



INSIGHT

ISSUE NO. 7

A technical newsletter by Raths, Raths & Johnson, Inc. for the construction industry.

“Insight: to see into and understand; an item of knowledge gained by this power.”

In this issue of *RRJ Insight*, we take a look at two unique services offered by RRJ. Our work with manufacturers in product development combines the experience and expertise of our designers, investigators, and testing specialists. The article titled “RRJ Provides Technical Assistance to Manufacturers” gives several examples of the range of projects we have encountered. In the following article, “The Trend in CAD is Elevating to a New Dimension”, we discuss RRJ’s use of three dimensional CAD models and how they help solve and communicate design and construction problems.

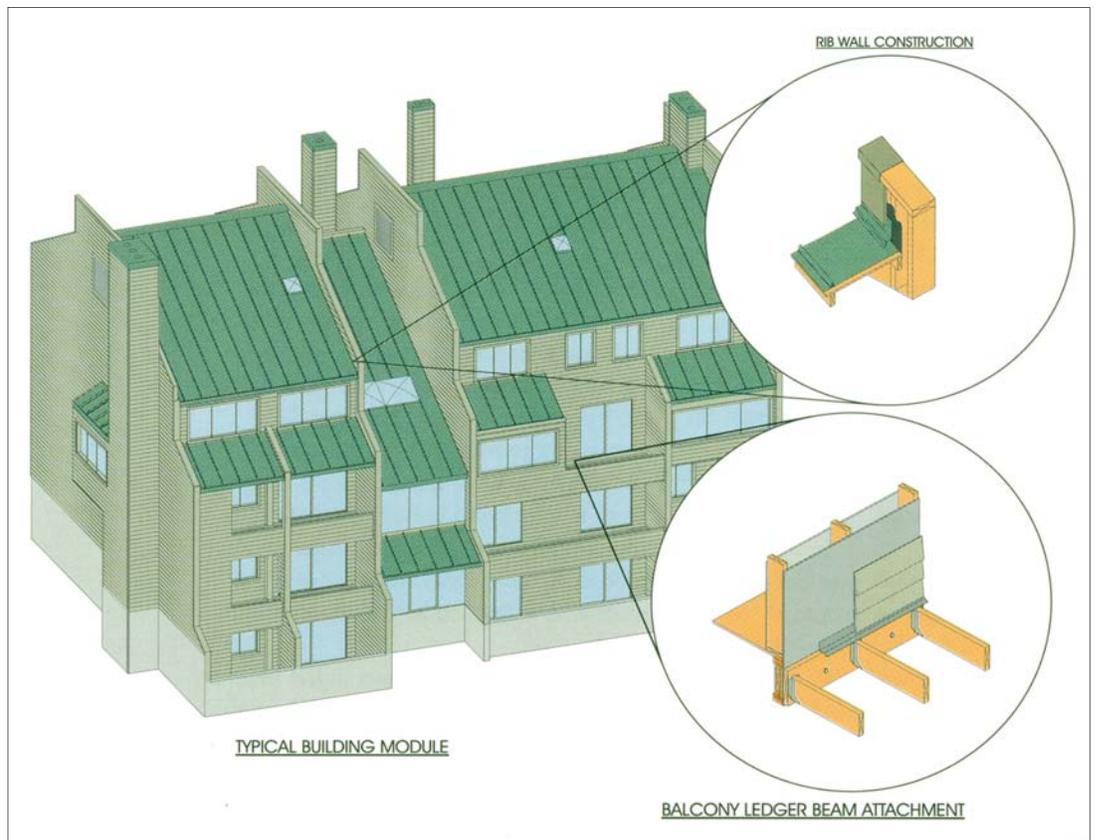
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Solid 3D model of complete building with additional 3D models to explain details.

Project Profile

RRJ Provides Technical Assistance to Manufacturers

Over the years RRJ has been asked by a variety of manufacturers to provide technical assistance during the development of new products. This level of this assistance has included laboratory testing according to the client's specifications, assistance with formulating a product based on material properties, complete structural and architectural design of components, preparation of design guides and marketing materials. RRJ attributes the success of these projects to our interactive approach of combining the experience and expertise of designers, investigators, and testing specialists. For RRJ, these projects provide interesting and unusual opportunities to use the talents of our staff. Several examples of these projects are cited below.

In the Senergy EIFS Product Development project, **RRJ was retained by Senergy, Inc. to provide consultation in the development of new exterior insulation and finish system (EIFS) wall cladding.** This service consists of: assistance in developing architectural detailing, development of integration recommendations with adjacent wall materials, peer review of the manufacturer's product literature and model specifications, establishing procedures, and assistance in preparing submittal packages to Model Code Agencies. This project, currently in progress, is timely in light of the current high use of EIFS in new home developments.

The BSF Connections Technical Design Manual was prepared by RRJ as an engineer's guide to designing with the new *BSF Precast Concrete Beam to Column Connection System*, a hidden connection system that eliminates the need for column corbels. **RRJ adapted a Norwegian design to U.S. standards by performing a complete structural review of all components, redesigning portions as needed** to meet building code requirements throughout the U.S. Following the technical review, RRJ prepared the text, figures, and examples

for the published manual.

RRJ was retained by the Glen-Gery Corporation to evaluate a proposed surface treatment for their clay brick units. **Masonry walls built with and without the new treatment were fabricated and tested in RRJ's research laboratory to study the effects of the new process on masonry wall water permeability and structural bonding of the brick units.** RRJ also made recommendations regarding mortar mixes, and placing and tooling techniques to achieve optimum performance.

In order to evaluate the capability of JVI Masticord bearing pads to carry compressive loads during concurrent shear and rotational movements, RRJ developed and conducted a research and development program. The test results were used to develop design criteria for the selection and sizing of bearing pads based on calculated structural member end reactions and rotations. **This work culminated in a published design guide and handbook prepared by RRJ, with companion computer software and example solutions.** During the beginning stages of this program, through material testing, RRJ determined that the manufacturing process for this material promoted unilateral behavior (material properties in one direction were different from those in the perpendicular direction) and suggested a modification which gave the material isotropic behavior (properties in both loaded directions are the same). At that time and for many years JVI, Inc. was the only bearing pad supplier to have this type of product available.

JEENE SSJS Expansion Joint verification testing was performed on a new expansion joint product line developed by Hydrozo/JEENE. Tests were performed to verify product compliance to ASTM expansion joint requirements, and included a host of material tests ranging from tensile bond to heat of distortion temperature, and structural tests for load/deflection characteristics and the ability to withstand hydrostatic pressure.

Based on RRJ's reputation in the industry and our design and analysis credentials, we were awarded the contract as the Editor for the new *PCI Precast Concrete Design Handbook, Fifth Edition*, a valuable resource for the precast/prestressed concrete industry. **RRJ's role includes a technical overview of all committee prepared materials, including design methods for wall panels, flexural members, columns, and connections.** Text, charts, figures, and example problems are also being updated. For the first time the book is being generated entirely in an electronic format due to RRJ's suggestion. This has facilitated improvements in text as well as graphic style and consistency, moreover, it will provide for the efficient production of future editions of the Handbook.

As these examples illustrate, **RRJ provides a variety of services to help the manufacturer with technical knowledge in the development of products or communication of technical facts.** In many projects, RRJ's input provided increased marketing potential to clients by helping turn a simple manufactured product into an engineered product.

- Barbara J. Smith, S.E., P.E.

Tech Tip

The Trend in CAD is Elevating to a New Dimension

Making the transition from the drawing board to the computer is not an issue anymore. Most firms, whether they are in construction or manufacturing, have been using CAD (computer aided drafting) for several years. Most of these firms use their CAD software to create two dimensional drawings that look very much like the drawings they created by hand ten years ago.

The new obstacle to overcome is the use of the third dimension to create models in the computer. Consider the advantages of building and using 3D models to solve design and construction problems. **Once a model is constructed, infinite points of view may be generated to find the best vantage point,** to look at a problem from a different angle or present a solution with the clarity of seeing the whole object. RRJ currently uses this technology to assist clients in understanding complex engineering problems.

Likewise, the effectiveness of 3D graphical models has been used in courtroom exhibits where it is necessary to explain the intricacies of building construction to an audience not familiar with the industry. The model shown here was made to explain one such project. **The different layers of construction can be turned on or off to show partial or complete construction of the structure.** Adding video to the process can also be used to show cause and effect animation or a virtual reality walk through demonstration.

RRJ uses a combination of techniques to construct 3D models in the computer. Models can exist as wireframe, surface or solid. Wireframe models are exactly what the name implies. If you were to build a model of a house using only



Partial roof and walls turned off in order to show interior elements.

piano wire, you would see the outlines of the various shapes but you could see through it. Surface models are like taking your wireframe model and covering it with sheets of tissue. The model now has surface definition but it is hollow. Solid models are like using clay or wood to build your model. These are the easiest and fastest to build and have a few added properties that wireframe and surface models do not offer. A solid object has mass properties that can be reported back to the operator such as the center of gravity, moments of inertia and so on. Solid models can also be exported to other software for study. There are structural engineering programs that can test a 3D solid model for stress points and failure. A 3D model may also be exported to an animation program for cause and effect analysis.

The transition to 3D is an easy decision to simplify detailed explanations and when physical model building is too bulky. **The ability to solve and communicate design and construction problems with this technology is a great advantage.**

- Robert R. Oswald, CAD Operator