MASTER

**ROSEWOOD PLANTATION PROJECT:
A SUMMARY REPORT**

Celeste B. Porter

October 1981

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U.S. DEPARTMENT OF ENERGY
under contract number DE-AC02-79CS30166 ✓

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SSEC/TP--41287

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Rosewood Plantation Project: A Summary Report

Introduction

In October 1979, the Southern Solar Energy Center (SSEC) reviewed numerous multifamily projects in the Southeast to select a pilot development under the DOE-funded Multifamily Program. Subsequently, SSEC contacted the J.T. Holding Company to recommend that it incorporate energy conservation and passive solar features in its new 105-unit condominium development, Rosewood Plantation. The development is located in Atlanta, Georgia. In this pilot project SSEC offered the assistance of its technical staff in providing architectural and engineering support to Rosewood's designers to enable them to design condominium units incorporating energy-saving and passive solar features.

Rosewood's developer accepted the design assistance and subsequently agreed to modify 12 units to incorporate passive solar features. This number was largely dictated by the existing site plan, which provided only limited solar access. All 105 units were modified to incorporate some of the energy conservation features recommended; however, several variations from SSEC's recommendations resulted in the construction of units that performed below anticipated energy consumption levels.

The experience with the Rosewood Plantation project illustrates many of the problems involved in dealing with the attitudes of the building community and the constraints on innovation imposed by what it perceives as the market for housing and methods of marketing housing. Since overcoming these problems is critical to the success of the technology transfer effort, it is useful to study the history of the Rosewood project to identify methods for improving the process.

One year after the opening of Rosewood Plantation, SSEC reviewed the project to assess the impact of its design assistance effort on the finished product--the constructed units--and to identify methods for improving and refining the technology transfer process. As part of the review, SSEC interviewed both the project architect and the developer to get their views on the condominium project in retrospect, to gain a sense of their plans to apply energy conservation and passive solar techniques to other developments, and to discuss their views of the market for passive solar in multifamily developments. The following report summarizes the results.

Project Background

J.T. Holding Company is a major development company in metropolitan Atlanta, Georgia, and California. In 1980, it constructed approximately 150 housing units in two Atlanta developments. Up until the time SSEC contacted the company it had not included significant energy conservation options in its developments.

The company constructs housing for the middle-income residential market. The Rosewood Plantation units were designed to sell in the \$80's to \$90's. The developer profiled his potential buyer as a well-educated white-collar worker.

SSEC selected the Rosewood Plantation development as the subject of its first multifamily pilot effort because of the favorable timing of the project. At the point of the initial contact, the site plan had been developed, and the working drawing phase was scheduled to start shortly. This provided an opportunity to test the developed working methodology for future projects. The concept utilized a low-cost consulting agreement with the project architect and a no-cost letter of understanding with the developer.

As stated, when SSEC became involved with Rosewood, architect and land planner Zachary Henderson of Roswell, Georgia, had already developed an 18th-century Williamsburg architectural style and had had the site plan for the project approved by the county zoning board. Though this imposed limitations on the potential for solar applications, the developer agreed to review SSEC's recommendations and to incorporate in Rosewood's plans those measures deemed practical - i.e., those that would not significantly increase construction costs.

The site plan limited solar access to only a few of the condominium units, and the architectural style precluded the incorporation of large glazed areas without altering the overall exterior appearance of the buildings. SSEC decided to proceed with the project, because overcoming the limitations and constraints imposed by existing conditions would demonstrate the broad applicability of passive solar and energy conservation techniques.

SSEC's Recommendations

After evaluating the site plan and the architect's designs, SSEC recommended that a direct gain system using large bay windows be incorporated into those units facing south and that units facing north employ a sunspace on the rear or south side. These modifications would not alter the Williamsburg style of the buildings. It was further recommended that brick floors be laid in the bay window areas and the sunspace for thermal storage. The sunspace was to have brick walls as well, small fans for heat transfer to the living area, and double-glazed French doors to provide access to the sunspace and to close it off when solar heat gain was not desirable.

SSEC recommended that an energy conservation package be included in all the Rosewood units. The package included double-glazed windows, R13 fiberglass and insulating sheathing in walls, R19 ceiling insulation, perimeter insulation for the floors, and careful sealing of all exterior wall joints and plumbing and electrical openings. The conservation package would not alter exterior appearances in any way, and even units without southern orientation would thus have lower heating and cooling requirements. The developer agreed to the recommendations.

The SSEC technical staff performed detailed calculations to test the energy benefits to be gained from its recommendations. They also provided the architect and developer with detailed specifications for the incorporation of the passive/energy-saving features and spent adequate time with the Rosewood designers to thoroughly explain the recommended features. The technical staff also reviewed designs prior to the execution of working drawings to assure that every opportunity for energy conservation was taken.

Results of Design Assistance Effort

Though Rosewood's developer and architect were enthusiastic about the energy-saving recommendations during the design phase, the supervision of the various subcontractors proved difficult. Several variations from SSEC's recommendations reduced the effectiveness of the energy features. The subcontractor omitted perimeter insulation from several of the first units built. As a result of construction technique, the corner units had a lower R-value than the adjacent walls and higher levels of air infiltration. Sealant was not used to reduce infiltration at wall joints and at plumbing and electrical openings.

The sunspace design (insulated, brick end walls) that SSEC produced was not used. Instead, the builder substituted another design (glazed roof and end walls), which did not properly function as a passive solar sunspace. The sunspace was installed on a model unit and offered as an option on others. As constructed on the model the sunspace proved to be a nonmarketable option.

The bay windows were installed according to specifications. The architect subsequently remarked that buyers responded favorably to the bay windows, but primarily for aesthetic reasons.

Throughout the construction process building techniques were adjusted to improve energy performance of the units. The omission of perimeter insulation was corrected, but sealant was not used on the wall joints or plumbing and electrical openings.

However, it should be borne in mind that during the construction period, winter-spring 1980, interest rates were rising rapidly. The building industry was experiencing a worsening slump, and Rosewood's developers were no doubt reluctant to do anything that might either slow down construction or increase the selling price.

The end result of the effort was one of partial success. All the Rosewood condominium units included a majority of SSEC's energy-conservation recommendations. As a result of SSEC's effort, a major developer modified design and construction practices to include passive and energy conservation techniques and has continued to do so in subsequent developments. The project architect has continued to use passive solar and energy conservation techniques in his practice and his own residence.

Homeowners at Rosewood experience lower energy consumption than they would if SSEC had not made its design assistance effort. The energy consumption from Rosewood Plantation was compared to computer averages provided by Atlanta Gas Light Company of over 10,000 similar multifamily units. Varying occupant

lifestyle and unit location were stated to effect energy consumption levels up to 40 percent above or below this average. The participating Rosewood units with six months of performance data averaged approximately 10 percent energy savings over the Atlanta Gas Light figures with a 40 percent thermal performance swing. Further analysis of Rosewood's thermal performance during winter 1980-81 can be found in Appendix A and C.

In spite of the fact that all the passive solar features were not incorporated according to SSEC's recommendations, the developer advertised Rosewood as "Atlanta's first condominium development to include passive solar energy concepts." Though he mentioned solar in this context, the marketing staff did not take full advantage of the solar features as a sales tool. They perceived the public to be more responsive to an "energy conservation package."

Interview With Architect

Project architect Zachary Henderson stated that he felt his association with SSEC on the Rosewood Plantation Project had been a positive learning experience. He felt that he had been knowledgeable of passive solar applications prior to the project, but that his knowledge was enhanced by working with SSEC's technical staff, learning to compute actual energy savings, to calculate heat loss and gain, and to properly size passive components.

Henderson cited reduction in operating costs for the homeowner as the most important reason for incorporating a passive solar system. He feels it is a good investment, because it is a fixed-cost energy producer and renders a portion of the home's operating costs nonescalating.

Henderson believes there is a lack of public awareness and comprehension of passive solar, which diminishes its value as a marketing tool. He feels, however, that the buying public understands and appreciates the value of energy-conserving measures. Rosewood's market research staff recommended that, because of this lack of awareness of solar, the developer gear his marketing of Rosewood to the energy conservation package rather than passive solar features.

Henderson was aware of the variation from SSEC's recommendations in the actual construction. Though perimeter insulation was omitted from several of the units initially constructed, it was added to those constructed later. Sealant on doors, windows, and electrical and plumbing outlets was omitted, against his recommendation, because of cost and subcontractor reluctance to installation.

Asked what he would do differently if he had Rosewood to do all over again, Henderson said he would keep the sunspace option and use sealant, as SSEC recommended, to control infiltration. He felt that unit density precluded any changes in site orientation to allow more units to have southern exposure. He would have liked to have included an air-tight, woodburning stove; however, the developer's marketing staff discouraged this addition.

In the past year, the architect has continued to use energy conservation and passive solar concepts in his practice. He has designed several custom houses with a passive sunspace and one featuring a pool atrium with masonry decking for thermal storage. He incorporates good insulation and infiltration control measures, overhangs, and landscaping to enhance solar gain and says that his clients' response to these features has been good. Though he is having no technical problems with his designs, he has trouble convincing homeowners of the necessity for manual operation of passive solar devices as opposed to exclusively using the thermostat for comfort control.

Henderson feels there is good potential for applying passive solar design to multifamily construction; however, he identified three levels of resistance based on his experience. The first level is the owner-developer who does not know the marketing advantages of passive solar and views it as an added cost with no added sales value. The second level is the real estate agent who does not understand solar, and therefore cannot use it to attract sales. The third level is the buyer who has no understanding of the investment value of passive solar and thus views it as additional front end cost and no more. The architect feels that changing the attitude at the first level will create a domino effect through the other two levels with the end result being buyer awareness and demand for passive solar.

Based on his experience in the Rosewood Plantation project, the architect feels that the role of SSEC in similar future projects should continue to focus on working with both the private professional and the owner-developer, where the potential impact is the greatest. An awareness seminar for developers and their marketing group would be of particular benefit to allay existing negative attitudes toward, and lack of knowledge of, passive solar techniques.

Interview With Developer

James MacMahan of the J.T. Holding Company says that for marketing reasons, he was interested in SSEC's proposal to recommend energy conservation and passive alternatives to reduce energy consumption at Rosewood Plantation. He builds his townhome developments for the educated white-collar worker who is aware of the energy crisis in the country and its impact on utility bills.

Because the developer perceived an awareness of energy issues in the type of buyer he wanted to attract, he marketed Rosewood's energy package in literature and promotional campaigns. The energy-conserving features are highlighted when a townhome is shown to a customer. He feels that owners of the units with passive features (bay windows) definitely chose them for their energy-saving benefits rather than their aesthetics.

The units with passive features (bay windows) were higher priced and sold out rapidly. He believes the utility bills of the Rosewood units to be one-half of similar townhome developments that he built two years prior to Rosewood, though he had no data to support this contention. He says owners have indicated to him that their energy costs are lower than anticipated.

MacMahan felt that the sunspace was an unpopular option because owners did not want to sacrifice their only private open-air space to a closed space. He also had difficulties with the sunspace supplier. The sunspace was offered as an option, but no one bought it.

Proper building orientation or siting was the most important aspect of passive solar design that the developer learned from his association with SSEC on the Rosewood Plantation Project. If the plot plan for the Rosewood site had not already been passed by the time SSEC became involved, he would have changed the site plan to include more south-facing units. He said that Georgia law prohibited the change of a site plan after zoning had been passed. In a subsequent townhome development in Atlanta, he planned one-third of the units for south-facing bay windows and installed tiles for thermal storage. He has continued to use high insulation standards and double-glazed windows and doors, and now uses a sealant on exterior wall joints and on plumbing and electrical openings. He expects to continue the use of conservation and passive features in future units, because he can sell more at a higher price with these features.

In the past year, his developments in Georgia are the only townhomes in which the developer has incorporated conservation and passive solar features. He believes there is no market for these features in his company's similar developments in California, since heating needs there differ from those in Georgia. One of J.T. Holding Company's townhome developments built before Rosewood was later retrofitted with storm windows and doors and gas hot water and space heating installed as energy conservation measures. The developer felt these measures would be significant in reducing utility bills and thus make the units more popular in the market.

MacMahan believes there is a significant potential for passive solar applications in multifamily housing. He expects energy costs to continue to rise. He believes that the same principle that motivates consumers to choose small, fuel-efficient cars with good resale value will apply to their choice of housing. In his experience, people will pay more initially for housing when they know fuel bills will remain low.

He thinks that SSEC could best meet his present and future needs for technical assistance by providing information on active solar systems in addition to passive design assistance. He believes many developers are interested in incorporating active hot water systems but do not have sufficient information on the cost-effectiveness, performance, or reliability of products on the market. They want to minimize the risk associated with this type of investment.

In conclusion, he is interested in solar in a productive way; he is ready to incorporate solar features in his developments.

APPENDIX A
Rosewood Plantation
Thermal Performance - Winter 1980-81

Rosewood Plantation, a multifamily condominium development located in north Atlanta, Georgia, is the result of a cooperative design effort between J.T. Holding Company; Zachary Henderson, architect; and the Southern Solar Energy Center (SSEC). Approximately one year after the opening of Rosewood Plantation, SSEC reviewed the project and studied the thermal performance.

Only two unit clusters with south-facing condominiums had been occupied through the winter of 1980-81. With the cooperation of the developer, the owners, and the utility company, the gas bill history was obtained and analyzed. Of those participating, 10 units had been occupied for six months (11/80 - 4/81) and 14 units had been occupied for five months (12/80 - 4/81), which was considered a sufficient number to obtain verifiable data. A site plan of these units is included in the Appendix (east-, south-, and west-facing units in U-shaped cluster).

All of these units have natural gas heat/hot water service, R-30 insulation (roof), R-18 insulation (walls), therma-pane double-hung wooden windows, energy-efficient exterior doors, and a wood-burning fireplace with gas log lighter.

Additional data were obtained for the study to determine thermal performance (Btu/DD/ft^2) of each unit. In order to compare buildings of different sizes in different locations it is necessary to remove parameter effects from the comparison; Btu/DD/ft^2 is such a measure. The measurement for heat consumption (Btu) was calculated using information given by the utility company. To obtain the amount of gas used for space heating only, the average amount of hot water usage was approximated for each unit and subtracted from the total amount of gas used per billing period. From this amount, the consumption figures were calculated. The degree days (DD) were determined per billing period for Atlanta from daily temperature records in "Local Climatological Data" by the National Oceanic and Atmospheric Administration at the National Climatic Center in Asheville, North Carolina. Degree days measure the severity of the heating season in a particular locale. Square footage (ft^2) of each unit was obtained from the architect's plans.

The following observations were made from monthly Btu/DD/ft^2 figures weighted according to monthly degree days. There were tremendous variations between the best to worst units in terms of energy consumption levels. The units represent good energy-conserving construction (average 9.52 Btu/DD/ft^2) and use less than one-half the energy projected in the proposed BEPS standard for an average house of the same size (21 Btu/DD/ft^2). However, the average energy consumption was twice what was originally anticipated. The difference from what was assumed and the actual can be partly accounted for by the infiltration caused by the construction technique used to apply wall insulation and the omission of sealant during construction. It is important to remember that the energy consumption level predicted was a maximum expectation that could be achieved with the given design constraints.

Some units performed close to the predicted level, and one unit was even better than predicted. Given that the units were similarly constructed, occupant lifestyle greatly affected the performance of the units. The best four units averaged 6.06 Btu/DD/ft² while the worst four units averaged 12.69 Btu/DD/ft². Different household habits account for the variation, including frequent travel, thermostat settings, and hours spent at home. Use of a fireplace increases consumption levels; if the damper is not closed after use, heat is continuously lost. The slightly increased consumption of all the units during December (holidays, when most people are home) is probably attributed to frequent use of the fireplace.

As anticipated, the interior units performed better than end units on the average because of greater protection from the weather and less opportunity for infiltration. The monthly average energy consumption for all the units followed expectations, peaking in December with a following decline, in accordance with the heating degree day pattern. On the average, a slight increase of energy consumption occurred during April, probably due to occupant lifestyle. (See Appendix C.)

The south-facing units without bay windows used less energy than those facing east or west. However, in comparing the two clusters, one set of east-facing units performed better than the other, which could be attributed to either some variation in construction or occupant lifestyle. The participating units with south-facing bay windows were end units and had above average energy consumption. Any solar heat gained was offset by the combination of the infiltration associated with the bay window and end units and occupant lifestyle. Nonetheless, the cooling season performance of the south-facing units should be better than the other units; south walls receive less solar radiation during the summer and are readily shaded by fixed roof overhangs.

In conclusion, the units represent good energy-conserving construction as evidenced by their thermal performance. The use of sealant and more careful installation of wall insulation would have further improved the performance. As in any residence, the occupant lifestyle greatly effects the level of thermal performance achieved.

ROSEWOOD PLANTATION SITE PLAN

BY RIVER PLANTATION COMPANY

Zachary W. Henderson, A.I.A., Inc.

ARCHITECTS

PLANNERS

988 Old Canton Street / Marietta, Georgia 30066 / 404-592-3000

TWO & THREE BEDROOM TOWNHOUSES

105 UNITS (9.6 UNITS PER ACRE)

10.94 ACRES

210 PARKING SPACES

MONTHLY ENERGY CONSUMPTION

ROSEWOOD PLANTATION

□ AVERAGE-HIGHEST 3 UNITS
▬ AVERAGE-ALL UNITS
□ AVERAGE-LOWEST 3 UNITS

APPENDIX D
ROSEWOOD PLANTATION
FLOOR PLANS AND PHOTOGRAPHS
OF SOUTH-FACING UNITS

UNIT NO: CITY:	SUBJECT: PASSIVE SOLAR UNITS		PROJECT: ROSEWOOD PLANTATION ROSWELL ROAD ATLANTA, GEORGIA	ARCHITECT: PLANNER: 948 Old Canton Street / Historic Roswell, Georgia 30076 / 404-452-2889	NO. WORKSHEET:	DESCRIPTION:
	DRAWN: WEP	CHECKED:			NO. WORKSHEET:	DESCRIPTION:
	DATE: 8-30	ASN: 7948			NO. WORKSHEET:	DESCRIPTION: