Construction Technology

Applying Building Science

Course Outline

Construction Technology - Applying Building Science

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understanding Overall Moisture Control Strategy

The builder's main responsibility is to construct walls that resist moisture penetration while at the same time allowing moisture that gets into the wall to easily escape. This section deals with the movement of moisture in and out of wall assemblies and shows the basic principles by which walls can stay dry.

The moisture load on a building envelope is a measure of the amount of moisture that a falls on or is thrown against the building envelope. understanding the severity of the moisture loading of building is important because it will help determine the type of wall and roof construction that will be the most durable

Understand Building Science

Understand Overall Moisture Control Strategies
Explain Concept of Moisture Balance
Describe the Overall Strategy for Mois Control in Walls

Understand Applied Building Science

Understand Moisture Load

Understand Moisture Load
Describe Measures of Moisture Load
Describe Weather Exposure
Identify Moisture Indices for Various BC Communities

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understand Moisture Movement Mechanisms

In order to prevent moisture movement into building envelopes it is necessary to understand the forces and conditions that cause water movement.

For water to penetrate a wall there must be water on the surface of the wall, an opening and a force to move the water through the opening. If any one of these is eliminated then water penetration cannot occur. The following learning tasks cover the various forces that cause water to pass into walls from the exterior and how those forces can be neutralize thereby preventing water penetration

Understand Building Science

Understand Moisture Movement Mechanisms

- Describe Moisture Movement Mechanism
- Rank the Relative Magnitude of Moisture Movement Mechanisms

Understand Conditions for and Forces Causing Water Leakage

- Describe Conditions for Water Leakage to Occur
- List Driving Forces that can Cause Water Leakage

Understand Applied Building Science

Understand Methods for Controlling Forces Causing Water Leakage

Describe Methods for Controlling Water Leakage Caused by Gravity
Describe Methods for Controlling Water Leakage Caused by Momentum
Describe Methods for Controlling Water Leakage Caused by Capillarity Tension
Describe Methods for Controlling Water Leakage Caused by Air Pressure Differences

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understand Capillary Action and Causal Factors

Capillarity is a major cause of water entry into buildings it can also cause water to be held inside building assemblies leading to deterioration of the assembly

Capillary action is the movement of water by surface tension through porous materials such as wood and concrete or through narrow gaps and joints between non porous materials.

Understand Building Science

Understand Capillary Action and Causal Factors

- Describe Capillary Action
- Describe Factors Causing Capillary Action

Understand Applied Building Science

Understand Methods for Controlling Capillary Action

- Describe methods for controlling capillary action
- Explain the Term, “Surfactants”

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understand Air-bourne Moisture and Causal Factors

Water vapour is held in air, as air moves the water vapour in that air moves with it. Air leakage can move large amounts of water vapour from inside a building into attics and walls which in winter can lead to condensation.
As warm moist indoor air is driven into insulated cavities by wind, the stack effect and mechanical equipment through cracks and openings in interior finishes it carries water vapour that condenses when it comes into contact with cold surfaces. In coastal climates the second largest source of water in the building envelope after rain is air bourne moisture. In colder drier climates air bourne moisture can be the major cause of moisture accumulation inside the building envelope.

Understand Building Science

Understand Air-bourne Moisture and Causal Factors

- Explain Air-borne Moisture
- Describe Conditions for Air-borne Moisture to Occur
- Understand Principles of Air Tightness

Understand Applied Building Science

Understand methods for controlling air-borne moisture

- Describe Methods for Controlling Air-borne Moisture
- Describe Methods for Controlling Openings
- List Essential Features of an Air Barrier
- Identify the Role of Other Occupations in Controlling Air-borne Moisture

- Describe Key Features of R-2000 Technology, as they apply to the importance of air barriers in walls
- Describe Alternate Techniques for Creating Air Barriers Walls

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understand Vapour Diffusion and Causal Factors

Vapour diffusion has to be controlled to prevent moisture accumulation in insulated cavities while also promoting drying

After rain water penetration and air leakage the third way in which moisture can enter the building envelope is through vapour diffusion.

Understand Building Science

Understand Vapour Diffusion and Causal Factors

Explain Vapour DiffusionList and Explain Factors Affecting Vapour Diffusion

Understand Applied Building Science

Understand Methods for Controlling Vapour

Describe Methods for Controlling Vapour
Explain Vapour Permeability
Identify the Role of Other Occupations in Controlling Vapour

Construction Technology

Explain controlling moisture flow (moisture movement mechanisms, i.e., bulk moisture movement, capillary action, air-borne moisture and vapour diffusion)

Understand Condensation, Resulting Problems and Moisture Removal/Drying

The following concepts about water vapour help explain why condensation can occur in building assemblies under certain conditions.
Condensation on interior finishes of a building can lead to mold growth, staining and corrosion. Condensation can form inside insulated cavities also leading to mold growth and potentially rot. Condensation is caused when moisture laden air comes into contact with a surface that is below its' dew point temperature

Understand Building Science

Understand Condensation, Resulting Problems and Moisture Removal/Drying

- Describe Condensation and Related Concepts
- Describe problems with high relative humidity and condensation
- Describe Moisture Removal/Drying

Understand Applied Building Science

Understand Methods for Controlling Condensation and Drying

- Outline Methods for Preventing/Limiting Condensation
- Describe Methods for Removing Moisture/Drying Walls

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Explain controlling heat flow (heat flow mechanisms, i.e., conduction, convection and radiation)

Understand Heat Flow and Insulation

Heat flow, air flow and moisture flow are interrelated
Air barriers are essential part of a durable building envelope. When a building has been constructed with a continuous air barrier the rate of natural air leakage is significantly reduced. In the past natural air leakage has been relied upon to provide make up air for bath fans and range hoods. This is no longer the case in airtight buildings. During the heating season opening a window alone does not provide effective air exchange and will compromise security.

Understand Building Science

Understand Heat Flow and Insulation

Describe Heat Flow Mechanisms
Describe the Principles of Insulation Performance

Understand the Role of Mechanical Systems and Control of Interior Moisture Load .....

Construction Technology

Explain “House-as-a-system” concept

Understand “Building as a System” Concept

The building as system concept refers to the fact that buildings are made from a series of components (roofs, walls, floors, foundations, windows and doors, insulation, air barriers, heating and ventilation systems and plumbing and electrical systems) that work together as a system to provide durable, comfortable and energy efficient places for people to live and work. The building itself interacts with the surrounding environment (weather, ground water etc.) and is also affected by how the users of the building operate the building and their activities within the building. When constructing and operating buildings it is useful to understand the building as a system concept to ensure that the building performs as expected.

Understand Building Science

Understand “House-as-a System” Concept
Describe the “House-as-a System” Concept
Describe the Main Components of the Overall System
Identify Key Components of the House System

Construction Technology

Explain “House-as-a-system” concept

HOW YOUR HOUSE WORKS

Understanding how your house works before starting a retrofit will help ensure that the job meets your expectations and that you will not be causing new issues while resolving old ones. This chapter explains how building science principles can help you control the flow of heat, air and moisture, and why you must

The basics of house performance
Control of heat flow
Control of airflow
Control of moisture flow
Older homes

Construction Technology

Understand building envelope details that focus on the following:

Distinguish wall design: heat loss and moisture control, alternate details

MATERIALS

Choosing the right materials and installing them properly ensures the finished job lives up to your expectations. This chapter describes insulation, air barrier and vapour barrier materials.

Materials

Insulation
Insulation values table
Air barrier materials
Vapour barrier materials

Construction Technology

Understand building envelope details that focus on the following:
Classify air barriers (materials and details)

COMPREHENSIVE AIR LEAKAGE CONTROL

Air leakage control is the single most important retrofit activity, and it should be considered first in any retrofit strategy. Air leakage control is essential, so every time you insulate, install or upgrade the air barrier system, ensure that moisture does not enter the insulation or building envelope. Comprehensive air leakage control is the systematic identification and sealing of as many air leakage paths as possible with weather stripping and caulking and by applying gaskets and tapes.

Comprehensive air leakage control
Identify leakage areas

Caulking and other air sealing materials

Construction Technology

Understand building envelope details that focus on the following:

Distinguish roof construction and attics: air leakage into attics, details at critical locations, heat loss control, details to deal with specific problems, e.g. truss uplift, ice damming

ROOFS AND ATTICS

Relatively easy access has made the attic a favourite starting point to insulate for many homeowners, despite the fact that most other areas, such as basements and uninsulated walls, lose more heat than the typical attic. Even if an attic is already insulated, there may still be an opportunity to improve the energy efficiency and soundness of the house through air sealing. Air leaks into the attic can account for substantial heat loss and can lead to a variety of moisture-related problems. The importance of air sealing cannot be overstated. Read this entire chapter if you are upgrading your attic for helpful tips and other relevant information.

Roofs and attics.

General considerations for all attics
Easily accessible attics

Houses with half storeys

Cramped attics, cathedral ceilings and flat roofs

Ice dams

Renovations and repair

Construction Technology

Understand building envelope details that focus on the following:

Distinguish foundation design: types of foundations, heat loss control, and moisture control

BASEMENT INSULATION

Basements can account for about 20 percent of a home's total heat loss. This is due to the large, uninsulated surface area both above and below grade level. Contrary to popular opinion, earth is a poor insulator. There is also a lot of air leakage through basement windows and penetrations (including cracks in these areas) and at the top of the foundation wall (sill area).Many basements have little or no insulation, so this means there is much potential for improvement. Insulating can often be tied in with other repairs or renovation work such as waterproofing, radon remediation or finishing the basement.

Basement insulation

Insulating the basement from the outside

Insulating the basement from the inside

Crawl spaces

Open foundations

Concrete slab on grade

Construction Technology

Understand building envelope details that focus on the following:

Distinguish wall design: heat loss and moisture control, alternate details

INSULATING WALLS

Walls can account for about 20 percent of heat loss in houses. In addition to heat loss through the walls, there are many cracks and penetrations that allow uncontrolled air leakage into and out of the house.

Insulating walls

Blown-in insulation

Renovating the interior

Renovating the exterior

Miscellaneous spaces: attached garages and more

Additions and new construction

Construction Technology

Understand building envelope details that focus on the following:

Distinguish windows and doors: installation guidelines to control heat loss and gains and moisture

UPGRADING WINDOWS AND DOORS

Windows and doors can account for up to 25 percent of total house heat loss. This chapter deals with upgrading or replacing windows and doors

Upgrading windows and doors

Windows

Doors