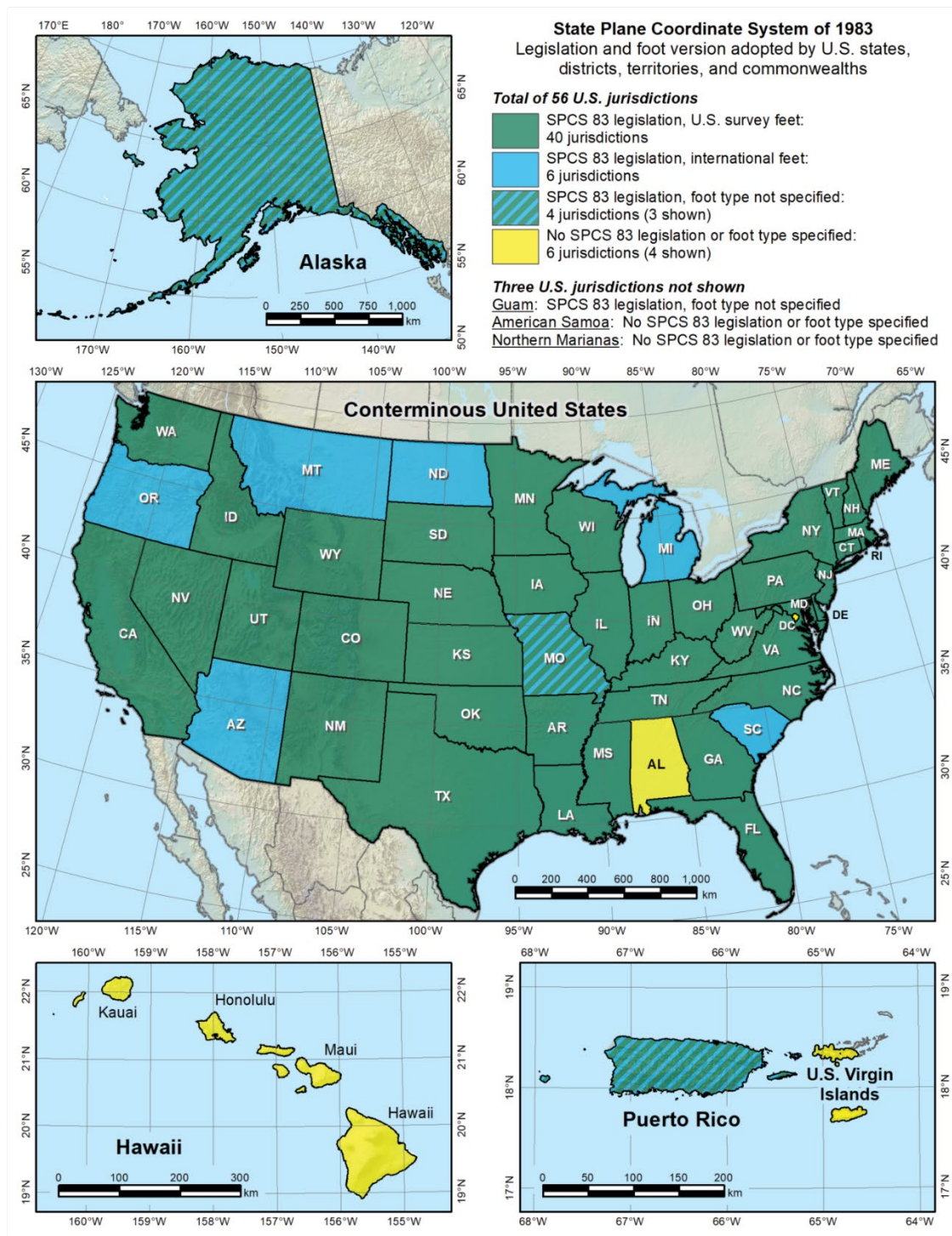
*“Although the U.S. survey foot is longer than the international foot by only 2 parts per million, this small discrepancy accumulates over large distances and can result in significant errors in surveying and civil engineering projects, regardless of the size of the project. For example, when a one-mile distance is surveyed, the difference is approximately 0.01 ft (or 0.12 in). However, the impact becomes substantial when longer distance measurements or conversions are made, such as those involving rectangular plane coordinates of the State Plane Coordinate System (SPCS). In these cases, the difference between the two definitions can also result in large direction and position location errors, in many cases reaching tens of feet for SPCS coordinates.”<sup>2</sup>*

Currently, the use of the foot conversion varies across the United States. Some states, like South Carolina, have already adopted the international foot standard, while others, like North Carolina, have historically used the U.S. Survey Foot but are in the process of transitioning. This inconsistency can cause confusion, especially for projects that cross state borders, as contractors must determine which standard to apply. However, there is movement towards standardizing the use of the International Foot across the entire country. With NIST’s official retirement of the U.S. Survey Foot at the end of 2022, states that have not yet transitioned -- such as Virginia -- will likely need to adopt the International Foot soon to ensure consistency and avoid costly errors. The map below shows an overview of the current adopted measurement across the country.

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<sup>1</sup> Source: <https://oceanservice.noaa.gov/geodesy/international-foot.html>

<sup>2</sup> Source: <https://www.nist.gov/pml/us-surveyfoot/frequently-asked-questions-faqs#3>



Source: American Surveyor

In line with this transition, [S.L. 2023-93](#) provided updates to [Chapter 102 of the North Carolina General Statutes](#) to adopt the International Foot as the official conversion factor from meters

to feet for the state. This legislation also included language for a new horizontal reference frame and a new state plane coordinate system, further aligning North Carolina's standards with federal guidance.

## **SUMMARY OF PROPOSED RULES**

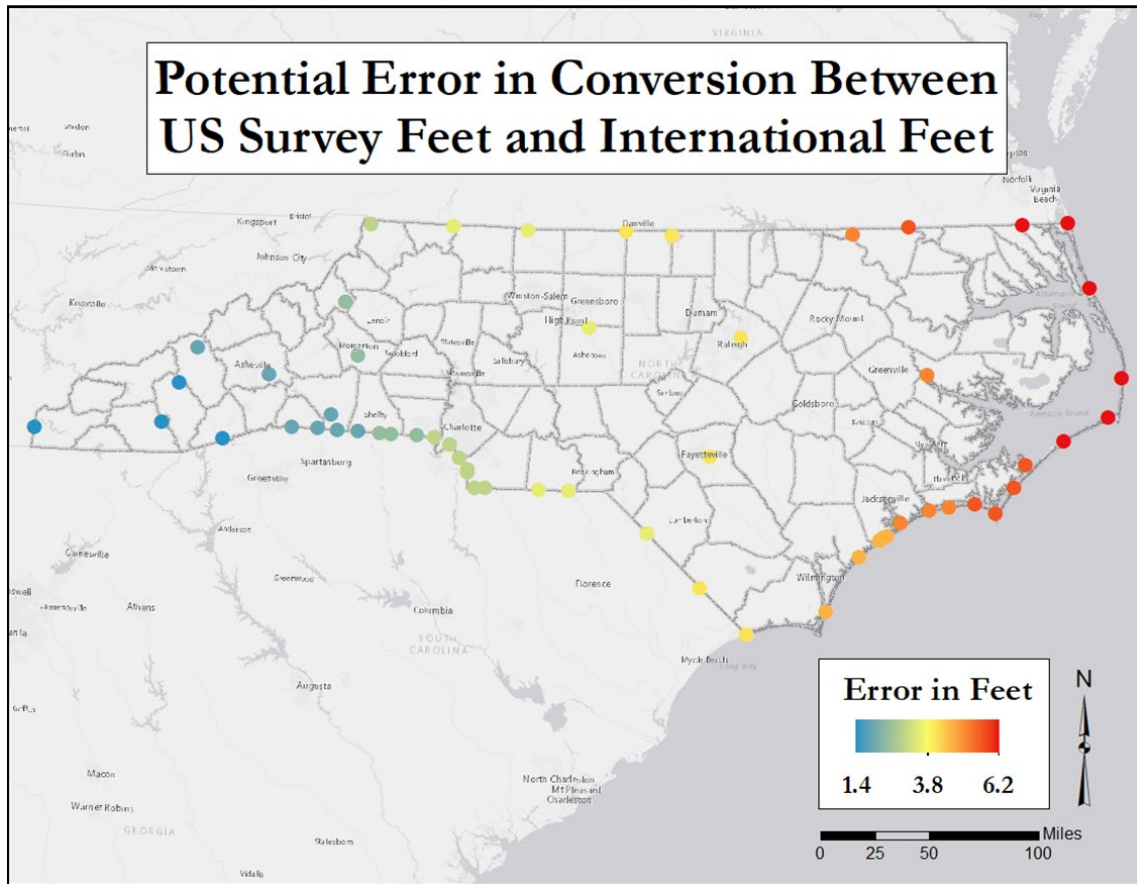
The proposed rules clarify when to use the U.S. Survey Foot versus the International Foot, specifying the foot conversion standards as follows:

1. The International Foot, 1 foot = 0.3048 meter exactly, when coordinates are based on the North American Terrestrial Reference Frame of 2022 (NATRF2022) as described in §102-1.2 of the North Carolina General Statutes, and for all subsequent coordinate systems adopted by the North Carolina Geodetic Survey or its successor.
2. The International Foot, 1 foot = 0.3048 meter exactly, when heights are based on the North American-Pacific Geopotential Datum of 2022 (NAPGD2022), and for all subsequent coordinate systems adopted by the North Carolina Geodetic Survey or its successor.
3. The U.S. Survey Foot, 1 foot = 1200/3937 meter exactly or 1 foot = 0.304800609601219 meter approximately, when coordinates are based on the North American Datum of 1983 (NAD 83) or the North American Datum of 1927 (NAD 27) as described in §102-1.1 or §102-1, respectively, of the North Carolina General Statutes.
4. The U.S. Survey Foot, 1 foot = 1200/3937 meter exactly or 1 foot = 0.304800609601219 meter approximately, when heights are based on the North American Vertical Datum of 1988 (NAVD 88) or the National Geodetic Vertical Datum of 1929 (NGVD29).

## **IMPACT ANALYSIS**

The proposed rules primarily impact professionals and entities relying on standardized measurements, including those in surveying, construction, engineering, agriculture, mapping, and state and local government. These rules clarify existing requirements -- currently scattered across statutes and federal standards -- to promote consistent understanding and application of foot conversion standards. Although not imposing new mandates, the rules provide essential clarity which should help to reduce costly errors caused by inconsistent unit use.

Errors from misapplied foot conversions can lead to significant project delays and expenses, as illustrated by scenarios where infrastructure components built using different foot standards fail to align. Such discrepancies are especially significant over large distances or when integrating legacy data, with coastal areas experiencing some of the largest measurement errors.



*Source of Map: North Carolina Emergency Management (Geodetic Survey)*

To illustrate the importance of clarifying foot conversions standards, consider the following hypothetical yet plausible scenario:

A North Carolina Department of Transportation bridge and connecting highway project in eastern North Carolina is planned and designed in 2025 using the U.S. Survey Foot. Funding was provided for the project in 2027 and awarded to two contractors - one contractor to build the bridge and a different contractor to build the road that connects to the bridge. The bridge contractor builds the bridge using International Foot units because the National Institute of Standards officially retired the U.S. Survey Foot at the end of 2022. The road contractor uses U.S. Survey Foot to build the road that connects to the bridge. When the last stage of the road is built, the two contractors determine the bridge and road don't align properly. Additional design, right of way acquisition, and construction costs are then required to correctly connect the road and bridge, delaying the completion of the project. The marginal costs, including both direct expenditures and opportunity costs, could be considerable.

The above scenario illustrates the significant risks and costs that arise from inconsistent use of measurement standards across projects. Clarifying and standardizing the application of foot conversions is therefore critical to avoid such costly errors.

The direct financial impact of adopting these clarifications is expected to be limited, with most costs arising from adjustments to internal protocols and documentation rather than major operational changes. Stakeholder feedback has been positive, with no opposition reported from the National Geodetic Survey, North Carolina Board of Examiners for Engineers and Surveyors, North Carolina Society of Surveyors, or North Carolina Department of Transportation. As the NC Society of Surveyors noted, “The executive committee has reviewed the documents, and all agreed that they both read clearly and concisely. They are also glad this is being done, as it will confuse many.”

Many public and private entities have already begun aligning systems with the International Foot, and these rules will help formalize a uniform statewide standard, improving project accuracy and efficiency. By incorporating these standards into the administrative code, agencies such as the NCDOT will be able to reference them directly in contracts and project documentation. This ability provides a clear and consistent baseline for measurement expectations, reducing ambiguity and making contract terms more transparent and enforceable.

The added clarity may also lead some entities to discover and correct errors in ongoing projects -- for example, in cases where the International Foot was used prematurely. While this may create some near-term costs as projects transition to the correct conversion standard, the presence of clear rules should help prevent future mistakes and contribute to long-term cost savings.

North Carolina Emergency Management staff have already begun education and outreach efforts related to these standards, which will continue with minimal additional cost to the state. Local governments, including counties and municipalities involved in planning, infrastructure, public works, and land management, will benefit from having standardized measurement practices. Clear foot conversion standards should reduce costly errors, improve project coordination, and help ensure compliance with state and federal guidelines.

## **CONCLUSION**

The proposed rules are intended to support North Carolina’s ongoing transition to the International Foot standard by reducing confusion caused by having multiple measurement standards. By providing clear guidance in the North Carolina Administrative Code, these rules will help ensure that projects use the correct units, which should reduce the likelihood of errors, save time, and minimize unnecessary costs. This clarity will benefit a wide range of stakeholders, including state and local government agencies responsible for planning and infrastructure, as well as private entities in industries such as surveying, construction,

engineering, mapping, and agriculture. By promoting consistent measurement practices across these sectors, the rules should enhance efficiency and accuracy in project execution throughout the state.

## **ATTACHMENT 1**

14B NCAC 03 .0601 is proposed for adoption as follows:

### **SECTION .0600 – U.S. Survey foot/international foot**

#### **14B NCAC 03 .0601 PURPOSE**

The purpose of this rule is to provide guidance to government agencies, and the engineering, surveying, construction, agriculture, mapping and geospatial industries in the State of North Carolina on when to use the United States Survey Foot and the International Foot.

*History Note: Authority G.S. 102-1; 102-1.1; 102-1.2; 102-1.3; 102-2; 102-8; 102-9 Eff.*

## ATTACHMENT 2

14B NCAC 03 .0602 is proposed for adoption as follows:

### **14b NCAC 03. 0602 Required foot conversion**

When coordinates are provided in feet, the conversion between the foot and meter shall be based on the coordinate system used for determining the coordinates. This requirement applies to horizontal plane and vertical coordinates, and to all values associated with or derived from these coordinates. That includes, but is not limited to, distance, elevation, height, area, and volume, along with values computed from the foot, such as the chain, pole, rod, mile, square mile, and acre. The following foot conversion shall be used:

1. The International Foot, 1 foot = 0.3048 meter exactly, when coordinates are based on the North American Terrestrial Reference Frame of 2022 (NATRF2022) as described in §102-1.2 of the North Carolina General Statutes, and for all subsequent coordinate systems adopted by the North Carolina Geodetic Survey or its successor.
2. The International Foot, 1 foot = 0.3048 meter exactly, when heights are based on the North American-Pacific Geopotential Datum of 2022 (NAPGD2022), and for all subsequent coordinate systems adopted by the North Carolina Geodetic Survey or its successor.
3. The U.S. Survey Foot, 1 foot = 1200/3937 meter exactly or 1 foot = 0.304800609601219 meter approximately, when coordinates are based on the North American Datum of 1983 (NAD 83) or the North American Datum of 1927 (NAD 27) as described in §102-1.1 or §102-1, respectively, of the North Carolina General Statutes.
4. The U.S. Survey Foot, 1 foot = 1200/3937 meter exactly or 1 foot = 0.304800609601219 meter approximately, when heights are based on the North American Vertical Datum of 1988 (NAVD 88) or the National Geodetic Vertical Datum of 1929 (NGVD29).

*History Note: Authority G.S. 102-1; 102-1.1; 102-1.2; 102-1.3; 102-2; 102-8; 102-9  
Eff*