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To: Members of the Ohio Manufactured Homes Commission

RE: Comments on Revisions to 4781 Related to ABS Pads

Criterium-Cincinnati Engineers attended the Commission hearing on April 20, 2011 where revisions to 4781 were discussed. At this meeting, we commented on the changes proposed for the use of ABS pads in the installation of manufactured homes. This letter is a follow-up to our comments made at the hearing to help clarify our position on the use of ABS pads.

The proposed rules allow ABS pads to be used. We believe that ABS pads, as used for manufactured homes, are a form of footing system rather than a foundation system. To that end, our comments in this letter address use of ABS pads as footings within the manufactured home structural system.

We have no doubt that ABS pads can be used as an alternative footing system when used under certain conditions. Therein is our concern. We question whether proper ABS pad use conditions, as well as restrictive use conditions, are being adequately explained. Our experience tells us that some installers will be all too willing to substitute ABS pads for conventional concrete footings without consideration of whether installation conditions are right for the pads simply because they are a less expensive alternative. Just as likely, some inspectors will be all too willing to allow ABS pads to be used under conditions for which they are not designed due to ignorance about those design conditions.

The revised rules state that ABS pads can be used "in accordance with manufacturer installation instructions and/or specification sheet of the specific ABS pad being used." In preparation for the hearing, we reviewed the installation instructions for the top three selling ABS pads, Polyvulc, Oliver and Tie-Down Systems. These same instructions were distributed at the hearing as representatives of these manufacturers spoke. As engineers, we believe that the installation instructions we reviewed are not adequate to fully explain the conditions and restrictions on the use of the ABS pads. We also note one example where Oliver's manufacturer representative provided information of frost-free foundation systems as a condition where ABS pads could be used; on the contrary, Oliver's instructions only mention installing the pads at frost depth.

When installation instructions are not adequate, a second recourse for information is usually publicly available in hard and electronic information sources and educational resources. Conventional concrete footing systems have a history of documented use, design and research that goes back over 100 years. A great deal of information on these footings is readily available in both hard and electronic copy. Further, many educational resources in the forms of seminars, webinars and classes are available where installers and inspectors could learn more about these footing systems. A great body of research has also been published in peer-reviewed journals that provide credibility to the research.

Based on our searches, we cannot say that ABS pads have nearly as extensive a history, information sources and supportive research as concrete footings. As the Tie-Down Engineering representative stated, ABS pads have only been around for about 17 years compared to concrete footings. We could also only find a couple publicly available research publications on ABS pads; but none of the research we found was in peer-reviewed journals. As far as educational resources, we only found mainly repetitions of the manufacturer's installation instructions and the handouts provided by the manufacturers. We did not find any educational resources on-line and those mentioned by the manufactured representatives in discussions were regional, such as those offered in a few states for their installers and inspectors.

We further note that the manufacturer representatives supported the used of ABS pads based on the fact that Clayton Homes allowed them in its installations. The documentation from Clayton that supported use of ABS pads was research performed by Mr. Paul Hayman, P.E. and funded apparently by Systems Building Research Alliance (SBRA). We note that this research was specifically for what SBRA called a Frost-Free Foundation. This foundation design requires control of water under the home to prevent frost heave under the manufactured home. Therefore, a restriction on the use of ABS pads is implied in this research that water control under and around the home is necessary. Another finding that we noted about this research is that Mr. Hayman is a licensed engineer in Ohio who resides in North Carolina. We do not know whether he has ever designed foundation systems in Ohio. We also could not determine whether his Frost-Free Foundation was tested in Ohio. In the research provided, only Kentucky and West Virginia are particularly discussed. If we had more time to dig into this research, we likely would have found other important notable points.

Other research that included ABS pads that was particularly mentioned at the hearing is that by the Ohio Manufactured Homes Association in apparent cooperation with Ms. Diane Roller at Ohio Department of Health. This research was never published publicly that we could find, nor was it peer-reviewed. This research was conducted specifically in several locations in Ohio and also included other types of footing systems besides ABS pads. We are trying to obtain this research to determine the conditions under which the testing was performed; but time limitation on hearing comments does not permit our providing opinion from this research.

Another important issue raised at the hearing was the method for testing soil penetration, which is related to the soil bearing capacity. Soil bearing capacity is particularly important in the selection of the proper ABS pad. We provided some discussion about the fact that the standard method used by geotechnical engineers is the Standard Penetration Test, in which a standard weight is dropped a standard distance for three 6-inch increments (total of 18 inches). The number of weight drops (blows) for the weight to penetrate each 6-inch increment is related to the soil density or bearing capacity.

On the other hand, the method chosen by HUD model standard and currently supposed to be used by Ohio's inspectors and installers is the pocket penetrometer. All penetrometers have accuracy issues. Among these are: moisture content of the soil, measurement site selection, depth of measurement, read and test method errors, etc. The major issues in Ohio with using the penetrometer is lack of standardized test methods and little training in use of the penetrometer and interpretation of measurement results.

Without accurate readings of soil bearing capacity, we believe that the effect on ABS pads would be more critical than on the current concrete footings because weight bearing on the latter is spread over greater area than for ABS pads. With ABS pads, the weight on the pad is borne only on that pad. Even if individual concrete footings are used, they are required to go to frost depth, which means that they have much greater mass to carry the weight and they go deeper into the soil where assumedly the soil is denser to due compaction.

In fact, soil compaction is another critical issue with the use of ABS pads. When conventional footings are installed, the soil under the footing is required to be compacted. The ABS pad instructions state that the soil can be either compacted or "undisturbed". Nowhere is a definition of undisturbed provided. Essentially, virtually any soil in Ohio has been disturbed at one time. If the home is located on former farm property, the soil has a good chance of having been disturbed a lot. Supposedly, measurement of the soil bearing capacity should determine if the soil is adequate; but Oliver, for example, states that if the soil is not measured, an assumed soil bearing capacity can be assumed.

We close our comments by restating that ABS pads may be usable in Ohio as footings under certain conditions. In light of the numerous issues surrounding the use of and unknowns about the pads, we are recommending the rules state the following:

- ABS pads should be restricted to frost-proof foundation systems or other proven foundations systems as approved by the OMHC or be installed at or below frost grade, unless a licensed professional engineer approves the foundation system using the pads.
- A proper drainage system and slope around the home, as required for conventional footings systems, be installed.
- Installers need to provide calculations that show the weight that each pad will bear.

- Installers need to provide soil bearing capacity test data.
- Installers need to provide manufacturer's installation instructions that include installation requirements and tables showing pad selection versus pad bearing capacity.
- All inspectors and installers must take a standard course on selection, use, conditions and restrictions of use of ABS pads to assure that everyone is on the same level of understanding.
- Inspectors should have the option of opting out of the requirement to inspect ABS pad installations. That is, if inspectors do not agree with or support the use of the pads, they can opt out of inspecting them. For engineers, inspecting them could be a liability issue should the pads fail especially given the relatively sparse available research, in particular peer-reviewed research, supporting the pad's use.

Acceptance of ABS pad use in Ohio particularly shows that the OMHC needs to develop standard operating procedures for soil bearing capacity testing. Such an SOP should specify at the least instrumentation, soil moisture content, depth of measurement, and sample location selection. We also HIGHLY recommend that specific training be required for making bearing capacity testing. The current level of training is not adequate.

We would have liked to have more time to comment on the details that came about at the hearing because we would have liked such time to more thoroughly review the documentation supplied at the hearing as well as other documents cited by those documents. If we had more time, we believe that we could have provided additional input into this critical issue, and we believe it is a critical issue because acceptance of ABS pads will likely open a flood gate of their use in the state. Our hope is that the OMHC critically reviews all input into its decision and considers the big picture as far as shoring up other current deficiencies in the program, such as the lack of training in specific areas.

We appreciate this opportunity to provide our input on this important issue and wish the OMHC well in its decision process.

Sincerely,

Criterium-Cincinnati Engineers

Matt Klein, P.E.
President