NATIONAL BUREAU OF STANDARDS REPORT

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REPORT ON FIRE INVESTIGATION
SCHOLZ HOMES
WESTVIEW PROJECT
WESTVIEW, OHIO

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

NATIONAL BUREAU OF STANDARDS

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The Bureau comprises the Institute for Basic Standards, the Institute for Materials Research, the Institute for Applied Technology, the Center for Radiation Research, the Center for Computer Sciences and Technology, and the Office for Information Programs.

THE INSTITUTE FOR BASIC STANDARDS provides the central basis within the United States of a complete and consistent system of physical measurement; coordinates that system with measurement systems of other nations; and furnishes essential services leading to accurate and uniform physical measurements throughout the Nation's scientific community, industry, and commerce. The Institute consists of an Office of Measurement Services and the following technical divisions:

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THE OFFICE FOR INFORMATION PROGRAMS promotes optimum dissemination and accessibility of scientific information generated within NBS and other agencies of the Federal government; promotes the development of the National Standard Reference Data System and a system of information analysis centers dealing with the broader aspects of the National Measurement System, and provides appropriate services to ensure that the NBS staff has optimum accessibility to the scientific information of the world. The Office consists of the following organizational units:

Office of Standard Reference Data—Clearinghouse for Federal Scientific and Technical Information [3]—Office of Technical Information and Publications—Library—Office of Public Information—Office of International Relations.

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[1] Headquarters and Laboratories at Gaithersburg, Maryland, unless otherwise noted; mailing address Washington, D.C. 20234.
[2] Located at Boulder, Colorado 80302.
[3] Located at 5285 Port Royal Road, Springfield, Virginia 22151.

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by

Richard G. Bright

Prepared for:

Department of Housing and Urban Development

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1.0 PURPOSE OF INVESTIGATION

On September 4, 1970, a fire occurred in a Scholz Homes apartment project under erection in the village of Westview, Ohio. Before this fire had been extinguished, eight apartments on the second floor of a two-floor apartment building had been destroyed. The loss is estimated at $160,000.

Because of the similarity of these Scholz Homes to their OPERATION BREAKTHROUGH prototypes, it was decided that a representative of the National Bureau of Standards should visit the site and conduct a fire investigation. This is the report of that investigation. The investigation was conducted on September 11, 1970.

2.0 DESCRIPTION OF THE PROPERTY

The Scholz's Westview Project is a group of two-story (multifamily low-rise) apartment buildings being erected in the village of Westview adjacent to the town of Berea, Ohio. The 12-foot-wide, volumetric modular units are constructed at the plant in Grand Rapids, Michigan. From here the units are towed, as a self-supporting trailer, by a tractor over the Michigan and Ohio roads to the Westview site. At the site a large crane hoists the units onto prepared concrete block foundations. The second floor units are then hoisted onto the first floor units. The second floor units carry the roofs which are either pop-up type panels (on the newer units) or a fixed, low-profile roof on the older units (as on the unit involved in the fire). For the Westview project, a 6-inch, hollow concrete block firewall is field erected and runs transversely through the center of the apartment building.

The apartment building where the fire occurred consists of eight apartments on the first floor and eight apartments on the second floor. The eight apartments on each floor are split so that there are four on one side and four on the other. In other words, they are back-to-back down the length of the building. Thus, four apartments share a party wall

longitudinally with the other four apartments on a floor. Each of four apartments, two up and two down, are served by a common main entrance, resulting in four main entrances, two on one side of the building and two on the other. A unique feature of these apartments is that there is a passage from one main entrance to the one directly behind. On the first floor, this passage is through a small utility room used as a laundry. On the second floor, the passage is through a doorway. On both the first and second floors this cross passageway is equipped with Class B (one-hour), composite, wood-faced fire doors, thereby maintaining the fire cut-off between one side of the building and the other.

These particular Scholz Homes also have installed an automatic and manual fire alarm system in the common lobbies. Fire (heat) detectors are strategically placed at the top of stairs while manual fire alarm pull boxes and large gongs are placed on the first floor. For tenant fire fighting, a 10-lb. all-purpose, dry chemical fire extinguisher is installed in a cabinet in the lobbies on the first floor.

3.0 STORY OF THE FIRE

The erection of the fire building had been completed. Carpenters were installing the door casings for the doorways between modules. They were also in the process of placing the outside trim and installing the roof covering. The plumbers were sweat-soldering the copper waste lines and copper water lines between the first and second floor units. Portions of the wall panels are omitted during construction at the factory to permit these plumbing connections to be made in the field.

Sometime around 2:30 p.m., the plumbers, who were working in an end unit's bathroom, discovered a fire in the second floor bathroom walls. They attempted to extinguish the fire using the dry chemical extinguishers. After a passage of time, perhaps five or ten minutes, they notified the project supervisor of the fire. He came with additional fire extinguishers but was also unsuccessful in containing the fire which by now had penetrated into the attic. A telephone call was made to the volunteer fire department in the village of Westview for assistance. This call was received by the fire department at 2:59 p.m. The fire department responded, arriving at 3:20 p.m. It was reported that they weren't able to apply water onto the fire until 3:40 p.m. By this time over an hour had elapsed, give or take ten minutes, since the start of the fire. By now, the fire had spread throughout the half of the second floor up to the firewall. Some time prior to the arrival of the fire department, the fire passed around (or perhaps over) the firewall and the other half of the second floor was, also, well involved in fire. By the time the fire was extinguished, it had consumed most of the second story down to the flooring. In some locations, the fire had burned through the flooring and had begun to attack the top of the first floor module.

4.0 CAUSE OF THE FIRE

The only two ignitions sources present in the building, and therefore suspect as possible fire causes, were smoking and the plumbers' propane-fueled torches. The electricity had not been turned on and was therefore ruled out as a possible cause. It was assumed by the project supervisor that the fire originated from a plumber's torch. This is a reasonable assumption as the fire was first discovered in a bathroom wall where the plumbers had been working. The project supervisor was of the opinion that the fire had started in the second floor bathroom wall as this is the location where he first observed the fire. It appears, however, that the fire started in the first floor bathroom wall and the reasons for this opinion will be detailed in a moment. But first a description of this wall is necessary.

The bathroom wall is a common wall between the two-bedroom apartments located back-to-back at each end (and on each floor) of the building. The wall is, in effect, a pipe chase in that there are two independent rows of wood studs separating the two apartments with the copper waste and water piping installed between the stud rows. A fibrous glass insulation batting is fastened between the studs on one wall only - the opposite wall from the opening left for the completion of the plumbing connections. This insulation batting is contained within a kraft paper envelope.

A propane torch is usually used by the plumbers to sweat solder the joints in copper piping. It is relatively easy to set fire to nearby combustible materials when soldering the joints and in this case would be even easier as the kraft paper on the fibrous glass insulation batting is only two inches or so away from the copper piping. Usually, the plumbers use some form of heat insulating shield such as a piece of gypsum board or cement-asbestos board to protect combustibles in the vicinity of the work. In examining the bathroom on the first floor directly below the bathroom where the fire was first observed, a piece of sheet metal was found lodged behind a joint in the waste piping going to the second floor bathroom above. Upon removal of the piece of sheet metal it was found that the paper directly behind the sheet metal had been completely consumed by fire. It appeared that the plumber had soldered the waste pipe joint and had used the sheet metal for protection for the paper directly behind. However, the sheet metal only conducted the heat through to the kraft paper, setting it afire while, at the same time hiding the fire from the plumber. As the joint is just below the ceiling (and the bottom of the second floor wall), the fire could have passed unnoticed into the second floor wall traveling on the kraft paper.

5.0 COMPARISON OF OPERATION BREAKTHROUGH GUIDE CRITERIA (VOLUME II), AND THE WESTVIEW FIRE

5.1 Ignition

Housing with combustible structural elements is permissible under BREAKTHROUGH Guide Criteria provided the structure has less than 10,000 square feet of undivided area per floor. The total floor area of the fire building was less than this and was further divided by the concrete block firewall. This type of housing is more vulnerable to small ignition sources while under construction than after completion as the combustible structural members are exposed during construction.

5.2 Spread of Fire

If the ignition should occur, it is also likely that the spread of fire will be faster during the construction phase than after the building has been completed for the same reasons given above. To limit the vertical spread of fire, the Guide Criteria requires that interior partitions should not provide paths for smoke and fire to travel from one floor to the next.

The Guide Criteria calls for 3/4 hour, fire-resistant draft stops in the roof ceiling assembly at each dwelling separation. In the fire building such separations were not provided. Had they been, the speed of the spread of fire through the attic spaces would have been reduced. This spread was the major cause of the fire destroying the second floor.

5.3 Fire Endurance

This criterion was not a factor in this fire as the fire started within a partition or literally, within the fire-resistant protection.

5.4 Flame Spread

This criterion was not a factor in this fire. Had the building been over 10,000 square feet in undivided floor area, then the flame spread of the insulation within the bathroom wall would have been limited to 75, but see further comments on this factor in 6.0 below.

5.5 Smoke Generation

This criterion was not a factor.

5.6 Potential Heat

This criterion was not a factor.

5.7 FIREWALL

The Guide Criteria does not require a firewall for a building the size of the fire building at Westview. However, it is interesting to compare the construction and performance of the existing firewall in the fire building with the Guide Criteria's requirements for a firewall.

The firewall was a six-inch, hollow concrete block wall. The wall was constructed flush with the exterior plywood surface of both the side walls and the roof. It should be noted that the firewall was neither parapeted or fendered. (Parapeting is the extension of the wall above the finished roof surface and fendering is extension of the wall past the sides of the building, either perpendicular or parallel to the side face). The firewall was designed so that the roofing materials and the side wall finishing materials would pass over the firewall and hide the wall. As these materials are combustible, it could be anticipated that a fire originating on one side of the wall could pass over or around the firewall on the train of combustible materials if fire fighting was not begun promptly. Essentially, this is what happened at Westview.

The Guide Criteria takes cognizance of this problem by requiring that the firewall, which is to have a fire resistance of 2 hours be brought up tightly against the fire-resistant roof/ceiling assembly (Volume II, Criterion B.4.5.3). A fire resistance of 3/4 hour is specified for the roof/ceiling assembly (Volume II, Criterion F.4.1.1). The roof/ceiling assembly is not required to be of noncombustible construction. This could mean that a fire could pass over the firewall if fire fighting efforts are not begun before complete burnout of the apartment below.

6.0 FLAME SPREAD LIMITATIONS ON SOUND AND THERMAL INSULATION

The criterion for interior space dividers states that if the walls are noncombustible, then the sound or thermal insulation within the wall should have a flame spread not to exceed 75. In the Westview project, the kraft paper on the fibrous glass insulation in the inter-dwelling bathroom walls did not meet this criterion. But the building did not require noncombustible walls as the total area of the building was less than 10,000 square feet (Volume II, Requirement B.4.4).

6.1 POTENTIAL PROBLEMS WITH JOINTS

In the erection of volumetric modular housing, such as the Scholz Homes in Westview, there is a joint between the walls of each module. In this particular fire, the joints were not a problem but could have been had the fire occurred within a room, particularly on the first floor, as the joints represent a point of weakness in the fire resistance of the walls and ceilings of the rooms.

In Scholz Homes, the joints occur in the doorways within an apartment. In the other modular designs, these joints may be in other locations than the doorways. At Westview, the joints are covered by the field installation of a wood doorframe. This means that for all practical purposes, the fire resistance between the rooms and the joints is that which is obtained with 5/8-inch wood trim of the door frame. A fire resistance of one hour is specified for the inter-dwelling, floor/ceiling assembly in Multi-family Low Rise (Volume II). It is estimated that the 5/8 inch trim could hold back a fire for about five minutes. At the end of that period, the fire would be into the joint and spreading horizontally as well as vertically.

This joint problem has been discussed with Scholz Homes and Stiles-Hatton personnel. They are aware of the problem and have already developed some tentative design changes for these joints. In addition, they will probably be installing sheet metal, fire stops over these joints at the top of their modules. Our problem will be to determine that adequate fire resistance is incorporated into the joint designs of all of the Housing System Producers' systems using volumetric modular units.

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