MHCC MEETING
December 12, 2016

APPENDIX E:
MHCC COMMENTS ON THE DRAFT
Interpretative Bulletin for Model Manufactured Home Installation Standards
Foundation Requirements in Freezing Climates

MHCC

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

24 CFR PART 3285

(Docket no. FR-xxxx-X-xx)

Interpretative Bulletin for Model Manufactured Home Installation Standards

Foundation Requirements in Freezing Climates

24 CFR Part 3285.312(b)

Agency: Office of the Assistant Secretary for Housing-Federal Housing Commissioner, HUD.

Action: Notice of Proposed Installation Interpretative Bulletin I-1-17

Summary: The purpose of this proposed Interpretative Bulletin is to provide guidance for designing and installing manufactured home foundations in areas subject to freezing climates with seasonal ground freezing, in accordance with 24 CFR § 3285.312(b) of the Model Manufactured Home Installation Standards, wherever soil conditions are susceptible to frost heave. Specifically, this guidance is being provided for installing manufactured home foundation systems in areas where frost susceptible seasonally frozen ground conditions are encountered and when footings do not extend below the frost depth at the site. These types of foundation systems are often called "frost-free foundations" (FFF), or "frost-protected shallow foundations" (FPSF). In addition, guidance is also being provided for installing manufactured homes where non-frost susceptible soil conditions are available at the site to protect foundations against the effects of frost heave.

DATES: Comment Due Date: [Insert date 60 days from the date of publication in the FEDERAL REGISTER].

ADDRESSES: Interested persons are invited to submit comments regarding this Interpretative Bulletin to the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 Seventh Street, SW, Washington, DC 20410-0500. Room 10276, Washington, DC 20410-0500.

Communications must refer to the above docket number and title. There are two methods for submitting public comments. All submissions must refer to the above docket number and title.

1. Submission of Comments by Mail. Comments may be submitted by mail to the Regulations Division, Office of General Counsel, Department of Housing and Urban Development, 451 7th Street, SW, Room 10276, Washington, DC 20410-0500.

2. Electronic Submission of Comments. Interested persons may submit comments electronically through the Federal eRulemaking Portal at www.regulations.gov. HUD strongly encourages commenters to submit comments electronically. Electronic submission of comments allows the commenter maximum time to prepare and submit a comment, ensures timely receipt by HUD, and enables HUD to make them immediately available to the public. Comments submitted electronically through the www.regulations.gov website can be viewed by other commenters and interested members of the public. Commenters should follow the instructions provided on that site to submit comments electronically.

Note: To receive consideration as public comments, comments must be submitted through one of the two methods specified above. Again, all submissions must refer to the docket number and title of the rule.

No Facsimile Comments. Facsimile (FAX) comments are not acceptable.

Public Inspection of Public Comments. All properly submitted comments and communications submitted to HUD will be available for public inspection and copying between 8 a.m. and 5 p.m. weekdays at the above address. Due to security measures at the HUD Headquarters building, an advance appointment to review the public comments must be scheduled by calling the Regulations Division at 202-708-3055 (this is not a toll-free number). Individuals with speech or hearing impairments may access this number through TTY by calling the Federal Information Relay Service at 800-877-8339. Copies of all comments submitted are available for inspection and downloading at www.regulations.gov.

FOR FURTHER INFORMATION CONTACT: Pamela Beck Danner, Administrator, Office of Manufactured Housing Programs, Office of Housing, Department of Housing and Urban Development,

451 Seventh Street, SW, Washington DC 20410; telephone (202) 708-6409 (this is not a toll free number). Persons with hearing or speech impairments may access this number via TTY by calling the toll free Federal Information Relay Service at1-800-877-8389.

SUPPLEMENTARY INFORMATION:

II. Background

The National Manufactured Housing Construction and Safety Standards Act of 1974 (42 U.S.C. 5401-5426) (the Act) as amended in 2000 authorizes the Department to establish Model Manufactured Home Installation Standards (Installation Standards) and establish an installation program to enforce those Installation Standards. Section 604(a)(3) of the Act as amended in 2000 also created the Manufactured Housing Consensus Committee (MHCC), in which section 604(b)(3) of the Act directs HUD to provide the consensus committee with an opportunity to review any HUD proposed Interpretative Bulletin and to provide written comments to the Department for a period of up to 120 days.

As a result of problems and inquiries related to the proper design, use, and installation use of frost protected foundation systems in areas subject to freezing climatic conditions, HUD commissioned a study and report to assess both design and installation practices of manufactured homes located in climates with seasonally frozen ground. HUD provided the consensus committee with a report of its findings on October 26, 2016, entitled "An Assessment of Design and Installation Practices For Manufactured Homes in Climates with Seasonally Frozen Ground" prepared by SEBA Professional Services, LLC (see Appendix), and announced it would form the basis for an Interpretative Bulletin to be issued on the subject.

The study and resulting report found some key factors needed for long-term and consistent success require special considerations that are often neglected, particularly for FFF designs and installations that rely on well-drained and non-frost susceptible soil conditions. These factors include appropriately engineered installation details, site investigation practices, fulfillment of responsibilities by all parties associated with manufactured home installation, and verification procedures to ensure that

important design conditions are actually being achieved in practice. Accordingly, this Interpretative Bulletin was developed for the purpose of clarifying requirements and providing practical guidance for the manufactured housing industry when designing or setting foundations for manufactured homes in locations subject to freezing climates with seasonal ground freezing.

HUD also indicated at the October 26th meeting of the MHCC, that it would consider any comments received from the consensus committee on the report and scheduled a teleconference on November 28, 2016, with the Regulatory Subcommittee of the MHCC and with the MHCC on December 12, 2016, to receive feedback and recommendations from the subcommittee and MHCC. As a result of those discussions, the Regulatory Subcommittee recommended that HUD draft an Interpretative Bulletin for the December 12, 2016, teleconference with the full MHCC, taking into consideration the comments from the Regulatory Subcommittee teleconference and comments from the MHCC. A large part of the discussion focused on what constitutes acceptable engineering practice. Some members of the subcommittee expressed concerns on whether the SEI/ASCE 32-01 Standard should exclusively define accepted engineering practice or if other engineering alternatives should be allowed. HUD has considered comments from the Regulatory Subcommittee and the MHCC and included them where it deemed appropriate in the text of the Interpretative Bulletin.

II. The Interpretative Bulletin.

This guidance is being issued in response to numerous requests, inquiries, and questions regarding how to comply with HUD's requirements for foundations in freezing climates, in accordance with 24 CFR § 3285.312(b) of the Model Manufactured Home Installation Standards, when footings do not extend below the frost depth at the site. Engineered foundations designs such as "frost-free foundations" (FFF) including monolithic slab systems (3282.321(b)(2) that rely on non-frost-suceptible soil conditions) and frost-protected shallow foundations (FPSF) including insulated foundations (3282.312(b)(3) that rely on insulation to prevent ground freezing) have great appeal and potential in freezing climates as a cost-effective means of installing manufactured homes on seasonally-frozen

ground. Understandably, their use has been promoted and increased in recent years as a means for reducing manufactured housing installation costs when compared to using conventional or proprietary foundation support systems in freezing climates. However, some key factors important to their long-term and consistent success require special considerations that are often neglected, particularly for FFF designs and installations. These factors include appropriately engineered installation details, site investigation practices, and verification procedures to ensure that important design conditions are actually being achieved in practice.

Important factors or design considerations in any frost-protected foundation include:

- clarity of technical requirements;
- definite criteria for determining soil frost susceptibility and soil moisture sub-surface drainage conditions; and
- guidance on water table depth to determine if the site is suitably well drained.

In addition, for foundations being placed on non-frost susceptible soil, it is also necessary to provide guidance on appropriate site-specific details such as the depth of non-frost-susceptible soil or fill layers required for the frost depth encountered at the site and the layout of sub-surface drainage, when sub-surface site conditions are not well drained. Clarification and accuracy of roles during the site testing and installation process also plays an important part in ensuring that frost-protected foundation designs meet the requirements of HUD's Manufactured Home Model Installation Standards.

The HUD commissioned study reviewed a selection of representative FFF designs in current use for consistency with the HUD code, the SEI/ASCE 32-01 (ASCE 32) standard titled *Design and Construction of Frost Protected Shallow Foundations,* and generally accepted engineering practice. These reviews and additional technical information (including terminology and technical references) are included in an engineering assessment report located in the Appendix. Thus, the Appendix provides the technical basis for the guidance and recommendations included herein.

A summary of key findings from the engineering assessment in the Appendix are as follows:

- One of the reviewed FFF designs demonstrated an appropriate application of the HUD code and ASCE 32 standard's technical requirements for frost protection of foundations. Thus, it is possible to develop a compliant FFF design in accordance with acceptable engineering practice or ASCE 32..
- All other reviewed FFF designs contained a number of flaws or non-conformances, including:
    - A lack of clarity of technical requirements in manufacturer installation instructions, details, and notes
    - Missing or vague criteria for identification and measurement of soil frost susceptibility
    - Missing or vague guidance for determining soil moisture, sub-surface drainage conditions, and water table depth in relation to determining if the site is "well drained" and suitable for an FFF installation.
    - Missing guidance to direct appropriate site specific adjustments of important installation details (e.g., depth of non-frost-susceptible soil or fill layers and lay-out of sub-surface drainage when required).
- A number of the FFF installation designs reviewed showed a pattern of confused roles and responsibilities, often assigning design decisions and site engineering evaluations to local regulatory officials who are typically neither qualified nor trained in foundation engineering or soil mechanics and engineering. Furthermore, they are not charged for such responsibilities because it may pose a conflict of interest (i.e., enforcers making design and construction decisions or judgments on matters they will be enforcing) and a potential conflict with state engineering practice laws (i.e., conducting engineering or design activities for which they are not licensed). Consequently, this practice can lead to an incorrect selection of the proper foundation and drainage system for the site.

Consequently, most of the reviewed FFF designs were found to be not in conformance with the HUD Code and the ASCE 32 reference standard for frost-protection of shallow foundations. In addition, one state's installation rules were reviewed and provisions related to FFF design and installations were found

to be similarly non-compliant. Thus, a need exists to clarify requirements and provide guidance for proper and compliant applications of FFF designs as an alternative to a conventional (frost depth) footing or a conventional FPSF design using insulation to protect against ground freezing per the ASCE 32 standard.

In view of the above, each organization involved in the process of foundation design, approval, and installation has responsibilities that must be met. These responsibilities are described in more detail in the Interpretative Bulletin.

- Manufacturers need to ensure their foundation designs fully comply with 24 Code of Federal Regulations (CFR) 3285, Model Manufactured Home Installation Standards (HUD Code) by use of acceptable engineering practice or applicable provisions of the SEI/ASCE 32-01 Standard, Design and Construction of Frost-Protected Shallow Foundations (ASCE 32). In general, acceptable engineering practice is defined in and is consistent with ASCE 32.
- Manufacturers also need to review and, as appropriate, delete or revise any installation instructions that rely exclusively on surface drainage to prevent the effects of frost heave and inform installers that prior to beginning the installation, a site-specific soil test is required to determine soil frost susceptibility, the water table level, and sub-surface drainage conditions.
- Retailers need to verify that the installations are performed only by licensed installers. Additionally, retailers need to notify HUD of any new manufactured home sales within or into a HUD-administered state by filing the required HUD forms.
- Design professionals and Design Approval Primary Inspection Agencies (DAPIAs) need to ensure that foundation designs comply with all aspects of the HUD Code as provided in 24 CFR 3285 as well as the ACSE 32 standard incorporated by reference. Designs that rely on surface drainage exclusively or do not specify the means of assessing frost susceptibility of soils and their sub-surface drainage characteristics need to be disapproved or revised to meet the provisions of

this Interpretative Bulletin. Additionally, design and installation responsibilities may not be delegated to local regulatory authorities.

- Installers should consider all sites in freezing climates as frost susceptible unless a soil test or other evidence is provided to prove the site is non-frost susceptible.
- Installers should never install a new home on a site that has conditions not covered in the manufacturer's installation instructions or the engineered foundation plan, and should bring the site conditions to the engineer or architect of record or any licensed architect or engineer for design consideration. Once the plan is updated to address site conditions and sealed, it is to be sent to the manufacturer and its DAPIA for approval as well as the Local Authority Having Jurisdiction (LAHJ), as applicable. Installers should not use any design that has them take on the responsibility of assessing frost susceptibility and sub-surface drainage conditions without proper soil analysis.
- Regulatory officials and inspectors need to reject installation plans that require them to take on any aspect of design responsibility. If a site is claimed to have soil that is non-frost susceptible and that is well-drained, soil tests or other evidence must be provided to the regulatory official and/or inspector.
- Installation plans including engineered foundation plans need to be available on-site during inspections. If these plans are not available, the home cannot pass inspection.
- In areas where no set local frost depth is determined, the depths corresponding with the Air Freezing Index (Figure 1) may be used.
- Installation rules in both states and local municipalities should be compared to the ASCE 32 standard and the HUD Code to ensure conformity.

In view of the above described concerns, this Interpretative Bulletin was developed for the purpose of clarifying requirements and providing practical guidance for the manufactured housing industry when designing or setting foundations for a manufactured home in locations subject to freezing

climates with seasonal ground freezing. This guidance is intended for first-time installations, not replacement installs when current foundations exist on site.

In summary, in order to resolve the identified problems and previously discussed concerns in this Preamble associated with frost protected shallow foundations designs and installation practices, it will be necessary for all responsible parties in the process to follow and adhere to the guidance in this Interpretative Bulletin. These concerns and issues involve designers, DAPIAs, manufacturers, installers, and regulatory authorities. The most important factor in reducing problems is a properly designed installation instruction giving appropriate direction and details for installers to implement and regulatory officials to verify and inspect. Because this over-arching concern is applicable to all methods of installation related to foundation frost-protection, specific recommendations and guidance for various design and installation options are provided in the Interpretative Bulletin.

INSTALLATION INTERPRETATIVE BULLETIN I-1-17

FOUNDATION REQUIREMENTS IN FREEZING CLIMATES

(insert definitions of FFF and FPSF)

(remove all references to ASCE 32 where possible)

This Interpretative Bulletin is being issued to provide guidance for all parties associated with designing and installing manufactured home foundation systems in areas subject to freezing climates in accordance with 24 CFR 3285.312(b) of HUD's Model Manufactured Home Installation Standards. A detailed review of several systems outlined in the report provided in the Appendix indicate that many Frost Free Foundation (FFF) designs and practices are not conforming to the requirements outlined in 24 CFR part 3285.312(b) , and as such are not in conformance with acceptable engineering practice or SEI/ASCE 32-01, *Design and Construction of Frost-Protected Shallow Foundations*. ~~In general, the basis for acceptable engineering practice is described and defined by consensus in the SEI/ASCE 32-01 Standard~~.

These non-conformances are largely due to lack of consistency in design approaches, insufficient or nonexistent instructions in Manufacturers Installation Instructions related to FFF designs, the lack of understanding of best practices for installation site analysis and foundation installation, and an overreliance on localities that often do not possess officials with specialized knowledge of FFF designs and requirements. These shortcomings can be improved by establishing consistent, well-documented best practices and supplemental guidelines for the use of FFF designs.

I. Recommended Practices and Procedures

The following recommendations, practices and procedures need to be followed by all parties involved in manufactured home installations in order to ensure that foundations installed in freezing climates are not subject to frost heave.

1. Recommendations for Manufacturers:

Manufacturers should require that design professionals who submit plans to them for approval, as required by 24 CFR Part 3285.2 (c) (1) (ii), develop foundation frost-protection installation methods

that comply with applicable provisions of the HUD's Model Manufactured Home Installation Standards, 24 CFR 3285~~0~~.312(b)(2) or (3). To ensure consistent and effective conformance, options with detailed guidance for complying designs are provided below and need to be followed. ~~These directions should also be incorporated into their Manufacturer Installation Instruction manual as required by 24 CFR Part 3285.2 (c)(2).~~

- Current Frost Free Foundation (FFF) installation instructions that rely exclusively on surface drainage as a means of foundation frost-protection ~~are to be~~ should be deleted from the manufacturer's installation instructions or immediately revised.
- Manufacturer installation instructions for FFF designs need to indicate that, prior to commencement of installation; a site-specific soil test is required in order to determine if the site soil is non-frost-susceptible and that the soil is "well-drained" with a water table depth consistently and sufficiently below the frost line.
- Manufacturer installation instructions should indicate that a ground water assessment needs to be done prior to commencement of installation.
- Manufacturer's installation instructions need to identify what steps need to be taken to ~~confirm~~ identify unusual soil conditions or frost susceptible soil as required by local jurisdictions or the installer ~~that the site soil is non-frost-susceptible~~. ~~If a soil test is not done to prove that the soil is non-frost susceptible, then the site must be assumed to be frost susceptible and must be developed accordingly, as such tests must be done prior to commencement of installation.~~
- To facilitate installations in locations subject to freezing, manufacturer instructions should have at least one example of an acceptable foundation system for frost and non-frost susceptible soil conditions for use in freezing climate locations. These designs must have a design professional's seal, and if not previously part of the manufacturer's instructions, be approved by the manufacturer and its Design Approval Primary Inspection Agency (DAPIA).

~~2. Recommendations for Retailers and Park Owners Operating as Retailers:~~

- ~~Retailers and park owners operating as retailers must provide buyers with a copy of the required consumer disclosure which indicates that new manufactured homes must be installed by licensed installers and need to verify and employ only installers that have the proper licenses and training to install manufactured homes within the state of each home's installation.~~

  ~~For new home installations in HUD-Administered Installation States, retailers and park owners acting as retailers must notify HUD of the certification and location of each home installation (HUD 305 form) and the completion of the installation certification (HUD 306 form) after each installation must be inspected by a qualified inspector (see 24 CFR § 3286.511(a)) and the acceptability of the installation verified on a HUD approved inspection form (HUD 309 form).~~

3. Recommendations for Design Professionals and DAPIAs:

   Foundation frost-protection methods used for installation designs must comply with HUD's Model Manufactured Home Installation Standards by use of acceptable engineering practice or the ASCE 32 standard. To ensure consistent and effective conformance, alternatives with detailed guidance for development of complying designs by manufacturers and for DAPIA review and approval are provided in the next section of this Interpretative Bulletin, *"Design Options, Compliance Checklists, and Installation Practices"*.

   - FFF installation designs that rely exclusively on surface drainage as a means of foundation frost-protection are not acceptable. Any existing installation designs of this type should be removed for use and DAPIA approval withdrawn.
   - FFF installation designs that do not specify appropriate means of assessing the frost-susceptibility of soils and their sub-surface drainage characteristics on a site-specific basis ~~need to~~ should be removed from use and the manufacturer's installation instructions and DAPIA approval withdrawn.

- ~~FFF installation designs that assign design responsibilities to local regulatory authorities, such as assessing site drainage, water table depth, or soil frost-susceptibility are also not acceptable and need to be disapproved.~~

4. Recommendations for Installers

When installing a new home on a site that has conditions not covered in the manufacturer's installation manual or an engineered foundation plan, the special site conditions should be brought to the attention of the engineer or architect of record. If there is no engineer or architect of record, a licensed engineer or licensed architect should be retained to evaluate the conditions and then design a plan to install the home. Once this plan is finalized and sealed, it must be sent to the manufacturer and its DAPIA for approval per 24 CFR Part 3285.2(c)(1)(ii). ~~The plan should also be submitted to the Local Authority Having Jurisdiction (LAHJ) for approval if applicable.~~

- Installers should never install manufactured homes using FFF installation designs that rely exclusively on surface drainage as a means of frost protection.
- Installers should never initiate a FFF installation where the instructions require them to take on design responsibility of assessing soil frost-susceptibility and sub-surface drainage conditions without proper soil testing and analysis. Instead, installers should verify that appropriate soil testing and site assessment for use of a FFF design has been completed prior to initiating an installation. Refer to the next section for guidance.
- Prior to installation of an engineered system that is not included in the manufacturer's installation instructions, installers need to verify that the installation plan is stamped by an engineer or architect of record as well as approved by the manufacturer and its DAPIA. ~~In addition, an LAHJ may require that the plans be reviewed and sealed by an engineer or architect that is licensed in the state where the installation is occurring.~~

- ~~Installers should only use foundation~~ Frost-Free Foundation plans that have been approved ~~by the manufacturer and its DAPIA on or after~~ prior to January 1, 2009, ~~the effective date of HUD's installation program~~ should be reviewed and reapproved by the manufacturer and DAPIA.

5. Recommendations for Local Regulatory Officials and Inspectors:

   Regulatory officials and inspectors should verify compliance with 3285.312. ~~reject installation plans that require them to execute a design responsibility such as assessing the subsurface drainage, water table depth, or frost susceptibility of soils on a given site. Freezing climate installation plans that rely exclusively on surface drainage as a means of frost protection should not be approved by local regulatory officials.~~

   - Where a site is claimed to have non-frost-susceptible and "well-drained" soils as a basis for setting foundation pads or footings above the design frost depth, evidence should be required including soils tests and site sub-surface drainage and groundwater investigation by a qualified soils laboratory or soils engineering professional or geologist. Single site soil samples may be taken in HUD administered states by the installer or by qualified soil engineering professionals with the soil tests done by a qualified soils engineering laboratory or soils engineering professional.
   - Regulatory officials should assure that the approved installation plans and the manufacturer installation instructions are on site and available during inspections. If approved installation plans are not available and on site during inspections, the home cannot pass inspection.
   - In areas where the local frost depth is unavailable, local regulatory officials should consider permitting design frost depths to be determined in accordance with Table 1. Design Frost Depth for Footings and Figure 1. U.S. Air Freezing Map Index.

II. DESIGN OPTIONS, CHECKLISTS AND INSTALLATION BEST PRACTICES

OPTION #1: Checklist for Conventional Footings in Freezing Climates

HUD Code, 24 CFR Part 3285.312(b)(1)

- Obtain the local-design frost depth for footings from either one of the following:
    - The local authority having jurisdiction (LAHJ),
    - Use Table 1 with the site's Air-Freezing Index (AFI) from Figure 1[1], or
    - Consult with a registered professional engineer, registered architect, or registered geologist.
- When using Table 1 and Figure 1 to determine frost depth for footings, the depth of interior pier footings complying with footnote (b) of Table 1 may be taken as one-half the depth required in Table 1 ~~with approval of the LAHJ~~.
- Based on the required frost depth for footings, dig the footing to the frost depth.
- Check the soil bearing at depth of the footing with a torque probe, pocket penetrometer or other suitable testing device.
- Based on the tested soil bearing value, properly size the footing according to the manufacturer's installation instructions or use Table to 24 CFR Part 3285.312 in the HUD Code.
- Place footing pads and construct piers or supports at locations specified in accordance with the manufacturer's installation instructions.
- Backfill as needed and grade the site as required for drainage:
    - Crown the finish grade at the centerline of the foundation
    - Slope grade a minimum of ½-inch per foot for a minimum distance of 10 feet away from the home perimeter.

[1] A list of AFI values for various states and counties can be found in the 2015 International Residential Code (IRC), Table R403.3(2), published by the International Code Council, Inc., and used as the model building code for most states.

TABLE 1. DESIGN FROST DEPTH FOR FOOTINGS[a]

AIR-FREEZING INDEX [See Figure 4]	MINIMUM DEPTH[b] (inches)
≤ 50	3
250	9
350	12
500	16
1000	24
1500	32
2000	40
2500	45
3000	52
3500	57
4000	62
4250	65

a. These design frost depths are intended to be used for protection of building foundations against frost heave and are not applicable to site or street utilities or other non-building applications.

b. These design frost depths for footings shall be permitted to be halved for footings interior to the building perimeter and located within an enclosed space. Where skirting is used to enclose the space, the skirting shall be insulated to a minimum R-5 (1000 to 2500 AFI) or R-10 (>2500 AFI) and vents shall be capable of ~~automatically~~ closing at outdoor temperatures below 40 deg F (which necessitates use of a ground vapor barrier).

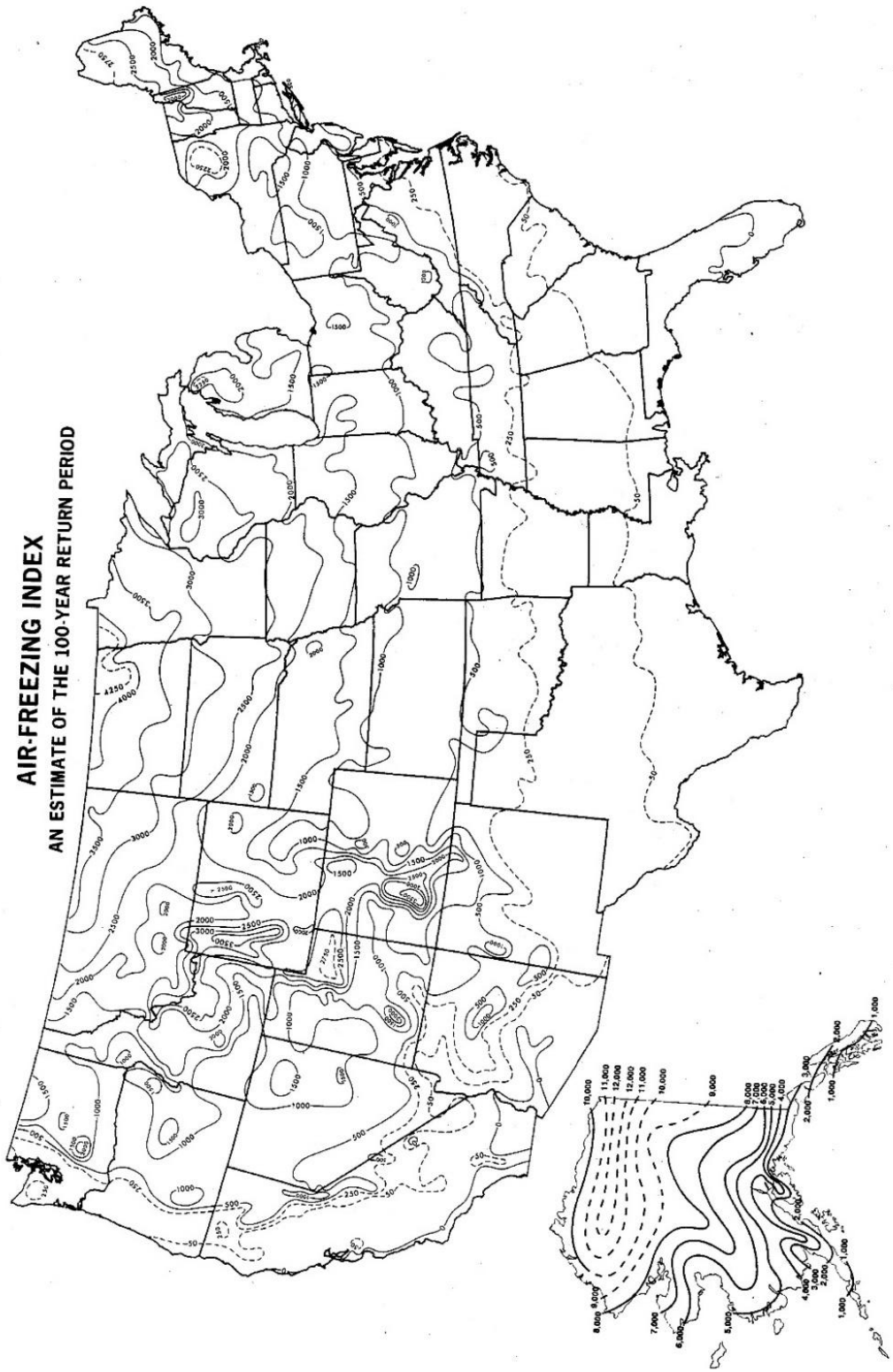

Figure 1. U.S. Air Freezing Index Map (based on Steurer, 1989 and Steurer and Crandell, 1995)

OPTION #2: Checklist for Monolithic Slab Systems in Freezing Climates ("Frost Free Footing")

HUD Code, 24CFR Part 3285.312(b)(2)

Pre-Installation Preparations:

- Before initiating installation, verify that the installation instructions are designed (sealed) by a registered professional engineer or registered architect, and approved by the manufacturer and its DAPIA. The LAHJ can require that the plans also be reviewed and sealed by an engineer or architect in the state where the installation is to occur.
- Verify that the LAHJ has accepted and approved the foundation and installation plan and all applicable permits are obtained. An approved installation design needs to comply with one of the following conformance options for the proposed installation design as permitted in HUD's Model Manufactured Home Installation Standards:
    - Complies with acceptable engineering practice or the ASCE 32 standard by use of non-frost-susceptible fills or existing soils (adequately tested and verified as defined in ASCE 32) and that such fills or soils extend to the local frost depth with provision for adequate surface drainage and, in addition, subgrade drainage where underlying soils are poorly drained and/or the water table is within two feet of the design frost depth.
    - Complies with acceptable engineering practice to prevent the effects of frost heave in a manner equivalent to the ASCE 32 standard. Equivalent alternative accepted engineering practices include: (1) the specification of an alternative criteria for testing the frost susceptibility of soils (e.g., different fines content allowances based on substantiating data), and (2) different frost depth determination based on thermal modeling of the climatic, soil, and foundation conditions

NOTE: Reliance solely on surface drainage to prevent frost heave without verification of non-frost-susceptible fill materials or existing non-frost susceptible soils to frost depth does not comply with the

SEI/ASCE 32 standard or HUD Code's allowance for "acceptable engineering practice to prevent the effects of frost heave."

- For designs that rely on well-drained sites and use of existing soils to frost depth that are non-frost susceptible, verify the following before initiating installation:
    - The non-frost-susceptible condition of existing soils above the frost depth (and below the base of the proposed slab) have been tested in accordance with ASTM D442 and determined to have a fines mass content of less than 6% passing a #200 sieve for the specific installation site or the development as a whole. A soils report should be provided by the engineer or soil lab of record for verification.
    - Alternatively, conduct such testing as follows:
        - Obtain a minimum of two soil samples per installation site (one at each end of the foundation area) and from any borrow materials on site used as fill. A materials report from a quarry may be used when material is supplied from a licensed quarry.
        - When conducting borings for soil samples, take a minimum of one pint (plastic bag full) of soil from depths of one foot and at the locally prescribed frost depth or as determined from Table 1, Design Frost Depth for Footings. Continue each boring to two feet below the locally-prescribed frost depth (as measured from the proposed finish grade) to determine if the water table is present.
        - Deliver or send the soil samples to a soils laboratory for particle size testing per ASTM D442.
        - If the soils laboratory report indicates greater than 6% fines by mass passing a #200 sieve then the soil at the site is frost susceptible and either footing to frost depth or one of the alternative foundation options (see Appendix) for frost susceptible soil conditions must be used.

- The water table condition of the site has been assessed by the engineer or architect of record and documentation provided of the water table being at least two feet below the local frost depth. Alternatively, make this determination using soil borings as described above.
- If the water table is higher than two feet below the local frost depth, a network of drainage pipes sloped to drain to daylight must be placed at the base of non-frost-susceptible fill (e.g., clean gravel or crush rock) placed to a depth equal to the local frost depth.
- Alternatively, a site specific foundation design can be prepared and sealed by a professional engineer or registered architect or geologist and approvedby the manufacturer and its DAPIA.
- Save documentation of all of the above and provide to the LAHJ for verification.

- For designs that rely on well-drained sites and use of fill materials to frost depth that are non-frost susceptible, verify the following before initiating installation:
  - The slab base and foundation fill materials are specified by the engineer or architect of record as non-frost susceptible such as clean gravel or crushed rock or other suitable material with no more than 6% fines by mass passing a #200 sieve per ASTM D442 test method. Non-frost susceptible subgrade materials are to be filled from the frost depth to the slab base for the entire extent of the slab plus any over dig.
  - The water table condition of the site has been assessed by the engineer or architect of record and documentation provided of the water table being at least two feet below the local frost depth. Alternatively, make this determination using soil borings as described above.
    - If the water table is higher than two feet below the local frost depth, a network of drainage pipe sloped to drain to daylight must be placed at the

base of non-frost-susceptible fill (e.g., clean gravel or crush rock) placed to a depth equal to the local frost depth.

- Save documentation of all of the above and provide to the LAHJ for verification.

Installation Phase:

- Excavate slab area to frost depth or only to the bottom of the slab's non-frost-susceptible base layer if existing soils have been determined to be non-frost susceptible down to frost depth during the pre-installation preparation phase (see above).
- Place foundation drains sloped to drain to daylight at the bottom of the non-frost-susceptible base or fill material layer.
- Place the non-frost-susceptible fill and base materials, compacting as required by the manufacturer's installation instructions and/or the engineer or architect of record. Do not initiate fill placement where compaction requirements and methods are not specified. Obtain compaction requirements, as needed, from the engineer or architect of record. The minimum requirement is 90% compaction per 24 CFR Part 3285.201 although the engineer or architect of record or LAHJ may require a higher compaction level based on the fill material used.
- Construct the reinforced monolithic slab in accordance with the manufacturer's installation instructions or according to the manufacturer and DAPIA approved plans.
- Backfill as needed and grade the site as required for drainage:
  - Slope grade a minimum of ½-inch per foot for a minimum distance of 10 feet away from the home perimeter.

NOTE: The above procedures also apply to designs where a monolithic slab is not used and pier footing pads are placed directly on non-frost-susceptible fill materials (e.g., clean gravel or crushed rock).

OPTION #3: Checklist for Frost Protected Shallow Foundations (Insulated Foundations).

HUD Code, 24 CFR Part 3285.312(b)(3)

Pre-Installation Preparations:

- Before initiating installation, verify that the installation instructions are designed (sealed) and certified by a registered professional engineer or registered architect, approved by the manufacturer and its DAPIA.
- Also, verify that the instructions include an approved installation design complying with one of the following basis for the proposed installation design, as permitted in the HUD Code:
    - Complies with acceptable engineering practice or the SEI/ASCE 32-01 standard by use of properly-specified insulation materials and sized in accordance with the local climate and located around the perimeter of the foundation (including insulated skirting with vents capable of closing at temperatures below 40 degrees) or the entire foundation pad is insulated where there is no skirting or the skirting is un-insulated or the skirting has non-closing vents. Non-frost-susceptible base materials are used at a minimum thickness required by acceptable engineering practice or SEI/ASCE 32, and insulation materials are protected against damage in accordance with acceptable engineering practice or SEI/ASCE 32.
    - Complies with acceptable engineering practice to prevent the effects of frost heave in a manner equivalent to the insulation provisions in the SEI/ASCE 32 standard. Equivalent alternative accepted engineering practices include: (1) the specification of an alternative insulation amounts based on dynamic thermal modeling of the climatic, soil, and foundation conditions specific to the site, and (2) alternative insulation materials or types with data substantiating long-term R-values in below-grade applications.

NOTE: Designs which place insulation materials in a discontinuous fashion, such that exposed slab edges or other types of thermal bridging occurs, do not meet the requirements of the SEI/ASCE 32 standard or

the HUD Code provisions that allow the use of "acceptable engineering practice to prevent the effects of frost heave."

- Obtain foundation insulation materials as specified in the installation instruction and verify the correct type is received. Commonly accepted insulation materials include Extruded Polystyrene (XPS) and Expanded Polystyrene (EPS) of various "types" in accordance with ASTM C578 and ASCE 32 standards.
- Insulation material conformance with the specified type should be verified by product labels or a certification from the insulation manufacturer. Materials commonly stocked in supply stores may not be the correct "type" even though it may be the correct "kind" (e.g., XPS or EPS).

NOTE: There is no need to determine the frost susceptibility of underlying soils to frost depth in the insulated foundation design approach when the provisions of ASCE 32 are satisfied.

Installation Phase:

- Excavate the foundation area to the correct shallow foundation depth as indicated in the manufacturer's installation instructions or by the engineer or architect of record (generally the foundation depth need not exceed 12" to 16" below finish grade).
- Place specified non-frost-susceptible base material and provide drainage pipes around the perimeter, at a minimum of 4 inches (within the base material layer) as required by the installation instructions. Pipes need to be run to day-light or have a mechanical means of draining the water (see detail in Appendix) .
- Sequence the foundation slab or pad construction and insulation placement in accordance with the design approach indicated on the manufacturer's installation instructions. Where sub-slab insulation is required, this will need to be placed before slab construction. Perimeter insulation may be placed after slab construction (see detail in Appendix).
- After construction of the slab and supports and placement of the home, construct the insulated skirting with automatically closing vents as required by the manufacturer's installation

instructions. Where the foundation slab is entirely insulated with horizontal below ground insulation (the design does not rely on perimeter insulation only), no skirting is required. (See detail in Appendix).

- Place wing insulation (extending outward horizontally underground from the perimeter of the foundation) as required by the installation instructions. Depending on the design approach and climate severity, wing insulation may or may not be required.
- Provide protection of any exposed exterior insulation or within 10 inches of the finish grade surface. (see detail in Appendix)
- Backfill as needed and grade the site as required for drainage:
    - Slope grade a minimum of ½-inch per foot for a minimum distance of 10 feet away from the home perimeter.

This Interpretative Bulletin is issued pursuant to 24 CFR 3285.2 and 3285.312(b) of HUD's Model Manufactured Home Installation Standards.

Date: _____

_____
Ed Golding
Principal Deputy Assistant Secretary for Housing

APPENDIX

MANUFACTURED HOMES IN FREEZING CLIMATES

An Assessment of Design and Installation Practices

For Manufactured Homes in Climates with Seasonally Frozen Ground

Prepared by: SEBA Professional Services, LLC

For

The U.S. Department of Housing and Urban Development

Office of Manufactured Housing Programs

Under Contract #DUIOOH-14-C-04