United States
Environmental Protection
Agency
Research and Development

Air and Energy Engineering
Research Laboratory
Research Triangle Park, NC 27711
EPA/600/SR-93/091 July 1993

EPA

Project Summary

Recommended Foundation Barrier Construction Standard of the Florida Radon Research Program

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The report gives results of a study to determine the causes of cracking in slab-on-grade construction, particularly for single-family residential structures in Florida, and to recommend a foundation barrier construction standard to minimize such cracking.

This Project Summary was developed by EPA's Air and Energy Research Laboratory, Research Triangle Park, NC, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Almost all of the radon that moves from the ground into buildings is carried along as part of a flow of soil gas that enters at every opening in the foundation that contacts or communicates to the soil. Soil gas will flow into the structure if there are openings and cracks and the pressure differential is favorable. Foundation openings are of two types: deliberate openings serving a purpose, such as control joints; and unintended openings such as cracks in slabs-on-grade.

Radon-resistant housing requires that these two types of openings be controlled and, if possible, eliminated. Quite different strategies are needed to control these different types of openings. In principle, as the deliberate openings are designed into the building, they can be either eliminated by a change in design, or closed by the application of sealants during the building process. Unintended openings, such as unplanned cracks, are common in many concrete slab-on-grade structures. Since these cracks are normally not a structural concern, the causes for their development and design options to minimize their extent have not been fully studied.

The purpose of this study is to determine the causes of cracking in slab-on-grade construction, particularly for single-family residential structures in Florida.

The objective of this study is to identify design and construction procedures that will lead to crack-free slabs in Florida. Crack-free or limited-crack slabs will contribute to the overall goal of radon resistant foundations for residential buildings in Florida. The objective of radon resistant construction is to produce a foundation free of openings connected to the soil. The radon concentration in soil gas is typically 1,000 times higher than the 1-2 pCi/L concentration desired in buildings. If the soil gas flow-rate into a building is less than 1/1,000 of the ventilation air flow-rate, then the building will be radon resistant. The natural pressure differential between building and soil is a few pascals, which implies that the effective leakage area of cracks and openings in a typical house slab must be less than that of an unobstructed 1/4-in. (0.6 cm) hole. In practice the effective leakage area of cracks is much less than the apparent size, but it is clear that only a small amount of cracking will severely reduce the effectiveness of a concrete slab as a soil gas and radon barrier.

Many factors affecting drying shrinkage are related to concrete materials and to construction practice in regard to slab construction.

To identify the causes of cracking and recommend construction methods for their control, the following methodology was adopted:

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1. Literature search to identify variables that influence and contribute to crack development and their importance.
2. Batch plant monitoring in Florida, consisting of visiting batch plants, collecting concrete mix design data, and interviewing batch plant operators.
3. Construction practice monitoring in Florida, consisting of monitoring of slab construction and interviewing contractors relating to drying shrinkage.
4. Crack development monitoring of slabs-on-grade in Florida.
5. Evaluation of field data, to identify which major variables that influence, in general, cracks in slabs-on-grade also affect cracking in Florida's residential houses.
6. Recommendation of construction methods to control cracking in slabs-on-grade in Florida.

*U.S. Government Printing Office: 1993 — 750-071/80028

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The complete report, entitled "Recommended Foundation Barrier Construction Standard of the Florida Radon Research Program" (Order No. PB93-199388/AS; Cost: $17.50, subject to change) will be available only from:

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
Telephone: 703-487-4650

The EPA Project Officer can be contacted at:

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