

Unearth the No. 1 Cause of Structural Failures

by Walt Keaveny, Risk Manager, MS, PE, PG

What is the leading cause of residential structural failures? Did you guess expansive soils? Soft organic soils? Improper drainage? How about inadequate engineering design? Low-strength concrete? Poor framing practices? Nope, none of those. What may surprise you is that the leading cause of structural failures is avoidable. Warnings to avoid this significant construction liability are found in project specifications, common codes, and industry standards. What then is this real hazard that is misunderstood and overlooked? Improperly compacted structural fill material.

2-10 Home Buyers Warranty (2-10 HBW) is the national leader in new home structural warranties, who has nearly 40 years of forensic analytics and investigations that concludes fill material is the leading cause of residential structural failures. These failures can occur anywhere that existing or new fill material is used to support a foundation. Since 80% of all structural failures are due to soil movement beneath the foundation, proper use of structural fill is every bit as critical as determining building location, selecting trade partners, and a sellable home design.

Structural fill material must be of sufficient quality and density, or else it can consolidate, causing excessive

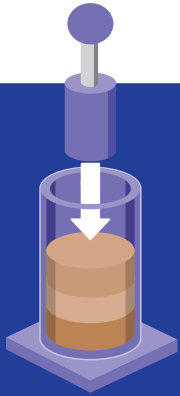
settlement. This may result in damage to foundations, framing, and interior finishes. Structural distress resulting from improper fill is likely to begin soon after construction is completed. Due to common over-irrigation of the new landscaping and concentrated roof drainage, the fill quickly consolidates under the new foundation load and it is saturated and further weakened. Less than a one foot thickness of improper fill may cause serious distress. The damage caused by fill is typically more severe and costly to repair than other causes of structural failures. This is because the entire foundation is commonly underlain by fill. The average cost to investigate and repair a qualifying fill claim is about \$50,000. This does not include the cost of the home builder's reputation for quality construction practices.

To avoid structural failures caused by fill material, builders should confirm that prospective land to be developed with "existing" fill was properly compacted and tested. Developers typically sell land "as-is", leaving the home builder liable for any existing fill. "New" structural fill to be placed by the home builder should be properly compacted and tested to verify the density. This is an industry standard practice, and a requirement of the local, state, and International Building Codes (IBC), the building department, plans and specifications, geotechnical engineer, and Department of Housing and Urban Development (HUD).

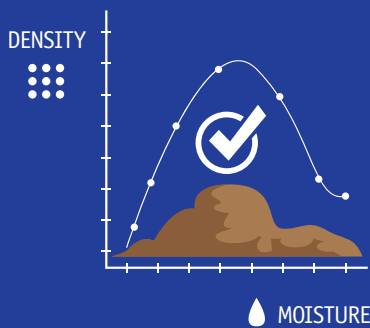
HUD's requirements are specified in their Data Sheet 79G Land Development with Controlled Earthwork which states, "For any development in which buildings



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are to be placed on graded areas, all earthwork shall be designed, engineered, and constructed in such a manner that there will be no adverse differential movement which may cause damage to the structure..." HUD further specifies that, "Field density tests shall be made by the Soils Engineer..." Structural fill material should be placed in relatively thin lifts at, or near, optimum moisture content. Just the right amount of moisture lubricates the fill which allows it to achieve optimum density. Optimum moisture and density for a particular fill are determined using a Proctor test in a soils laboratory. Each lift should be properly compacted. It is important to note that the weight of the bull dozer or front-end loader used to place the fill is typically not sufficient to compact the fill. Dozers and loaders spread their weight over wide tracks, or tires, to avoid getting stuck, and are not designed to impart sufficient compactive effort like a true soil compactor. Density testing, conducted by a representative of the geotechnical engineer, should be used to confirm and document if proper compaction has been achieved to protect the home builder's liability.

Home builders can rely on the expertise of a geotechnical engineer, as needed, in order to identify existing undocumented fill, specify proper cut and fill methods, specify fill quality and compaction criteria, identify onsite and offsite fill sources, and test for proper fill density. The engineer can also assist the home builder to avoid other common problems associated with improperly compacted fill, such as slope failures, retaining wall failures, and drainage problems.

In summary, diligent practices regarding structural fill material include:

1. Check prospective land for existing undocumented fill
2. Check fill quality and use proper fill placement methods
3. Use the proper equipment for fill compaction
4. Test and document fill density
5. Utilize a geotechnical engineer as needed

Structural failures caused by fill material are avoidable. Proper fill placement will help protect a home builder's liability and hard-earned reputation.



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Mr. Keaveny is the Risk Manager and Principal Engineer for the leading new home warranty company, 2-10 Home Buyers Warranty. He earned a Bachelor's degree in Geological Engineering and a Masters in Geotechnical Engineering. He is licensed as both a Professional Engineer and a Professional Geoscientist, and has over 30 years of diverse engineering experience. He serves on the Construction Performance Standards Committee for the Texas Association of Builders, and is an invited speaker and author. Mr. Keaveny's work on the subject of structural claims has been published in major newspapers and has drawn international interest.



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