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*REPORT OF THE
COMPTROLLER GENERAL
OF THE UNITED STATES*

Poor Design Reviews And
Construction Inspections Of
Apartment Project In Rhode Island

Department of Housing and Urban Development

Residents of the federally insured Rock Ridge Apartment project complained of widespread and serious problems. Most of these problems were caused by a combination of faulty design and construction, with the faulty construction frequently resulting because approved plans and specifications were not adhered to by the contractor.

The review of project design before construction, inspections during construction, and inspections during the 1-year construction guarantee period were inadequate to protect the Department's interest and did not minimize the risk of mortgage default.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-167637

The Honorable Fernand J. St Germain, Chairman
Subcommittee on Financial Institutions
Supervision, Regulation and Insurance
Committee on Banking, Finance and
Urban Affairs
House of Representatives

Dear Mr. Chairman:

In response to your February 2, 1976, request and later discussions with your office, we reviewed the design and construction problems at the Rock Ridge Apartment project in Woonsocket, Rhode Island, which is insured by the Department of Housing and Urban Development.

We obtained the Department's comments and considered them in preparing this report. They are included as appendix III. We also discussed the findings in our review with the sponsor, architect, and contractor, and there was basic agreement with the facts we presented.

Copies of this report are being provided to the Director, Office of Management and Budget, and to the Secretary of Housing and Urban Development.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Thomas B. Steels".

Comptroller General
of the United States

REPORT OF THE
COMPTROLLER GENERAL
OF THE UNITED STATES

POOR DESIGN REVIEWS AND
CONSTRUCTION INSPECTIONS
OF APARTMENT PROJECT
IN RHODE ISLAND
Department of Housing and
Urban Development

D I G E S T

Under the section 236 Multifamily Rental Assistance program, the Department of Housing and Urban Development insures mortgages on multifamily rental housing and subsidizes interest payments on the mortgages to reduce rentals to lower income families. (See p. 2.) The Rock Ridge project in Woonsocket, Rhode Island, built at a cost of \$3,228,290, was, in some ways, poorly designed and constructed.

Project tenants had complained of frozen and burst water pipes, too much heat in upstairs bedrooms, cold kitchens, and poor drainage, which had gone uncorrected through the two winters since the project opened in July 1974. (See p. 5.) Reviews of project service records and interviews with tenants of 56 of the 151 apartments and the project management confirmed that problems were widespread and serious. (See p. 5.)

For example, water pipes froze or burst in 82 apartments spread among all 14 buildings. The frozen water pipes were primarily in the kitchens. The contractor had located the pipes in the exterior walls, thereby exposing them to the cold and possible freezing. Water pipes located in areas subject to freezing should be insulated or adequately protected. (See p. 7.)

Overheating of apartments occurred in all 14 buildings during both winters. Tenants reported temperatures of 80, 90, and 100 degrees, making sleeping difficult.

Both the architect/engineer and the construction contractor contributed to these problems.

The Department's Providence, Rhode Island, Insuring Office reviewed project design before construction started and made inspections during construction and also during the 1-year construction guarantee period. These reviews and inspections were

inadequate to protect the Department's interests, that is, minimization of risk of mortgage default. The reviews and inspections did not disclose deficiencies in design and construction which should have been identified. For example,

- inadequate data was submitted for the design of the heating systems,
- drain pipes were not installed under two buildings having below-grade center sections,
- attic hot and cold water branch pipes were inadequately protected,
- operating manuals and valve charts for heating systems were not provided, and
- grades sloped toward buildings.

Furthermore, once problems were identified during guarantee inspections, the insuring office did not specify who (contractor, architect/engineer, or maintenance) was responsible for the defects and relied on the sponsor for correction, which increased the risk of mortgage default.

Mortgage principal payments, as well as payments into a reserve account for replacing capital items, were deferred for 1 year to provide the funds needed for corrective work. The Department and the mortgagee agreed to the deferment. (See p. 43.)

The sponsor has taken action to correct several problems and plans to do more. The problems of frozen attic pipes and kitchen water supply pipes appear to be corrected. Attic pipes were insulated, and the kitchen pipes were moved from the exterior walls into the kitchen area.

This is the second time GAO has found that inadequate construction inspections caused problems at projects insured by the Department. Therefore the Secretary of Housing and Urban Development should determine whether this is a nationwide problem which merits aggressive corrective action to protect the interests of the Government, as well as homebuyers and tenants of Department-subsidized projects. (See p. 34.)

GAO recommends to the Secretary several methods for improving the Providence Insuring Office's reviews and inspections and for improving the quality of the contractor's construction at insured projects.

AGENCY COMMENTS

The Acting Deputy Assistant Secretary for Housing agreed with GAO's recommendations with one exception (see app. III) and made the following comments.

--The report's conclusion that most of the problems occurred because of design deficiencies and construction which did not comply with contract requirements or good construction practices is realistic.

--The report makes it apparent that the architectural staff in the Providence Insuring Office needs additional training concerning multifamily architectural procedures. Arrangements will be made by the Department to conduct a 2-day training program at the insuring office.

--Most of the corrective work at the Rock Ridge Apartment project has been completed, and a final inspection of the corrections will be conducted by a regional or central office staff architect when the work is completed.

The Acting Deputy Assistant Secretary disagreed with GAO's recommendation that the Department determine whether the problems noted at the Rock Ridge project are indicative of a nationwide problem needing correction. He stated that each regional office had developed a monitoring system to review the performance of the field offices and that these field office reviews adequately precluded any nationwide problem.

The monitoring system referred to was established in 1972 before construction of the Rock Ridge project. This system did not preclude the problems at Rock Ridge from occurring. GAO therefore disagrees that the Department's monitoring system precludes any nationwide problem. (See p. 35.)

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ABBREVIATIONS

FHA	Federal Housing Administration
GAO	General Accounting Office
HUD	Department of Housing and Urban Development
MPS	Minimum Property Standards for Multifamily Housing
SCS	Soil Conservation Service

CHAPTER 1

INTRODUCTION

On February 2, 1976, the Chairman, Subcommittee on Financial Institutions Supervision, Regulation and Insurance, House Committee on Banking, Currency and Housing (now the House Committee on Banking, Finance and Urban Affairs) requested us to review the role of the Department of Housing and Urban Development (HUD) in a multifamily housing development--Rock Ridge Apartments--in Woonsocket, Rhode Island. (See app. I.) This development is insured and subsidized by HUD under section 236 of the National Housing Act (12 U.S.C. 1715z-1), as amended, and under section 101 of the Housing and Urban Development Act of 1965 (12 U.S.C. 1701s), as amended. Tenants had complained to the Chairman about serious problems, such as freezing and bursting water pipes and poor development drainage. The types of complaints caused the Chairman to question the adequacy of HUD's review and approved process. In accordance with the Chairman's request and subsequent agreements with his office, we were asked to:

1. Determine whether major design and structural deficiencies exist at the Rock Ridge Apartments.
2. Identify deviations from HUD policies and procedures in approving the project that would have an impact on the deficiencies noted.
3. Identify deviations from HUD policies and procedures in performing construction inspections at the project.
4. Identify actions taken or being taken to correct the noted deficiencies.

SECTION 236 PROGRAM

Section 236, which was added to the National Housing Act by section 201 of the Housing and Urban Development Act of 1968, authorized HUD to insure mortgages on multifamily rental housing and to subsidize interest payments on the mortgages for reducing rentals to low-income families.

Because of HUD's interest subsidy, a basic monthly rent is established that is lower than would apply if the project were not subsidized. Section 236 requires that a tenant pay the greater of either the basic rent or 25 percent of his monthly income but not exceeding the rent that would apply without HUD's subsidy. The project owner must pay to HUD all rental charges collected in excess of the basic rents.

ROCK RIDGE APARTMENTS

Rock Ridge Limited--hereinafter referred to as the sponsor--constructed a garden-type apartment complex with 151 units of one-, two-, and three-bedroom apartments in 14 two-story buildings at Rock Ridge Apartments. (See illustration on the next page.) Construction began in March 1973 and was accepted as substantially complete in August 1974 at a cost of \$3.3 million. This complex is located in a suburban setting, near shopping plazas and is protected from through traffic. The project has been occupied since July 1974.

In addition to the sponsor/owner, other entities directly involved in the construction and operation of the project included

- Gindele and Johnson (architects), hired by the sponsor to design and project and monitor construction;
- CE Maguire, Inc. (engineers), hired by the architect for engineering work;
- Casden Construction Company, Inc., hired by the sponsor to construct the project, and its subcontractors; and
- Rock Ridge Management Corporation, hired by the sponsor to manage the project, including operation and maintenance.

The sponsor, construction contractor, and project management organization had common ownership interests. This "identity of interest" among sponsor, contractor, and management was permitted under HUD policy.

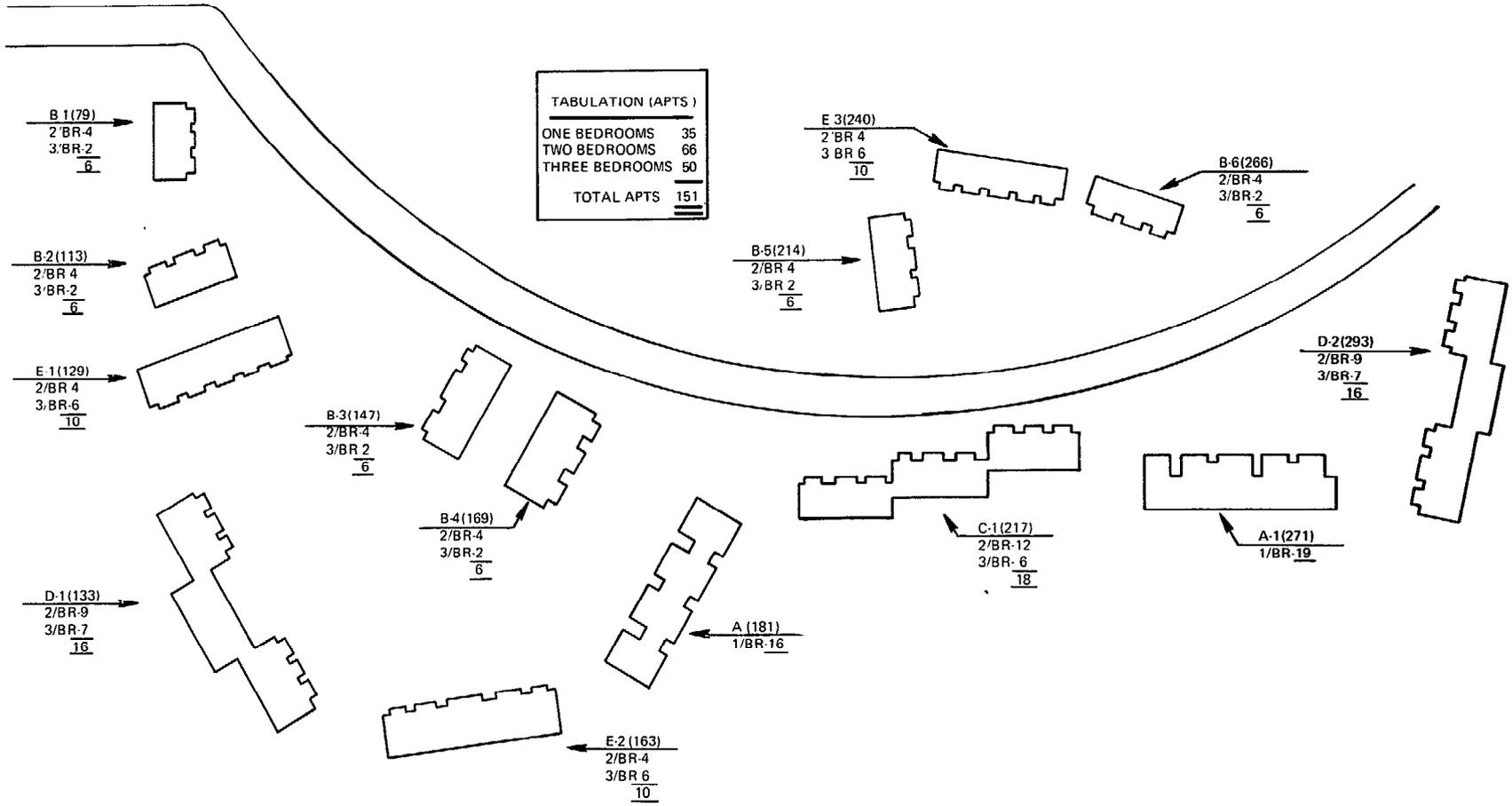
HUD's interest subsidy of Rock Ridge Apartments for calendar year 1975 amounted to about 5 percent of the average outstanding mortgage principal, and the mortgagor's interest payments amounted to about 2 percent. The interest subsidy totaled about \$153,000 or \$1,000, for each unit. HUD's section 101 commitment for rent subsidies extends to 60 apartments and is limited to a maximum of \$78,144 annually.

Each building has from 6 to 18 apartments, except building A1 which has 19 apartments plus the management's office. Two buildings contain only one-bedroom units (35 total). The remaining 12 buildings contain two- and three-bedroom townhouse-style apartments. (See p. 3.)

ROCK RIDGE APARTMENTS LAYOUT
BUILDINGS AND APARTMENTS

TABULATION (APTS)	
ONE BEDROOMS	35
TWO BEDROOMS	66
THREE BEDROOMS	50
TOTAL APTS	151

3



SCOPE OF REVIEW

We conducted our review at HUD headquarters in Washington, D.C., HUD's Insuring Office in Providence, Rhode Island-- hereafter referred to as the insuring office--and the Rock Ridge Apartments in Woonsocket. We reviewed the provisions of the National Housing Act and examined the policies and procedures followed by the insuring office concerning project reviews and approvals, construction and warranty inspections, and resolution of construction deficiencies. We interviewed representatives of the city of Woonsocket; the sponsor; the sponsor's architect; the contractor, Casden Construction Company, Inc.; a subcontractor, Eastern Mechanical Corporation; and Rock Ridge Management Corporation. We also held discussions with selected tenants of the Rock Ridge Apartments.

We employed a consultant that is a licensed professional engineer to provide expert opinions regarding construction of the project and obtained the opinions of a HUD headquarters' heating system specialist on the facilities at the project. Also the Soil Conservation Service (SCS), Department of Agriculture, provided us with an analysis of selected elevations and drainage conditions at the project.

CHAPTER 2

FAULTY DESIGN AND CONSTRUCTION CONTRIBUTED TO WIDESPREAD PROBLEMS AT PROJECT

Rock Ridge Apartments has experienced serious problems that have adversely affected the livability of many apartments since occupancy in July 1974. Of the 151 apartments, for example, 82 had frozen water pipes and 45 had burst water pipes, which caused damage and shutdowns of building water supplies until repairs were made. Continual overheating has occurred on the second floors of most of the 116 upstairs/downstairs type of apartments. Water ponding due to poor drainage after heavy rains, particularly in late winter and early spring, has flooded yards and walks at apartment entrances, which created slippery conditions during freezing temperatures. Soil erosion due to poor drainage has marred the aesthetics of the project area. Tenants have also complained of cold kitchens.

Our review showed that most of these problems were caused by a combination of faulty design and construction, with the faulty construction frequently resulting because approved plans and specifications were not adhered to by the contractor.

We interviewed 56 tenants to determine the types of problems they had experienced. A group of 28 tenants was interviewed initially to obtain coverage of all buildings on the project. To make an indepth analysis of the problems noted, we subsequently concentrated our efforts on three of the buildings and interviewed 28 additional tenants to obtain thorough coverage in these buildings and to expand our sample. The results follow.

<u>Problem</u>	<u>Number of tenants that reported problems (out of a total of 56 tenants)</u>	<u>Percent of total</u>
Frozen pipes	32	57
Burst pipes	18	32
Overheating	52	93
Cold kitchens	33	59
Drainage--ponding	31	55
Drainage--erosion	2	4

BURSTING WATER SUPPLY PIPES
IN KITCHENS AND ATTICS

Through discussions with project management and tenants and a review of maintenance records, we identified 82 apartments that had experienced one or more instances of frozen water pipes in the two winters since occupancy in July 1974. Also the freezing became so acute that the pipes burst in 45 apartments.

Tenants reported as many as six freezings of kitchen pipes in 1 month. A burst pipe in any one apartment necessitated shutting water off for all other apartments in that building until repairs were completed. Frozen and burst pipes repeatedly left tenants without water for periods of several hours to several days. Burst pipes flooded ovens, kitchen cabinets, floors, and carpeting.

For example, in one of the more seriously affected apartments, water pipes froze in the kitchen and in downstairs and upstairs bathrooms during both winters--bursting pipes at each location at least once. The downstairs bathroom pipes burst twice in January 1976 which flooded the apartment both times, knocked a cabinet off the wall, and sprayed hot water across the apartment. Building tenants were forced to use neighboring building toilets and drinking water facilities until repairs were completed.

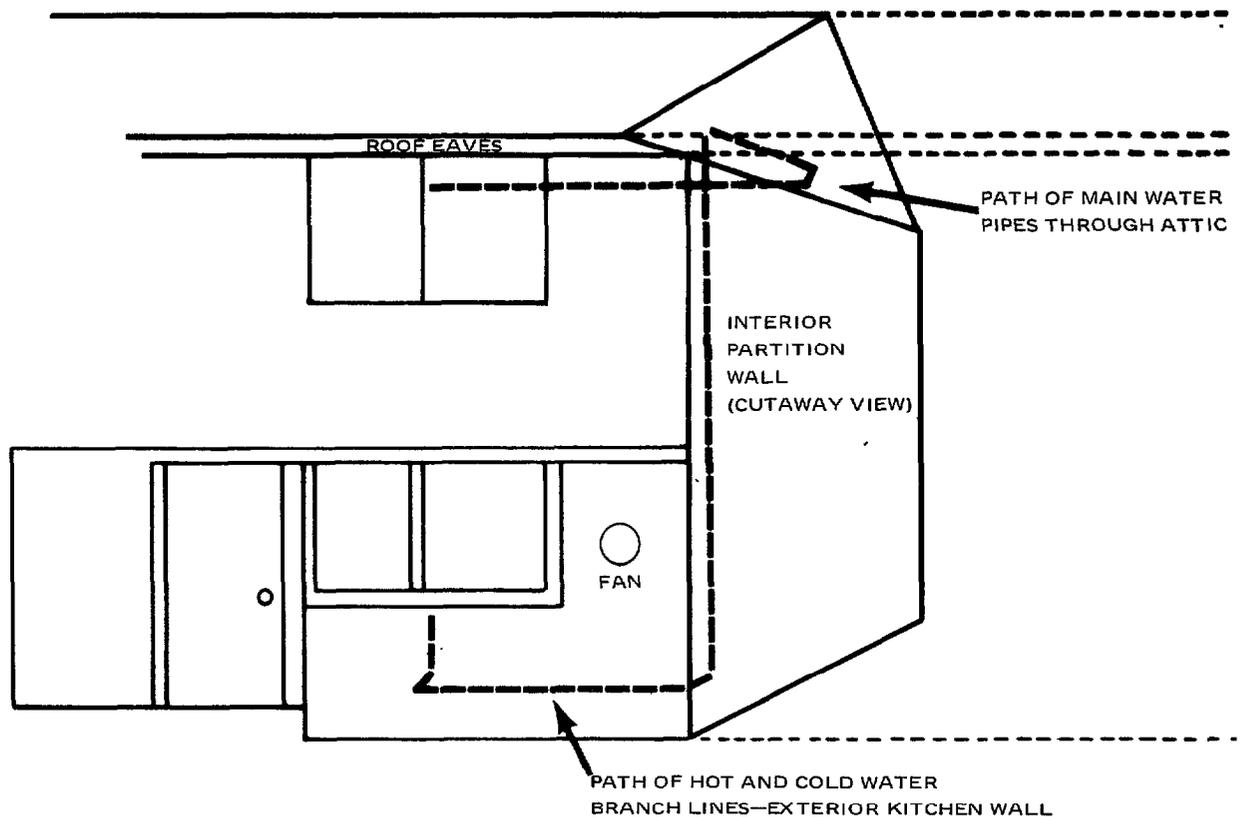
In another case, when a tenant was preparing Christmas dinner in 1975, a kitchen water pipe burst and flooded the kitchen and the living room.

During a particularly cold day in January 1976, there were 39 frozen pipes, of which 29 burst. Eleven buildings were affected.

Faulty construction was the primary
cause of frozen and burst pipes

The freezing and bursting of water supply pipes occurred primarily in 2- and 3-bedroom, upstairs- and downstairs-style apartments located in 11 of the buildings. Of the 82 apartments that experienced freezing pipes, 72 were apartments where pipes were located in exterior walls. These apartments also accounted for 41 of the 45 apartments that experienced burst pipes. The main hot and cold water supply pipes serving these apartments are located in the center of the attics. Smaller 1/2-inch pipes (branch lines) extend from the main supply pipes to near the eaves areas, then drop down through the partition between apartments about 12 inches from the exterior

kitchen wall. The pipes then extend into the exterior wall, run horizontally inside the partition and enter at the kitchen sink cabinets. The following diagram shows the configuration.



In contrast to the above piping configuration used in buildings without basements, the main supply pipes for 18 of 19 basement apartments located in sections of 4 buildings run through heated basement areas, and branch lines to apartments are not located in exterior walls. None of the 18 apartments experienced frozen or burst water supply pipes in kitchens. Pipes for the remaining apartment run through an unheated basement room and did freeze.

Construction deficiencies

Deficiencies in construction were the primary causes for frozen and burst pipes in the two- and three-bedroom, upstairs and downstairs apartments. Pipes froze and/or burst because they were installed in the attics and exterior kitchen wall partitions and were subject to freezing temperatures without adequate protection--the conclusion reached by both our consultant and one hired by project management. In the attics, hot water pipes were not insulated, although this is required

by HUD's Minimum Property Standards for Multifamily Housing (MPS) ^{1/} and contract specifications. Also the pipes were installed in close proximity to eaves where ventilation openings and air leaks permitted cold air to enter and contact the pipes. Attic water supply pipes burst in three buildings.

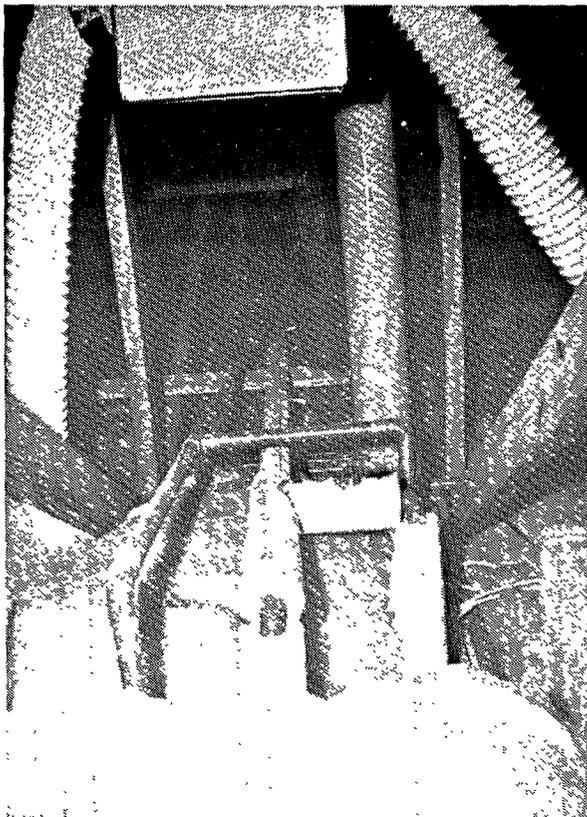
In the kitchens, the location of the hot and cold water pipes in the exterior wall led to several conditions that subjected the pipes to freezing temperatures. Contributing factors included:

1. Wall insulation between the pipes and the exterior had gaps that allowed cold air to reach the uninsulated pipes.
2. Kitchen exhaust fan systems installed in the exterior walls in proximity to the pipes allowed cold to infiltrate wall partitions.
3. Foundations and floor slabs were a source of cold which was transmitted into the exterior wall partitions.
4. Sinks and stoves were located flush against the exterior wall which prevented any warm room air circulation from reaching the exterior wall surfaces at the pipe locations.
5. Exterior sidings at foundation walls had buckled which allowed cold air to infiltrate into the exterior wall partitions.

The following sections discuss some of the conditions in detail, especially as to design and construction practices and specifications.

1. Uninsulated attic pipes--Contract specifications, MPS, and the National Plumbing Code require that water pipes located in building areas subject to freezing be insulated or adequately protected. The photograph on page 9 illustrates inadequate protection of attic pipes. The hot water pipe is uninsulated, the cold water pipe lacks insulation at elbows, and both pipes are above ceiling and floor insulation blankets.

^{1/} MPS defines the minimum level of acceptability of design and construction standards.

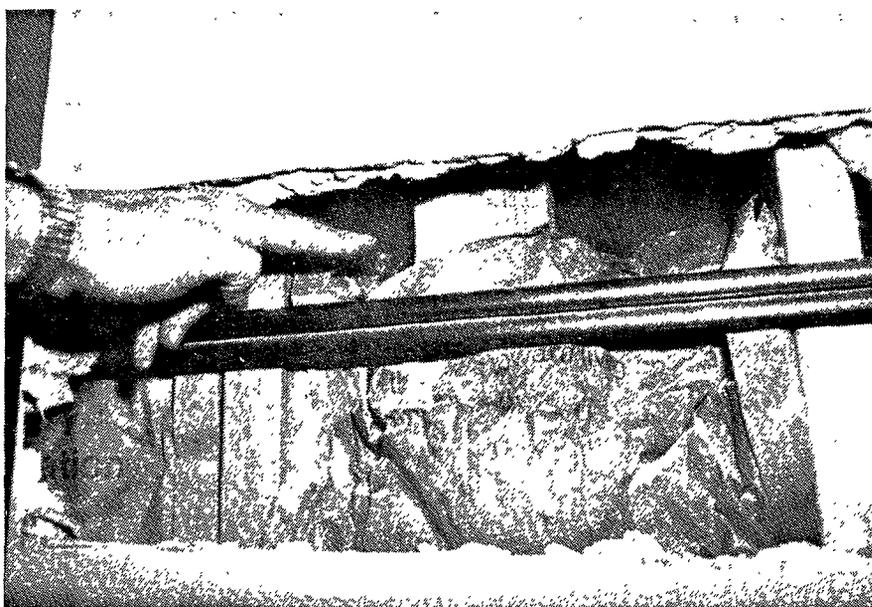


SOURCE: GAO

**INADEQUATELY PROTECTED HOT AND
COLD WATER PIPES IN BUILDING D2,
ROCK RIDGE APARTMENTS--APRIL 1976**

2. Location of pipes in exterior walls--The location of water pipes to the kitchen sinks were not specified in the HUD-approved plans. The decision to locate them in the exterior walls was made by the contractor. According to our consultant, a HUD headquarters engineer, and a member of the subcommittee that drafted the energy conservation portion of the Rhode Island State Building Code, locating water pipes in exterior walls is not a generally accepted practice. The National Plumbing Code states that, if pipes are located in exterior walls, precautions be taken to ensure that the pipes are adequately protected from freezing.

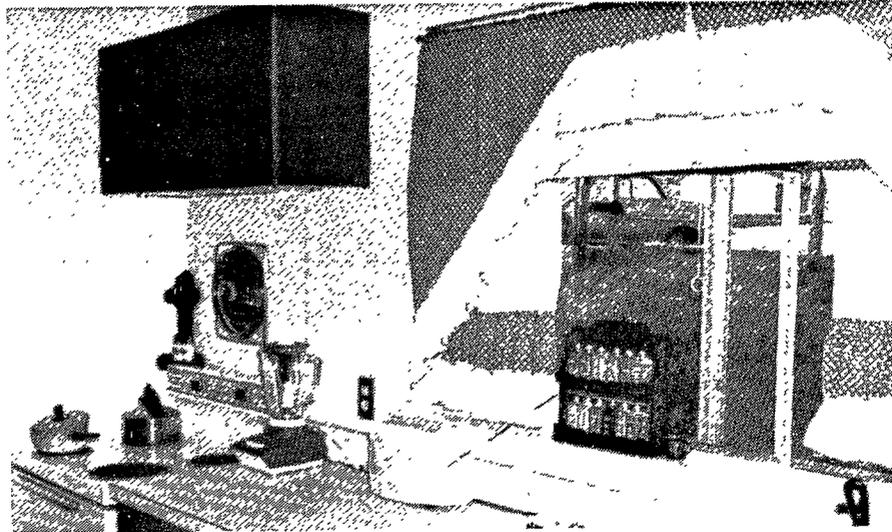
3. Inadequate installation of insulating material--The contractor, after consulting with the design engineer, chose to rely on blanket insulation installed in exterior walls for protection of kitchen pipes. The professional engineer assisting us said this provided inadequate insulation against cold infiltrating from above (exhaust fans) and below (foundation slabs) the pipes. In addition, deficient installation of insulating material resulted in inadequate protection.



SOURCE: GAO

**GAPS IN BLANKET INSULATION OF EXTERIOR KITCHEN WALL
IN APARTMENT 217F--MARCH 1976**

4. Sinks and stoves located against exterior walls--According to our consultant, locating the pipes at a level which resulted in sinks and stoves keeping warm room air from reaching the wall adjacent to the pipes was another factor contributing to the frozen and burst pipes in the kitchens. In addition, the above-mentioned subcommittee official stated that contractors in practice relied primarily on heat loss through walls to prevent freezing of pipes, but he felt that this was not good practice.



SOURCE: GAO

LOCATION OF WATER SUPPLY PIPES IN WALLS BEHIND SINK AND STOVE IN TYPICAL APARTMENT--OCTOBER 1976

5. Exhaust fans located in exterior walls--The HUD-approved contract plans provided that the kitchen exhaust systems would include ducts that would carry the exhaust to the roof via a wall partition other than the exterior wall where the pipes were located. The contractor, however, installed exhaust systems in the exterior walls where the piping was located. According to a project management consultant's report, "exhaust fans over electric ranges are of poor design and slight misalignment allows cold winter air to seep in profusely".

OVERHEATING OF APARTMENTS

Overheating has occurred in apartments located in all 14 buildings during both winters since occupancy and has affected tenants' comfort and livability. Tenants have experienced the most discomfort on the second floors of the buildings in upstairs and downstairs apartments. The problem resulted because the type of heating system, including its related controls as designed and installed, was not capable of achieving and maintaining the uniform comfortable temperatures set forth in MPS and contract specifications.

Of the 116 tenants in 12 buildings, we interviewed 56; of these 52 stated that overheating was a problem. Tenants who had checked temperatures in the upstairs and downstairs apartments reported that temperatures rose to 80, 90, and 100 degrees. Tenants most frequent complaints were that the uncomfortably high temperatures made sleeping in second-floor bedrooms difficult.

For example, one tenant stated that it was always too hot upstairs in cold weather and that his children woke up sweating from the heat. He described it as suffocating and said that he ran his upstairs air conditioner on "ventilate" all winter.

Heating systems not capable of meeting MPS comfort standards

MPS requires that heating facilities be provided for each living unit, which will assure interior winter comfort--design temperature of 70 degrees minimum--and that:

"Heating systems shall be provided with a heating control system designed to vary the amount of heat provided to maintain indoor temperatures at design conditions in proportion to fluctuations of outdoor temperature."

The contract specifications require that the heating system provide a uniform temperature of 70 degrees in all living spaces when the outside temperature is at the design temperature established by HUD for the locality.

Description of the heating system

The heating systems installed in the 14 buildings are basically similar, although they differ in ways such as number of boilers, configuration of piping, and location of boiler rooms. The systems are oilfired, forced hot water distributed to fin baseboard radiation units. In most larger buildings the boilers are located in basements near the center, and in the smaller buildings the boilers are located in a room at the end of the building. Heating supply pipes go through the attics to supply each apartment.

The design for the heating system provides for balancing the hot water flows to apartments by adjusting the valves on individual radiation units. Once balanced and set, the central controls would vary the quantity and temperatures of hot water recycled through the systems. Tenants cannot control the temperature, except by adjusting flaps over the radiation housings that can be closed to reduce the flow of air over the radiation elements.

The central controls include sensors to measure outdoor temperatures and heating supply water temperatures. A circulator pump sends heated water to apartments whenever outside temperatures drop below a set point. Controls activate boilers as needed to attain appropriate supply water temperatures. An automatic valve stops the flow of water from the boilers when a desired water temperature is reached.

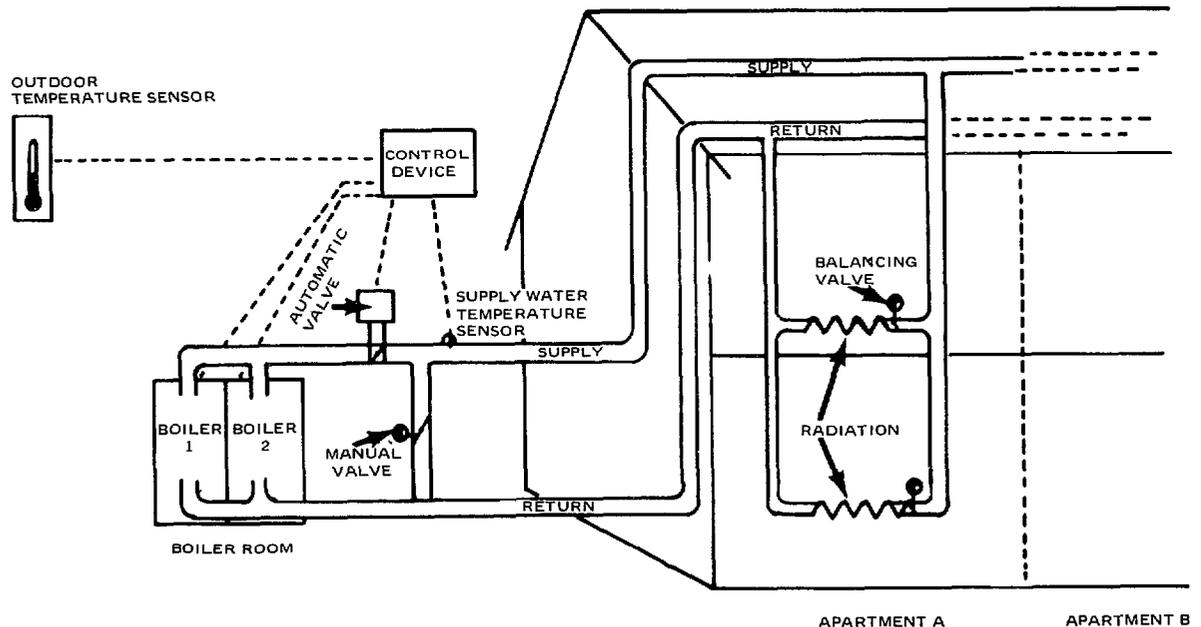


Diagram illustrates the project's heating system controls. (Piping loops to apartment have been simplified for illustration.)

Heating system inadequacies

The previous project manager stated that the system had never worked properly and believed the problem was due to poor installation and design. We therefore obtained the views of a variety of individuals, including our consultant, as to the probable causes of the overheating problem.

A consulting engineering firm report to project management dated December 1975 stated that:

--Experience shows that the use of outdoor reset control alone to control heating of areas with different exposures, heat losses, and occupancies does not work.

- Detailed study of the piping arrangement proved balancing the system was impossible.
- Far too much radiation is installed for constant circulation of water without overheating.
- No distinction was made between apartments having differing heat losses and the quantity of radiation installed.

The manufacturer of the heating and central control system told us that it was not intended that the central control system installed be used without individual apartment controls.

A HUD headquarters heating system engineer who assisted us concluded that piping, controls, valves, air separators, and pump hook-up in boiler rooms resulted in overheating and should be changed to comply with industry design guides.

Our consultant concluded that the overheating on the second floors was caused by a lack of individual apartment controls, heating systems out of balance, excess radiation in rooms, and chimney effect of the stairway.

The contractor, architect, and engineer believe, however, that a central control system can give satisfactory results without having individual apartment controls.

In addition to identifying the basic inadequacies of the heating system and its controls, we identified the following deficiencies in design or construction contractor performance involving the heating system.

1. No evidence of satisfactory performance--The construction contract requires that the systems be balanced and tested to the satisfaction of the architect. We could find no documentation that the system was ever balanced and tested successfully. Both the architect and insuring office stated that they did not observe such testing. The contractor stated that the required performance testing was not accomplished. (See ch. 3 for a discussion of the insuring office's role.)

2. As-built drawings not prepared--The contractor and insuring office inspector are required by HUD procedures and the construction contract to prepare and maintain as-built drawings. According to each party, this was not done. As a result, we were unable to determine the locations of the heat distribution systems which were mostly concealed in the building walls.

3. Open stairways and locations of heating element--
The design of these apartments includes open stairways which act as flues or chimneys carrying heat from the first floor to the second floor, according to the project management consultant and our consultant. Heat is thus added to an already oversupplied second floor. The heating element, located at the base of the stairway, distributed heat primarily to the second floor because of the chimney effect of the stairway.

4. Operating manuals and equipment identification not provided--The contract requires that the contractor provide complete instruction manuals describing system operation, list and identify equipment by manufacturers and model, provide literature on each equipment, and include a copy of each valve chart and parts list. Except for some manufacturer's literature, these items were not provided by the contractor.

PROJECT DRAINAGE

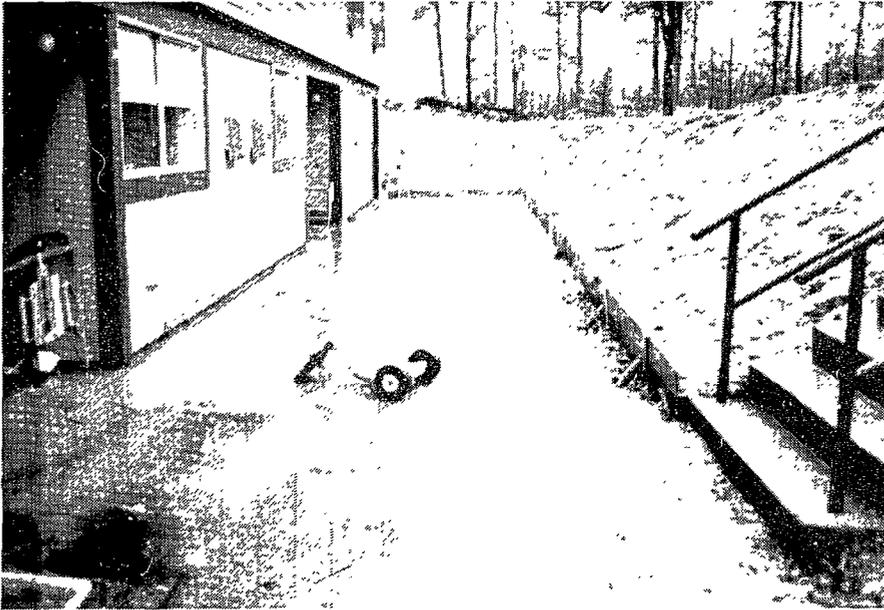
Entrance walks and yards around 10 buildings have been affected by either poor drainage or soil erosion during heavy rains, especially during periods of rains and melting snow in early spring. Our review showed that the ponding of water at entrances, walks, and in yards and mud from soil erosion were primarily due to faulty construction.

Although seven buildings, containing a total of 74 apartments, have had storm drainage problems, tenants in 2 buildings--D1 and D2 which contain 16 apartments each--have been most seriously affected.



SOURCE: GAO

BUILDING D1 DURING HEAVY RAIN IN APRIL 1976



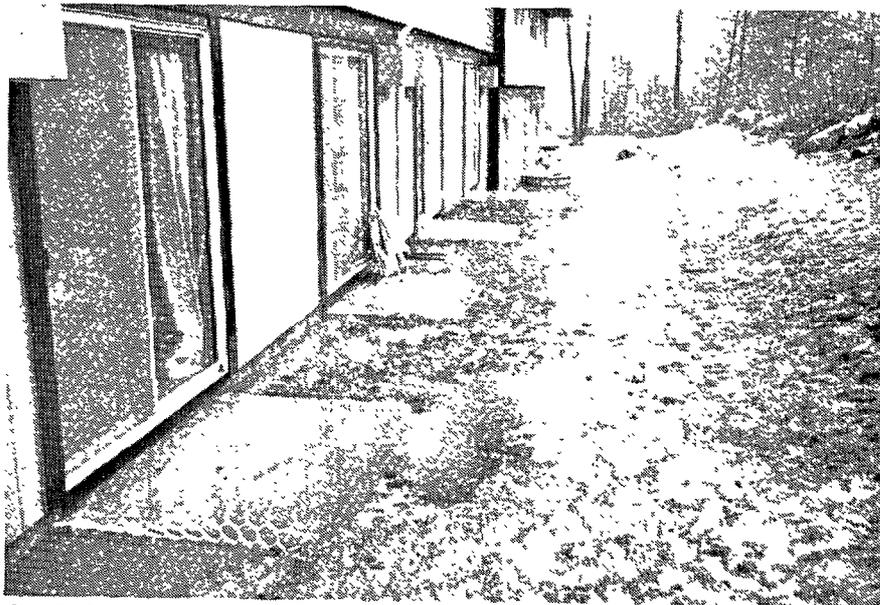
SOURCE: GAO

WEST END OF BUILDING D2 AFTER RAIN IN APRIL 1976



SOURCE: GAO

SUNKEN LAWN AT BUILDING D2--APRIL 1976



SOURCE: GAO

REAR OF BUILDING E1 DURING RAIN SHOWING LACK OF DRAINAGE AND CLOSENESS OF ENTRANCE TO FINISHED GRADE--APRIL 1976

According to tenants, the ponding and erosion problems created a hazard of slipping and falling on walkways when water froze, making it necessary to wear boots or similar footwear when entering and leaving apartments, causing mud to be tracked into apartments, and restricting the use of yards after rains.

Faulty construction was the primary cause of ponding water and erosion

Our consultant and SCS representatives assisted us in analyzing the causes of the problems for buildings that experienced the more severe ponding of water and erosion. According to our consultant, the final grades and improvements are not in conformance with the contract drawing and MPS requirements.

Slopes and grades

The SCS representatives checked building floor elevations at three buildings and concluded that the floor elevation for one building was 2 feet below the plan elevations. In addition, design elevations of ground floors are much lower than original ground contours which make grading away from buildings difficult.

The architect told us that buildings D1 and D2 were located below surrounding grades because of site characteristics and the need to use the flatter areas for automobile parking.

According to SCS representatives, the soil conditions are such that percolation is slow, especially during high runoff and high water table. For example, during the spring when rainfall is heavy, large pools of water create ponds and flood entrances. The representatives stated further that:

"No provisions were shown on the plans for discharging roof runoff except for outletting on the ground near the buildings. During periods of heavy rainfall, the infiltration rate of the soil is not rapid enough to absorb all the runoff from building roofs. Excess water now runs over sidewalks. Runoff ponds in low lying areas near buildings. The first floor elevations are only about six (6) inches above finish grade around buildings."

Our consultant used the SCS data and concluded that final grades for six buildings did not comply with contract drawing requirements at buildings where water accumulated in that either they did not slope away from the buildings or, where

they did slope away from the building, water was trapped causing it to pond. At these buildings, water accumulated in pockets across front lawns and walks, and roof drains were a primary source of runoff water. He cites:

"Section 1, paragraph 1c-11 of the contract specifications require that the project comply with all the latest aspects of the F.H.A. Document MPS2600. Referring to the Minimum Property Standards, Chapter X, Site Improvements, Paragraph M1000 provides that 'positive drainage of the site and the diversion of surface water away from the buildings and other facilities, and its disposal from the site.' At Building Nos. 129, 133, 163, 240, 266 and 293, this provision was not complied with."

According to our consultant, erosion problems are due primarily to slopes that are too steep (see photograph, p. 20) and the general lack of vegetation to absorb rain water. He stated that the slopes in specific cases did not comply with MPS.

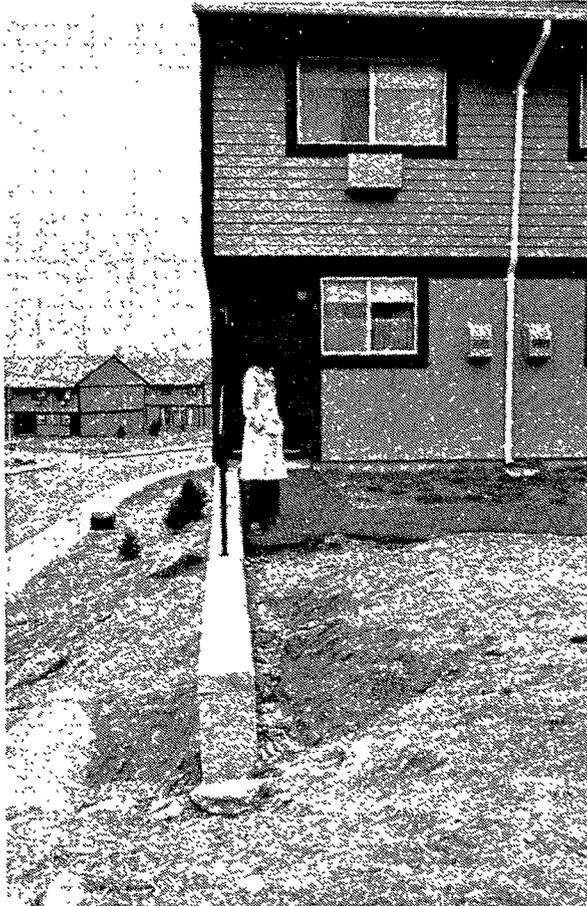
"Where erosion occurs at the most serious instances, namely, at slopes located in the West side of building 214 (B5) and the North side of building number 293 (D2), the finished slopes are in excess of the minimum gradient required by the F.H.A. Minimum Property Standards (Paragraph M1002-3, 2b) which is 2 horizontal to 1 vertical. Steeper slopes may be accepted by F.H.A. after analysis."

Drainage in center sections of buildings D1 and D2

The center sections of buildings D1 and D2 are set below ground level, as illustrated by the photograph on page 17. Contract plans provided that inlets in the patio areas were to be pipes to dry wells located in the rear of the buildings. The contractor stated that it did not comply with the plans. Further, our consultant and the SCS representatives noted that dry wells were installed in the center areas, rather than the rear, of these buildings and that the pipes required by the plans to discharge the runoff water to the rear areas were not installed. As a result of the poor percolation conditions, the dry wells--located on or near bedrock--have not accommodated the runoff.

Erosion at building B5

As cited earlier, the grade slope at the eroded area does not comply with plans and MPS in that it is too steep. Our consultant stated that the slope was used as a travel walk by tenants. He pointed out that the contract drawings called for a stairway between the walkway and the sidewalk at the bottom of the slope which, if constructed, probably would have allowed vegetation to grow.



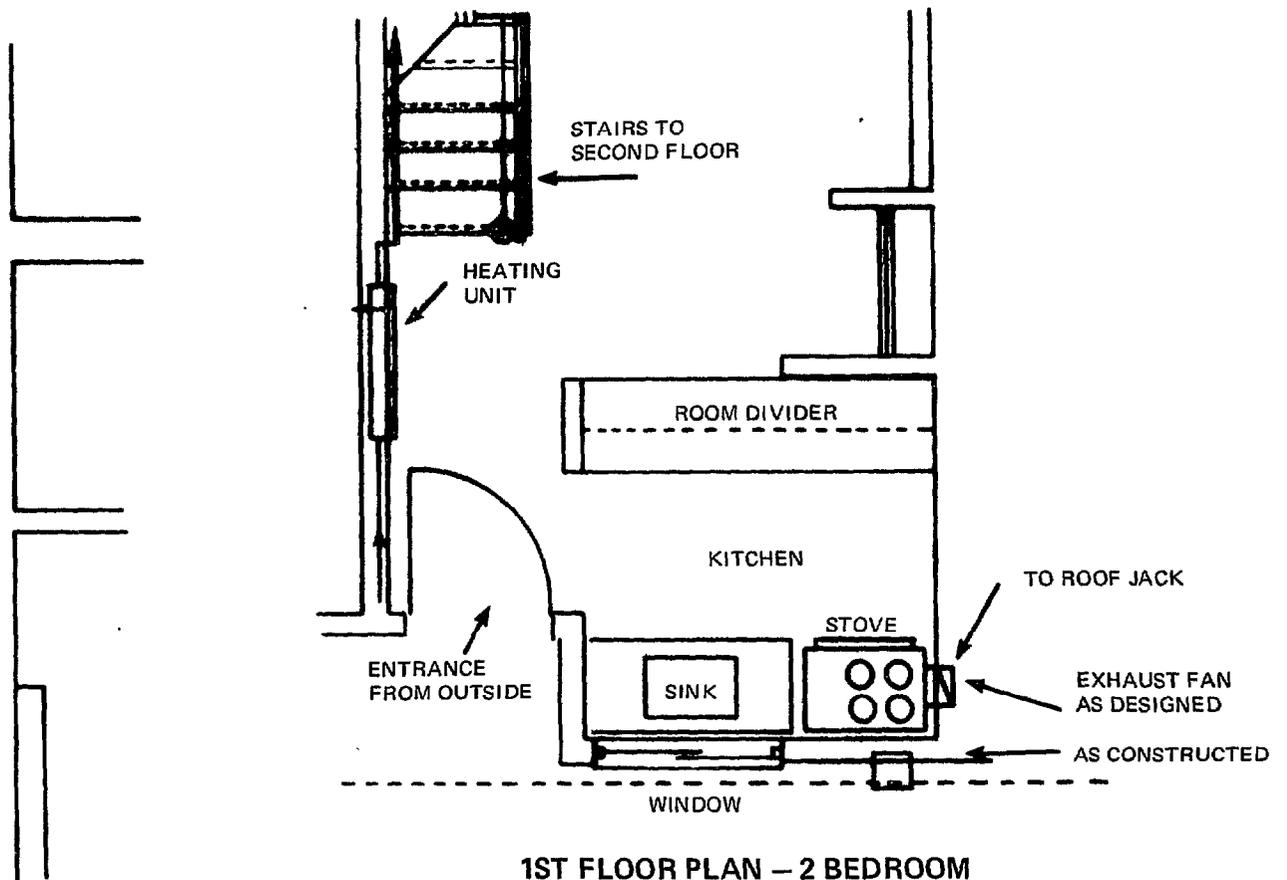
SOURCE: GAO

**TOO STEEP SLOPE AND SOIL EROSION
AT BUILDING B5--MARCH 1976**

The SCS representatives believed that, in addition to the walkways, runoff from the roof should be piped to the street below.

COLD KITCHENS

Most two- and three-bedroom apartments, according to a project management consultant's report, experience cold temperatures in the kitchens during cold weather months. Apartments having an upstairs and downstairs total 116 and are located in 12 of the 14 project buildings. Faulty design, coupled with a construction deficiency, appears to have led to the condition. The following diagram shows the kitchen area and the location of the stairway and heating element in a typical apartment.



The design of the kitchen areas for the two- and three-bedroom apartments having upstairs and downstairs rooms did not provide for a heating unit in the kitchens. The nearest heating element is at the bottom of the stairway leading to the second-floor bedrooms. According to management's consultant, the unit was intended to provide heat to both the kitchen and the foyer but was rendered ineffective

primarily because of the stairway's location. The stairway acted as a flue for heat from the first floor to be drawn to the second floor.

In addition, the outside door opens so that cold air that enters pushes the heat toward the stairway, and the room divider traps the cold air in the kitchen. The divider also keeps warmer living room air from reaching the kitchen.

According to our consultant, about 50 percent of the heat loss on the first floor was in the kitchen and adjacent entrance area where cold air seeped in from the outside door, window, and exhaust fan. In addition, heat is lost through the concrete floor slabs.

Other contributing factors to the cold kitchen condition were the contractor's installation of an exhaust fan over the stove which extended through the exterior wall to the outside, which was not as provided in the contract plan. Tenants complained of drafts entering from the fans. According to management's consultant, cold air seeped through profusely because of the poor design of the fan unit. We observed also that back draft dampers on the units were not closing securely.

We discussed the factual information developed in our review with the sponsor, architect, engineer, and contractor who were in basic agreement with the facts presented. Where additional information was offered, we considered it in finalizing the report.

CONCLUSIONS

Rock Ridge Apartments has experienced serious problems, such as frozen and burst water pipes, overheating of apartments, cold kitchens, and ponding of water due to poor drainage that have adversely affected the livability of many apartments since occupancy in July 1974. Most of these problems occurred because of design deficiencies and construction that did not comply with contract requirements or good construction practices.

AGENCY COMMENTS

The Acting Deputy Assistant Secretary for Housing, in commenting on this report (see app. III), agreed with our conclusions and said that the report presented a realistic evaluation of the causes of the problems.

CHAPTER 3

INEFFECTIVE HUD REVIEW AND INSPECTION

LED TO WIDESPREAD PROBLEMS

Poor construction inspection by the HUD insuring office allowed deficiencies in design and construction and contractor noncompliance with approved plans and specifications to go undetected, which resulted in problems that adversely affected tenants' apartment livability. In addition, a more thorough review of design plans and specifications could have alleviated several of the problems. The insuring office did not identify any specific variations from MPS in approving the contract plans. As a result, HUD's interests in the project were not adequately protected and tenants have had to endure unnecessary discomforts and disruption of their daily activities.

BETTER DESIGN REVIEW COULD HAVE HELPED REDUCE SERIOUSNESS OF SOME PROBLEMS

Several of the problems that have adversely affected tenants' apartment livability were caused, in part, by design deficiencies that should, in our opinion, have been detected by a more thorough insuring office review of design plans and specifications. The problems include the overheating of apartments, cold kitchens, and the ponding of water. Although the insuring office appropriately processed the sponsor's application through the various HUD processes and procedures, the quality of review was less than adequate. Detection and correction of design inadequacies during the planning and design review phase are, we believe, of utmost importance to avoid costly construction changes and tenant dissatisfaction resulting from problems and difficulty in holding the architect responsible for correcting construction defects later attributed to poor design.

HUD review and approval milestones

The purpose of the insuring office's project application review and approval is to determine the feasibility of the proposed project and the acceptability of physical improvements and to provide data necessary to assess and minimize mortgage risk. The scope of HUD's design review includes buildings and mechanical and construction elements therein, parking, adaptation of buildings to site, land improvements, and all other elements of design or construction.

The HUD review process prior to start of construction includes the following milestones. (See app. II for details on processing flow.)

1. Feasibility--The sponsor submits a project feasibility application to the insuring office setting forth basic information on the site and proposed building characteristics, equipment and services, and estimated costs to complete and operate the project. In assessing feasibility, the insuring office estimates project costs, analyzes the proposed site, assesses marketability and project economics, and checks the sponsor's reliability. The insuring office issues a formal feasibility letter which contains the estimated budget for the project and indicates whether the project warrants further consideration and, if so, invites the sponsors to proceed to the next stage of processing.

2. Conditional commitment--The sponsor submits another application together with schematic architectural drawings and outline specifications. The insuring office reviews these for consistency with the feasibility agreement and with HUD's design standards. After review and approval, the insuring office issues a conditional commitment to insure and subsidize the project mortgage, thus allocating subsidy funds contingent on the sponsor developing acceptable detailed design plans and specifications and satisfying legal processing requirements.

3. Firm commitment--The sponsor develops final drawings and specifications acceptable to HUD for use as working documents during construction. After review and approval of the design documents, the insuring office issues a firm commitment to insure the project, meaning the design has been accepted and subsidy funding allocated. Shortly thereafter, a closing conference is held where legal and contract documents necessary for the start of construction are signed by the sponsor, contractor, mortgagee, and HUD.

The insuring office began formal processing of the project sponsor's application in October 1971 and issued its firm commitment to insure in November 1972. Continuous construction began in March 1973.

Design deficiencies that could have been detected by more thorough review

Overheating of second floors

One factor contributing to the overheating of the second floors in the upstairs- and downstairs-style apartments has been the lack of adequate controls over heat distribution. According to our analysis in chapter 2, problems with the control system installed were reasonably foreseeable. The insuring office, however, approved the plans and specifications based on inadequate heating system design data. The applicable HUD manual provision states:

"Heating and cooling layouts shall be shown as separate drawings unless the system is so simple that it can be shown on other drawings. All pertinent design data shall be included."

According to the HUD headquarters heating specialist that assisted us in reviewing the heating system problem at Rock Ridge Apartments, he would not have approved the heating system specifications, stating that design data was not adequate because it did not describe the systems' controls. Our consultant engineer said contract documents failed to specify design temperature drops across apartment radiation to permit proper balancing. The plans showed that individual apartment controls were not to be installed. As discussed in chapter 2, several consultants indicated that their experiences have shown that centrally controlled systems without individual apartment controls or more precise central control do not provide adequate heating. Also the system manufacturer told us it was common knowledge that more than the central control system as installed would be needed with the level of control used. Insuring office officials said they did not review the proposed heating system in detail because

--the chief architect's staff did not have the expertise,
and

--a heating design engineer was not routinely available.

Cold kitchens

The design of the kitchens and entrance areas, in conjunction with the location of the heating element, indicated the potential for insufficient heat in the kitchens and loss of first-floor heat to the second floor in upstairs and downstairs apartments--which eventually materialized.

About 50 percent of first-floor heat losses were through the kitchen walls, windows, and front entrances; yet, the kitchen space was designed with no heating element. In addition, the partition between the kitchen and dining area restricted circulation of warm air from that space. The nearest heating element--in the entry hall at the base of the stairs--would lose much of its heat up the stairway to the second floor. The design engineer stated it was unusual to have a room with an outside wall without a heating element. We believe it was reasonably foreseeable that the design would not meet HUD's minimum comfort standards. The insuring office's chief architect and a headquarters engineer commented that engineers sometimes omitted heating elements in kitchens, reasoning that, when occupied, heat would be generated by the stove.

Final plans differ from last working set

The insuring office reviewed detailed plans and specifications and identified changes or additions which were required as conditions to issuing a commitment to insure the project mortgage. However, our comparison of HUD's requested changes and the subsequent final contract plans which HUD approved showed that:

- The insuring office requested the heating pipes in attics be insulated to comply with MPS. The final plans and specifications did not incorporate the requested change. Attic pipes were not insulated.
- The insuring office requested clarification as to where the building D2 drainage pipe from the below-ground center area would discharge, but final plans did not clarify it.

POOR CONSTRUCTION INSPECTIONS

Insuring office inspectors were responsible for seeing that construction conformed to contract plans and specifications, sound construction practices, and MPS. In addition, any design problem was to be referred to the insuring office's design representative. The inspectors did not adequately fulfill their responsibilities; therefore, widespread problems resulted which adversely affected tenants' apartment livability.

Project construction began in March 1973 and the project was accepted by the insuring office as being substantially complete about 17 months later, on August 1, 1974. Tenants began occupying apartments in July 1974. Based on HUD's acceptance of the construction as substantially complete, all moneys due the contractor were released, except for an escrow of \$126,000 to assure correction of damage caused by a fire in the project and installation of screen doors.

The HUD handbook on inspections states the purpose of inspections as:

"Inspections of multifamily housing projects are made to protect the interest of the Administration. Inspections are made to evaluate the architect's performance; to obtain construction in accordance with the contract documents; and to report on conformance with prevailing wage and other requirements."

The inspector's duties in protecting HUD's interest are further explained.

"The HUD inspector is * * * the field representative of HUD. As such, he is * * * exacting in his determination to obtain construction which conforms to the drawings and specifications and sound construction practice within the scope of the contract."

HUD receives an inspection fee of one-half of 1 percent of the mortgage amount, or \$15,000 for the Rock Ridge Apartments project.

The insuring office made 68 inspections at the project, including the final construction inspection. Time spent on these inspections ranged from 1 hour to 6 hours each and were generally made at weekly intervals as much as practicable, according to the inspectors. The inspector assigned initially was responsible until June 1973, at which time another inspector was assigned for about 8 months. The initial inspector returned in February 1974 and completed the remaining construction inspections. Insuring office officials said the substitution was made to relieve the initial inspector of a heavy workload.

The inspectors stated that their inspections were of general surveillance of the construction underway at the time of each visit and was concerned primarily with observing work in progress and comparing it with contract plans and specifications. Also they relied to a great extent on the sponsor's architect and engineer, especially on questions of contract interpretations concerning plans and specifications. Insuring office officials stated that the office was understaffed during this period in relation to its workload.

Inadequate monitoring of architect's performance

The architect was hired by and was responsible to the sponsor of the project to keep the sponsor apprised of construction progress. He was not, according to the construction contract, required to make detailed or exhaustive inspections. The architect was also responsible for processing construction field orders and change orders.

Construction field orders are changes which do not involve any major changes in the project; conversely, change orders involve major changes. The construction change order must be processed through the lending institution which financed the project since these will have an effect on the design or cost

of the project. Once the lending institution has approved the architect's change order, it is then forwarded to the insuring office for incorporation into the master set of drawings.

The insuring office's procedures provide that the architect's performance shall be evaluated along with insuring office inspection responsibilities as follows:

"The inspector makes sufficient inspections to determine the adequacy and efficacy of the inspections being made by the architect * * *. He determines construction is in accordance with the contract documents."

During construction the sponsor's architect and/or engineer made 30 inspections, or about twice monthly. The insuring office's project files do not contain information concerning evaluations of the architect's performance. The architect stated that he drove 200 miles to the project on inspection days and spent most of his time at the site discussing contractor production problems and then drove 200 miles back. He said he had little time for compliance inspections.

In reviewing the changes related to project problems, we found that the inspector did not fulfill his responsibility to obtain and review a construction change order he was aware of and did not inspect physical changes for another change order that was formally submitted. HUD inspectors said they were not aware of several construction changes for which the architect had issued informal change drawings to the contractor but had not submitted the changes to the insuring office. HUD's handbook provides that:

"Construction changes must all be documented by prior approved requests.

"In considering any change in drawings and specifications, the Field Office Director must bear in mind that such changes can be accepted only when they provide for equivalent betterments or changes due to necessity.

"All deviations permitted * * * shall be documented at the appropriate place in the contract drawings and specifications, and supported by a certification from the inspecting architect that the change is one which does not conflict with the contract drawings and specifications or is necessary to overcome an unpredictable condition that would otherwise impede or bar construction. Each certification called for herein will

include the amount of the difference in cost, if any, and the reason necessitating the change."

The handbook further specifies that the HUD inspector review copies of the architect's decisions and spot check the construction related to approved change orders.

In several instances inspectors failed to monitor the architect's performance and to properly process construction changes related to construction features, which increased problems. For example, although the HUD inspector said he was aware of a change in location and the type of kitchen exhaust fans in apartments having an upstairs and downstairs, no change order was processed. As discussed on page 11, this change affected design, and it resulted in a less costly exhaust fan system. The contractor's stated reason for the change was cost reduction. The inspector said he thought a change had been processed. He also stated he did not inspect for a storm drain change, at building D2, executed by an architect's field order, but the drain, as noted on page 19, was never installed.

Insuring office officials stated that inspectors were concerned only with reviewing field orders and change orders submitted by the architect. Only two change orders were processed during project construction. The inspectors made no effort to assure that the architect submitted all required orders but relied upon him to meet his responsibility. They stated that the architect should have submitted a change order for the exhaust fan deviation cited above.

As-built set of drawings
not prepared and maintained

HUD processing instructions state the insuring office issues to the inspector upon assignment:

"A complete set of working drawings and specifications. This set * * * is used by the inspector to record changes. He conforms it to the contractor's 'as-built' set."

In addition to the insuring office inspector being required to prepare and maintain a set of as-built drawings, he is required to insure that the contractor maintains an as-built set of drawings.

The construction contract states:

"The Contractor shall maintain at the site for the Owner one copy of all Drawings, Specifications,

Addenda, approved Shop Drawings, Change Orders and other Modifications * * * marked to record all changes made during construction."

Maintaining a set of as-built drawings provides the inspectors with a continuing record of construction changes and deviations that is useful in focusing inspection effort and that assures evaluation of all changes from contract plans and specifications. It also affords a basis upon which the inspector can judge the reliability of the contractor in advising the architect of such changes. Stated purposes of as-built drawings and specifications include use by HUD during guarantee inspection and for review of the master set following the final guarantee inspection.

The contractor stated to us, in response to our request to look at his set of as-built drawings, that such as-built drawings were not prepared or maintained. Although the construction contract required the contractor to prepare and maintain as-built drawings, he stated that he was not required to maintain them. Insuring office inspectors stated they did not prepare or maintain such a set although this was required and they did not require the contractor to do so. The chief architect stated, however, that the plans plus copies of field orders and change orders were maintained which provided data reflected in as-built drawings. We disagree with this statement since there were changes made during construction that the insuring office did not have on record. For example, no field order or change order was processed when the location of the exhaust fan was changed; therefore, any plans maintained by the insuring office would have been incomplete.

Drainpipes omitted at buildings D1 and D2

According to contract plans, proper drainage of storm water runoff in the below-ground-level center lawn areas of buildings D1 and D2 depended on routing the water through drainpipes beneath the building to a dry well installed in back of each building. A SCS representative stated that locating buildings and yards below surrounding grades required careful engineering to avoid problems.

The contractor, as discussed on page 19, constructed a dry well in the center of each sunken lawn area and did not provide for piping surface water runoff to the rear of either building. This was a construction change that reduced contractor costs for excavation and materials. There was no documentation, however, authorizing the change in either HUD's or the architect's files. The HUD inspectors stated they had not checked to insure that the pipes and dry wells were constructed according to contract plans.

Attic water supply pipes not insulated

The contractor was required by contract plans and specifications, MPS, and general construction practice to insulate hot water pipes in the attics as discussed on page 8. The contractor did not do so and, in addition, did not insulate cold water pipes in the attic at many joints. The insuring office inspector stated he did not inspect a completed attic in any of the 14 buildings because he did not consider it necessary. He therefore did not notice the absence of insulation.

Water supply pipes in exterior walls

The contractor's decision to locate water supply pipes in exterior kitchen walls, as discussed on page 9, was a deviation from generally accepted construction practice. In electing to do so, it was incumbent on the contractor to assure that the pipes were adequately protected from the cold. The possibility of these pipes freezing was brought to the attention of the architect, engineer, and HUD by the contractor's superintendent. The HUD inspector stated he relied on the judgment of the engineer and architect to assure adequate protection of the pipes. The HUD chief architect stated this was the general procedure of the insuring office for technical problems raised during construction. According to the inspectors, they made no special effort to check the protection of pipes during construction.

Heating system performance

The plans and specifications did not provide adequate design data on the heating control systems. Insuring office officials said they relied on the sponsor's architect and engineer to assure design and installation of a system that met HUD requirements.

The contract provided that the heating system be performance tested to the satisfaction of the architect. Neither the architect nor the insuring office inspector witnessed any system testing before final acceptance of the construction, nor did they obtain any documentation to support that the systems tested satisfactorily.

The heating system was accepted by HUD following final construction inspection on August 1, 1974, without qualification. With final construction inspection occurring in warm weather, the contract required that the contractor's work be proved satisfactory to the architect during cold weather. According to the architect and the contractor, this was not done.

Valve charts and operating instructions
not provided for heating system

The HUD inspectors also did not detect that the contractor had not provided design data, valve charts, and operating instructions for the heating systems, although this is required by the contract. Each building's heating system, while basically similar, had individual differences, including the configuration of piping, locations of controls, and different numbers of boiler units. These differences necessitated individual charts and operating instructions for each building.

HUD procedures provide that, before submitting a final construction inspection report, the inspector

"* * * shall assure that all design data, valve charts and operating instructions are mounted and securely posted near the appropriate equipment. At least two copies of guarantees, service agreements, maintenance instruction, and parts lists for major items of equipment shall also be provided, bound in hard covers."

The contractor did not provide operating instructions and valve charts for the systems. The project manager provided only an engineering catalog from the boiler manufacturer giving general descriptions of various equipment the manufacturer produced and suggested installation methods. The data did not explain the operation and control of individual systems at the project, nor did it specify how valves were to be installed in the systems. Management said this was the only data provided by the contractor. The insuring office inspector said he did not check for these items and did not know whether they were provided.

It is apparent to us that the insuring office inspector did not concern himself with the acceptability of the project heating systems.

Amounts not escrowed

HUD's handbook on architectural analysis, including inspections, provides that minor incomplete items may be accepted in the final construction inspection provided that they do not preclude occupancy and are included by the inspector on a list of items for delayed completion. When this occurs the final inspection report should be endorsed by the insuring office's chief architect as follows:

"Construction acceptably completed, subject to the escrowing of sufficient funds to assure acceptable completion of items listed as Items of Delayed Completion."

HUD instructions further provide that:

"With respect to all incomplete items, the amount held in escrow for completion must be at least one and one-half (1 1/2) times the estimated cost of completion. The amount of any escrow shall be sufficient to assure an incentive to complete the work, taking into consideration a possible rise in cost * * * and the Director will ascertain that the items to be completed and properly identified by attachment* * *."

In addition to amounts escrowed for fire damage, the insuring office escrowed \$6,510 or one and a half times the cost estimate to complete installation of screen doors, play-yards, grading, and seeding. The list of escrows did not identify what grading and seeding work was incomplete, and the HUD inspector could not recall. With the exception of some drainage work, the deficiencies described in chapter 2 were not identified for correction and, therefore, no provision was made for escrows related to these items.

Because the heating systems had not been satisfactorily tested or balanced at final inspection, HUD had no assurance that the systems worked properly. Thus it appears that escrow funds should have been set aside for the heating systems. Insuring office officials stated they did not, as a general practice, escrow funds for heating work where systems could not be tested by final construction inspection, but office practice was changed during 1975 to establish escrows for incomplete cold weather testing and adjustments. Insuring office officials stated that this change had not been put into writing.

Insuring office officials expressed basic agreement with the facts included in this chapter. Information provided to us for clarification on several statements which they did not agree with was considered in finalizing the chapter.

CONCLUSIONS AND RECOMMENDATIONS

The problems experienced at Rock Ridge Apartments would have been minimized and perhaps avoided if the insuring office's review of project plans and specifications had been more thorough and if construction inspections had been

reasonably effective. We believe that, in particular, items such as grades sloping toward buildings, too steep grades, uninsulated water pipes in attic, lack of demonstrated performance of heating systems, omission of drain pipes at buildings D1 and D2, and absence of valve charts and heating system operating instructions and as-built drawings should have been detected by the inspectors. We therefore conclude that the insuring office's inspections were not adequate to protect HUD's interests.

To preclude the problems experienced at the Rock Ridge Apartments from occurring on future projects approved by the Providence Insuring Office, we recommend that the Secretary of HUD direct the insuring office to:

- Comply with established HUD policy and procedures in evaluating changes in construction that deviate from approved contract plans and specifications, including the proper processing of change orders.
- Monitor the performances of HUD inspectors to ensure that inspections are performed properly.
- Require design reviewers to bring to the attention of inspectors those items which have been identified during their review as potential problems or areas of concern. The inspector can then give special attention to such items during his inspections to ensure that construction is according to plans and that problems will not materialize.
- Insuring the availability of adequate capability needed to properly review the design and installation of heating systems.
- Insuring that escrow amounts are withheld from contractors until heating systems have been sufficiently tested to demonstrate satisfactory performance.

This is the second instance of our finding inadequate construction inspections to be a major cause of problems at a HUD-insured project. On October 20, 1976 (CED-76-148), we issued a report entitled "Construction Problems With Country Club Estates, Merrimack, New Hampshire--A Section 235 Housing Project." The Country Club Estates project had serious problems, such as septic system failures, large pools of water covering yards and driveways, water in basements, and improperly installed chimneys. We therefore recommend that the Secretary determine whether this is a nationwide problem which merits aggressive corrective action to protect the

interests of the Government, as well as the interests of homebuyers and tenants of HUD-subsidized projects.

AGENCY COMMENTS AND OUR EVALUATION

The Acting Deputy Assistant Secretary for Housing agreed with our recommendations with one exception. He stated that each HUD regional office had developed a monitoring system to review the performances of their offices. HUD believes that these field office reviews preclude any nationwide problems.

The monitoring system referred to was established in 1972 before construction of the Rock Ridge project. This system did not preclude the problems at Rock Ridge from occurring. We therefore disagree that HUD's monitoring system precludes any nationwide problems.

CHAPTER 4

EVALUATION OF CORRECTIVE ACTIONS--

INCLUDING HUD'S ROLE

HUD inspections made during the 1-year construction guarantee period were not adequate to detect construction defects. When problems were detected, the insuring office did not analyze them to determine whether the contractor should be held accountable but relied, instead, on the sponsor, a partnership that included principals from the contractor corporation, to analyze problems and assure correction. We believe this increased the mortgage risk since HUD did not develop a basis for exercising its rights, and the mortgagee's rights, to require correction by the contractor and has accepted a deferment in mortgage and replacement reserve account payments to provide funds for correction. We also believe the insuring office reduced contractor incentive to correct problems by waiving HUD's requirement that a cash escrow be held to assure contractor performance under the contract guarantee. As of November 4, 1976, the sponsor had taken some corrective action, particularly on the problem of freezing water pipes, and planned additional actions on heating and drainage problems; however, the sponsor had not decided on a plan for correcting the heating problems.

INSURING OFFICE DID NOT MEET ITS RESPONSIBILITIES EFFECTIVELY

Guarantee inspections were ineffective

To further protect the interests of HUD, through minimizing the risk of mortgage default and assuring tenant satisfaction, HUD procedures require the insuring office to perform guarantee inspections subsequent to the date of substantial completion or the final inspection of construction. These inspections are to be made during the 1-year construction guarantee period beginning at the date of substantial completion, August 1, 1974, for Rock Ridge. Their purpose is to permit the detection of construction defects that may not have been identifiable during construction and to obtain correction by the contractor. The construction contract requires the contractor to correct such defects brought to his attention during this period. Final inspection of the project was made on July 31, 1974.

Insuring office did not perform necessary
cold weather inspection of heating systems

HUD's handbook specifies that guarantee inspections must be made as follows:

"At least two HUD guarantee inspections are required to determine that the construction is acceptable. In addition, other inspections will be made as conditions may require."

* * * * *

"Regular guarantee inspections may occur in a season which would preclude effective inspection of items, such as heating, or planting. Therefore, incidental guarantee inspections may be necessary during appropriate seasons."

Insuring office staff stated that they made only two regular guarantee inspections and did not inspect the heating systems during the first winter of occupancy.

As a result, the insuring office failed to identify problems as early as it could have. Problems with heating systems were not cited as problems for correction until July 30, 1975, on the second and final guarantee inspection.

First guarantee inspection
did not identify defects

Although the number and timing of guarantee inspections, other than the two required, are left to the discretion of the insuring office, the first required inspection is to be made near the middle of the ninth month of the guarantee period. The handbook explains the purpose of this inspection as follows:

"The first guarantee inspection is scheduled sufficiently in advance of the expiration of the guarantee period to permit the discovery and correction, within the guarantee period, of all latent defects."

This inspection is to be made in the company of the sponsor's architect.

This "9-month" inspection was made in May 1975. The inspector said that his inspection consisted of walking about the project and discussing matters with the project manager and the sponsor's architect and that he relied primarily on

the project manager to identify problems to him. He did not obtain tenant feedback or check service files.

No problems were identified by the inspector. He said that neither the manager nor the architect informed him of any problems at the project. Our review showed, however, that the manager and architect were aware, since the first winter, of heating system problems, freezing and bursting pipes, and ponding and erosion problems. Also our review of the manager's service files and interviews of tenants showed that the problems were identifiable from these sources during the first winter.

In our opinion, relying on the project manager does not assure identification of existing defects and is not justified in the light of the common ownership interests among the contractor, sponsor, and management entities. Insuring office officials stated that, in view of the issues we raised, they plan to develop more effective procedures for guarantee inspections.

Insuring office's management section identified problems but failed to treat them as guarantee items

During February and March of 1975, problems identified in our review were identified by tenants and by management to the insuring office's housing management staff and while conducting a regularly scheduled management staff review for project operations problems. The Housing Management Division is responsible for a project once HUD has endorsed the mortgage insurance following completion. The Division monitors the management and financial operations of the project throughout the economic life of the mortgage.

The problems identified in the Management Division's records included ponding and erosion, freezing pipes and drafts in kitchens, and heating system noise and control problems. The Management Division, however, did not treat these problems as possible guarantee items because it did not believe them to be widespread. In addition, they did not communicate the problems to the architectural staff for attention during their guarantee inspections. As a result, items which were known problems to the Management Division in February and March of 1975 were not noted as problems by the HUD inspector for contractor action until the July 30, 1975, final guarantee inspection. Furthermore, several of the problems identified were not included in the final guarantee inspection report, thus endangering HUD's or the mortgagee's guarantee rights, as noted in the handbook:

"Notice shall be given by registered mail with return receipt requested to establish proof of notice. The notice must be given promptly because failure to do so might nullify the guarantee, since defects must be discovered and reported within one year from the date of substantial completion."

Final guarantee inspection
identified problems--insuring office
action was inadequate

In the second guarantee inspection on July 29, 1975, the inspector relied, as before, primarily on the project manager to identify problems. The inspector said most of the problems would not have been identified without the manager having told him, since most problems would have been apparent only in cold or wet weather. The problems identified included: freezing pipes, overheating, noisy heating systems, and erosion.

The inspector stated, however, that he did not cite these problems as construction defects because it was not readily apparent to him that they were the contractor's responsibility. The chief architect said that the contractor was notified of the problems needing correction and that the burden of proof was placed on him to show they were not construction defects. Insuring office officials said it was their general practice not to analyze the cause but to rely on the contractor or the sponsor to do this, especially when the cause was not readily apparent. They said that their interpretation of the manual was that the insuring office was not responsible for determining the cause and that they did not have the resources to do so.

According to HUD's manual applicable to guarantee inspections:

"When he [the inspector] finds work unacceptable, he describes the item which is not acceptable and includes recommendations as to the method for making the work acceptable. He includes the estimated current cost of making each correction."

* * * * *

"* * * the report prepared at this time becomes the basis for any action taken to exercise the rights of the mortgagee and the Administration under the guarantee, so it must be accurate and complete."

We believe the manual requirements contemplate that the insuring office make assessments as to cause or fault and

identify the means of correction; otherwise, it is difficult to see how the report could be used as a basis to exercise rights under the guarantee.

The contractor said that he did not reply to HUD's notice of problems and that he was not responsible for correcting the problems unless someone demonstrated to him that the problems were construction defects.

Insuring office officials said they were aware of the fact that the sponsor had tried unsuccessfully to get the contractor to correct problems; they therefore elected to rely on the sponsor to correct the problems.

The insuring office did not prepare, or assure that the sponsor prepared, evidence necessary to support an action to exercise the mortgagee's and HUD's rights under the contract guarantee. Neither HUD nor the sponsor was able to provide us with conclusive data as to causes of the problems we investigated. In our opinion, the insuring office's failure to fulfill its duties to cite construction defects and to fully define the nature and extent of these defects makes it difficult for the insuring office to support an action against the contractor and thus results in increased risk of mortgage default, since mortgage principal payments and payments to a capital reserve account were deferred for corrective work.

Releasing cash escrow to contractor

HUD has established standard minimum requirements, applicable to the Rock Ridge project, for assurances of completion of construction in its Initial Closing Commitment for Project Mortgage Insurance Handbook as follows:

"ASSURANCE OF COMPLETION. HUD-FHA standardized requirements, which are described below, are minimum requirements imposed primarily for HUD-FHA's own protection. Nothing in these instructions will be construed as limiting or restricting the absolute right of the mortgagee or the owner to impose additional or stricter requirements, but the HUD-FHA requirements will not vary up or down from the amount prescribed below:

* * * * *

"As an exception to the foregoing [payment and performance bonds] requirements, a Completion Assurance Agreement, FHA Form 2450, with a cash deposit or an irrevocable letter of credit

equal to one-half of the amount of the indicated performance bond or 10 percent of the estimated cost of construction rehabilitation, whichever is the greater, may be accepted in lieu of the performance and payment bonds. The amount of bonds, cash deposits or letters of credit will in each instance be calculated on the HUD-FHA estimate of construction or rehabilitation costs."

A Completion Assurance Agreement was used for Rock Ridge Apartments; hence, the following HUD Final Closing Commitment for Project Mortgage Insurance Handbook instruction applied:

"CASH ASSURANCE. If a Completion Assurance Agreement, FHA Form 2450, was used at initial closing, the Field Office Director may, after final endorsement of the credit instrument, release the escrow funds except for an amount equal to 2 1/2 percent of the total amount of the construction contract. The retained percentage shall be held in the escrow account during the one-year guarantee period...."

However, at final endorsement, the insuring office waived the requirement of the Completion Assurance Agreement with the required escrows and accepted a maintenance bond for \$75,000, roughly 2-1/2 percent of the contract price. The maintenance bond is a third-party pledge to assure the correction of any defects in the work performed under the contract which are directly attributable to defective materials or workmanship. The contractor stated that he requested the escrow be waived due to cash problems. The insuring office accepted the maintenance bond based on the advise of its legal counsel.

When the initial construction lender tried to transfer the mortgage to the Government National Mortgage Association in 1975, the Association would not accept it with the maintenance bond, requiring either a cash escrow or letter of credit. Consequently, the sponsor established a letter of credit to guarantee correction of latent defects.

An official of the Government National Mortgage Association stated that the Association had refused to accept a maintenance bond because it was declared to be ineligible under the requirements set forth in the Sellers Guide. (The Sellers Guide is the Association's Manual which is used by lending institutions.) He stated also that HUD regulations for multifamily project mortgage insurance did not clearly establish the eligibility of maintenance bonds and

that the Association had reservations that, if it ever had to place a claim against the bond, their position would be jeopardized.

In our opinion, the insuring office did not have the authority to accept a maintenance bond in lieu of the cash escrow. Obviously, the bond provides less protection than the cash escrow because it is more difficult to obtain corrective action or damages from a bonding company than from the lender-held cash escrow. In addition, the contractor would have less incentive to correct construction defects than if a part of his payment were withheld.

CORRECTIVE ACTIONS--TAKEN AND PROPOSED

The insuring office relied on the sponsor, rather than the contractor, to make corrections. The sponsor has taken some corrective action, particularly on the problem of freezing pipes, and plans to do more. As of November 4, 1976, however, the sponsor had not decided on a plan for correcting the overheating problem and was not considering action to correct the cold kitchen problem.

Corrective actions planned by sponsor initially

The insuring office identified the following problems during its 12-month guarantee inspection in July 1975.

- Freezing of hot and cold water pipes leading to kitchens.
- Overheating of apartments.
- Noisy heating plants in four buildings.
- Erosion at three buildings.
- Lawn areas needing reseeding.
- Steps and site walks damaged due to settlement.
- Lavatories loosened from walls.

This inspection did not identify the ponding of water or cold kitchen problems which had been previously pointed out to the insuring office's management section and did not identify the problem of insufficient hot water noted earlier in the management section's review, which we found affected seven buildings.

The insuring office relied on the sponsor to analyze the cause and to propose correction for the problems identified in its July 1975 guarantee inspection. In October 1975 the sponsor submitted a plan for correction and developed a cost estimate with assistance from the insuring office, based on the sponsor using his maintenance personnel rather than contracting for the work.

The estimated costs of the corrections follow.

Heating systems	\$32,600
Kitchen plumbing	22,800
Site work	13,600
Lavatory work	<u>6,000</u>
Total	<u>\$75,000</u>

The sponsor's estimated cost of heating repairs was accepted after review by the insuring office, but the adequacy of the plan as to correcting the problem was not analyzed.

Mortgage principal payments, as well as payments into a reserve account for replacing capital items, were deferred for 1 year to provide the funds needed for the corrective work. HUD and the mortgagee agreed to the deferment.

Corrective actions completed by the sponsor

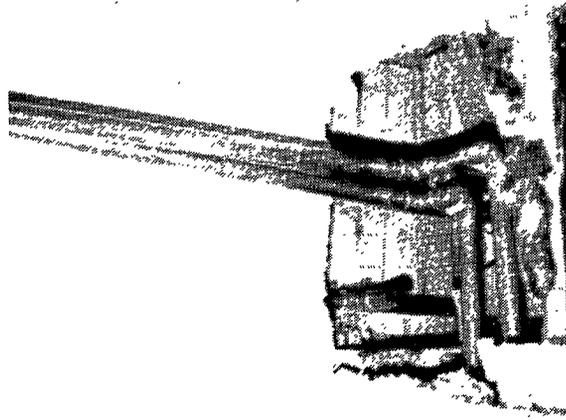
As of August 31, 1976, the sponsor had completed corrective work for

--kitchen plumbing--water supply pipes relocated from within kitchen exterior walls to kitchen interior walls in 97 apartments (see photograph on page 44),

--lawn reseeding, and

--lavatories.

Work on some erosion problems had begun.



SOURCE: GAO

**WATER SUPPLY PIPES RELOCATED TO
INSIDE OF KITCHEN IN APARTMENT
217A--MAY 1976**

In addition to the above items that had been identified during the guarantee period, the sponsor added insulation to uninsulated pipes in the attics of all 14 buildings near areas of greatest cold infiltration and had partially alleviated water ponding problems at 2 buildings by installing underground drainpipes. Portable pumps are used in center sections of buildings D1 and D2 to pump out ponding water. This solution does not satisfactorily resolve the problem, since tenants are still subjected to the ponding of water. HUD offices have been unable to tell us how much of the \$75,000 allocated for corrective work had been expended. They state they would furnish us the information as soon as it was obtained from project management.

Adequacy of completed actions

Our consultant concluded that relocating kitchen water supply pipes should correct the problem of freezing and bursting of these pipes and that the insulation added to attic pipes should eliminate the freezing of these pipes except perhaps in the event of a prolonged power failure, in which case the branch lines near attic eaves still may freeze. Attic branch lines, he believes should have been afforded the same

protection given to other pipes in the attic, i.e. placed beneath the 6-inch fiberglass ceiling insulation.

Although our consultant concluded that drains installed at two buildings would reduce ponding, he stated that pipes may be rendered ineffective by ice buildup in winter months due to their location within the frost zone.

Additional corrective work proposed by the sponsor

The sponsor told us that he was reconsidering his original plan for heating system corrections. The original plan, submitted to and accepted by HUD, would not have satisfied corrections judged as necessary by either our consultant or the HUD heating specialist who assisted us. Both advisors determined that individual heat controls would be more effective, and the HUD engineer said changes in boilerroom controls were needed. As of August 1976, further study of the problem had been made but the sponsor was awaiting advice from another engineer before deciding on a plan. Thus, work on the overheating problem had not begun and a final corrective plan had not been established. No action has been proposed by the sponsor to correct the cold kitchen problem. The insuring office told us that the deadline for completing all work was extended for the second time to February 15, 1977.

No provision has been proposed by the sponsor to permanently relieve ponding problems in sunken lawn areas at buildings D1 and D2 nor to correct ponding in doorways at building D2 or E3 and in the rear yard of building E3.

SCS concluded that erosion could be controlled at building D2 by terracing, by revegetating, and by restricting tenant traffic by building a fence--as proposed by the sponsor. At building B5 both SCS and our consultant engineer cited the lack of restrictions on foot traffic as contributing to the erosion, but the sponsor's plan of correction does not include any action.

The insuring office expressed basic agreement with the facts in this chapter. In several instances, insuring office staff provided clarification where they did not agree, and their comments were considered in this chapter.

CONCLUSIONS AND RECOMMENDATIONS

Insuring office guarantee inspections were not adequate in that construction defects and the widespread problems at the project were not detected until the final guarantee inspection in July 1975. Once the problems were known to the

insuring office, it did not analyze the problems and therefore did not have a basis for requiring the contractor to correct the defects under the contract guarantee. As a result, the insuring office requested the sponsor to correct the problems.

Actions taken or proposed should correct the water supply pipe freezing problems and some water ponding and erosion problems. Other ponding and erosion problems need further work beyond that proposed for permanent solution, but no plan exists. We were not able to evaluate the plans to correct heating system problems because the sponsor had not decided on the method of correction.

In relying on the sponsor to correct problems, the insuring office agreed to a deferment of mortgage payments and reserve for replacement account payments to provide funding for the work. Thus the insuring office has increased the risk of mortgage default rather than seek corrections under the contract guarantee.

Accordingly, we recommend that the Secretary of HUD direct the Providence Insuring Office to:

- Insure that guarantee inspections are performed adequately and include more than reliance on project management for identification of construction defects.
- Insure that seasonal inspections, such as cold weather inspections of heating systems, be made as required by HUD policy.
- Require the housing management staff to notify the chief architect of any problems they identify during the guarantee period for determination of whether they represent construction defects covered by the guarantee.
- Adequately analyze and document problems identified during the guarantee period to determine whether the problems are construction defects for which correction should be obtained from the contractor under the contract guarantee.
- Adhere to HUD policies for establishing escrows for assuring satisfactory contractor performance.
- Adequately analyze the sponsor's proposed plans for corrections and monitor corrective work to determine

whether they will resolve problems at Rock Ridge Apartments before releasing the sponsor's letter of credit.

AGENCY COMMENTS

The Acting Deputy Assistant Secretary for Housing, in commenting on this report (see app. III), agreed with our recommendations and made the following comments. The report makes it apparent that the architectural staff in the Providence Insuring Office needs additional training related to multifamily architectural procedures. A 2-day training program is available for this purpose and has been used at other offices. The training program covers architectural analysis, including required architectural exhibits and design review; inspection procedures, including guarantee and annual inspections; and change orders and escrow procedures. It also covers a review of contract documents, such as Owner-Architect Agreements, Construction Contracts, and the American Institute of Architects General Conditions, and HUD/FHA Supplementary Conditions. HUD will arrange to have this program conducted in the Providence Insuring Office by its Regional Architectural Advisor stationed in Boston.

With respect to the corrective work being done at the Rock Ridge project, the Acting Deputy Assistant Secretary for Housing said that the Director of the Providence Insuring Office had already had meetings with the sponsor and that they had agreed on a plan for correction. He said that (1) most of the corrective work had already been completed, (2) his staff was continuously monitoring the progress of the work, (3) some exterior work related to grading and landscaping would be completed when seasonably possible, and (4) HUD would arrange for a final inspection of this project by a regional or central office staff architect after completion of the work.

*ERNANI J. ST GERMAIN, R.I., CHAIRMAN

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AND HOUSING

NINETY-FOURTH CONGRESS

WASHINGTON, D.C. 20515

February 2, 1976

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Honorable Elmer B. Staats
Comptroller General of the United States
General Accounting Office
Washington, D.C.

Dear Mr. Staats:

An unprecedented number of complaints continue to be received from the tenants of a Section 236 project known as Rock Ridge, located in Woonsocket, Rhode Island (project number 016 44 054). The project consists of 151 units, built at a cost of \$2,988,763.87. Advance Mortgage Corporation served as the mortgage originator. The Federal National Mortgage Association purchased the mortgage on November 3, 1975. It is my understanding that two relatively minor modification agreements, totalling \$75,000, were executed on November 1 and December 7, 1975.

From the type complaints received, there is a substantial question in my mind as to the adequacy of the plan review stage which should take place subsequent to the initial approval stage and prior to final approval accompanied by a notice to proceed. In addition, it is my belief that required inspections made during the course of construction and certainly the final inspection prior to final disbursement would have brought to light major structural and design defects. The principal complaint involves the location of piping in unheated areas of each unit causing widespread freezing and bursting of pipes with extensive damage to carpeting, doorjamb, etc. With the final assignment of the mortgage to FNMA and I assume final payment to the contractor, it is not surprising that the tenants are receiving very little, if any satisfaction inasmuch as the government appears to have lost all leverage.

In view of the foregoing, I request that a full investigation be made beginning with the original application leading to preliminary approval. Special attention should be given to excavation costs to determine whether or not an adequate allowance was made for such rock excavations as may have been required which should have been supported by test boring results. If variations were made in the approved plans, your investigation should verify an appropriate adjustment or modification in the approved contract price.

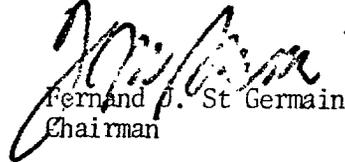
Honorable Elmer B. Staats

February 2, 1976

Please ascertain whether the required inspections were in fact made, and particularly whether the final inspection noted potential design difficulties concerning the location of piping and design of required heating systems. Projects of this nature, as you can appreciate, if attributed to poor administration unfairly reflect on otherwise well conceived housing programs compounding our difficulties to structure programs for the benefit of low to moderate income individuals.

Should your investigation tend to confirm departmental laxity, I would appreciate your looking into similar projects performed by the general contractor in other states since I suspect inadequate attention may have also been given to relevant work experience prior to final approval.

Sincerely,



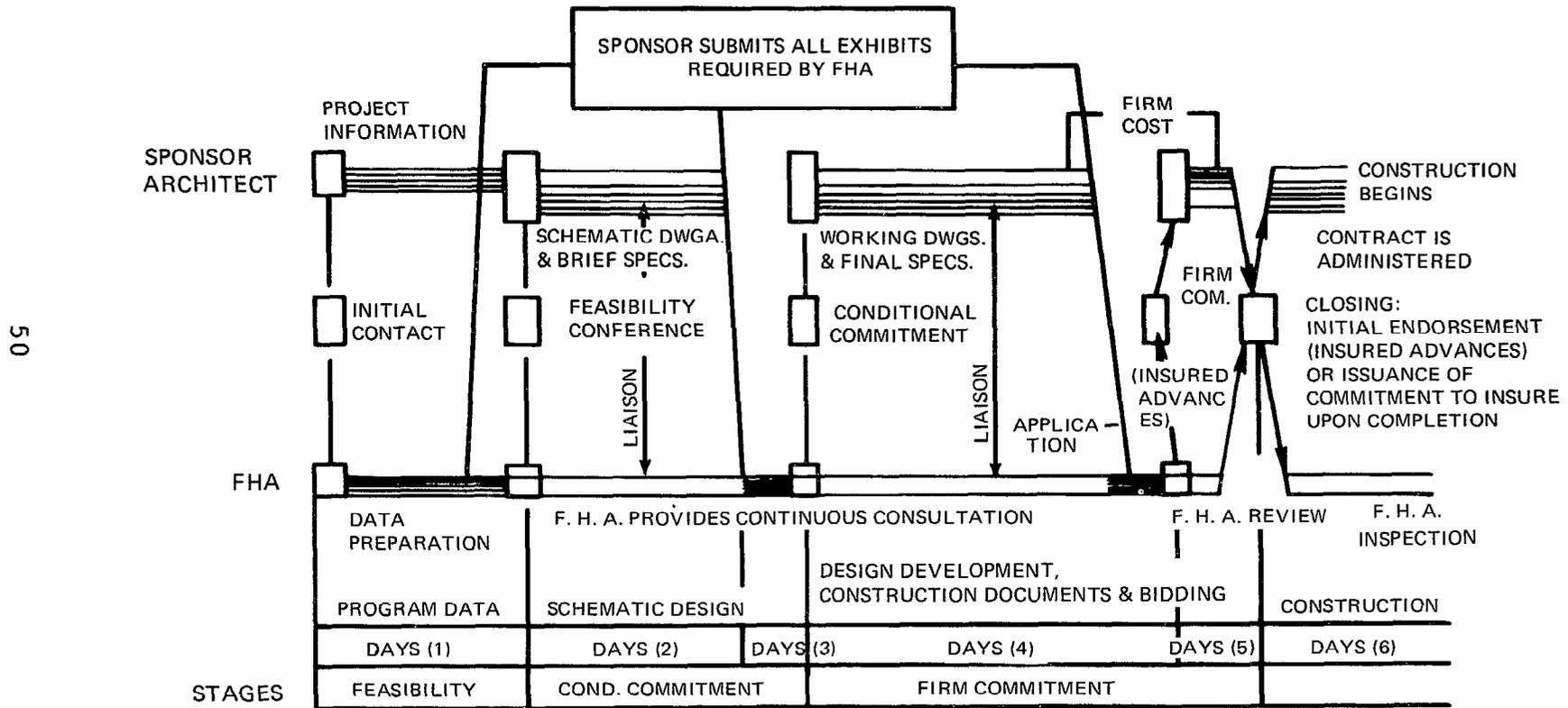
Fernand J. St Germain
Chairman

FJStG:hSh

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
MULTIFAMILY PROCESSING FLOW CHART FOR

SECTION 236 PROJECT
MORTGAGE INSURANCE

PROJECT FLOW CHART



THE FHA INSURING OFFICE WILL ESTIMATE THE NUMBER OF DAYS.

THE FOLLOWING TIMES WILL SERVE AS GUIDES:

1. 32 DAYS (WORKING DAYS)
2. 28 DAYS
3. 4 DAYS
4. 32 DAYS
5. 4 DAYS
6. 14 DAYS



DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
WASHINGTON, D.C. 20410

OFFICE OF THE ASSISTANT SECRETARY FOR
HOUSING--FEDERAL HOUSING COMMISSIONER

APR 4 1977

IN REPLY REFER TO:

Mr. Henry Eschwee
Director, Community and Economic
Development Division
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Eschwee:

Your letter of January 18, 1977, addressed to the former Secretary of Housing and Urban Development transmitting a draft of a report to the Chairman, Subcommittee on Financial Institutions, Supervision, Regulation and Insurance, House Committee on Banking, Currency and Housing on, "Poor Design Reviews and Construction Inspections of Rock Ridge Apartments, Woonsocket, Rhode Island--A Section 236 Housing Project," has been referred to me for reply.

After a thorough review of the report, I believe the conclusion on page 25 stating that: "most of these problems occurred because of design deficiencies and construction that did not comply with contract requirements or good construction practices" presents a realistic evaluation of the cause of the problem.

I, therefore, believe your recommendations on pages 39 and 52 are sound. The report, also, makes it apparent that the Architectural Staff in the Providence Insuring Office needs additional training related to multifamily architectural procedures. A two-day training program is available for this purpose and has been used at other offices. The training program covers architectural analysis including required architectural exhibits and design review, inspection procedures including guarantee and annual inspections, change orders and escrow procedures. It also covers a review of contract documents such as Owner-Architect Agreements, Construction Contracts and the American Institute of Architects General Conditions and HUD/FHA Supplementary Conditions. We will arrange to have this program conducted in the Providence Insuring Office by our Regional Architectural Advisor stationed in Boston, Massachusetts.

With respect to your recommendation on page 53 concerning the corrective work, the Director of the Providence Insuring Office has advised me that he has already had meetings with the sponsor and they have agreed on a plan for correction. In fact, most of the corrective work has already been completed. His staff is continuously monitoring the progress of the work. Some exterior work related to grading and landscaping will be completed when seasonably possible. We will arrange for a final inspection of this project by a Regional or Central Office staff architect when the work is completed.

On page 39a you mention the construction problems at Country Club Estates subdivision, Merrimack, New Hampshire and recommend that the Secretary determine whether the construction deficiencies discovered there and at Rock Ridge Apartments represent a nationwide problem which merits aggressive corrective action in order to protect the interests of the Government, as well as homebuyers and tenants of HUD-subsidized projects. Each of our Regional Offices has developed a monitoring system to review the performance of their field offices. We believe these field office reviews adequately preclude any nationwide problems. Consequently, I do not believe that further corrective action on this point is necessary at this time.

Sincerely,



Morton A. Baruch
Acting Deputy Assistant Secretary

GAO note: Page number references in this appendix may not correspond to pages of this report

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