

# What We Do

## Building Science

BSC's expertise lies in understanding the complexity of today's building technology. We take our name from the field of building science which is the study of the interaction between the various materials, products and systems used in building construction, the occupants of these buildings, and the environments in which they are located. BSC uses its in-depth understanding of building science to provide leadership and services in the areas of building performance and durability.

## Design/Construction Review

With our unique understanding of architecture and building performance, BSC encourages the development of resource efficient, healthy and durable buildings by offering design and construction project review. We work directly with the design and construction team to incorporate the building science principles that will improve the performance and durability of buildings. Our goal is to complement and expand the knowledge base and capabilities of full service engineering and architecture firms as well as of builders.

## Forensic Investigation

BSC originally developed its business and established its reputation investigating problems related to the durability and performance of buildings.

The vast majority of in-service failures of building enclosures are caused by the penetration of air or water. Through forensic investigations, BSC has gained considerable expertise in the application of rain screen principles, drainage planes and in the application of air flow retarder and vapor diffusion retarder systems. We have developed industry-recognized protocols to determine building and interstitial air pressure relationships and specialized techniques for the pressurization and depressurization of building enclosures.

From our understanding of air and moisture flow within buildings, indoor air quality investigations and assessments are a regular component of our services. As a result of our experience in moisture migration, we have specific expertise in conducting microbial, mold, and moisture investigations in commercial and institutional facilities located in southern and humid climates.

## Architecture

Building Science Corporation designs buildings and communities to promote a more sustainable world. We believe that our understanding of building science ensures our designs are energy efficient, durable and provide healthy indoor air quality to the occupants. We believe that educating our clients leads to social transformation from which all citizens will benefit.

We begin the process of design by understanding the client and his or her goals and by listening to learn their design expectations as well as budgetary and scheduling needs. We are open to creative ideas, and work to translate these ideas into the reality of a successful building. We strive to design buildings that fit into the neighborhood as well as meet our client's design aesthetic. It is important to us that buildings we design are functional, and that the space enclosed within the building is used effectively, so we work with the client to develop the program and fine-tune their spatial needs..

We work with other consultants where appropriate and promote the integrated design team approach for all of our designs to ensure that the different disciplines work well together. We believe that setting goals at the beginning of the design process allows us to continue to check our designs to ensure that the project goals are being met. We also believe in following up after the construction is complete to commission the project and to learn how the process might be improved in future jobs.

As a full service architecture firm, BSC utilizes a multi-disciplinary team approach to create comfortable, durable, healthy and energy-efficient buildings for our clients. Our work includes both new construction and retrofit projects that start with schematic design and are taken through construction documents, bidding, permitting, construction administration and post-construction monitoring.



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## Designs That Work

Designs That Work are profiles for residential construction developed by BSC to be appropriate for specific climates. The profiles include building cross sections, enclosure and mechanical design recommendations, field expertise notes, material compatibility analysis as well as climate challenges. Each climate has multiple profiles listed as there is more than one possible solution for design and construction of a high performance building within a single region.

## House Plans

House Plans are fully integrated sets of construction drawings created by BSC for specific locations and climates. The sets include floor plans, detailed framing plans and wall framing elevations, exterior elevations and sections, advanced framing and enclosure details, as well as mechanical and electrical plans.

Through our multi-disciplinary team approach, interior, framing and mechanical layouts are designed and coordinated well before the start of construction. Duct layouts are not only shown on the mechanical plan but on the framing plan as well. This level of coordination limits changes made in the field and helps to ensure assemblies and systems are installed as designed.

## Portfolio

Given the multi-disciplinary resources available at BSC, we are able to create energy-efficient single and multi-family residences, both new and retrofit, for all parts of the country. Our designs combine our client's special needs and wishes with energy efficiency, comfortable and healthy environments and region-specific responses. All of our projects provide a significant energy use reduction compared to houses built to current code.

To view samples of our projects, visit [www.buildingscienceconsulting.com](http://www.buildingscienceconsulting.com).

## Building Performance

BSC provides a wide range of building performance design, testing, and monitoring services. The type and scope of work that we do varies widely from whole building design assistance in the preliminary design and design development phases, through detail review and specific system design, and into system performance testing and monitoring of completed projects. We believe in an integrated design approach that considers all of the building systems together to develop optimized solutions for durable low energy consumption buildings.

## Whole Building Design Assistance

BSC provides a variety of design assistance services for residential, commercial and institutional buildings. We place our focus on integrated design, examining the enclosure, mechanical and operational systems of the building together in order to help develop a unified design solution for each unique project. Design assistance can be provided during any phase of the design process and is often provided throughout the entire project, starting with preliminary design and continuing through construction documents and details.

## Preliminary Design

Preliminary design assistance starts with defining both the energy and the performance goals for the project. Climate appropriate solutions to meet these goals are developed by examining the existing exterior climate and the desired interior conditions. We then provide design direction as well as fundamental building science education to assist the project team in developing the overall design strategies needed to implement the solutions that will allow them to meet the project's established goals.

## Design Development

Design development assistance focuses on developing the enclosure and mechanical design concepts. This is done in the context of the project's goals and overall design strategies that were established during preliminary design. By analyzing the project's specific environmental and operational loads, BSC works with the project team to provide solutions for comfortable, durable, and low energy use buildings. The following analyses are offered during a project's design development phase:



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- Interior and exterior environmental load
- Operational load
- Climate specific enclosure durability
- Enclosure assemblies conductance efficiency
- Peak conditioning load
- Energy use reduction

## Enclosure Details

BSC provides detail design assistance for all dimensions of a building's enclosure design. We not only review the overall enclosure design, but also examine specific connection details and enclosure system continuity, material use and compatibility, as well as constructability and construction sequencing concerns. The following reviews and assessments are conducted during the enclosure detail review:

- Enclosure system design
- Thermal enclosure continuity
- Thermal and vapor gradient
- Connection details
- Window systems and installation details
- Product assessment and recommendations

## Mechanical Details

For residential projects, BSC provides detail design assistance for all aspects of the mechanical systems. We review the system design strategy based on geographic location, available fuel sources, and overall system efficiency in order to optimize the system for low energy use and low utility cost. We follow the integrated design approach and incorporate into the house all aspects of space conditioning, ventilation, dehumidification, domestic hot water, and renewable energy technologies. We also provide peak heating and cooling load analysis, system sizing (Manual J), as well as duct sizing and layout.

## Hygrothermal Analysis

BSC provides a wide range of services relating to building enclosure thermal performance and durability analysis. We design and model enclosure assemblies to examine heat and moisture flow through as well as within the enclosure components. This analysis examines the energy performance, condensation and moisture accumulation potential, and durability risk for the assemblies. We can perform modeling of heat flow through building enclosure elements, and calculate overall U values. These results can be used to demonstrate compliance with the increasingly stringent maximum U values in newer standards such as ASHRAE 90.1 and ASHRAE 189.1-2009. We utilize various engineering and analysis methods to complete the design and assessment including, but not limited to, one- and two-dimensional heat flow modeling programs (THERM, HEAT 3D), hygrothermal modeling software (WUFI and WUFI Pro), as well as other in-house proprietary modeling programs.

## Field Monitoring

BSC offers services in system performance monitoring. We instrument and measure actual energy use of installed mechanical systems to determine if the systems meet the desired operational performance. A variety of sensors are used to measure climate information, system runtime, and fuel usage. Based on the information collected, we identify any problems with the system installation and operation and provide recommendations to resolve these issues.

## Portfolio

As a building performance consultant, BSC provides services ranging from energy modeling and cost trade-off analysis at the beginning of a project to on-site demonstration of air-sealing during construction to performance testing at project completion. We work directly with the client, architect, contractor, and other team members to develop building solutions that work. While our goal is to optimize energy performance and durability of buildings, we approach this within the priorities, constraints, and objectives of each individual project.



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## Education and Training

Educating building professionals on building science is one of the ways BSC works to change the way the world builds. We regularly conduct workshops and seminars that cover both fundamental and advanced building science topics. In addition to our scheduled classes, workshops can be developed to meet the specific needs of an individual company or organization. For upcoming workshops and seminars, visit our Building Science Seminars website.

BSC also creates individualized handouts, manuals and other building science publications. Visit our Building Science Bookstore website to view our available products.

BSC team members can be seen speaking at conferences throughout the country. Please contact the organization sponsoring the event for conference seminar topics and schedules. To view recent presentations by the BSC team, see the Recent Presentations page of our Building Science Seminars website.

## Research, Development and Demonstration

Building Science Corporation, with our Waterloo office Building Science Consulting, Inc., offers a broad range of research, development and demonstration services for manufacturers of building materials and systems. Our work in this area includes:

- Product Design and Analysis
- Laboratory Testing
- Field Testing and Monitoring

### Product Design and Analysis

With our deep technical knowledge and experience in the building industry, BSC staff can provide valuable insight into product design and application. We employ a range of services to provide recommendations for new product design and new applications for existing building materials or systems. These include:

- Special building science consulting
- Building product feasibility studies
- Building product code approvals and evaluations

### Laboratory Testing

Material properties, required for modeling and analysis and often needed for forensic work, are frequently difficult to find. Our laboratory can simply measure most of the required material properties, such as vapor permeance (wet cup, dry cup, and across the full RH range), capillary transport, sorption isotherm, and thermal conductivity, as well as mechanical properties, such as hygrothermal movements and drying shrinkage.

#### Laboratory Facilities

- Constant Climate Room

For material property testing, the CCR controls temperature to between 15 and 30 degrees Celsius and relative humidity to between 30% and 70%.

- 8' x 12' Guarded Hot Box and ASTM 518 Thermal Conductivity Instrument

The hot box is built to run ASTM 1363 standard tests but has additional capabilities to measure at a wide range of temperature and air pressure gradients.

- High Resolution Wall Specimen Drainage and Drying Balance

The balance measures the drainage capabilities of full-scale wall assemblies as well as the water stored following drainage and the time it takes to dry.



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## Field Testing and Monitoring

Laboratory testing and performance simulations must be validated by in-situ measurements. Often this involves the instrumentation, monitoring and analysis of existing structures. BSC also maintains field exposure facilities for smaller test specimen in Waterloo, Ontario and Vancouver, British Columbia (see descriptions below), and supports clients' private facilities in various locations across North America.

### Field Facilities

- RBETS

BSC owns and operates a Relocatable Building Enclosure Test Station (RBETS) for full-scale field testing of wall specimens.

- Vancouver Field Exposure Testing Facility

Building Science Corporation and Gauvin 2000 Construction Ltd. have established a private, full-scale environmental field-testing facility in Coquitlam, BC, a suburb of the city of Vancouver. The climate is typical of Lower Mainland, BC and the Pacific Northwest, an area that includes Seattle, WA and Portland, OR.

## Building America

Building America is a research program funded by the U.S. Department of Energy to design and construct quality homes that use less energy without costing more to build. BSC, along with its industry partners, work together as Building Science Consortium, which is one of the six research teams participating in Building America.

The Building America program brings together all segments of the housing industry including designers, builders, developers, financial institutions, material suppliers as well as equipment manufacturers. Traditionally, these industry groups have worked independently of one another, slowing development and adoption of new technologies. By working together, decisions can be made with consideration for the entire design, manufacturing, and construction process, which increases quality and performance without raising cost.

### Case Studies

Case Studies provide a summary of results for each of the homes built in partnership with BSC's Building America team. BSC creates the case studies after construction, testing and field monitoring are complete. A case study typically includes the project overview, both enclosure and mechanical designs, results of performance testing as well as the builder profile and unique project highlights.

### Expert Meetings

BSC, along with its Building America team, regularly holds expert meetings on research topics relevant to the Building America projects. Experts in the field are invited to present their latest research, which is followed by discussion. Presentations, discussions, as well as results or conclusions reached are summarized in the meeting's final report.

Visit [www.buildingscienceconsulting.com](http://www.buildingscienceconsulting.com) for the list of meetings held in the recent years.

### Project Partners

Building Science Corporation is currently assisting numerous builders around the U.S. with Building America principles. To learn more about the baseline criteria for Building America projects visit our Building Science Information website.

Visit [www.buildingscienceconsulting.com](http://www.buildingscienceconsulting.com) for the list of builders and manufacturers.



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