Welcome! **The 60-Hour program is made up of 8 separate courses. Many of the courses are available in both Video and/or Text. It is not necessary to complete both versions. We offer both versions to ensure your learning style is addressed. You can choose whether you want to watch the video, or read the text, but you DO NOT have to do both. You can use either version for study purposes- just be sure to take the all quizzes in one version OR the other.**

This study course provides an overview of building trade skills. The information provided in this course would be advantageous for anyone seeking to start a residential building project or enter into the building industry.

****The 2010 Carpentry and Building Construction text book, the Michigan Residential Code book and the lesson text should be used as primary reference sources. If you have not purchased these books, and have no other comparable resources, please call our office at 1-800-727-7104 or go online to www.licensetobuild.com for ordering information.**

If you are taking this course as part of the 60-Hour Prelicense Program, please read the information below:

The 60-Hour program is made up of 8 separate courses listed below. Many of the courses are available in both Video and Text/Online. It is not necessary to complete both versions. You can choose whether you want to watch the video version or read the text version. As the videos for the other four courses are completed, they will be added to your registration at no additional charge.

COURSES

1. Business of Building (Video or text)
2. Contracts, Liabilities and Risk Management (Video or text)
3. Project Management for Contractors (Video or text)
4. Marketing for Building Contractors (Video or text)
5. Building Green (Video or text)
6. Residential Code Review (Video coming soon)
7. Michigan Construction Safety (Video or text)
8. Overview of Building Trades (Video or text)

PLEASE CONTINUE READING:

FREE WITH PURCHASE

These are all optional and not required in order to complete the 60-Hour program, but the math tutorial and exam prep are extremely helpful in studying for the State exam.

--3-Hour Math Tutorial video for State exam prep

--Michigan Exam Prep (sample questions for State exam prep)

You will be sent the following via U.S. Postal Service and should receive them within 3-5 business days:

-- Applications to the state of Michigan

-- PSI Testing Information booklet

-- MIOSHA Test Review sheet

-- Books (if ordered)

Overview of Building Trades

Site Considerations

RETAINING WALLS	GROUNDWATER	MISS DIG

Learning Objectives

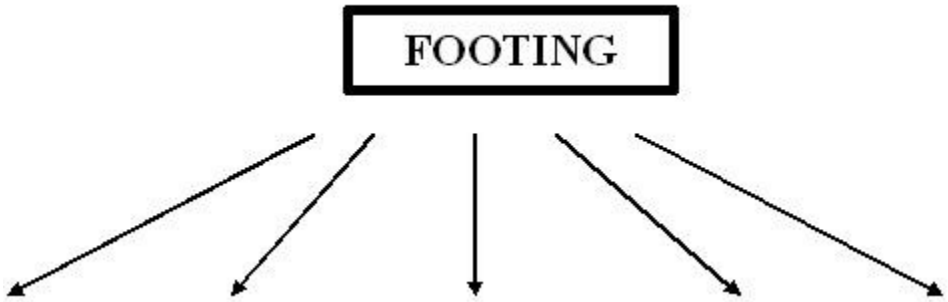
Define dewatering and the various laws and regulations surrounding dewatering activities.

Describe the purpose and steps involved in contacting MISS DIG before beginning a construction project.

Retaining Walls

If your project requires excavation near a retaining wall, special precautions must be taken. Retaining walls have a system built into the wall construction that is hidden in the soil behind the face of the wall. Extreme caution should be taken to preserve this system. If the system is destroyed, the wall will fail.

Another concern is excavating below the level of the bottom of the footing. Footing weight is dispersed not only directly below the footing, but also to the soil next to the footing. See the diagram below:



Excavating below the level of the footing, even near the footing, puts the system in jeopardy.

GROUNDWATER

Dewatering:

Dewatering is the temporary removal of ground or surface water from a construction site to allow construction to be done under dry conditions. Dewatering of cofferdams and trenches is a common practice during the construction of bridges, culverts, and public utilities. While water is usually removed using well points, drilled wells, and power driven pumps, dewatering can also occur from shallow sumps (less than eight feet below the excavation elevation) that are installed for the purpose of removing underground water that collects in the sump. These structures (such as electric manholes and basements during construction) are often equipped

with a low-lift pump to remove the water that would otherwise interfere with the construction work.

Dewatering activities are regulated by various laws and regulations.

COUNTY ORDINANCES

County ordinances may require that a permit be obtained for the installation of dewatering wells. The contact in this regard is the county or district health department.

PUBLIC HEALTH CODE:

Part 127, Water Supply and Sewer Systems, of the Public Health Code, Public Act 368 or 1978, as amended requires that dewatering contractors be registered by the State of Michigan; these contractors must submit well construction records. More information about contractor registration can be found in Chapter 3.4 of the DEQ Permit and Licensing Guidebook, from www.michigan.gov/deq, select "Permits" from the menu bar and then within the page select "DEQ Permit and Licensing Guidebook". In addition, contractor registration information can be found from www.michigan.gov/deqwater, select "Drinking Water" then "Water Well Construction".

WELL CONSTRUCTION CODE:

The Well Construction Code (Rules 325.1601 of the Michigan Administration Code), regulates the construction, operation, and abandonment of dewatering wells. These rules include provisions such as actions necessary to prevent surface water from entering the well and screening requirements. The Well Construction Code exempts regulation of the shallow sumps so long as they are constructed within the limits of the excavation. In additions, wells with an inside casing diameter of 2 inches or less, and where the total depth of the casing and well point is not more than 25 feet, are exempt from the Well Construction Code.

The relevant portion of the Well Construction Code can be found online at www.michigan.gov/deqwater, select "Drinking Water", then "Water Well Construction", and finally "Part 4- Dewatering Wells Administrative Rules".

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION ACT:

If the groundwater is contaminated and is to be discharged on the site, then a wastewater discharge permit will likely be necessary from the Water Bureau of the DEQ (Section 324.3112, Part 31, Water Resources Protection Act [NREPA], PA 451 of 1994, as amended). In the alternative, arrangements can be made to dispose of contaminated groundwater by pumping and hauling it to a wastewater treatment plant or by making arrangements with a licensed liquid industrial or hazardous waste hauler (depending upon the characteristics of the pollutants). More information about these disposal options can be found in Chapter 3 (Wastewater) of the Michigan Manufacturers' Guide to Environmental, Health, and Safety Regulations.

Special requirements may also be identified within permits issued by DEQ. For example, dewatering activities that take place under the control of an Inland Lake and Stream Permit from the Land and Water Management Division (Part 301, Inland Lakes and Streams of the NREPA) often require controls to prevent the release of sediment into surface waters. In addition, dewatering activities must be addressed in the soil erosion and sedimentation control plans submitted to obtain permits under Part 91, Soil Erosion and Sedimentation Control, of the NREPA. More information about applicability of related DEQ permits can be found in the Permit Information Checklist and corresponding DEQ Permit and Licensing Guidebook.

BEST MANAGEMENT PRACTICES:

The implementation of Best Management Practices (BMPs) is beneficial. BMPs help prevent effects on others such as impacts to

neighboring wells and pollution of surface waters. BMPs also help dewatering contractors stay in compliance with relevant laws and rules.

Groundwater Quality:

The temporary withdrawal of groundwater by a dewatering well can affect the operation of nearby water wells. The DEQ does not have authority to investigate these instances because Part 317, Aquifer Protection and Dispute Resolution, of NREPA exempts well failures caused by dewatering wells from the groundwater dispute resolution provisions. However, Rule 325.1755 of the Well Construction Code requires the minimization of impacts to others through the following actions:

-The pumping water level in a dewatering well shall be maintained at the minimum possible depth below the ground surface that will dewater the excavation.

-Duration of operation shall also be regulated by the contractor to minimize time of pumping to the period actually needed to dewater the excavation effectively.

-The contractor, consulting engineer, and the owner of the construction project for which the dewatering wells are being drilled shall give due consideration as to what effect lowering the groundwater table will exert on existing wells.

Surface Water Quality:

Several legal mandates provide surface water protection from dewatering activities. Rule 325.1755 of the Well Construction Code requires that water pumped from a dewatering well be conveyed to a natural watercourse in a manner that does not cause damage to abutting property, create a hazard, or cause silting in the receiving stream. Further, discharges of wastewater that can harm uses made of surface waters, such as turbid discharges, are also

prohibited under our spill laws contained in Part 31, Water Resources Protection of NREPA (Section 324.3109).

The Dewatering chapter of the Guidebook of BMPs for Michigan Watersheds* specifies the following:

-Minimize dewatering discharge velocity to avoid scouring the receiving area. Design structural controls--such as basins or sumps--that receive discharge water to handle the anticipated discharge flow.

-Before releasing dewatering discharge to rivers, lakes, or wetlands, filter the discharge through bags made of geo-textile fabric. For additional treatment, direct the discharge across onsite vegetated buffer/filter strips. Refer to the Filters and Buffer/Filter Strips Guidebook* chapters.

-Obtain permission from the appropriate drain commission or drain board prior to releasing dewatering discharge to county or inter-county drains.

-Inspect the dewatering site regularly to ensure that the discharge is adequately controlled.

-Check geo-textile filter fabric bags for clogging, replace if necessary, and properly dispose of full filter bags, preferably at an appropriate upland location.

-Make sure any vegetated buffer/filter strips are preventing sediment from leaving the site. Maintain sediment basins using guidelines from the Sediment Basin Guidebook* chapter.

*The Guidebook is available on the Web. Go to www.michigan.gov/deqwater, select "Surface Water" on the left side, then "Non-point Source Pollution" in the middle right and finally select "Technical Manuals" under the heading "Technical

Assistance" in the middle left. This last Web page individually lists the Guidebook chapters.

For general question or DEQ contact information, you may contact the Environmental Assistance Center at 800-662-9278.

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MISS DIG

HOW IT WORKS

MISS DIG Systems, Inc., is a utility communication system that helps contractors comply with State Law (Public Act 53), which requires notification of utilities before they excavate, tunnel or discharge explosives 3 full working days before starting a project.

MISS DIG can assist the contractor in fulfilling one of the responsibilities under Public Act 53 by calling the **MISS DIG** number, **800-482-7171** or alternate number **1-248-MISSDIG**.

The call will be received by a trained operator who will ask for the following information:

Call Back Phone Number:	Where the caller can be reached during the day.
Name of Caller:	Person placing the staking request.
Contractor:	Person who will be doing the work, address & fax.
Type of Work:	Indicate work being performed.
Done for (if contractor is performing work for another party):	
County:	Where work will be done.
City/Village or Township:	Physical location where work will be performed.
Work Location:	Address with cross streets.
Additional Information:	Instructions of where locating of underground facilities will be needed (street address, lot number, subdivision name) and exact location of where digging will be done (front, back or sides: North, South, East or West side of location).
Town, Range & Section:	This information can be obtained from county maps.
Start Date & Time:	When contractor will begin the work.
Overhead Question:	Will you be able to maintain a minimum of 10 ft. clearance from overhead electric lines with the equipment you will be using on the job?

If the caller is requesting information about overhead electric lines, the MISS DIG operator will arrange a meeting between the caller and a representative from the electric company to discuss the overhead lines in the area. State and federal safety standards have established protective measurements to assure adequate clearance between wires and equipment.

After the operator has taken all the information needed to process the utility notification, the caller will then be provided with a MISS DIG ticket number which should be kept for future reference should the caller need to verify having placed a call as required by law.

All calls are voice tape-recorded. The information received is entered into a computer, which documents the time and date of the call and transmits this information to terminals at the participating MISS DIG utility.

If the underground facilities need to be located due to an emergency such as a gas leak, water main break, etc., the MISS DIG toll-free number can be called anytime, day or night. MISS DIG operates 24 hours a day.

Participating private, public and municipal utilities with underground cable, pipes or other facilities in the area will identify the location of underground facilities. This can be done by using color-coded stakes, markers and/or paint using the color-code required by Michigan state law as follows:

Electric power distribution and transmission	Safety red
Municipal electric systems	Safety red
Gas distribution and transmission	High visibility safety yellow
Oil distribution and transmission	High visibility safety yellow
Dangerous materials and product lines	High visibility safety yellow
Telephone and telegraph systems	Safety alert orange
Police and fire communications	Safety alert orange
Cable television	Safety alert orange
Water systems	Safety precaution blue
Sewer systems	Safety brown
Storm drains	Safety green
Land survey	High visibility safety pink

Documentation of all utility notifications received and transmitted is kept for future reference for four years. A MISS DIG utility notification can be modified before the start time and date by calling the MISS DIG toll-free number and informing the operator that you wish to change the information on a previous order and providing the MISS DIG ticket number of that order.

THE MISS DIG OPERATOR CANNOT MODIFY A PREVIOUS ORDER WITHOUT THE MISS DIG TICKET NUMBER THAT WAS ISSUED FOR THAT ORDER. A NEW ORDER WOULD HAVE TO BE PLACED.

For a nominal fee and through written request, MISS DIG will search its records and provide the requestor with a copy of the requested order if it has been placed within the last four years. For more information, please call the MISS DIG administrative office a (248) 874-3406 or write to MISS DIG System, Inc. at 1030 Featherstone Rd., Pontiac, MI 48342-1830.

Progress Check

- How does the Well Construction Code help minimize the impact of dewatering practices on nearby wells?
- Where is the Guidebook of BMPs for Michigan Watersheds available?
- How long is documentation of utility notifications kept?

Overview of Building Trades

Soil Classification

GEOPHYSICAL TESTING	SOIL VOLUME	SOIL TYPES	APPLICATIONS	SOIL TESTING

Learning Objectives

Describe the methods by which soil and rock deposits are classified and analyzed.

Explain the various tests which determine absorption, density and moisture of soil.

Soil Classification System

Soil conditions vary in their weight bearing capacity, drainage characteristics, frost heave potential, and volume change potential (expansion). These soils are classified according to groups and

symbols. In areas likely to have problems with soil condition, the building official may require a soil test to determine the soil's actual condition at a particular location. This test must be made by an approved agency.

TABLE R401.4.1
PRESUMPTIVE LOAD-BEARING VALUES OF FOUNDATION MATERIALS[a]

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CI, ML, MH and CH)	1,500[b]

For SI: 1 pound per square foot = 0.0479 kN/m^2.

a. When soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.

b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

TABLE R403.1
MINIMUM WIDTH OF CONCRETE OR MASONRY FOOTINGS (inches)[a]

	LOAD-BEARING VALUE OF SOIL (psf)			
	1,500	2,000	3,000	≥ 4,000
Conventional light–frame construction				
1-story	12	12	12	12
2-story	15	12	12	12
3-story	23	17	12	12
4-inch brick veneer over light frame or 8-inch hollow concrete masonry				
1-story	12	12	12	12
2-story	21	16	12	12
3-story	32	24	16	12
8-inch solid or fully grouted masonry				
1-story	16	12	12	12
2-story	29	21	14	12
3-story	42	32	21	16

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m^2.

a. Where minimum footing width is 12 inches, a single wythe of solid or fully grouted 12–inch nominal concrete masonry units is permitted to be used.

TABLE 2-B—TYPES OF SOILS AND THEIR PROPERTIES

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines.	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines.	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines.	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines.	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures.	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures.	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay mixtures.	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture.	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays.	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity.	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts.	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils.	Unsatisfactory	Medium	High

GEOPHYSICAL TESTING

Requirements include having each soil and rock deposit classified by a competent person. The basis of classification must be determined by one visual analysis and one manual analysis.

Visual Test:

1. Observe soil that is excavated in regards to the site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavation material.

2. Soil that is primarily comprised of fine-grained material is cohesive material. Soil that is composed primarily of coarse-grained sand or gravel is granular material.

3. Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

Manual Test:

Provide information on soil properties in order to properly classify.

1. Plasticity--mold a moist or wet sample into a ball and attempt to roll it into threads as thin as 1/8" in diameter. Cohesive material can be successfully rolled. For example, if at least a 2" length of 1/8"diameter thread can be held by one end without tearing, the soil is cohesive.

2. Dry Strength--dry soil that crumbles on its own or with moderate pressure into individual grains or into fine powder is granular. If soil is dry and falls into clumps that break up into smaller clumps, and the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand, or silt. If the dry soil breaks into clumps which do not break up into smaller clumps, and can only be broken with difficulty, and there is no visual indication that the soil is fissured, the soil may be considered unfissured.

3. Thumb Penetration:

Examples--

Type A-- only with great effort can the thumb penetrate.

Type B-- can be easily penetrated with the thumb several inches.

4. Other Strength Tests--pocket penetrometer or hand operated shear vane.

5. Drying Test--the basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. Take a 1" thick by 6"

thick diameter sample and dry it thoroughly. Check for the following characteristics:

a. If the sample develops cracks as it dries, significant fissures are indicated.

b. If the sample dries without cracking, break it up into your hand. If considerable force is necessary to break the sample, the soil can be classified as unfissured cohesive material.

c. If the soil breaks up easily by hand, it is either fissured cohesive material or granular material. To distinguish between the two, pulverize the dried clumps by hand or by stepping on them. If they pulverize easily, the soil is granular. If they do not pulverize easily, the soil is cohesive with fissures.

Progress Check

- What is the basic purpose of a "drying" test?
- What is soil that is primarily composed of coarse grained sand or gravel?

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SOIL VOLUME CALCULATING

The formula to calculate volume is length times width times height. The order of these does not matter as long as all three are used. Calculating soil that will be needed to fill a given area is a bit more difficult because there are actually 3 conditions that soil can be in:

1. Bank Soil--this is soil in its undisturbed state before it gets excavated.

2. Loose Soil--when soil is excavated it swells. This means that 10 yards of bank soil could expand to possibly 12 to 15 yards or more

after it is excavated depending upon the moisture content and the type of soil.

3. Compacted Soil--when soil is compacted it shrinks in volume. Soil on construction sites needs to be compacted. The amount of soil needed to be purchased also needs to be correctly calculated in order to be able to bid jobs accurately.

Soil purchased in loose cubic yards will compact to a percentage of that volume. For example: the compaction ratio of a soil is 27%. To calculate the volume of material to purchase, you need to calculate the area volume--length times width times height in feet.

A hole 24' x 30' x 8' = 5760 CF

Then divide the number by 73%, (100%-27% - 73%) because a 27% compaction rate means 5760 CF loose will compact to only 73% of its previous volume.

5760÷73% = 7890 CF

Test this by taking the 7890 - 27% = 5760 CF

Understand that in order to fill a space with properly compacted soil we have to purchase more loose soil.

Now convert the 7890 CF of material into the correct quantity unit of cubic yards, by dividing cubic feet by 27.

7890÷ 27= 292 cubic yards.

This would provide an accurate estimate when the compaction ratio is 27%.

Soil Compaction

Soil compaction is defined as the method of mechanically increasing the density of soil. In construction, this is a significant part of the

building process. If performed improperly, settlement of the soil could occur and result in unnecessary maintenance cost or structure failure. Almost all types of building sites and construction projects utilize mechanical compaction techniques.

What is Soil?

Soil is formed in place or deposited by various forces of nature--such as glaciers, wind, lakes and rivers--residually or organically. The following are important elements in soil compaction:

1. Soil type
2. Soil moisture content
3. Compaction effort required

Why Compact?

There are **five** principal reasons to compact soil:

1. Increase load-bearing capacity
2. Prevent soil settlement and frost damage
3. Provide stability
4. Reduce water seepage, swelling and contraction
5. Reduce settling of soil

Types of Compaction:

There are **four** types of compaction effort on soil or asphalt:

1. Vibration
2. Impact

3. Kneading

4. Pressure

These 4 different types of effort are found in the two principal types of compaction force--**static and vibratory**.

Static Force is simply the deadweight of the machine, applying downward force on the soil surface, compressing the soil in particles. The only way to change the effect of compaction force is by adding or subtracting the weight of the machine. Static compaction is confined to upper soil layers and is limited to any appreciable depth. Kneading and pressure are two examples of static compaction.

Vibratory Force uses a mechanism, usually engine-driven, to create a downward force in addition to the machine's static weight. The vibrating mechanism is usually a rotating eccentric weight or piston/spring combination (in rammers). The compactors deliver a rapid sequence of blows (impacts) to the surface, thereby affecting the top layers as well as deeper layers. Vibration moves through the material, settling particles in motion and moving them closer together for the highest density possible. Based on the materials being compacted, a certain amount of force or impact must be used to overcome the cohesive nature of particular particles.

Progress Check

- Why is mechanical compaction a significant part of the building process?
- Define static force.

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SOIL TYPES AND CONDITIONS

Every soil type behaves differently with respect to maximum density and optimum moisture. Therefore, each soil type has its own unique requirements and controls both in the field and for testing purposes. Soil types are commonly classified by grain size determined by passing the soil through a series of sieves to screen or separate the different grain sizes. Soil classification is categorized into 15 groups, a system set up by the American Association of State Highway and Transportation Officials. Soils found in nature are almost always a combination of soil types. A well-graded soil consists of a wide range of particle sizes with the smaller particles filling voids between larger particles. The result is a dense structure that lends itself well to compaction. A soil's makeup determines the best compaction method to use. There are **three** basic soil groups:

1. Cohesive

2. Granular

3. Organic (this soil is not suitable for compaction and will not be discussed here).

COHESIVE SOILS

Cohesive soils have the smallest particles. Clay has a particle size range of .00004" to .002". Silt ranges from .0002" to .3". Clay is used in embankment fills and retaining pond beds.

Characteristics--Cohesive soils are dense and tightly bound together by molecular attraction. They are plastic when wet and can be molded, but become very hard when dry. Proper water content, evenly distributed, is critical for proper compaction. Cohesive soils usually require a force such as impact or pressure. Silt has a noticeably lower cohesion than clay. Silt is still heavily reliant on water content.

GRANULAR SOILS

Granular soils range in particle size from .003" to .08" (sand) and .08" to 1.0" (fine to medium gravel). Granular soils are known for their water-draining properties.

MOISTURE VS. SOIL DENSITY

Moisture content of the soil is vital to proper compaction. Moisture acts as a lubricant within soil, sliding the particles together. Too little moisture means inadequate compaction--the particles cannot move past each other to achieve density. Too much moisture leaves water-filled voids and subsequently weakens the load-bearing ability. The highest density for most soils is at a certain water content for a given compaction effort. The drier the soil, the more resistant it is to compaction. In a water-saturated state the voids between particles are partially filled with water, creating apparent cohesion that binds them together. This cohesion increases as the particle size decreases (as in clay-type soils).

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APPLICATIONS

Soil is compacted in consecutive layers called "lifts", at 6" per lift. This will provide the proper compaction throughout all levels.

The desired level of compaction is best achieved by matching the soil type with its proper compaction method. Other factors must be considered as well, such as compaction specifications and job site conditions.

Cohesive soils like clay require a machine with high impact force to force the air out. A rammer is the best choice, or a pad-foot vibratory roller when higher production is needed.

Granular soils are not cohesive, so the particles require a shaking or vibratory action to move them. Vibratory plates that travel forward are the best choice.

SOIL TESTING

Percolation Test

A percolation test(perc test) is a test to determine the absorption rate of soil for a septic drain field or "leach field". The results of perc tests are required to properly design a septic system. In its broadest terms, percolation testing is simply observing how quickly a known volume of water dissipates into the subsoil in a drilled hole of a known surface area. While every jurisdiction will have its own laws regarding the exact calculation for the length of line, depth of pit, etc., the testing procedures are the same.

In general, sandy soil will absorb more water than soil with a high concentration of clay, or where the water table is close to the surface.

Testing Method

A perc test consists of digging one or more holes in the soil of the proposed leach field to a specified depth, presoaking the holes by maintaining a high water level, then running the test by filling the

holes to a specific level and timing the drop of the water level as the water percolates into the surrounding soil.

Soil Density Tests

To determine if proper soil compaction is achieved for any specific construction application, several methods were developed. The most prominent by far is soil density. Soil density testing accomplishes the following:

-Measures density of soil for comparing the degree of compaction vs. specifications.

-Measures the effect of moisture on soil density vs. specifications.

-Provides a moisture density curve identifying optimum moisture.

Types of Soil Density Tests

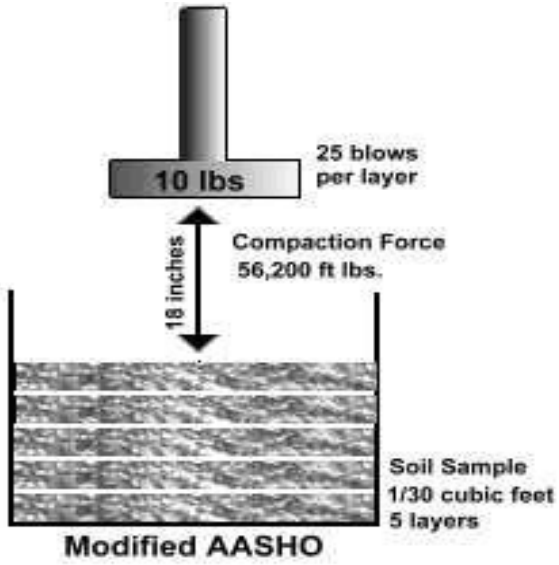
Tests to determine optimum moisture content are done in the laboratory. The most common is the Proctor Test, or Modified Proctor Test. A particular soil needs to have an ideal (or optimum) amount of moisture to achieve maximum density. This is important not only for durability, but will save money because less compaction effort is needed to achieve the desired results.

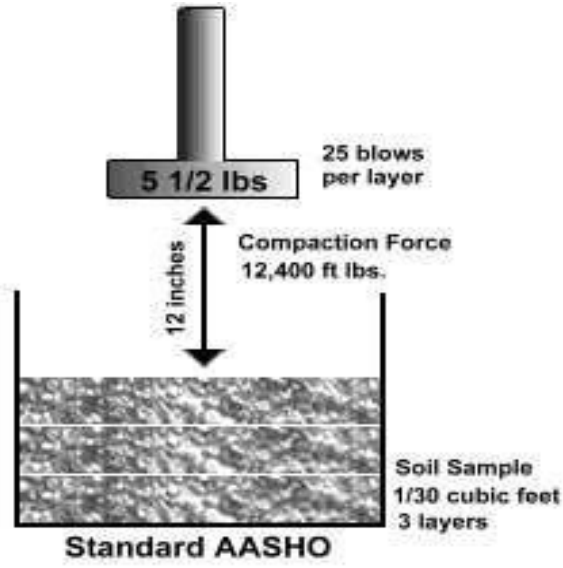
Hand Test--a quick method of determining moisture is known as the "Hand Test". Pick up a handful of soil. Squeeze it in your hand. Open you hand--if the soil is powdery and does not retain its shape--it is too dry. If it shatters when dropped, it is too dry. If the soil is moldable and breaks into only a couple of pieces when dropped, it has the right amount of moisture for proper compaction. If the soil is plastic in your hand, leaves traces of moisture on your fingers and stays in one piece when dropped, it has too much moisture for compaction.

Proctor Test--the Proctor, or Modified Proctor Test, determines the maximum density of a soil needed for a specific site. The test first

determines the maximum density achievable for the materials and uses this figure as reference. Secondly, it tests the effects of moisture on soil density. The soil reference value is expressed as a percentage of density. These values are determined before any compaction takes place to develop the compaction specifications. The Modified Proctor Test values are higher because they take into account higher densities needed for certain types of construction projects. Test methods are similar for both results.

Modified Proctor Test ***This is similar to the Proctor Test except a hammer is used to compact the material for greater impact. The test is normally preferred in testing material for higher shearing strength.***
Proctor Test ***A small soil sample is taken from the jobsite. A standard weight is dropped several times on the soil . The material is weighed and then dried for 12 hours in order to evaluate water content.***

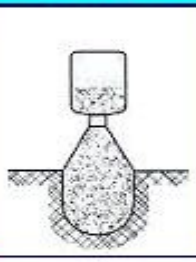
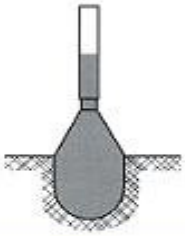
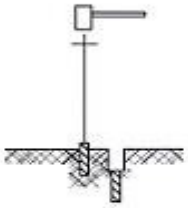




Field Tests--it is important to know and control the soil density during compaction. The following are common field tests that can determine, on the spot, if compaction densities are being reached.

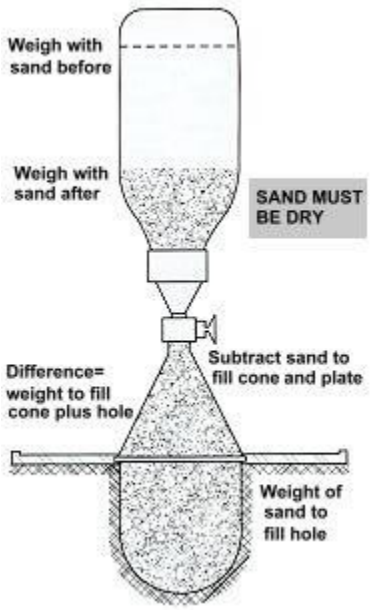
Field Tests

It is important to know and control the soil density during compaction. Following are common field tests to determine on the spot if compaction densities are being reached.

Field Density Testing Method				
	Sand Cone	**Balloon Dens meter**	**Shelby Tube**	**Nuclear Gauge**
				
Advantages	* Large sample * Accurate	* Large sample * Direct reading obtained * Open graded material	* Fast * Deep sample * Under pipe haunches	* Fast * Easy to redo * More tests (statistical reliability)
Disadvantages	* Many steps * Large area required * Slow * Halt Equipment * Tempting to accept flukes	* Slow * Balloon breakage * Awkward	* Small Sample * No gravel * Sample not always retained	* No sample * Radiation * Moisture suspect * Encourages amateurs
Errors	* Void under plate * Sand bulking * Sand compacted * Soil pumping	* Surface not level * Soil pumping * Void under plate	* Overdrive * Rocks in path * Plastic soil	* Miscalibrated * Rocks in path * Surface prep required * Backscatter
Cost	* Low	* Moderate	* Low	* High

Sand Cone Test

A small hole (6"x6") is dug in the compacted material to be tested. The soil is removed and weighed, then dried and weighed again to determine its moisture content. A soil's moisture is figured as a percentage. The specific volume of the hole is determined by filling it with calibrated dry sand from a jar and cone device. The dry weight of the soil removed is divided by the volume of sand needed to fill the hole. This gives us the density of the compacted soil in pounds per cubic foot. This density is compared to the maximum Proctor density obtained earlier, which gives us the relative density of the soil that was just compacted.



Nuclear Density--Nuclear Density meters are a quick and fairly accurate way of determining density and moisture content. The meter uses a radioactive isotope source (Cesium 137) at the soil surface (backscatter) or from a probe placed into the soil (direct transmission). The isotope source gives off photons (usually Gamma rays) which radiate back to the meter's detectors on the bottom of the unit. Dense soil absorbs more radiation than loose soil and the readings reflect overall density. Water content can also be read, all within a few minutes. A relative Proctor density with the compaction results from the test.

Soil Modulus (soil stiffness)--this method is a very recent development that replaces soil density testing. Soil stiffness is the ratio of force-to-disbursement. Testing is done by a machine that sends vibrations into the soil and then measures the deflection of the soil from the vibrations. This is a very fast, safe method of

testing soil stiffness. Soil stiffness is the desired engineering property, not just dry density and water content. This method is currently being researched and tested by the Federal Highway Administration.

Progress Check

- What are the characteristics of cohesive soil?
- Which test determines the absorption rate of soil for a septic drain-field?
- What is the difference between a Proctor Test and a Modified Proctor Test?

Overview of Building Trades

Easements & Topography

EASEMENTS	FLOOD PLAINS/WETLANDS	SURVEY MONUMENTS	NEW WELLS

Learning Objectives

Describe what kind of restrictions may be involved in regards to easements, flood ways, and wetlands.

Explain why it is important to identify and protect survey monuments.

PUBLIC UTILITY EASEMENTS

It is important to understand the ways in which use of your property may be restricted due to an easement. For example, if a sewer easement runs though your property, there may be restrictions against placing any structures over it. If repairs are ever required, the holder of the easement will have the right to access the line

(usually by digging up your property!). If part of your property is subject to a conservation easement, you may not have the right to cut down trees or build structures in the easement area. If you do build a structure without first obtaining any necessary approvals, you may have to later tear down the structure.

According to Section 560.190 Public Utility Easements:

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(d) The public utilities shall have the right to trim or remove trees that interfere with their use of easements.
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Site Plans

Site plans generally include four basic components or pieces of information. The first is the Building Restriction Line (BRL), which indicates the area that the structure or building must stay within. The site plan will also show any easements that may be present. The property line is the legal boundary of the land parcel and is usually marked with heavy lines. Contour lines depict the topography and elevation of the parcel--generally the lay of the land.

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A Sample Site Plan

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Please be aware that since every project is unique there may be some situations where you will be asked to provide additional information.

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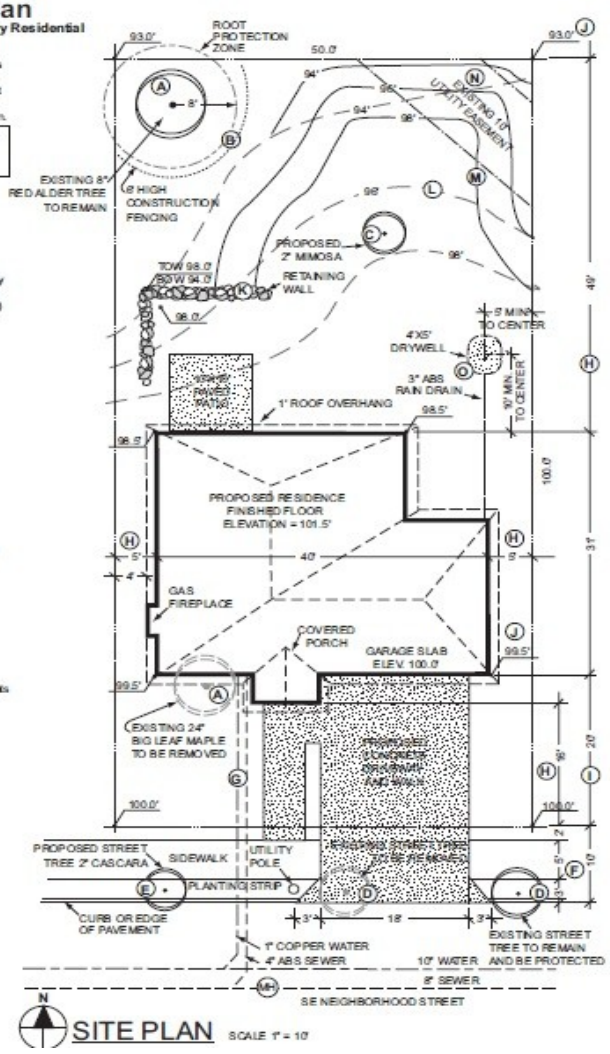

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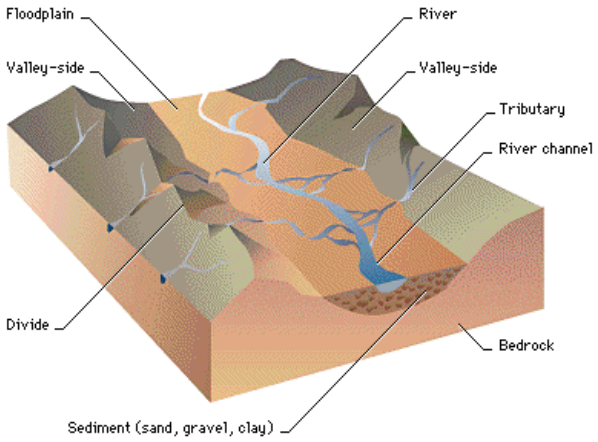
If any part of a proposed subdivision lies within the floodplain of a river, stream, creek or lake, approval of the final plat shall be conditioned on the following:



(a) No buildings for residential purposes and occupancy shall be located on any portion of a lot lying within a floodplain, unless approved in accordance with the rules of the water resources commission of the department of conservation.

(b) Restrictive deed covenants shall be filed and recorded with the final plat that the floodplain area will be left essentially in its natural state.

(c) The natural floodplain may be altered if its original discharge capacity is preserved and the stream flow is not revised so as to affect the riparian rights of other owners.

What is a flood?

The National Flood Insurance Program defines a “flood” as a general and temporary condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters or from the unusual and rapid accumulation or runoff of surface waters from any source.

What is the 100-Year Floodplain?

The 100-year floodplain is the land adjacent to a river, lake or

stream that will be inundated by water during a flood which has a 1% chance of occurring or being exceeded in any given year. Every river, lake or stream has a floodplain associated with it.

What types of activities will require a state floodplain permit?

Any construction, fill or alteration of a floodplain of a river, stream, or drain which has a drainage area greater than or equal to 2 square miles will require a state floodplain permit under Part 31 of the Natural Resources and Environmental Protection Act. Such projects as building a house, placement of fill, installing a culvert or bridge, all would require a permit under Part 31.

Can I build in the Floodplain?

In general, construction and fill may be permitted in the portions of the floodplain that are not flood way, provided local ordinance and building standards are met. In addition, compensating excavation must be provided that is equal to the volume of fill placed in the floodplain. Flood ways are the channel of a river or stream and those portions of the floodplain adjoining the channel which are reasonably required to carry and discharge the 100 year flood; these are areas of moving water during times of flood. New residential construction is specifically prohibited in the flood way.

The current building codes in Michigan requires that new construction or substantially improved buildings within the 100 year floodplain have the lowest floor, elevated at least one foot above the 100 year flood elevation. Basements that are below grade on all sides must be at or above the 100 year elevation.

What is a flood way?

The flood way includes the channel of a river or stream and area adjacent to the channel that will carry moving water during times of flood. This is a high hazard portion of the floodplain. The flood way is that portion of the floodplain that we see on television where the houses have been swept off their foundation. In addition to being a hazard to residents, the flood way also presents a hazard to rescue personnel.

Residential construction is prohibited within the flood way portion of the floodplain. Commercial construction may be permitted within the flood way, however, a hydraulic analysis may be required which demonstrates that the proposal will not harmfully increase flood stages or shift flood flows onto adjacent property owners.

If a Flood Insurance Study has been published for your community, the community may have a copy of the Flood Boundary and Flood Way Map, or it may be available online, or in your local library.

If a flood way map has not been prepared, the District Floodplain Engineer may be able to provide some guidance into the location of the flood way. Because of workload, please allow 4 to 8 weeks for a determination.

How much does a state floodplain permit cost?

The cost to apply for a permit under Part 31 to alter the floodplain

varies depending on what is being proposed. If the project is not located within the flood way portion of the floodplain, the project would meet the "minor" category, and the application fee is $100.

What is a Wetland?

Michigan's wetland statute, Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, defines a wetland as "land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh." The definition applies to public and private lands regardless of zoning or ownership.

Most people are familiar with the cattail or lily pad wetland found in areas with standing water, but wetlands can also be grassy meadows, shrubby fields, or mature forests. Many wetland areas have only a high ground water table and standing water may not be visible. Types of wetlands include deciduous swamps, wet meadows, emergent marshes, conifer swamps, wet prairies, shrub-scrub swamps, fens and bogs.

According to Part 303, Wetlands Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, a person may not do any of the following activities in a wetland without a permit from the Department of Environmental Quality (DEQ).

Progress Check

- List the conditions that must be met in order to build within the floodplain of a river, stream or creek.
- Is commercial construction allowed within a flood

way?

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Survey Monuments

A survey monument can control the location of public or private property lines. Many monuments are referred to in property deeds and unless protected, could result in unnecessary cost to the landowner. It is important to be able to identify and protect survey monuments. Every survey of conveyance of land must start from evidence that proves the position of at least two survey monuments are somehow related to the written record.

It is important to understand that only the original monuments control a conveyance location. In resurveying a tract of land according to a former plat or survey, the surveyor's function is to relocate, upon the best available evidence, the corners and lines at the same place originally located.

A monument size can range from a small tack in a lead plug in concrete to a large house size boulder, a 200-year old fir tree or the center of a river. Monuments can be either natural or a man made material.
The collection of evidence to identify monuments are:

- Who set the monuments?
- What type of monument was set?
- When did they set the monument?
- Where did they set the monument?
- Why did they set the monument?

Any monument set by a land surveyor to mark or reference a point on a property or land line shall be permanently marked or tagged with the certificate number of the land surveyor setting it.

Monuments set by a land surveyor shall be sufficient in number and durability and shall be efficiently placed so as not to be readily disturbed in order to assure the perpetuation or re-establishment of any point or line of survey.

Deed Restrictions

Real estate deed restrictions are restrictions on the deed that place limitations on the use of the property. Restrictive covenants are an example of deed restrictions. Deed restrictions are usually initiated by the developers – those who determined what the land would be used for, divided the land into plots, and built homes, office buildings, or retail buildings on it. Deed restrictions come with the property and usually can't be changed or removed by subsequent owners.

Deed restrictions such as restrictive covenants are often put in place to maintain a desired look in a neighborhood. To that end, deed restrictions may prevent owners from building more than a pre-established number of homes on one lot. Deed restrictions can also specify what materials or style a building may or may not be constructed of, and how close to the street it can be. Deed restrictions can even specify the minimum size that a house on the lot may be.

Deed restrictions govern more than just the construction of buildings on a property. Restrictive covenants in a residential neighborhood dictate what types of materials fences may be made out of, or establish limits regarding pets, such as how many pets can be kept in a home or the conditions they must be kept in. Covenants often protect the aesthetic appearance of the neighborhood by providing a list of acceptable paint colors for the exterior of the house, regulating tree-cutting and other landscaping issues, prohibiting the use of the lot for storage of campers, trailers or cars that don't run. Covenants might also establish road maintenance or amenities fees.

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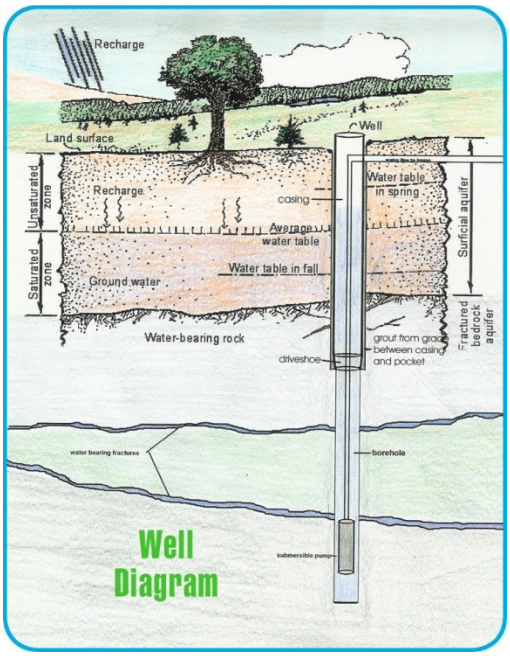
New Water Well Requirements

A new water supply shall not be used until the construction and installation have been approved by the Health Department. The following conditions must be met before the Health Department shall approve a new water supply.



a. An onsite inspection has been completed by the Health Department and the water supply is found to be in compliance with the applicable provisions of the state regulations and permit requirements.

b. A completed "Water well and pump record" has been submitted to the Health Department.

c. The Health Department has received copies of the results of the analysis of water samples indicating that the raw water quality meets minimum public health standards. Analysis of water samples shall be performed by laboratories certified by the Michigan Department of Public Health.

Progress Check

- Define and provide examples of deed restrictions.
- What is the purpose of a survey monument?
- What 3 conditions must be met in order to gain approval for a new well?

Overview of Building Trades

Easements & Topography

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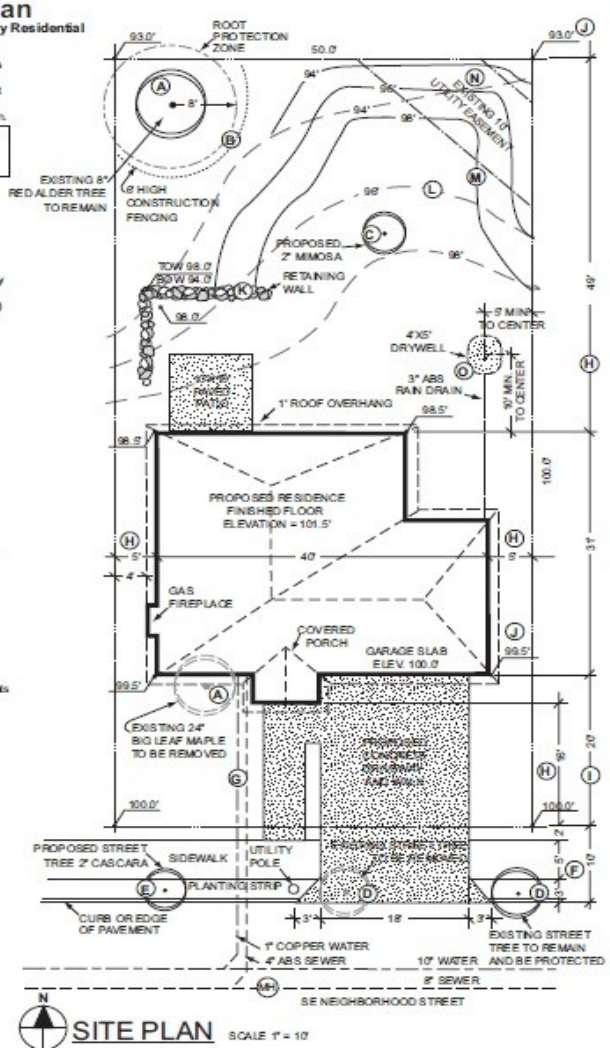

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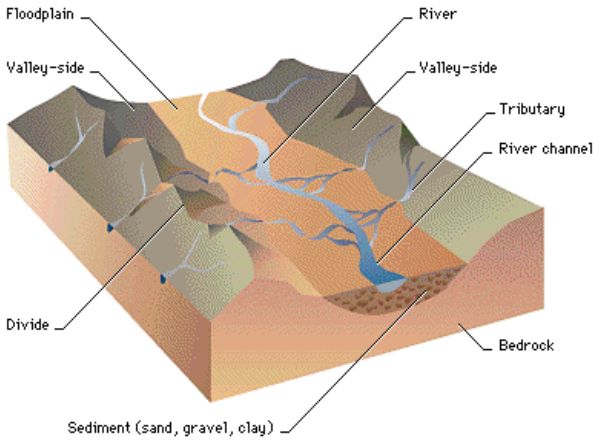

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A survey monument can control the location of public or private property lines. Many monuments are referred to in property deeds and unless protected, could result in unnecessary cost to the landowner. It is important to be able to identify and protect survey monuments. Every survey of conveyance of land must start from evidence that proves the position of at least two survey monuments are somehow related to the written record.

It is important to understand that only the original monuments control a conveyance location. In resurveying a tract of land according to a former plat or survey, the surveyor's function is to relocate, upon the best available evidence, the corners and lines at the same place originally located.

A monument size can range from a small tack in a lead plug in concrete to a large house size boulder, a 200-year old fir tree or the center of a river. Monuments can be either natural or a man made material.
The collection of evidence to identify monuments are:

- Who set the monuments?
- What type of monument was set?
- When did they set the monument?
- Where did they set the monument?
- Why did they set the monument?

Any monument set by a land surveyor to mark or reference a point on a property or land line shall be permanently marked or tagged with the certificate number of the land surveyor setting it.

Monuments set by a land surveyor shall be sufficient in number and durability and shall be efficiently placed so as not to be readily disturbed in order to assure the perpetuation or re-establishment of any point or line of survey.

Deed Restrictions

Real estate deed restrictions are restrictions on the deed that place limitations on the use of the property. Restrictive covenants are an example of deed restrictions. Deed restrictions are usually initiated by the developers – those who determined what the land would be used for, divided the land into plots, and built homes, office buildings, or retail buildings on it. Deed restrictions come with the property and usually can't be changed or removed by subsequent owners.

Deed restrictions such as restrictive covenants are often put in place to maintain a desired look in a neighborhood. To that end, deed restrictions may prevent owners from building more than a pre-established number of homes on one lot. Deed restrictions can also specify what materials or style a building may or may not be constructed of, and how close to the street it can be. Deed restrictions can even specify the minimum size that a house on the lot may be.

Deed restrictions govern more than just the construction of buildings on a property. Restrictive covenants in a residential neighborhood dictate what types of materials fences may be made out of, or establish limits regarding pets, such as how many pets can be kept in a home or the conditions they must be kept in. Covenants often protect the aesthetic appearance of the neighborhood by providing a list of acceptable paint colors for the exterior of the house, regulating tree-cutting and other landscaping issues, prohibiting the use of the lot for storage of campers, trailers or cars that don't run. Covenants might also establish road maintenance or amenities fees.

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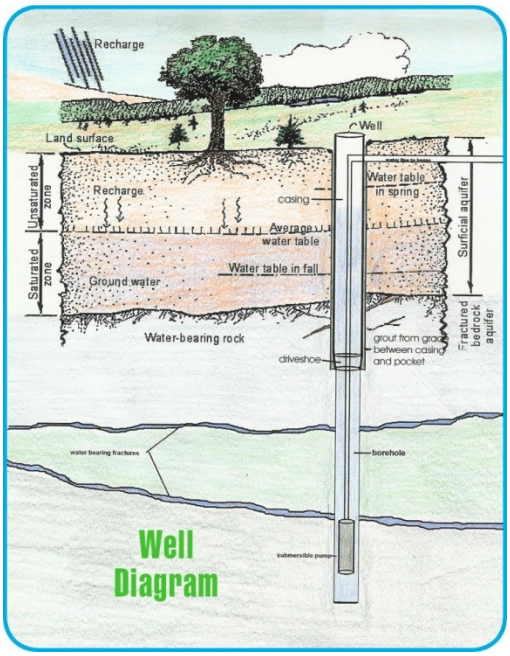
New Water Well Requirements

A new water supply shall not be used until the construction and installation have been approved by the Health Department. The following conditions must be met before the Health Department shall approve a new water supply.



a. An onsite inspection has been completed by the Health Department and the water supply is found to be in compliance with the applicable provisions of the state regulations and permit requirements.

b. A completed "Water well and pump record" has been submitted to the Health Department.

c. The Health Department has received copies of the results of the analysis of water samples indicating that the raw water quality meets minimum public health standards. Analysis of water samples shall be performed by laboratories certified by the Michigan Department of Public Health.

Progress Check

- Define and provide examples of deed restrictions.
- What is the purpose of a survey monument?
- What 3 conditions must be met in order to gain approval for a new well?

Overview of Building Trades

Site Preparation

EQUIPMENT TYPES	MEASUREMENTS/MARKINGS	EROSION CONTROL

Learning Objective

Describe the basic methods and tools required for site preparation.

The area of a property that is going to be prepared for a yard with lawn and landscaping needs first to be cleared of brush including trees that will be in the area of the building and trees that the owner decides to remove.

Next, the topsoil needs to be stripped off and stockpiled (not near a

drainage way). The excavation of the hole for the building is dug and that soil is also stockpiled.

APPLICATIONS

The desired level of compaction is best achieved by matching the soil type with its proper compaction method. Other factors must be considered as well, such as compaction specifications and job site conditions.

Cohesive soils – clay is cohesive, its particles stick together.* Therefore, a machine with a high impact force is required to ram the soil and force the air out, arranging the particles. A rammer is the best choice, or a pad-foot vibratory roller if higher production is needed.

*The particles must be sheared to compact.

Granular soils – since granular soils are not cohesive and the particles require a shaking or vibratory action to move them, vibratory plates (forward travel) are the best choice.

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EQUIPMENT TYPES

Compaction Equipment

Rammers - Rammers deliver a high impact force (high amplitude) making them an excellent choice for cohesive and semi-cohesive soils. Frequency range is 500 to 750 blows per minute. Rammers get compaction force from a small gasoline or diesel engine powering a large piston set with two sets of springs. The rammer is inclined at a forward angle to allow forward travel as the machine jumps. Rammers cover three types of compaction: impact, vibration and kneading.

Vibratory Plates - Vibratory plates are low amplitude and high frequency, designed to compact granular soils and asphalt. Gasoline or diesel engines drive one or two eccentric weights at a high speed to develop compaction force. The resulting vibrations cause forward motion. The engine and handle are vibration-isolated from the vibrating plate. The heavier the plate, the more compaction force it generates. Frequency range is usually 2500 vpm to 6000 vpm. Plates used for asphalt have a water tank and sprinkler system to prevent asphalt from sticking to the bottom of the base plate. Vibration is the one principal compaction effect.

Backhoe

A backhoe is a piece of heavy equipment used mostly for digging trenches and ditches on construction sites. They are also used for small demolition, light transportation of building materials, powering building equipment, tree removal, breaking asphalt, and paving roads. A backhoe is the most versatile machine on the construction site.
The advantages of this type of machine, as compared to large excavators, are that they are very compact. They can maneuver in most construction sites and be easily transported.

Bulldozer

A bulldozer is a tracked vehicle with a large metal blade in the front. It is used for clearing and grading land. The tracks give them excellent ground hold and mobility through very rough terrain. Wide tracks help distribute the bulldozer's weight over large areas which will decrease pressure, preventing it from sinking in sandy or muddy ground. This would be a contractor's best choice for stripping topsoil and grading on a typical home building site. Site vision GPS system can be installed to help establish the final grade much faster.

Excavator

The excavator is a machine consisting of an articulated arm (boom stick), bucket and cab mounted on a rotating platform atop an undercarriage with tracks or wheels. They are used for digging trenches, holes, foundations, material handling, brush cutting, demolition and heavy lifting. Recently, excavators have been outfitted to utilize hydraulic powered equipment such as a breaker, a grapple or an auger.

Loader

A loader is also called a skip loader, bucket loader, scoop loader or pay loader. The loader is a tractor usually wheeled, sometimes on tracks. It has a front mounted square wide bucket connected to the end of two booms to scoop up loose material from the ground, such as dirt, sand or gravel, and move it from one place to another without pushing the material across the ground. A loader is commonly used to move stockpiled material from ground level and deposit it into an awaiting dump truck or an open trench excavation. Loaders can also be equipped with forks for lifting pallets or a clamshell bucket to act like a small bulldozer.

Skid Loader

A skid loader is also known as a skid steer. It is a machine with lift arms used to attach a wide variety of labor-saving tools or attachments. Though sometimes they are equipped with tracks, they are more typically four wheel drive vehicles with the left side drive wheels independent of the right side drive wheels. Skid loaders are capable of zero-radium, pirouette turning, which makes them maneuverable. They are very valuable for applications that require a compact agile loader.

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MEASUREMENTS AND MARKINGS

Batter Boards – used to create and maintain building lines are placed back from each corner at least four feet.

Builders Level – used to establish horizontal planes. It can measure if a floor is level, but it cannot measure if a wall is plumb.

Transit Level – used to establish horizontal planes and vertical plumb lines or straight lines.

Slope – a 3% slope means 3’ of drop in 100’ of run.

Finish Grade – this is the level of the soil in relationship to the home when the excavating is completed.

Site Plan – a plan that shows the building lot with boundaries, contours, existing roads, utilities, and other details such as existing trees and buildings. Also called a *plot plan*.

Setback – the distance from the property line that any part of the structure must maintain. To establish the depth of the excavation, contractors should use the highest elevation as the control point.

Benchmark – reference point from which measurements can be made.

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EROSION CONTROL FOR RESIDENTIAL CONSTRUCTION

1. Maintain as many grassed areas as possible to trap the soil before it reaches the roadway and storm water system.
2. Use only one exit/entry driveway to the site. Stabilize the driveway with gravel.
3. Keep soil stockpiles within the site areas and away from any roads or waterways.
4. Regularly remove any soil from the roads adjacent to your site.
5. Steep sites should have silt fences on low sides or bales of hay may be used.
6. Plant new vegetation as soon as possible.

7. Always inspect erosion control devices regularly and especially after a rainstorm of 1/2" or more.

Grading Definition-is changing the earth's surface by either excavating or filling or a combination of both.

Cut Grading-is changing the elevation of ground by removing earth with equipment such as a bulldozer.

Fill Grading-is changing the elevation of ground by bringing in additional soil by truck or possibly changing grade on the site where cuts are made in one area to provide fill for another area. This process is typically done by a bulldozer. Fill is changing the earth's surface by depositing earth material by artificial means. Never add fill before removing vegetation, non-complying fill or topsoil.

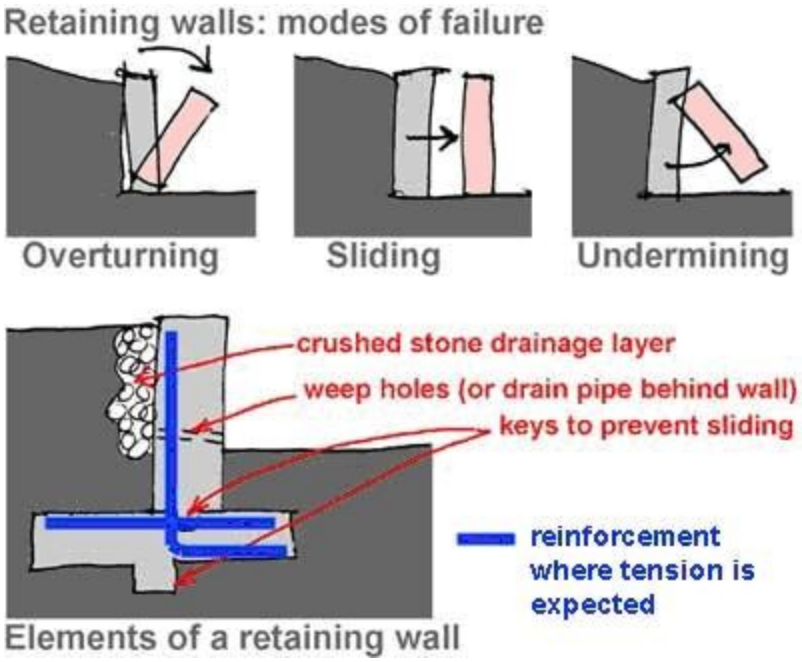
Rough Grading-after the foundation is built and either the floor is installed or the walls are braced, the foundation is backfilled. The property should be rough graded to the approximate elevation needed at final grade when the topsoil is again put back on top where it belongs. Be certain to provide the required slope (5% from the foundation for at least 10 ft).

Sloping-the building code states that homes must be backfilled so as to provide a minimum slope from the foundation wall for surface drainage away from the home. This slope must be at least 6" of fall for 10' of span (5% slope).

NOTE: Slope is a ground surface inclination expressed as a ratio of horizontal distance to vertical distance.

Retaining Walls-if your project requires excavating near a retaining wall, special precaution must be taken. Retaining walls have a system built into the wall construction that is hidden in the soil behind the face of the wall. Extreme caution should be taken to preserve this system. If the system is destroyed, the wall will fail.

Another concern is excavating below the level of the bottom of the footing. Footing weight is dispersed not only directly below the footing, but also to the soil next to the footing. See the diagram below.



Progress Check

- What is the difference between a rammer and a vibratory plate?
- Describe some basic measures to prevent erosion at a residential construction site.
- Define "fill grading" and how it is typically accomplished?

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The following practice questions refer to all the Excavation chapters.

EXCAVATION I, II, III, IV REVIEW QUESTIONS

Answer can be found on Page 82 in the Carpentry and Building Construction book.

1. How often should excavation be inspected for signs of soil movement that may pose a safety risk?

a. Hourly
b. Daily
c. Weekly
d. Monthly

Note: Immediately after ½" or more rain fall event.

Answer can be found on Page 82 in the Carpentry and Building Construction book.

2. The slope ratio used to provide a safe work environment for an excavated hole is dependent on:

a. The equipment operator
b. The soil type
c. The general contractor
d. Home owner

Answer – See information in Excavation I, II, III or IV.

3. What type of material allows for the best drainage?

a. Granular soil
b. Soft clay
c. Organic Matter
d. none of the Above

Answer – See information in Excavation I, II, III or IV.

4. The best way to compact sand is:

a. flooding
b. vibration
c. impaction
d. rolling

Answer – See information in Excavation I, II, III or IV.

5. A ground surface inclination expressed as a ratio of horizontal distance to vertical distance is called _____.

a. slope
b. incline
c. hill
d. decline

Answer can be found on Page 82 in the Carpentry and Building Construction book.

6. How far back from the edge of an excavated hole must an operator place excavated soil?

a. minimum of 1 1/2 feet
b. minimum of 2 feet
c. minimum of 2 1/2 feet
d. minimum of 3 feet

Answer – See information in Excavation I, II, III or IV.

7. Site vision GPS systems are installed on bulldozers to help establish:

a. Final grade
b. Lot locations
c. Dead reckoning
d. Relative bearing

Answer –See information in Excavation I, II, III or IV.

8. When compacting soils, soils should be compacted in _____ of 6 inches. This will provide for proper compaction through all levels.

a. Layers
b. Lifts
c. Sections
d. Piles

Answer – See information in Excavation I, II, III or IV.

9. Can dewatering activities on a jobsite affect the operation of nearby water wells?

a. Yes
b. No

Answer - See information in Excavation I, II, III or IV.

10. What are the three basic soil types?
a. Cohesive, granular, organic
b. Clay, sand, topsoil
c. Silt, clay, sand
d. Low plasticity, medium plasticity, high plasticity

Answer can be found on Page 242 in the Carpentry and Building Construction book.

11. The _____ distance is the minimum allowed by local code between the house and the property lines.
a. Setback
b. Restrictive
c. Easement
d. Layout

Answer can be found on Page 50 in the Carpentry and Building Construction book.

12. When you need to find the exact location a building is intended to be located upon a property, you would need to use the _____.
a. Elevation plans
b. Foundation plan
c. Plot plan
d. Section plan

Answer - See information in Excavation I, II, III or IV.

13. Every survey of conveyance of land must start from evidence that proves the position of at least _____ survey monuments.
a. 1
b. 2
c. 3
d. 4

Answer - See information in Excavation I, II, III or IV.

14. A wet land could be a _____

a. Grassy meadow
b. Shrubby field
c. Mature forest
d. Any of the above

Answer - See information in Excavation I, II, III or IV.

15. How far must a water well be kept from a sewage disposal absorption area?

a. 25’
b. 30’
c. 40’
d. 50’

Answer - See information in Excavation I, II, III or IV.

16. Of the methods of field testing soil density, which one is the most expensive?

a. Sand cone
b. Balloon density meter
c. Shelby tube
d. Nuclear gauge

Answer - See information in Excavation I, II, III or IV.

17. Proctor tests determine the _____.

a. Maximum density achievable
b. Optimum moisture content for compaction
c. A reference point to measure compaction from
d. All of the above

Answers to Excavation I, II, III, and IV Review

1. b
2. b
3. a
4. b
5. a
6. b

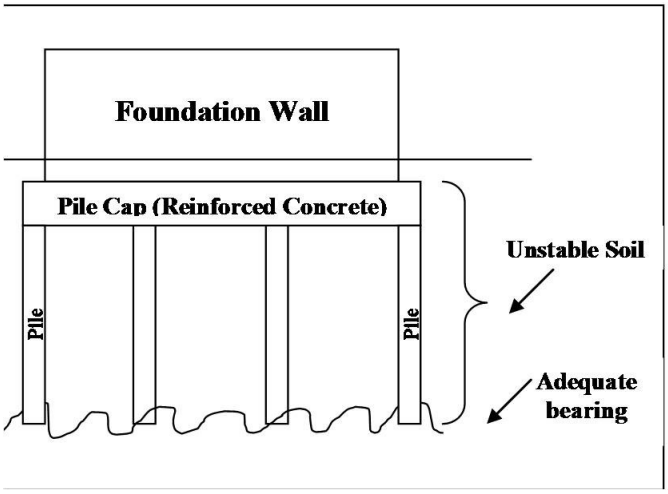
7. a
8. b
9. a
10. a
11. a
12. c
13. b
14. d
15. d
16. d
17. d

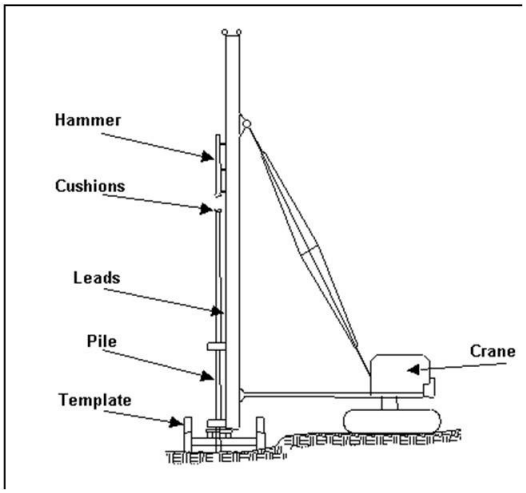
Overview of Building Trades

Footing & Foundation Walls

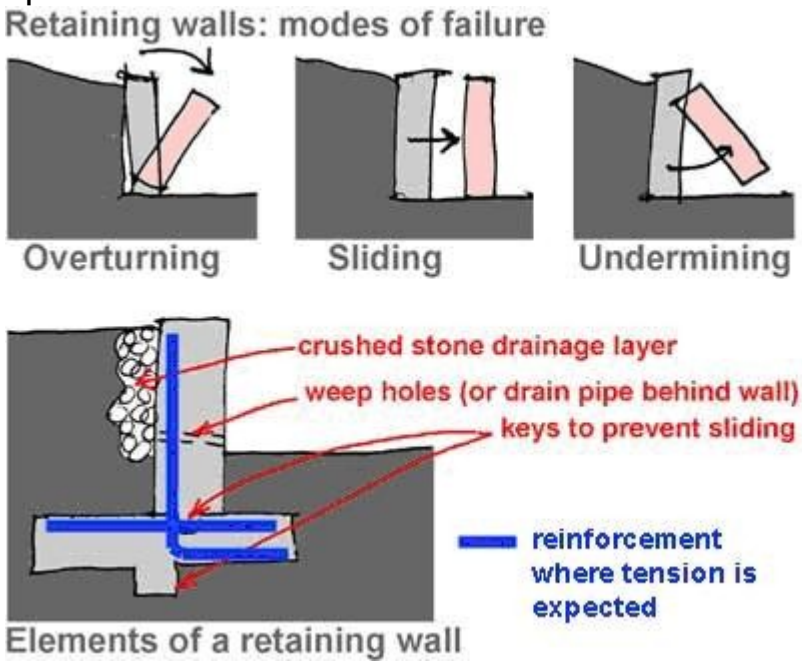
Pile Footings

Pile footings are used where the soil is not stable enough to support the weight near the surface. The soil may be loose or very wet. Long columns, made of either wood or steel, are driven into the ground. Concrete piles are made by drilling a deep hole and filling it with concrete.





Retaining walls: Designed to hold back earth at vertical discontinuities. Crushed stone is placed behind the wall to allow water to escape, either through weep holes in the wall, or into drain pipes behind the wall.



Why do we reinforce concrete?

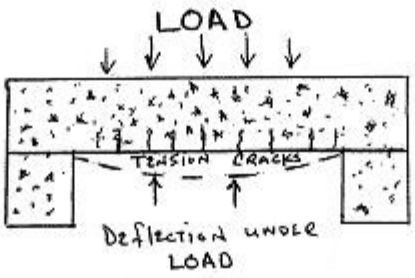
Concrete is strong in compression strength (ability to resist crushing), but weak in tensile strength (ability to resist being pulled

apart). Tensile strength also provides for the ability to withstand shock and vibration.

Steel is strong in tensile strength and, when properly placed in the concrete mass, will greatly add to the tensile strength.

In illustration "A" below, the load placed on the beam causes the beam to deflect or sag, causing the lower portion of the beam to crack under tension. This area is being stretched or pulled apart. Concrete that is not reinforced has little strength to withstand this

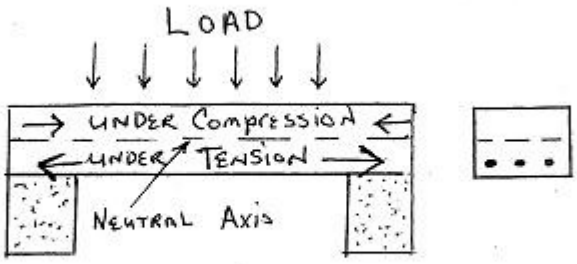
A



force.

By adding reinforcement in the area under the neutral axis (illustration "B"), the tensile strength is increased, which lessons the amount of deflection.

B



Progress Check

- What is the difference between tensile strength and compression strength?

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FOOTINGS & FOUNDATION WALLS REVIEW QUESTIONS

Answer can be found in R402.1.1.

1. Fasteners used below grade in wood foundations shall be _____.

a. Double dipped galvanized
b. Triple dipped galvanized
c. Zinc
d. Stainless Steel

Answer can be found in R506.2.2.

2. Concrete slabs below grade require a _____base course of sand, gravel or crushed stone if the existing base isn't a group 1 soil.

a. 3"
b. 4"
c. 5"
d. 6"

Answer can be found on Page 266 in the Carpentry and Building Construction book.

3. What is the term for concrete that is poured over concrete that was poured earlier and has already begun to cure in a poured wall application?

a. Break joint
b. Cold joint

c. Weak joint
d. Hot Joint

Answer – See information at the front of this section.

4. Concrete is very strong in _____ strength, but weak in _____ strength.
a. Flexoral / adhesion
b. Compression / Tensile
c. Tensile / Compression
d. Tensile / Flexoral

Answer can be found on Page 257 in the Carpentry and Building Construction book Table 14-A.

5. The minimum size of the footings needed to support a building structure is determined by:
a. the type of building
b. the number of stories
c. the type of soil supporting the building
d. all of the above

Answer can be found on Page 257 in the Carpentry and Building Construction book.

6. When steel reinforcement is required, it must be placed at least_____ above the bottom of the footing.
a. 2"
b. 3"
c. 4"
d. 5"

Answer can be found on Page 295 in the Carpentry and Building Construction book.

7. If a footing and foundation wall is constructed by the same form work and created by the same concrete pour, this is called _____.
a. Unibond construction
b. Monolithic construction

c. Time Management
d. All of the above

Note: This is also true for footings and a floor slabs that are constructed by the same pour.

Answer can be found on Page 257 in the Carpentry and Building Construction book.

8. A groove formed in the surface of a footing to support the foundation wall is called:
a. wall slot
b. keyway
c. strong tie
d. tie slot

Answer can be found on Page 260 in the Carpentry and Building Construction book.

9. What should the elevation change limit per step be for step footings?
a. 1'
b. 2'
c. 2 1/2'
d. 3'

Answer can be found on Page 265 in the Carpentry and Building Construction book.

10. What is the horizontal brace for wall forms called?
a. long brace
b. wale
c. shark
d. lead brace

Answer can be found on Page 271 in the Carpentry and Building Construction book and R406.1.

11. Protecting foundation wall against ordinary seepage such that may occur after a rainstorm is called:
a. waterproofing

b. damp proofing
c. parging
d. seal coating

Answer can be found in R407.3.

12. What is the minimum size of a steel column in residential construction?

a. 2 1/2" diameter
b. 3" diameter
c. 3 1/2" diameter
d. 4" diameter

Answer can be found in R606.14.

13. If a steel beam is seated on solid masonry how much bearing length must it have?

a. 1 1/2"
b. 2"
c. 2 1/2"
d. 3"

Answer can be found in R317.1

14. Wood girders must not be closer than _____ from exposed earth unless they are preservative treated or naturally durable wood.

a. 8"
b. 10"
c. 12"
d. 14"

Answer can be found in R317.1.4.

15. Wood post or columns that are in direct contact with the ground and support permanent structures must be preservative treated.

a. true
b. false

Answer can be found in R403.1.6.

16. Anchor bolts for anchoring the sill plate to the foundation shall be spaced not more than _____ and be a minimum of 1/2" in diameter.

a. 5' o.c.
b. 6' o.c.
c. 7' o.c.
d. 8’ o.c.

Answer can be found in R403.1.6.

17. Anchor bolts must be provided within _____ from the end of each piece of the sill plate.

a. 6"
b. 8"
c. 10"
d. 12"

Answer can be found in R403.1.6 and on pg. 268 in the Carpentry and Bldg. Construction book.

18. Anchor bolts shall be embedded into at least _____ of concrete or grouted masonry.

a. 7 "
b. 8"
c. 9"
d. 10"

NOTE: the CBC has a mistake - 8" o.c. should be 6' o.c. at a minimum.

Answer can be found on pg. 263 in the Carpentry and Building Construction book.

19. The holes in a plastic drain pipe should be placed so the holes are facing down.

a. True
b. False

Answer can be found on pg. 263 in the Carpentry and Building Construction book.

20. To keep water moving in a footing drain, the drainpipe should be sloped at least 1/8" per foot.

a. True
b. False

Answer can be found on pg. 262 in the Carpentry and Building Construction book.

21. How far from the footings do you place your drainpipe?

a. right next to it
b. 8"
c. 16"
d. centered over 12" of gravel

Answer can be found in R404.1.2.3.1.

22. The recommended minimum strength of concrete used for footings is:

a. 1000 lb./sq. in.
b. 2000 lb./sq. in.
c. 2500 lb./sq. in.
d. 3000 lb./sq. in.

Answer can be found on pg. 257 in the Carpentry and Building Construction book.

23. At what distance must rebars used in reinforced concrete footings be kept from the bottom of the footing?

a. 4 inches
b. 6 inches
c. 1 1/2 to 2 1/2 inches
d. 3 inches

Answer can be found in R506.1.

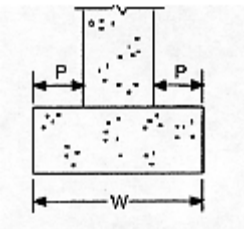
24. The minimum thickness of a slab on ground is:

a. 3"
b. 3 1/2"

c. 4"
d. 6"

Answer can be found in R403.1.1.

25. The minimum projection (P) of the footing is 2” and it should not exceed:
a. 4"
b. 6"
c. 8"
d. the thickness of the footing



Answer can be found in R404.2.4.

26. Wood foundations shall not be backfilled until the basement floor and first floor have been constructed or the walls have been braced.
a. True
b. False

Answer can be found in R405.1.

27. If approved drain tiles are to be used along the footing of the foundation wall rather than just the porous gravel fill, what are the coverage requirements of the fill?
a. 1 inch of porous gravel base, and 4 inches of porous gravel cover for the tile
b. 2 inches of porous gravel base and 4 inches of porous gravel cover for the tile
c. 4 inches of porous gravel base and 6 inches of porous gravel cover for the tile
d. 2 inches of porous gravel base and 6 inches of porous gravel cover for the tile

<u>NOTE:</u> Gravel should extend at least 12" from edge of footing.

Answer can be found in R403.1.6.

28. Maximum anchor bolt spacing is:

a. 2’
b. 4’
c. 6’
d. 8’

<u>Answers to Footings & Foundations Review</u>

1. d
2. b
3. b
4. b
5. d
6. b
7. b
8. b
9. b
10. b
11. b
12. b
13. d
14. c
15. a
16. b
17. d
18. a
19. a
20. a
21. a
22. c
23. d
24. b
25. d

26. a
27. d
28. c

Overview of Building Trades

CONCRETE

PROBLEMS	ADD MIXTURES	JOINTS	CURING

Learning Objectives

Describe and define 5 types of problems that typically occur with concrete.
Explain the difference between chemical and mineral add mixtures, and describe the several different types used.
Discuss how to construct proper concrete joints.

Concrete, a mixture of sand, cement, and gravel, has a density of 150 pounds per cubic foot. Since there are 27 cubic feet per cubic yard, a cubic yard weighs 4050 pounds, or a little over two tons.

Concrete is poured from a wet mix of cement, sand, aggregate and water. Prior to the mix drying, the concrete should be smoothed out on the desired surface. Power concrete screeds can be used in

place of a man powered screed bar to strike off excess concrete. A power screed assists in the smoothing out process by leveling out and vibrating the wet mixture. Power screeds rely on small gas powered engines or small electric motors such as a cordless drill.

PROBLEMS WITH CONCRETE

*Curling

Curling is the distortion of a slab into a curved shape by upward or downward bending of the edges. This distortion can lift the edges of the slab from the base leaving an unsupported edge or corner which can crack when heavy loads are applied. In other cases, slabs may curl over an extended period.

Why Do Concrete Slabs Curl?

Typically, upward curling of the edges of a slab is caused by shrinkage or concentration of the top relative to the bottom. When one surface of the slab changes size more than the other, the slab will warp at its edges in the direction of relative shortening. This curling is most noticeable at the sides and corners.

Change in slab dimensions which lead to curling are most often related to moisture and temperature gradients in the slab. One primary characteristic of concrete which affects curling is drying shrinkage. The most common occurrence of curling is when the top part of the slab dries and shrinks with respect to the bottom. The slab edges curl upward. Immediate curling of a slab is most likely related to poor curling and rapid surface drying; and anything that increases drying shrinkage will tend to increase curling.

Thin slabs and long joint spacing tend to increase curling. For this reason, thin unbonded toppings need to have a fairly close joint spacing.

In industrial floors, close joint spacings may be undesirable because of the increased number of joints and increased joint maintenance problems. However, this must be balanced against the probability of intermediate random cracks and increased curling at the joints. The other factor that can cause curling is temperature differences between the top and bottom of the slab. The top part of the slab exposed to the sun will expand relative to he cooler bottom causing a downward curling of the edges. Alternatively, during a cold night when the top cools and contracts with respect to a warmer subgrade, the curling due to this temperature differential will add to the upward curling caused by moisture differentials.

Curling Prevention

Use a low-slump concrete (2 to 3 inches) to reduce the potential difference between top and bottom.

- Sprinkle the subgrade with water to balance the effect of moisture loss from the surface.
- Eliminate the vapor retarder if it is not needed. If it must be used, cover it with 2 to 3 inches of compacted aggregate (crusher run stone) before placing the concrete; otherwise the vapor retarder contributes to the problem.
- Reduce the spacing between contraction joints. Smaller panels curl less.
- Cure immediately after finishing. Start with a membrane spray because it is possible to apply it early without disturbing the surface. Follow with wet burlap, waterproof paper, or polyethylene sheets. Leave the curing cover in place as long as possible (weeks, not days, if it can be done). That may favor the use of waterproof paper. Extended curing means higher strength concrete before drying starts, which means less curling from drying when it does occur.

- Cure the exposed surface of the slab when the forms are removed.

*** Efflorescence**

Efflorescence is a white crystalline or powdery, often fluffy/fuzzy deposit on the surface of masonry materials like concrete, brick, clay tile, etc. It's caused by water seeping through the wall/floor/object. The water dissolves salts inside the object while moving through it, then evaporates leaving the salt on the surface.

It can be relatively easy to remove compared to some other stains. Often these salts are water soluble and, if outside, may disappear of their own accord with normal weathering. This is particularly true of "new-building bloom." The water soluble salts can be removed by dry brushing or with water and a stiff brush. Heavy accumulation or stubborn deposits of white efflorescence salts can usually be removed with a solution of muriatic acid and scrubbing (1 part acid to 12 parts water -- this is a ***real*** acid, follow precautions on the label). Wet the surface well before and after the solution is applied. Less common salts, that change their chemical structure during efflorescence formation, require proprietary compounds to remove.

*** Crazing on Concrete Surfaces**

Crazing is the development of a network of fine random cracks or fissures on the surface of concrete or mortar caused by shrinkage of the surface layer. The cracks are rarely more than 1/8" deep and usually appear within a few days of the concrete's placement. They do not affect the concrete's structural integrity and rarely lessen its durability or wear resistance, but can be unsightly.

Why Crazing Occurs

- Insufficient curing
- Too wet a concrete mixture
- Poor finishing

What to Do About It

Taking the following precautions can minimize the risk of crazing:

● **Curing.** Improper curing allows the concrete surface to dry too quickly and may result in crazing. Start curing as soon after placement as possible by flooding the surface with water, or covering it with damp burlap and keeping it wet for at least three days. An alternative is to spray the surface with a liquid membrane-curing compound.

● **Concrete.** Use air-entrained concrete with a moderate slump. Air-entrainment refers to the amount of oxygen contained in the concrete mixture. Air-entrainment helps reduce the rate of bleeding of fresh concrete and reduces the likelihood of crazing. Slump refers to the amount of water contained in the concrete. A higher slump concrete may allow the concrete mixture to segregate, resulting in a weak surface layer.

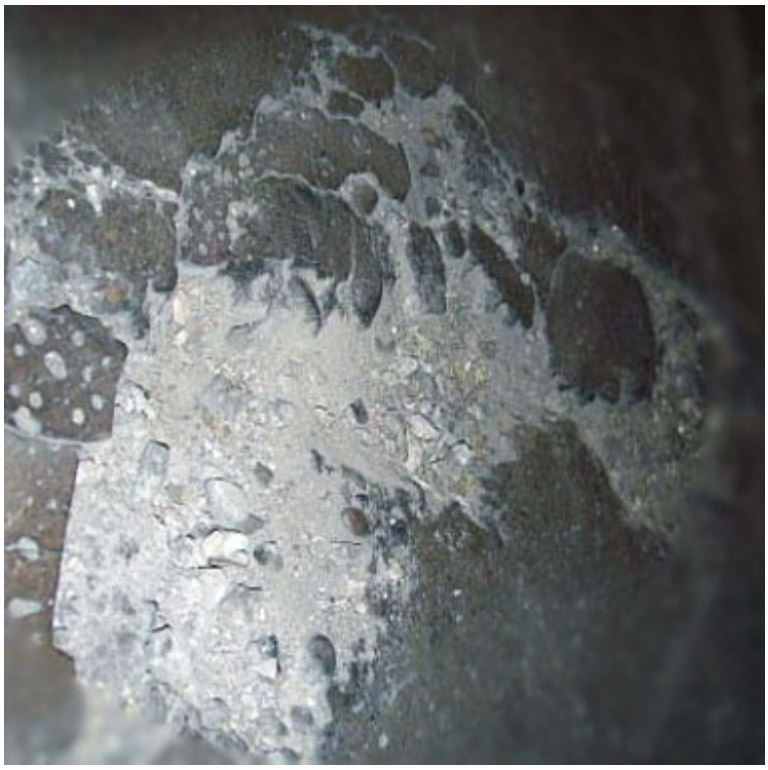
● **Finishing.** Don't begin finishing operations until the concrete is free of surface water. Troweling or bullfloating while there is still bleed water on the surface will produce a high water-cement ratio and weaken the surface layer. Don't sprinkle cement on the surface to dry up bleed water since this concentrates fines on the surface and may result in crazing.

*** Scaling**

Concrete scaling is the loss of surface mortar effectively ruining the finish surface. This is caused by hydraulic pressure from water freezing within the concrete.

*** Spalling**

Spalling is a surface defect that is deeper than scaling.



What type of concrete provides the greatest resistance to scaling and spalling?

Air entrained concrete to a **5%** to **8%** content resists the best. In fact, if air entrainment isn't provided and de-icers are used, the concrete will scale and spall.

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CONCRETE ADD MIXTURES

Add mixtures are ingredients other than water, aggregates, Portland cement and fibers that are added to a concrete batch immediately before or during mixing. Add mixtures are used to cause a desired effect which include improved quality, acceleration or retardation of setting time, enhanced frost and sulfate resistance, improved control of strength development, improved workability and improved finish ability. There are two basic types of add mixtures: chemical and mineral.

Mineral add mixtures

Fly ash, silica fume and ground granulated blast furnace slag. These products improve workability, improve resistance to thermal cracking and sulfate attack. They also reduce the amount of Portland cement needed per batch because they are also binders.

Accelerators

Accelerators are used to increase the rate of early strength development or to shorten the time it takes to set the concrete or both. It is usually used in cold weather. Calcium chloride is the most widely used accelerator. There is a concern that it promotes corrosion in reinforced concrete especially in moist environments.

The alternative to calcium chloride are non-chloride add mixtures. These products are more expensive and require a greater quantity to achieve the same results as calcium chloride.

Non-chloride Accelerators

- Triethonolamine nitrates

- Trietholamine
- Calcium formate

Air Entrainment

This is a process of intentionally generating air bubbles uniformly throughout a mixture of concrete. The major benefits are increased durability throughout the freeze/thaw process and resistance to scaling. The use of air entraining agents improve workability, reduces bleeding and segregation of fresh concrete. Because air entrainment improves workability, not as much water is needed. In cases of severe cold weather exposure, the air content in a concrete mix should be 5% to 7%. Air entrainment is also used to prevent scaling and spalling.

Water Reducers

Water reducers provide the ability to achieve a desired slump with up to 10% less water; this also produces a higher end strength. The result is the ability to achieve a comparable end strength to concrete that have higher ratios of cement in the mix.

Retarders

Retarders slow the setting time of concrete which counteract the accelerating effect that hot weather has on concrete. Retarders keep concrete workable during placement. Most retarders also function as water reducers.

Superplasticizers

The main purpose of using superplasticizers is the ability to produce high slump concrete without losing strength. This class of water reducers can achieve 7" to 9" slump concrete with 30% less water. Typically, by using superplasticizers, what would be a 2" slump is temporarily changed to a 7" to 9" slump.

Welded Wire Fabric

Welded wire fabric is used in slabs to insure that if a crack does develop, it will remain held tightly together. It should be placed in the upper 1/3 of the slab's thickness.

CONCRETE FORMWORK

Types of concrete forms:

Job-built - forms for one-time use. Form components are assembled piece-by-piece at the jobsite.

Prefabricated Job-Built Forms - these forms can be reused, usually referred to as gang or ganged forms.

Manufactured Forms -
These systems and panels are durable enough for many reuses. They are made of aluminum steel.

Insulating Concrete Forms - These are light and easy to assemble. They are held in place while pouring by reinforcement bar and bracing.

General guidelines for removal of forms in the absence of engineering specifications:

Walls - 12 hrs.
Columns - 12 hrs.

CONCRETE VIBRATION (Consolidation)

Right after placement, concrete contains up to 20% entrapped air. The amount varies according to the type of mix and its slump, the placement method, form size, and the amount of reinforcing steel used. Concrete vibration can improve the compressive strength of the concrete by about 3% to 5% for each percent of air removed. Vibration consolidates concrete in two stages: first by moving the concrete particles, then by removing entrapped air.

Vibration settles the concrete by subjecting the individual particles to a rapid succession of impulses, causing differential motion (each particle moving independently of the other). The particles consolidate as trapped air are forced to the surface, around rebar and flush against the form face. This eliminates voids (honeycombing) and brings paste to the surface to assist in finishing. Since concrete flows better with vibration, the mix can contain less water, thereby providing greater strength for the finished product.

Until both vibration stages are complete, the concrete isn't fully consolidated. If the vibrator is removed too soon, some of the smaller bubbles don't have enough time to move to the surface.

Progress Check

- What is the main advantage of using superplasticizing?
- What factors influence the amount of air trapped in newly poured concrete?
- List at least 4 measures that can prevent curling.

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JOINTS IN CONCRETE SLABS

Although concrete expands and contracts with changes in moisture and temperature the general overall tendency is to shrink and, therefore, crack. Irregular cracks are unsightly and difficult to maintain. Joints are simply pre-planned cracks.

Why Are Joints Constructed?

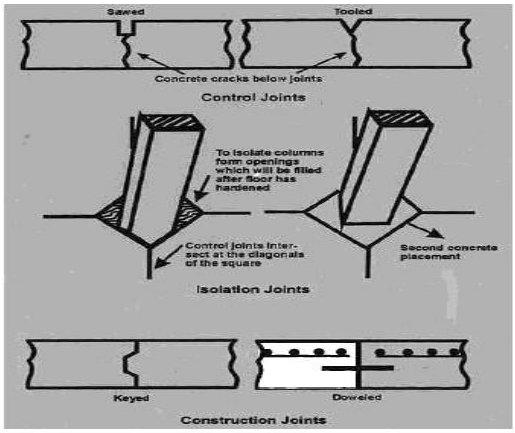
Concrete cracks cannot be prevented entirely, but they can be controlled and minimized by properly designed joints, because:

Some forms of joints are:

a. Control (contraction) joint – These joints are constructed to create planes of weakness so that cracks will occur at the desired location.

b. Isolation (expansion) joints – They separate or isolate slabs from other parts of the structure such as walls, footings, or columns, and driveways and patios from sidewalks, garage slabs, stairs, light poles and other obstructions. They permit movement of the slab and help minimize cracking caused when such movements are restrained.

c. Construction joints – These are joints that are placed at the end of a day's work. In slabs they may be designed to permit movement and/or to transfer load. Often in reinforced concrete a conscious effort is made to clean the joint and bond the next day's work.



How to Construct Joints

Joints must be carefully designed and properly constructed if uncontrolled cracking of concrete flatwork is to be avoided. The following recommended practices should be observed:

a. The maximum joint spacing in feet should not exceed 2.5 times the thickness in inches. For example in an 8 in. slab the joints should be no further apart than 20 feet.

b. All panels should be square or nearly so. The length should not exceed 1.5 times the width. L-shaped panels should be avoided.

c. The joint groove should have a depth of ¼ the thickness of the slab, but not less than one inch. Tooled joints must be run early in the finishing process and rerun later to assure groove bond has not occurred.

d. Control joints can be tooled during finishing or sawed with a carborundum blade at an early age. Sawed joints may not be practical if the concrete is made with hard aggregate such as quartz gravel or trap rock. Sawing is easier if coarse aggregates contain materials such as limestone or sandstone. If the joint edges ravel during sawing it must be delayed, but if sawing is delayed too long it may become difficult. With abrasive saw blades, sawing is often done at an age of one day or even earlier.

e. Premolded joint filler, building paper or polyethylene should be used to isolate slabs from building walls or footings. At least two inches of sand over the top of a footing will also prevent bond to the footing.

f. To isolate columns from slabs, form circular or square openings which will not be filled until after the floor has hardened. Slab control joints should intersect at the openings for columns. If square openings are used around columns the square should be turned at 45 degrees to have the control joints intersect at the diagonals of the square.

g. If the slab contains wire mesh, cut out alternate wires across control joints. Note that wire mesh will not prevent cracking. Mesh tends to keep the cracks and joints tightly closed.

h. Construction joints key the two edges of the slab together either to provide transfer of loads or to help prevent curling or warping of the two adjacent edges. Galvanized metal keys are preferred for

interior slabs, however, a beveled 1 by 2 inch strip, nailed to bulkheads or form boards, can be used in slabs that are at least 5 inches thick to form a key which will resist vertical loads and movements. Metal dowels can also be used in slabs that will carry heavy loads. Dowels must be carefully lined up and parallel or they may induce restraint and cause random cracking at the end of the dowel.

i. Joints in industrial floors subject to heavy traffic require special attention to avoid spalling of joint edges. Such joints should be filled with a material capable of supporting joint edges. Manufacturer's recommendations and performance records should be checked before use.

Follow These Rules for Proper Jointing

1. Plan exact location of all joints before construction.

2. Provide isolation joints between slabs and columns, walls and footing, and at junctions of driveways with walks, curbs or other obstructions.

3. Provide control joints and joint filling materials as outlined in specifications.

KEEP CONCRETE FROM FREEZING

Concrete must be kept above 50°F before it hardens. After it hardens, it must be kept above 40°F for around 14 days. Methods to keep concrete from freezing are to use hot water to warm up the aggregates initially. If the concrete is exposed to weathering, cover it with straw or other insulating material and a tarpaulin. Pay special attention to the edges' corner and surface areas. If the concrete is inside a building, space heaters are recommended, but be sure to provide adequate ventilation. The exhaust from the space heaters can cause the surface to weaken.

If the concrete does freeze, it will be green or soft. It should be broken out and replaced while it is still weak. The way to keep concrete from freezing is to maintain the temperature above freezing. Footings shall be protected. Concrete should **never** be poured over a frozen substrate.

Calcium chloride can be used to make the concrete cure at a faster rate. The faster it cures, the less chance it has of being harmed by a freeze early in the curing process.

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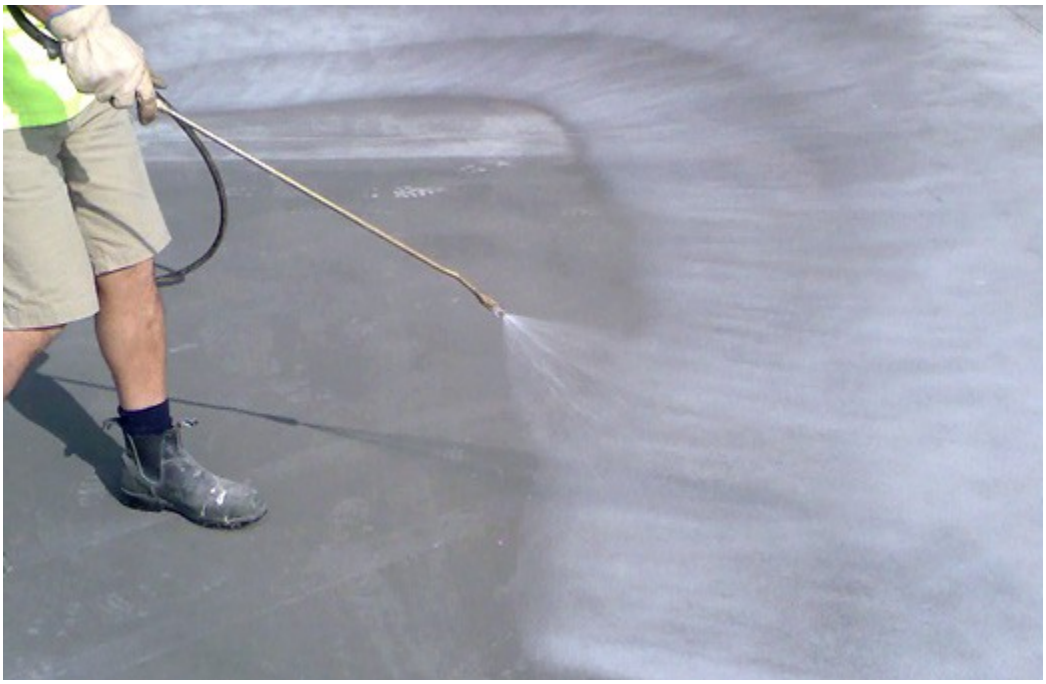
CURING CONCRETE

Curing begins after the exposed surfaces of the concrete have hardened sufficiently to resist marring. Curing ensures the continued hydration of the cement and the strength gain of the concrete. Concrete surfaces are cured by sprinkling with water fog, or by using moisture-retaining fabrics such as burlap or cotton mats. Other curing methods prevent evaporation of the water by sealing the surface with plastic or special sprays (curing compounds).

Special techniques are used for curing concrete during extremely cold or hot weather to protect the concrete. The longer the concrete is kept moist, the stronger and more durable it will become. The rate of hardening depends upon the composition and fineness of the cement, the mix proportions, and the moisture and temperature conditions. Most of the hydration and strength gain take place within the first month of concrete's life cycle, but hydration continues at a slower rate for many years. Concrete continues to get stronger as it gets older.



PRECAST CONCRETE WALL PANELS

Precast concrete foundation walls are panels that are cast and cured in a controlled factory environment, which helps ensure panel quality and uniformity.

Panels can be installed in a fraction of the time that poured concrete foundations and traditional exterior walls would take. When panels are delivered to the site, they are often erected in three or four hours. Because the concrete is cured in the factory, foundations can be backfilled as soon as the slab and first floor are braced. The factory fabrication process reduces or eliminates weather delays.

Panels are cast as solid reinforced precast concrete (flat panels), or as reinforced concrete ribbed panels with a thin exterior shell. Some manufacturers cast the concrete against foam insulation as a form, which provides additional insulation (higher R-value) for the structure. Concrete panels can be designed with a strength of 5,000 psi. This results in panels that are stronger than concrete block or most poured concrete walls, but are thinner and lighter weight. Walls may be customized during the order process to allow for door and window openings, steel beam pockets, and brick ledges.

Although precast concrete panels can be installed rapidly, installers who are not familiar with prefabricated panel assembly will need additional training. In fact, some manufacturers only allow certified installers to deliver and erect their systems.

Although precast concrete panels offer speedy installation, many manufacturers require panel assembly by their own certified installers. Panels require a crane for placement. The stone sub-base must be compacted and leveled to provide an even surface for panel erection, and later floor joist installation.

Configurations may be customized during the order process to allow for door and window openings, steel beam pockets, and brick ledges to be cast in to the panels. This requires additional initial effort during the planning stage.

Use of precast panels should be submitted for building code approval with the building permit application.

Progress Check

- What is the difference between contraction (control), expansion (isolation), and construction joints?
- Describe the best ways to keep concrete from freezing.
- What are the benefits of precast wall panels

References

1. ACI 302.1, "Guide for Concrete Floor and Slab Construction," ACI Manual of Concrete Practice.

2. "Slabs on Grade," ACI Concrete Craftsman Series, American Concrete Institute, Detroit, Mi.

3. "Cracks in Concrete: Causes, Prevention, Repair," a collection of articles from Concrete Construction Magazine, June, 1973.

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CONCRETE REVIEW QUESTIONS

Answer can be found on page 225 of the Carpentry and Building Construction Book.

1. Concrete materials can be proportioned by ratios in units of:
a. shovels
b. pails
c. wheelbarrows
d. all of the above

Answer can be found on page 220 of the Carpentry and Building Construction Book.

2. What type of cement is used to plug holes and cracks in foundations?
a. Self-sealing cement
b. Quickcrete
c. Hydrolic cement
d. Anchor cement

Answer can be found on page 227 of the Carpentry and Building Construction Book.

3. What are the dimensions of a slump cone?
a. 4” x 8” x 12”
b. 6” x 10” x 12”
c. 6” x 12” x 12”
d. 6” x 14” x 12”

Answer - See information at the front of this section.

4. A control joint allows for what?
a. Leveling the foundation
b. A place for a girder to rest
c. Movement, expansion or contraction
d. None of the above

Answer - See information at the front of this section.

5. Concrete slabs on grade have a tendency to curl upward because _____.
a. The ground may settle
b. The top cures faster
c. The middle is heavier
d. The sides are lighter

Answer can be found on page 304 of the Carpentry and Building Construction Book.

6. _____ concrete is the process of leveling the freshly poured concrete before it is floated.
a. Screeding
b. Brushing
c. Raking
d. Stomping

Answer can be found on page 305 the Carpentry and Building Construction Book.

7. Floating of the freshly screeded concrete is accomplished with a wood or magnesium bullfloat which smoothes out, levels, compacts and brings the small particles to the surface for finishing.
a. True
b. False

NOTE: after floating, the concrete will bleed, which brings water to the surface. Wait until all bleedwater has dissipated to begin finishing of the surface.

Answer - See information at the front of this section.

8. Air entrainment is an intentional generation of small air bubbles in freshly mixed concrete. It is often used to improve the concrete's resistance to _____ after it is set.
a. Frost damage
b. Wear and tear
c. Water damage
d. Mineral damage

Answer –See information at the front of this section.

9. On hot sunny days in the summertime, a contractor may decide to use _____ to slow down the setting time of concrete.
a. water
b. retarders

c. chloride
d. a tarp

Answer can be found on page 227 of the Carpentry and Building Construction Book.

10. A _____ is a 12" high cone which determines the amount of water in the mix.
a. Masonry cone
b. Concrete cone
c. Slump cone
d. Waffle cone

NOTE: The distance in inches the concrete drops after removing the slump cone is the measurement of slump. It is possible to decrease the slump in a concrete mix without adding more water by adding plasticizers. This will make the concrete more workable without losing strength.

Answer can be found on page 221 of the Carpentry and Building Construction Book.

11. The most commonly used additive to help concrete set rapidly is _____.
a. Calcium chloride
b. Fly ash
c. Hydrochloric acid
d. Paint catalyst

Answer can be found in Code R506.2.3 of the Michigan Residential Code Book.

12. What is the required thickness of the moisture barrier that must be used under the basement floor (slab)?
a. 2 mils
b. 4 mils

c. 6 mils
d. 8 mils

NOTE: 6 mils of polyethylene (plastic) provides for one perm of vapor barrier. Perm is a measurement of the effectiveness of a vapor barrier. The lower the number, the greater its effectiveness.

Answer - See information at the front of this section.

13. Air entrainment is used for what?
a. Making concrete more compressible
b. Making concrete more durable in freeze/thaw conditions
c. Making more concrete with less ingredients
d. All of the above

Answer can be found on page 218 of the Carpentry and Building Construction Book.

14. Concrete is made by mixing _____.
a. Lime, Portland cement and water
b. Cement, sand, water and gravel
c. Lime, mortar and water
d. None of the above

Answer can be found on page 225 of the Carpentry and Building Construction Book.

15. What is meant by 1:2:4 concrete mix?
a. 1 cement, 2 sand, 4 water
b. 1 sand, 2 cement, 4 water
c. 1 cement, 2 sand, 4 gravel
d. 1 cement, 2 gravel, 4 sand

Answer - See information at the front of this section.

16. In cases of severe cold weather exposure, the air content in a concrete mix should be about _____.
a. 3% to 5%
b. 5% to 7%
c. 8% to 10%
d. 10% to 12%

Answer can be found on page 230 TABLE 8-6 of the Carpentry and Building Construction Book.

17. Where concrete is cast against and permanently exposed to the earth, reinforcement still should be _____ from the earth.
a. 1”
b. 2”
c. 3”
d. 4”

Answer can be found on Page 306 in the Carpentry and Building Construction book.

18. Contraction joints, also known as control joints, in a slab are used to _____,
a. Control random cracking
b. Create dimensional character
c. Water drainage
d. Segregate the slab

Answer - See information at the front of this section.

19. Isolation joints isolate <u>differing parts</u> of a structure to permit independent _____.
a. Structures
b. Design
c. Movement
d. Placement

Answers to Concrete Review

1. d
2. c
3. a
4. c
5. b
6. a
7. a
8. a
9. b
10. c
11. a
12. c
13. b
14. b
15. c
16. b
17. c
18. a
19. c

Overview of Building Trades

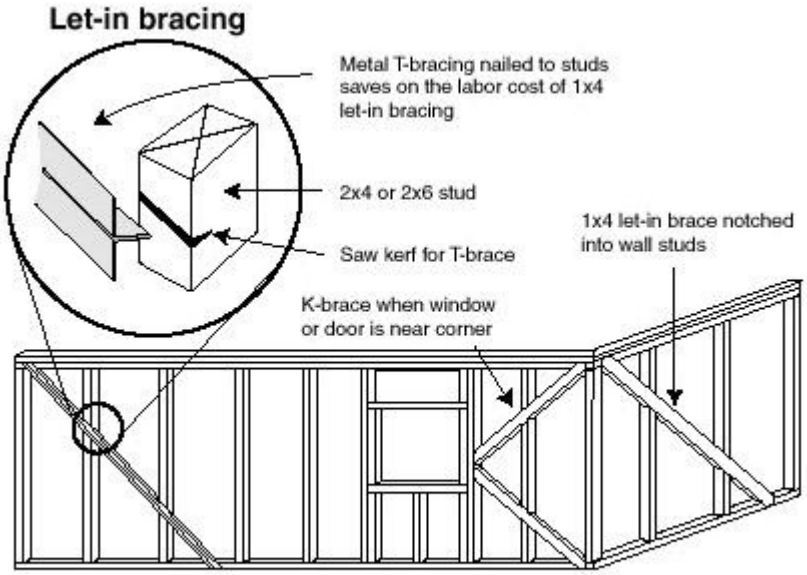
CARPENTRY

Manufactured Building Materials and the Building Codes

Generally, building materials that are manufactured by companies to provide a specific purpose such as: framing hardware, laminated beams, engineered floor joists, special fasteners, etc., may or may not even be referenced in the book of minimum standards. The Code Book provides standards for the most common ways that homes are constructed. Michigan's Code Book is the Michigan Residential Code 2006.

The way to insure compliance with the code is to use these engineered products the way in which the instructions specify. Always keep the instructions so that you will be able to provide them to the building inspector if necessary.

BRACED WALLS



Walls need to be braced when the sheathing isn't structural. An example of a non-structural sheathing product is styrofoam board which will add little to the structural integrity of a wall. This type of bracing is referred to as corner, wind and diagonal. The minimum standards are found in MRB 602.10.3.

CARPENTRY REVIEW QUESTIONS

Answer can be found in R311.7.5 and on page 729 of the Carpentry & Building Construction Book.

1. The floor at the top or bottom of each story where the flight of stairs ends or begins is a _____.

a. platform
b. well
c. landing
d. stoop

NOTE: The width of each landing shall not be less than the stairway or door served. Every landing shall have a minimum dimension of 36 inches measured in the direction of travel.

Answer can be found in R311.7.4.1

2. What is the maximum height difference on a stairway between the highest riser and lowest riser?

a. 3/8”
b. 1/2”
c. 3/4”
d. 1”

Answer can be found in R311.7.7.

3. Handrails should be provided on at least one side of stairways with four or more risers.

a. True
b. False

Answer can be found in R311.7.5

4. The maximum vertical rise between floor levels or landings in a flight of stairs is:

a. 8'
b. 9'
c. 11'
d. 12'

Answer can be found on page 784 of the Carpentry and Building Construction Book.

5. The standard depth for an upper kitchen cabinet is:

a. 12 inches

b. 15 inches
c. 18 inches
d. 24 inches

Answer can be found in R312.2

6. A balcony railing should be how high?

a. at least 36”
b. not more than 36”
c. a maximum of 4’
d. a minimum of 4’

Answer can be found on R312.3

7. Guard openings below the stair-railing should be no larger than:

a. 6”
b. 4 3/8”
c. 12”
d. large enough to egress from

Exception: The triangular openings formed by the riser tread and bottom rail of a guard at the open side of a stairway are permitted to be of such a size that a sphere 6” cannot pass through.

Answer can be found on R311.7.4.2

8. The MRC code requires a minimum tread depth of:

a. 8”
b. 8 1/2”
c. 9”
d. 11”

Answer can be found on R311.7.4.1

9. The MRC code requires a maximum riser height of:

a. 7 3/4”
b. 7”
c. 8"
d. 8 1/4”

Answer can be found on page 733 of the Carpentry and Building Construction Book.

10. The total rise of a stair run is:

a. the horizontal difference between floors
b. the vertical difference between the finished floors
c. the perpendicular difference between the floor below and the ceiling above
d. all of the above

Answer can be found on page 598 of the Carpentry and Building Construction Book.

11. What is the frame that surrounds an interior door called?

a. Casing
b. Trim
c. Door stop
d. jamb

Answer can be found in R311.7.4.3

12. Stairs with solid risers shall have a nosing between 3/4" and 1 1/4" unless the tread depth is _____or more.

a. 9"
b. 10"
c. 11"
d. 12"

Answer can be found on page 606 of the Carpentry and Building Construction Book.

13. When preparing the rough opening for a door, the opening should be about _____ wider and _____ higher than the door.

a. 1 1/2", 2"
b. 2", 1 1/2"
c. 2", 2"
d. 2", 3"

Answer can be found in R311.8.3.1

14. How high is the handrail when measured above the nose of the tread?

a. 34 - 36 inches
b. 32 - 36 inches
c. 32 - 38 inches
d. 34 - 38 inches

Answer can be found in R312.1.

15. Guards are required whenever a deck is more than _____inches above the ground.

a. 18”
b. 24”
c. 30”
d. 36”

Answer can be found on page 1014 of the Carpentry and Building Construction Book.

16. Metal deck flashing is needed to remove water that may get behind the siding to the outside of the ledger board.

a. True
b. False

Answer can be found in R301.5.

17. What is the live load for an exterior deck?

a. 60# /sq. ft.
b. 50# /sq. ft.
c. 40# /sq. ft.
d. 30# /sq. ft.

Answer can be found on page 432 of the Carpentry and Building Construction Book.

18. What is the name of the full-length stud that a trimmer stud is fastened to?

a. cripple stud
b. king stud
c. trimmer stud
d. joist

Answer can be found on page 3421 of the Carpentry and Building Construction Book.

19. Recommended installation of sheet subflooring over joists is:

a. vertical to joists
b. parallel to joists
c. perpendicular to joists
d. diagonal to joists

Answer can be found in R502.6.1.

20. Joists resting on beams or girders must overlap a minimum of how many inches, if they don't run continuous?

a. 5
b. 4
c. 3
d. 2

Answer can be found on page 449 of the Carpentry and Building Construction Book.

21. The bottom horizontal member of a wall frame in platform construction is called a:

a. bottomplate
b. header
c. stud
d. cripple

Answer can be found in R502.8.1.

22. Joists must not be notched:

a. within 12 inches of either end
b. within the middle 1/3 of the span
c. within the middle 1/2 of the span
d. they should not be notched

Answer can be found on page 714 of the Carpentry and Building Construction Book.

23. A saddle is used:

a. over the header of exterior doors
b. over a window opening
c. between the roof and chimney
d. over a fireplace

NOTE: A cricket is another name for a saddle.

Answer can be found in Table R602.3(1)

24. When nailing two studs together, how far apart are the nails?

a. 8”
b. 12”
c. 16”

d. 24”

Answer can be found on page 447 of the Carpentry and Building Construction Book.

25. What is used over door/window openings to transfer superimposed loads to vertical members?

a. ceiling joists
b. headers
c. rafters
d. wall top plates

Answer can be found in Table R602.10.2

26. When framing walls, let-in bracing may be:

a. 1 x 4 wood let in
b. metal wind bracing
c. none of the above
d. a and b

Answer can be found on page 406 of the Carpentry and Building Construction Book.

27. Rafters and floor joists should be installed with the:

a. bow down
b. bow up
c. crown up
d. b and c

Answer can be found on page 410 of the Carpentry and Building Construction Book.

28. The maximum size hole that may be bored into a 12” floor joist is:

a. 2”
b. 3”

c. 3 3/4"
d. 4 1/2"

NOTE: the 1/3 maximum hole dimension is taken from actual joist height. A 12" nominal dimension has an actual at 11-1/4.

Answer can be found in Table R602.3(1).

29. For nailing ceiling joists to the top plate you should use at least:

a. two 8d nails
b. two 16d nails
c. three 8d nails
d. three 16d nails

Answer can be found on page 492 of the Carpentry and Building Construction Book.

30. Why are trusses more commonly used over conventional rafter framing?

a. because trusses take less time to install
b. no need for interior bearing partitions
c. because trusses are cheaper
d. all of the above

Answer can be found on page 492 of the Carpentry and Building Construction Book.

31. The lowest horizontal member of a truss is called a:

a. bottom chord
b. brace
c. ceiling joist
d. stay

Answer can be found on page 543 of the Carpentry and Building Construction Book.

32. What is the name of the structural member that is nailed between two rafters, when roofs have long spans?

a. horse ties
b. collar ties
c. rafter jigs
d. bow ties

Answer can be found in R502.6.

33. What is the minimum amount of bearing area if a joist is placed over a wood girder or sillplate?

a. 1"
b. 1 1/4"
c. 1 1/2"
d. 1 3/4"

Answer can be found on page 498 of the Carpentry and Building Construction Book.

34. The name for the metal or wood plate used to strengthen the joints of a truss is:

a. gusset
b. chord
c. metal tie
d. none of the above

Answer can be found in R807.1.

35. What is the minimum size attic access hole?

a. 22” x 22”
b. 22” x 24”
c. 22” x 30”
d. 22” x 32”

Answer can be found in R311.6
36. The minimum hall width in a single family dwelling is:

a. 30”
b. 32”
c. 36”
d. 38"

Answer can be found in R302.11
37. Firestopping for enclosed stairs are required:
a. at the top and bottom of each stair run
b. near the top and bottom of the stair run
c. in the middle of each stair run
d. not required by code

Answer can be found in R302.12
38. According to the Michigan Residential Code draft stopping is required in all ceiling and floor openings larger than:

a. 100 square feet
b. 3000 square feet
c. 500 square feet
d. 1000 square feet

Answer can be found in R602.6.
39. Holes bored in a single stud in exterior walls and bearing walls shall not exceed 40% of the stud depth and not be closer than _____ to the edge of the stud.

a. 1/2”
b. 5/8"
c. 1”
d. 1 1/4”

Answer can be found on page 411 of the Carpentry and Building Construction Book.

40. When framing for large openings in the floor, the joist and header should be:

a. notched
b. tripled
c. reinforced
d. doubled

Answer can be found in R408.4

41. Crawl space access through a perimeter wall shall be a minimum dimension of:

a. 16” x 22”
b. 18” x 20”
c. 16” x 24”
d. 20” x 26”

NOTE: No crawl space access shall be under a door.

Answer can be found on page 370 of the Carpentry and Building Construction Book.

42. An advantage that balloon framing has over platform framing is:

a. Provides a space for mechanical installations
b. Shrinkage is reduced because the amount of cross-section lumber is low
c. The floors are tied together with common studs and won’t come apart as easily in high winds
d. All of the above

Answer can be found on page 850 of the Carpentry and Building Construction Book.

43. In steel frame construction, the stud must butt tightly inside its track. If the stud is not tight, the load will be on the:

a. Weld
b. Screws
c. Rivets
d. Nails

Answer can be found in R602.6.1.

44. When notching or drilling a hole in the top plate of a load bearing or exterior wall, if the hole or notch exceeds 50% of the top plates width, you must provide a galvanized metal tie that is a minimum of 16 gauge, 1-1/2 inches wide across each side of the opening with:

a. four 8dnails
b. six 16d nails
c. eight 10d nails
d. ten 16d nails

Answer can be found on page 383 the Carpentry and Building Construction Book.

45. What is meant by the term dead load?

a. Weight that is immobile
b. The total weight of the building
c. Weight from non-living objects
d. All of the above

Answer can be found on page 844 the Carpentry and Building Construction Book.

46. Steel framing typically uses the _____ method of frame construction when all vertical and horizontal load bearing members are aligned?

a. Straight line

b. In-line
c. Aligned
d. None of the above

Answer can be found on page 403 the Carpentry and Building Construction Book.

47. Span tables for horizontal spanning structural framing members provide the maximum span and spacing of these members given their:

a. Dimensions
b. Species
c. Grade
d. All of the above

Answer can be found in R802.9.

48. Headers in roof and ceiling framing shall be doubled when spanning more than:

a. 3’
b. 4’
c. 5’
d. 6’

Answer can be found in R802.9.

49. Headers in roof and ceiling framing shall be supported by hangers when spanning more than:

a. 4’
b. 5’
c. 6’
d. 8’

Answer can be found on page 383 the Carpentry and Building Construction Book.

50. What is meant by the term live load?

a. Weight that is not permanently attached
b. Weight from people
c. Weight from furniture
d. All of the above

↑**TOP OF PAGE**

Answers to Carpentry Review

1. c
2. a
3. a
4. d
5. a
6. a
7. b
8. c
9. d
10. b
11. d
12. c
13. c
14. d
15. c
16. a
17. c
18. b
19. c
20. c
21. a
22. b
23. c
24. d
25. b
26. d
31. a
32. b
33. c
34. a
35. c
36. c
37. a
38. d
39. b
40. d
41. c
42. d
43. b
44. c
45. b
46. b
47. d
48. b
49. c
50. d

27. c
28. c
29. c
30. d

Overview of Building Trades

MASONRY

Hydraulic Cement

Hydraulic cement is a blend of cement and ad mixtures used for plugging and stopping leaks in concrete structures and masonry walls.
Hydraulic cement is a fast setting product. It is non-corrosive, non-rusting and non-shrinking.

Paving Brick

Paving brick are solid masonry units. Their intended use is for foot traffic and light vehicular traffic.

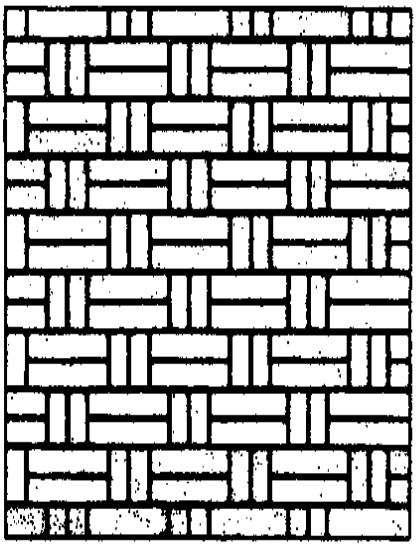
Paving brick are classified according to the expected traffic and abrasion levels.

Type 1 - extensive vehicular traffic and abrasion
Type 2 – high level of foot traffic
Type 3 – foot traffic

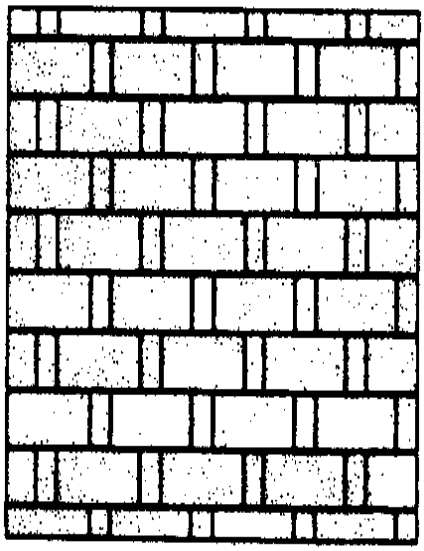
Natural Stone Grades

The varieties of natural stone are graded typically into 4 groups, statuary, select, standard and rustic.

EIGHT TYPES OF BASKETWEAVE PATTERNS



37. Basket weave, 4 × 8, 4 × 16 in.



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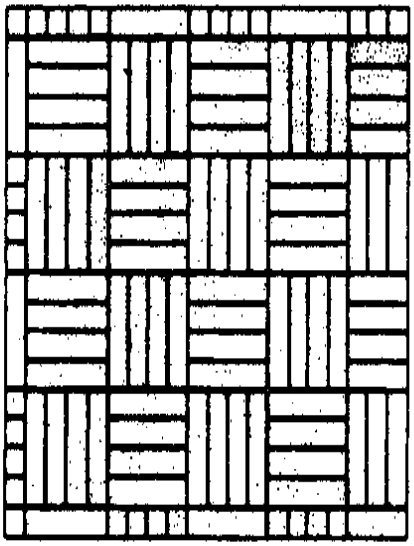
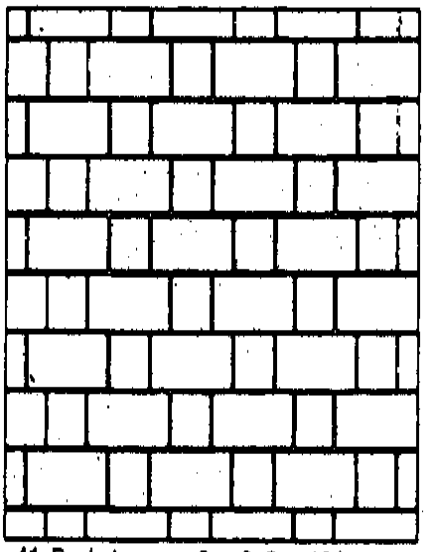
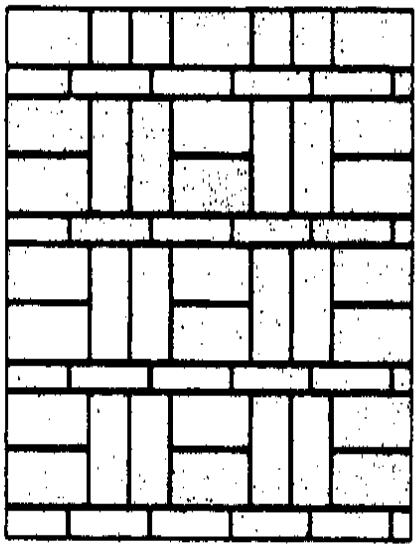


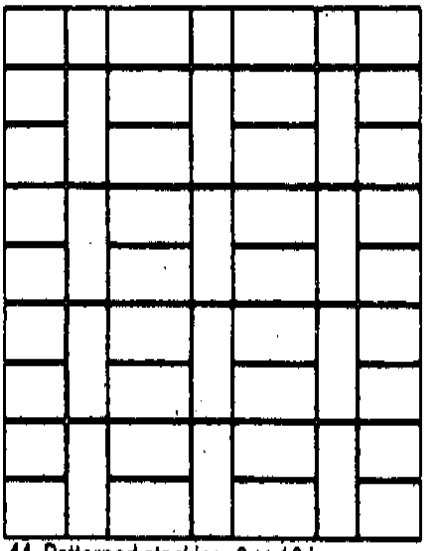
40. Basket weave, 4 × 16 in.



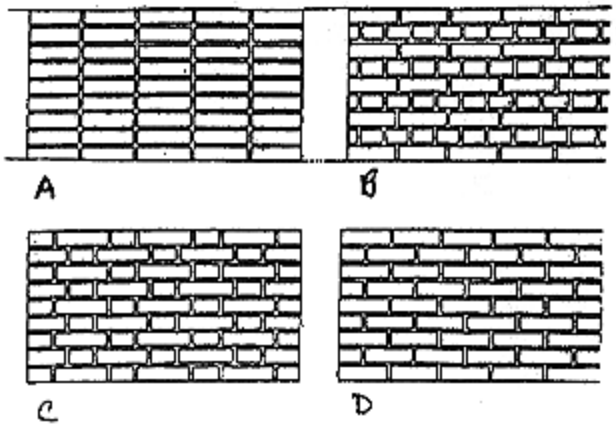
41. Basket weave, 8 × 8, 8 × 16 in.



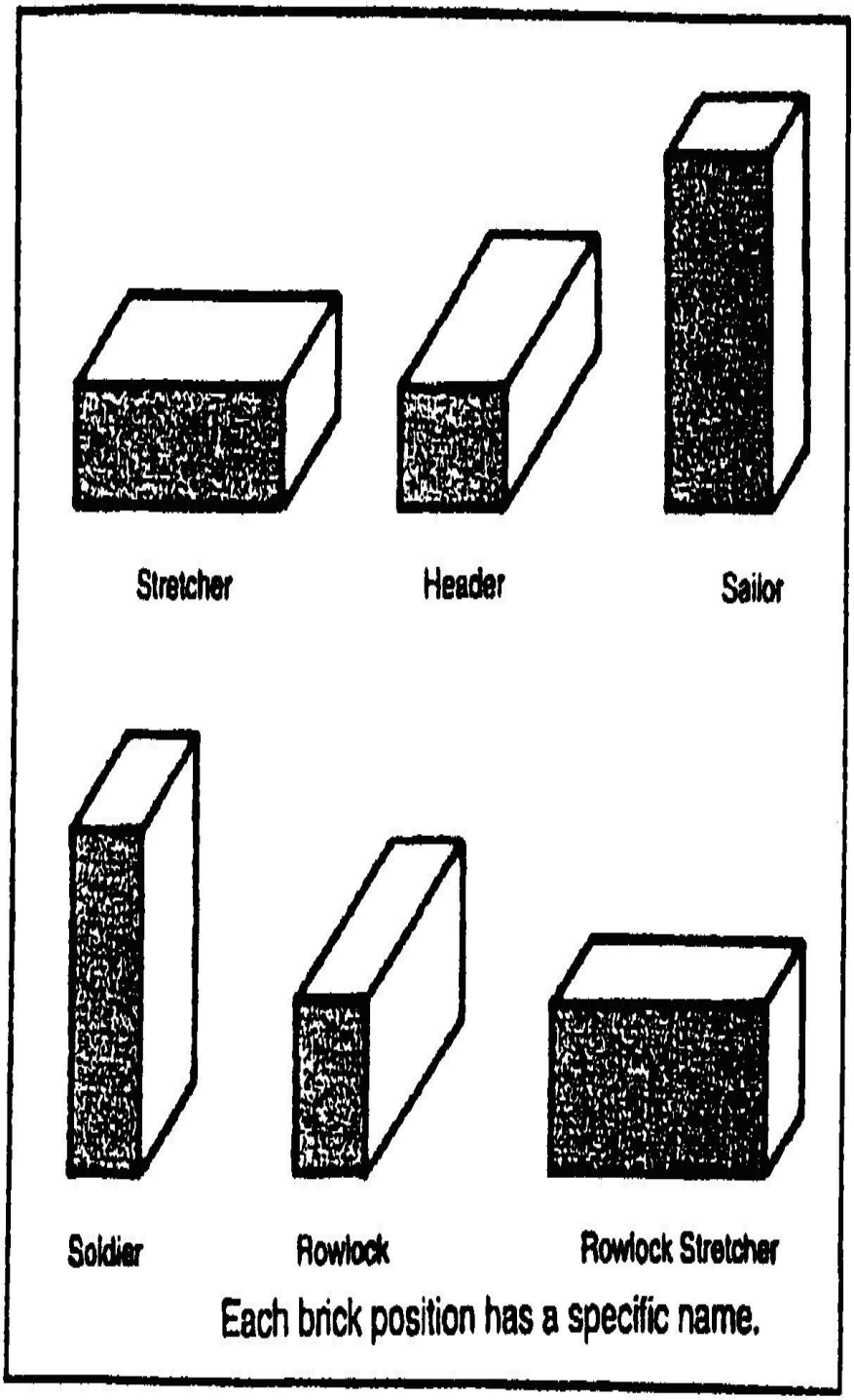
43. Basket weave, 4 × 16, 8 × 16 in.



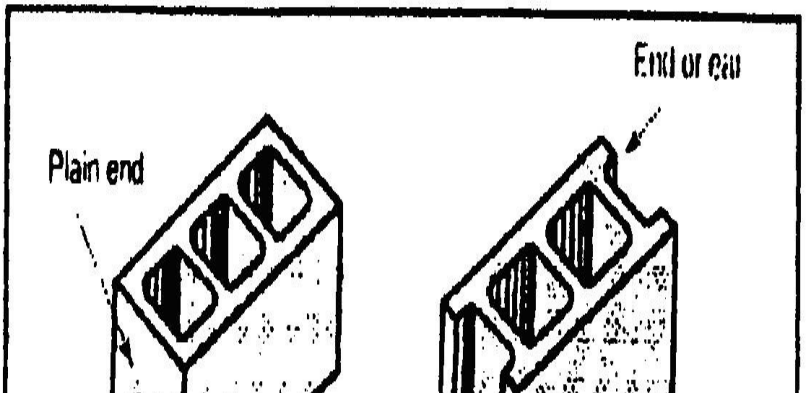
44. Patterned stacking, 8 × 16 in.



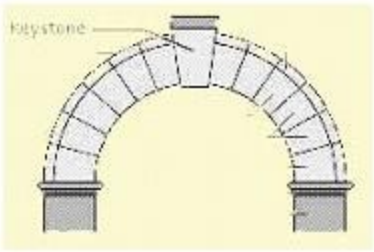
A. Stacked B. English C. Flemish D. Running



Each brick position has a specific name.



SCREEN BLOCK



KEYSTONE

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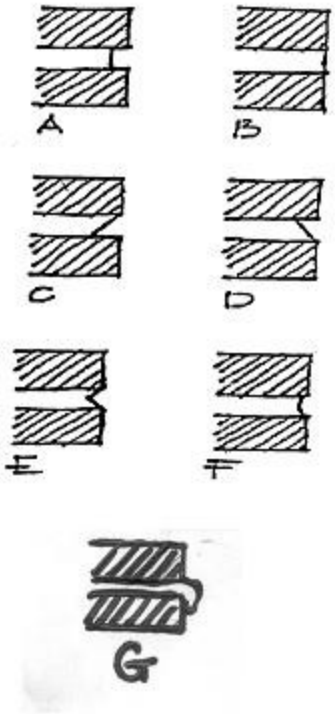

A. Raked
B. Flush
C. Stuck
D. Weathered
E. "V"
F. Concave
G. Extruded

MASONRY REVIEW QUESTIONS

Answer can be found in R703.7.4.2.

1. The minimum air space between brick siding and the plywood sheathing should be:

a. 1/2”
b. 3/4”
c. 1”
d. an air space is not required

Answer can be found in R703.7.6.

2. To insure that water moisture is not trapped behind brick veneer, small holes are made in the joints of the lowest course of bricks. These holes are called:
a. drying holes
b. air holes
c. crying holes
d. weep holes

Answer can be found in R703.7.4.1.

3. Brick ties should be placed every 2 feet horizontally and vertically so that no more than _____ square feet are supported by one tie.
a. 2 1/5
b. 2-2/3
c. 3-3/4
d. 4

Answer can be found on Page 275 in the Carpentry and Building Construction book.

4. In an 8” cement block, this measurement refers to:
a. length
b. diagonal size
c. width
d. height

Answer can be found on Page 275 in the Carpentry and Building Construction book.

5. A standard concrete block is:
a. 3/8” longer than its nominal dimension
b. 3/8” shorter than its nominal dimension
c. 1” longer than its nominal dimension
d. is almost exactly its nominal dimension

Answer can be found on Page 275 in the Carpentry and Building Construction book.

6. A masonry column that is used to support other structural members is called:

a. pile
b. pilaster
c. sill
d. stud

Answer can be found in R1003.18.

7. The space between the masonry of a chimney and the roof sheathing should be:

a. 3/4”
b. 1”
c. 1 3/4”
d. 2”

NOTE #1: Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch. The airspace shall not be filled, except to provide fire-blocking.
NOTE #2: Sheathing materials shall be permitted to abut a masonry chimney with a 1” clearance provided such combustible sheathing is a minimum of 12 inches from the inside surface of the nearest flue lining.

Answer - See information at the front of this section.

8. This row of bricks is called?

a. face course
b. vertical course
c. on end course
d. soldier course

Answer can be found on Page 279 in the Carpentry and Building Construction book.

9. When constructing a masonry building using block, the _____ are laid first.

a. lintels
b. starter brick
c. center block
d. corner leads

Answer can be found in R1003.9

10. What is the minimum height of a chimney located at the ridge of a roof?
a. 2 feet higher than the ridge
b. 16 inches higher than the ridge
c. 3 feet higher than the ridge
d. 18 inches higher than the ridge

NOTE: Carpentry and Building Construction text book says 2', but Michigan's code is different.

Answer can be found in R403.1.6.

11. The anchor bolt needs to be embedded into _____ of concrete or grouted masonry.
a. 4 "
b. 5"
c. 6"
d. 7"

Answer can be found in R703.7.3.

12. Where would a mason use angle iron?
a. arch
b. sill
c. lintel
d. attic

Answer can be found in R1001.10.

13. What is the minimum hearth extension in front of a fireplace with less than 6 sq. ft. opening?
a. 12"
b. 16"
c. 18"
d. 24"

Answer can be found in R1003.9 and the Appendix.

14. When the chimney is located on the slope of the roof the chimney must be how much higher?

a. 2’ higher than a point that is 10 ‘ on a horizontal measurement
b. 3’ higher than a point that is 10’ on a horizontal measurement
c. as high as a point that is 10’ on a horizontal measurement
d. can be lower than a point that is 10’ on a horizontal measurement

Answer can be found on Page 694 in the Carpentry and Building Construction book.

15. To retemper mortar that has stiffened:

a. add water and thoroughly remix
b. add chloride
c. heat to 72 degrees
d. place heated tarp over the top

Answer can be found on Page 282 in the Carpentry and Building Construction book.

16. The block which fills the final gap in a course between corners is called the:

a. corner block
b. closure block
c. arch block
d. center stone

Answer can be found in R607.2.1.

17. Bed joints are horizontal joints. The first course of bed joints can’t be less than ¼” or more than ¾”. Ideally, all joints should be:

a. 3/8”
b. 5/8”
c. 1/2”
d. 3/4”

Answer can be found in R607.2.1.1.

18. Other than the starting course, horizontal bed joints for masonry shall be:

a. 1/4" to 1/2"
b. 3/8" to 1/2"
c. 1/4" to 3/4"
d. 3/8" to 3/4"

Answer can be found in Masonry Text in the front of this section.

19. What product is a non-corrosive, non-rusting and non-shrinking material that is best used to seal cracks in masonry and concrete?
a. High quality silicone caulk
b. Plaster
c. Hydraulic cement
d. Cement paste

Answer can be found on Page 669 in the Carpentry and Building Construction book.

20. The first bricks that are laid are the:
a. starting course
b. corner leads
c. base course
d. first course

↑**TOP OF PAGE**

Answers to Masonry Review

1. c
2. d
3. b
4. c
5. b
6. b
7. d
8. d
9. d
10. c
11. d
12. c

13. b
14. a
15. a
16. b
17. a
18. b
19. c
20. b

Overview of Building Trades

ROOFING

Fire Ratings and Roofing Materials

All types of roofing products have a fire rating. Fire ratings are classified as A, B, or C.

A - Best 2-4 hrs.
B - 1 hr.
C - 20 min.

The time provided in the above rating is the burn time before ignition.

Asphalt Shingles

Asphalt shingles are very economical in terms of cost and life expectancy. Mineral reinforced asphalt shingles have a Class C rating and are gradually being replaced by fiberglass reinforced asphalt shingles which are Class A or B materials.

Metal: Sheet and Shingles

Metal roofing is sturdy, lightweight and noncombustible, but it does require gypsum underlayment for a Class A rating.

Wood Shakes and Shingles

The thin physical make-up and surface structure of wood shakes and shingles are readily combustible and conducive to fire spread.

Built-Up Roofs (BURs)

Built-Up roofs (BURs) consist of multiple plies of roof felts laminated together with bitumen. BUR material can consist of bitumen-saturated felt, coated felt, polyester felt or other fabrics. A surfacing is generally applied and can be asphalt, aggregate (gravel or slag), emulsion or a granule-surfaced cap sheet.

ROOFING REVIEW QUESTIONS

Answer can be found on Page 626 in the Carpentry and Building Construction book.

1. A square of roofing material is equal to:

a. 10 square feet
b. 100 square feet
c. 25 square feet
d. 250 square feet

Answer can be found in R905.7.5.

2. Wood shingles, when applied to a roof, must be spaced _____ apart.

a. 1/8”
b. 1/4”
c. 3/8”
d. 1/2”

Answer can be found in R905.2.8.3 and on Page 633 in the Carpentry & Bldg. Const. Book.

3. What must be done where the roof intersects with a wall?
a. shingle up to the wall
b. use metal step flashing between the shingles
c. use felt paper
d. nothing, this isn't the problem

Answer can be found on Page 550 in the Carpentry and Building Construction book.

4. The purpose of a _____ is to divert the flow of water and prevent ice and snow build-up behind the chimney.
a. saddle
b. fascia
c. drip edge
d. starter strip

Answer can be found in R905.2.6.

5. Three tab shingles require a minimum of how many nails per strip?
a. 2
b. 3
c. 4
d. 6

Answer can be found on Page 626 in the Carpentry and Building Construction book.

6. The distance (in inches) between the edges of one course and the next higher course.
a. exposure
b. head lap
c. coverage
d. shingle butt

Answer can be found on Page 516 in the Carpentry and Building Construction book.

7. The principle member of valley roof construction is called a:
a. valley rafter
b. hip rafter

c. valley beam
d. valley jack

Answer can be found on Page 646 in the Carpentry and Building Construction book.

8. The most common type of wood shingles are usually graded:
a. No. 1, 2 or 3
b. A, B, and C.
c. standard, utility and premium
d. short, medium and long

Answer can be found in R905.2.7.

9. The minimum roof pitch with one layer underlayment, which will accept asphalt shingles is:
a. 1 in 12
b. 2 in 1
c. 4 in 12
d. only on a flat roof

Answer can be found in R905.2.7.

10. Minimum pitch for asphalt shingled roofs with double underlayment is:
a. 1:12
b. 2:12
c. 3:12
d. 4:12

Answer can be found in R905.2.7.1.

11. Ice and water shield should be installed to a point that is:
a. one row high
b. 12” above the interior wall line when projected through the roof sheathing
c. 24” above the interior wall line when projected through the roof sheathing
d. two rows high

Answer can be found in R905.7.2.

12. Wood shingles shall not be installed on roof slopes below:

a. 2:12
b. 3:12
c. 4:12
d. 5:12

Answer can be found on Page 647 in the Carpentry and Building Construction book.

13. How far is the drip edge overhang for cedar shakes?
a. 1/2”
b. 3/4”
c. 1-1/2”
d. 2-1/4”

Answer can be found in R907.3.

14. What is the maximum number of layers of asphalt shingles on a roof?
a. 1
b. 2
c. 3
d. whatever is needed to keep the roof from leaking

Answer can be found on Page 645 in the Carpentry and Building Construction book.

15. The difference between wood shingles and cedar shakes is?
a. wood shingles are thinner
b. wood shingles are man made
c. shakes are made on a machine
d. wood shingles are all the same size

Answer can be found on Page 563 in the Carpentry and Building Construction book.

16. Plywood and OSB with a performance rating span or 32/16 means:
a. 32” roof and wall sheathing, 16” subfloor
b. 32” roof sheathing, 16” wall sheathing
c. 32” roof sheathing, 16” subfloor
d. any of the above

Answer can be found on Page 626 in the Carpentry and Building Construction book.

17. The exposed lower edge of the shingle is called the:

a. exposure
b. head lap
c. coverage
d. shingle butt

Answer can be found R1003.20.

18. Crickets must be installed when a chimney is greater than _____ in width and does not intersect with the ridgeline.

a. 24”
b. 30”
c. 36”
d. 42”

Answer can be found in R905.2.5.

19. Where the roofing sheathing is less than _____ thick, the fasteners shall penetrate through the sheathing when installing asphalt shingles:

a. 1/2”
b. 5/8”
c. 3/4”
d. 7/8”

Answer can be found in R905.7.6.

20. What is the minimum required end lap for metal valley flashing on wood shingle roofs?

a. 2”
b. 3”
c. 4”
d. 5”

↑TOP OF PAGE

Answers to Roofing Review

1. b
2. b

3. b
4. a
5. c
6. a
7. a
8. a
9. c
10. b
11. c
12. b
13. c
14. b
15. a
16. c
17. d
18. b
19. c
20. c

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5. Three tab shingles require a minimum of how many nails per strip?
a. 2
b. 3
c. 4
d. 6

Answer can be found on Page 626 in the Carpentry and Building Construction book.

6. The distance (in inches) between the edges of one course and the next higher course.
a. exposure
b. head lap
c. coverage
d. shingle butt

Answer can be found on Page 516 in the Carpentry and Building Construction book.

7. The principle member of valley roof construction is called a:
a. valley rafter
b. hip rafter

c. valley beam
d. valley jack

Answer can be found on Page 646 in the Carpentry and Building Construction book.

8. The most common type of wood shingles are usually graded:
a. No. 1, 2 or 3
b. A, B, and C.
c. standard, utility and premium
d. short, medium and long

Answer can be found in R905.2.7.

9. The minimum roof pitch with one layer underlayment, which will accept asphalt shingles is:
a. 1 in 12
b. 2 in 1
c. 4 in 12
d. only on a flat roof

Answer can be found in R905.2.7.

10. Minimum pitch for asphalt shingled roofs with double underlayment is:
a. 1:12
b. 2:12
c. 3:12
d. 4:12

Answer can be found in R905.2.7.1.

11. Ice and water shield should be installed to a point that is:
a. one row high
b. 12” above the interior wall line when projected through the roof sheathing
c. 24” above the interior wall line when projected through the roof sheathing
d. two rows high

Answer can be found in R905.7.2.

12. Wood shingles shall not be installed on roof slopes below:

a. 2:12
b. 3:12
c. 4:12
d. 5:12

Answer can be found on Page 647 in the Carpentry and Building Construction book.

13. How far is the drip edge overhang for cedar shakes?
a. 1/2”
b. 3/4”
c. 1-1/2”
d. 2-1/4”

Answer can be found in R907.3.

14. What is the maximum number of layers of asphalt shingles on a roof?
a. 1
b. 2
c. 3
d. whatever is needed to keep the roof from leaking

Answer can be found on Page 645 in the Carpentry and Building Construction book.

15. The difference between wood shingles and cedar shakes is?
a. wood shingles are thinner
b. wood shingles are man made
c. shakes are made on a machine
d. wood shingles are all the same size

Answer can be found on Page 563 in the Carpentry and Building Construction book.

16. Plywood and OSB with a performance rating span or 32/16 means:
a. 32” roof and wall sheathing, 16” subfloor
b. 32” roof sheathing, 16” wall sheathing
c. 32” roof sheathing, 16” subfloor
d. any of the above

Answer can be found on Page 626 in the Carpentry and Building Construction book.

17. The exposed lower edge of the shingle is called the:

a. exposure
b. head lap
c. coverage
d. shingle butt

Answer can be found R1003.20.

18. Crickets must be installed when a chimney is greater than _____ in width and does not intersect with the ridgeline.

a. 24”
b. 30”
c. 36”
d. 42”

Answer can be found in R905.2.5.

19. Where the roofing sheathing is less than _____ thick, the fasteners shall penetrate through the sheathing when installing asphalt shingles:

a. 1/2”
b. 5/8”
c. 3/4”
d. 7/8”

Answer can be found in R905.7.6.

20. What is the minimum required end lap for metal valley flashing on wood shingle roofs?

a. 2”
b. 3”
c. 4”
d. 5”

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Answers to Roofing Review

1. b
2. b

3. b
4. a
5. c
6. a
7. a
8. a
9. c
10. b
11. c
12. b
13. c
14. b
15. a
16. c
17. d
18. b
19. c
20. c

Overview of Building Trades

ROOFING

Fire Ratings and Roofing Materials

All types of roofing products have a fire rating. Fire ratings are classified as A, B, or C.

A - Best 2-4 hrs.
B - 1 hr.
C - 20 min.

The time provided in the above rating is the burn time before ignition.

Asphalt Shingles

Asphalt shingles are very economical in terms of cost and life expectancy. Mineral reinforced asphalt shingles have a Class C rating and are gradually being replaced by fiberglass reinforced asphalt shingles which are Class A or B materials.

Metal: Sheet and Shingles

Metal roofing is sturdy, lightweight and noncombustible, but it does require gypsum underlayment for a Class A rating.

Wood Shakes and Shingles

The thin physical make-up and surface structure of wood shakes and shingles are readily combustible and conducive to fire spread.

Built-Up Roofs (BURs)

Built-Up roofs (BURs) consist of multiple plies of roof felts laminated together with bitumen. BUR material can consist of bitumen-saturated felt, coated felt, polyester felt or other fabrics. A surfacing is generally applied and can be asphalt, aggregate (gravel or slag), emulsion or a granule-surfaced cap sheet.

ROOFING REVIEW QUESTIONS

Answer can be found on Page 626 in the Carpentry and Building Construction book.

1. A square of roofing material is equal to:

a. 10 square feet
b. 100 square feet
c. 25 square feet
d. 250 square feet

Answer can be found in R905.7.5.

2. Wood shingles, when applied to a roof, must be spaced _____ apart.

a. 1/8”
b. 1/4”
c. 3/8”
d. 1/2”

Answer can be found in R905.2.8.3 and on Page 633 in the Carpentry & Bldg. Const. Book.

3. What must be done where the roof intersects with a wall?
a. shingle up to the wall
b. use metal step flashing between the shingles
c. use felt paper
d. nothing, this isn't the problem

Answer can be found on Page 550 in the Carpentry and Building Construction book.

4. The purpose of a _____ is to divert the flow of water and prevent ice and snow build-up behind the chimney.
a. saddle
b. fascia
c. drip edge
d. starter strip

Answer can be found in R905.2.6.

5. Three tab shingles require a minimum of how many nails per strip?
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Answers to Roofing Review

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2. b

3. b
4. a
5. c
6. a
7. a
8. a
9. c
10. b
11. c
12. b
13. c
14. b
15. a
16. c
17. d
18. b
19. c
20. c

Overview of Building Trades

INSULATION and MICHIGAN ENERGY CODES

HOME INSULATION

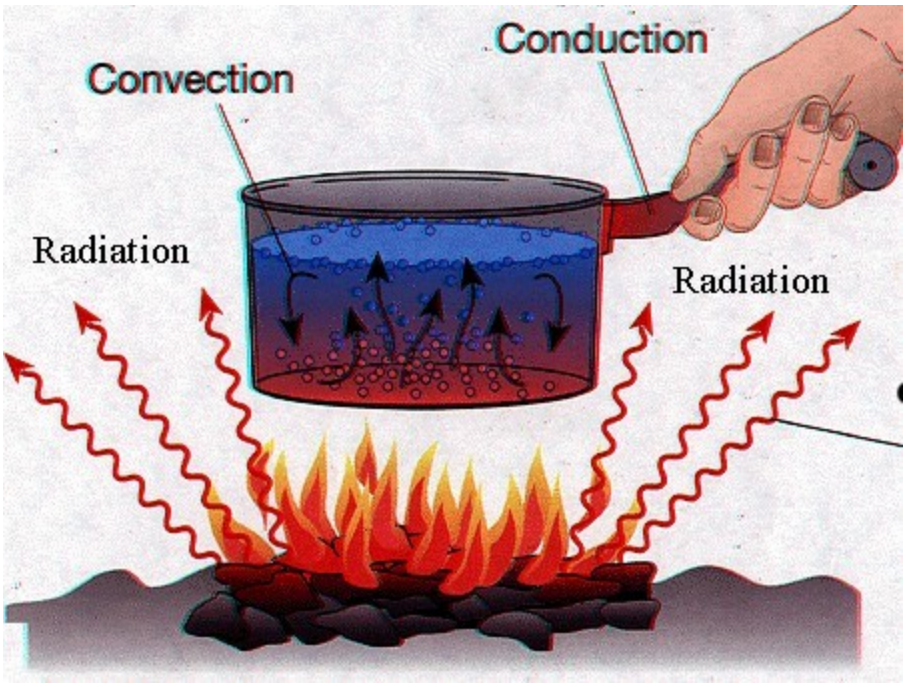
A well insulated home will create an effective weather barrier to keep indoor temperatures comfortable year-round and minimize your heating and cooling energy costs. Properly installed insulation will keep the heat outside in summer and inside in winter. The picture below shows all the places in your home that require insulation.

Heat moves through wall cavities, between roofs and attic floors or between floors and basements by a combination of conduction, and convection and radiation with radiation being the dominant method of heat transfer. Research shows that control of radiant heat transfer is the core of heating/cooling climate control.

Conduction - Conduction is the direct flow of heat resulting from physical contact of a warmer body with a cooler body. The transfer of heat by conduction is caused by molecular motion in which molecules transfer their energy to adjoining molecules and increase their temperature. An example is heat transferred from a hot burner to a pot through direct contact.

The denser a material is, the better it will conduct heat. Because air has such low density, air is a very poor conductor and therefore makes a good insulator. Insulation to resist conductive heat transfer uses air spaces between fibers, inside foam or plastic bubbles and in building cavities like the attic and the walls.

Convection - Convection is the transfer of heat caused by the movement of warmed air. Convective heat flow occurs whenever warm air contacts a cooler surface. Warm air rises, transfers its heat to a cooler surface, cools and then settles. The pressure from falling cool air helps push more warm air up. An example is warm air rising from a radiator - the air in direct contact with the radiator has first been heated by conduction. Heating increases the energy of the air causing its molecules to move about more rapidly and spread farther apart making the air less dense. Warm air is less dense (lighter) than cold air and so it rises.



Insulation to resist the flow of heat through convection uses small air spaces between fibers, foam, plastic bubbles, paper, straw, etc. to trap the rising air and slow heat loss through walls and ceilings. Common forms of mass insulation used to impede convective air flow include fiberglass or rock wool batts, rigid foam, spray foam, blown cellulose and straw.

Radiation - Radiation is the movement of infra-red energy through air or a vacuum. All surfaces above Absolute Zero emit radiation to different degrees including a stove, a ceiling and ordinary insulation. Radiant energy travels outward from a source in all directions at near light speed until it is absorbed by a body in its path, whereupon it is transformed into kinetic energy - or heat - within the intervening body. When this energy strikes a dense surface, it is absorbed and increases the temperature of that surface.

An example is radiation from the sun that strikes the outer surface of a house wall and is absorbed causing the wall to heat up. This heat flows from the outer wall to the inner wall through conduction and is then radiated again through the air spaces in the building to

other surfaces. Radiation is the dominant method of heat transfer in a building accounting for 65-85 percent of all heat transfer through walls, ceilings, attic and floors.

While other types of insulation are made to resist or impede the flow of warm air, reflective insulation reflects back radiant (infra-red) energy from the sun so it does not penetrate the building. It can also reflect back radiant heat inside the house so it does not escape. The concept is simple: each unit of radiant heat energy that is reflected away from your home in summer and each unit reflected back inside during winter means less operation of your air conditioning and heating systems, less wear and tear on your equipment, and less money you pay in utility costs.

Reflective insulation is commonly made of either aluminum foil attached to some sort of backing material or two layers of foil with foam or plastic bubbles in between creating an air space to also resist convective heat transfer. The aluminum foil component in reflective insulation will reduce radiant heat transfer by as much as **97%**.

Open Cell Spray Foam

-Open cell spray foam is very light. If you held it in your hand, you could easily crush it in your grip, whereas, closed cell you could not.
-It has a little better than half the R-value per inch as closed cell rated at 3.5.
-It is not a vapor barrier. Water and water vapor can permeate.
-It is less expensive than closed cell, and when the entire wall cavity is filled, it does provide an effective air barrier.
-Open cell foam insulation is an excellent sound deadener.

Closed Cell Spray Foam

-It is very dense or solid. It has the highest R-value per inch of all

commonly used residential insulating products at between R-6 and R-7.
-It has low permeability. Water and water vapor will not easily pass through it. It acts as a vapor barrier.
-It will effectively increase the structural strength of homes framed with lumber.
-It has a high cost per square foot compared to other methods. But the increased efficiency of the home will pay off for the home owner.
-It seals the inside cavities of walls, floors and ceilings very well. Done correctly it effectively stops air infiltration.

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Michigan Uniform Energy Code

Incorporating the 2009 edition of the International Energy Conservation Code
Excerpted from Impacts of the 2009 IECC for Residential Buildings in Michigan
Energy Efficiency & Renewable Energy/U.S. Department of Energy (www.eere.energy.gov/informationcenter)

SCOPE	COMPLIANCE	BLDG. ENVELOPE	AIR LEAKAGE	SYSTEMS

Learning Objectives

Explain the changes made to the 2009 Michigan Uniform Energy Code since 2003.
Understand what measures can be taken to incorporate these changes into construction projects/design.
Recognize how the changes can ultimately reduce and conserve energy consumption.

The adoption and enforcement of stringent residential energy codes offer considerable benefits and challenges. Constructing and operating buildings consumes **more** materials and energy than any other single entity in the United States (National Center for Appropriate Technology). Improved residential and commercial building codes could reduce primary energy use in buildings by approximately 0.5 quadrillion Btu per year by 2015. Total annual dollar savings would be more than $4 billion, and CO_2 emissions would be reduced by roughly 3%. (U.S. Dept. of Energy) Energy codes are designed to incorporate and regulate practices that will ultimately reduce the use of fossil fuel and non-renewable resources.

Builders are often challenged with the responsibility of complying to building codes, and justifying the added expense of energy-saving measures to their customers. Home owners want an energy efficient and functional home at a competitive price—yet many energy requirements are stringent and cost prohibitive. Builders must choose products and materials that fit the design of the building and meet the requirements of the energy code.

As of March 2011 the state of Michigan has adopted the 2009 International Energy Conservation Code (IECC) as it's energy code. The new code reflects several changes in energy efficiency for the **Michigan Uniform Energy Code** compared to the 2003 edition. Generally, the purpose of these changes is to conserve energy through improved efficiency in envelope design, mechanical systems, lighting, and new materials and techniques. It sets the baseline for the building envelope, systems, and equipment. These requirements affect the overall efficiency of a structure and apply to:

- Walls, floors and ceilings
- Doors and windows
- Heating, ventilation, and cooling systems and equipment
- Lighting systems and equipment
- Water-heating systems and equipment

The new codes are designed to incorporate and regulate practices that will ultimately reduce the use of fossil fuel and non-renewable resources. According to the Department of Energy, these changes may result in saving approximately $256 to $292 in energy costs for an average new home.

Scope

The scope of changes to the 2009 International Energy Conservation Code include residential, single and multi-family

homes that are three stories or less (above-grade), meant for permanent residence. This code applies to new buildings as well as additions, alterations, renovations, and repairs.

Exemptions to the scope include:

1. Structures with no conditioned space—i.e. garages
2. Historically significant buildings.
3. Very low energy use buildings (less than 3.4 Btu/h-ft^2), and buildings (or portions of) that are neither heated or cooled.

Existing Buildings

All **permit holders** (builders, remodelers and homeowners) are required to comply with 2009 MUEC. Replacement fenestrations must comply. Existing electrical, lighting, and mechanical systems may remain as is. The exceptions surrounding existing buildings are:

- Storm windows over existing windows
- Glass-only replacements
- Where the existing roof, wall, or floor cavity is not exposed.
- Reroofing where neither sheathing or insulation is exposed during the project, roofs without insulation shall be insulated either above or below the sheathing.
- Interior lighting alterations that do not increase the installed power—less than 50% of the luminaries are replaced and alterations that replace only the bulb and ballast of the existing fixtures.

- A building that is moved into or within a jurisdiction. A manufactured home that is shipped for initial installation/assembly on a building site shall not be considered a moved building.
- Spaces undergoing a change in occupancy that would result in an increase in demand for energy shall comply with this code. Any non-conditioned space that is altered to become conditioned space shall be required to be brought into full compliance with this code. Examples would be either converting a garage into a family room or heating a basement.

NEW 2009 IECC CHANGES

1. Focus on the building envelope (ceilings, walls, windows, floors and foundations). Insulation and fenestration levels, and solar heat gain coefficients are mandated. Infiltration control must be implemented through sealing and caulking to prevent air leaks.
2. Ducts--emphasis on sealing and insulation. Mandatory duct pressure testing along with allowable duct leakage rates is required when any portion of the system are outside the conditioned space.
3. Limited space heating, air conditioning, and water heating requirements are set by federal code--not IECC.
4. No mechanical trade-offs allowed for high efficiency heating, cooling, or water heating equipment.
5. Lighting equipment--50% of "lamps" must be high efficiency. The 2003 IRC has no lighting requirement.
6. Pool controls and covers--covers are required for heated pools.
7. Controls for driveway/sidewalk snow melting systems.
8. Moisture control requirements (i.e., vapor retarders) moved to the Michigan Residential Code (MRC).
9. No appliance requirements.

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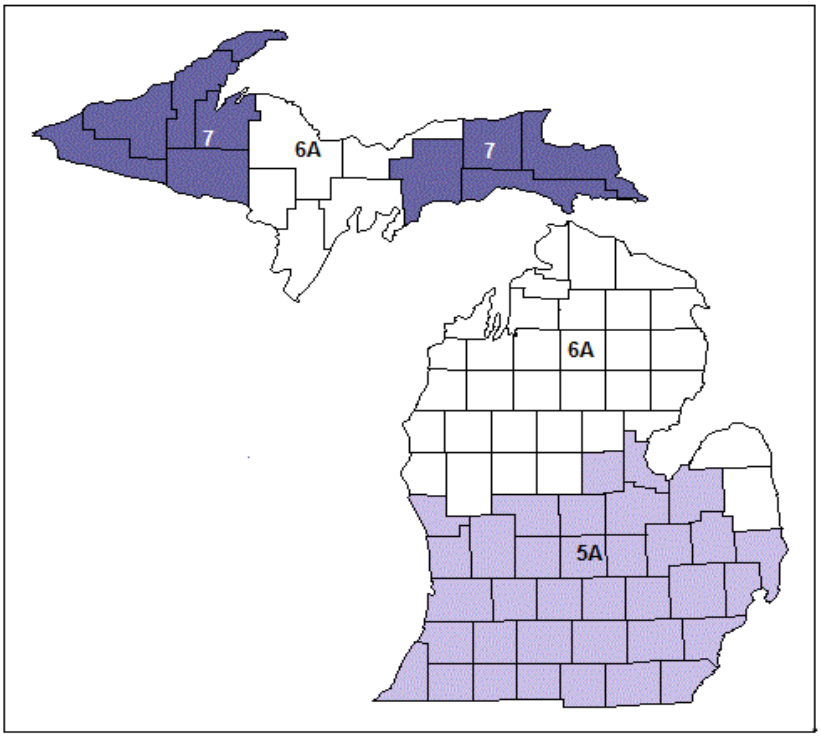
Compliance and Documentation

Michigan Uniform Energy Codes are based on the 2009 International Conservation Code (IECC). The key differences between the 2003 and 2009 editions surround key mandatory envelope requirements (the project design must meet these requirements regardless of location) which include moisture and infiltration control and duct insulation. Other envelope requirements such as insulation values and window efficiency are based on the climate of the project locations.

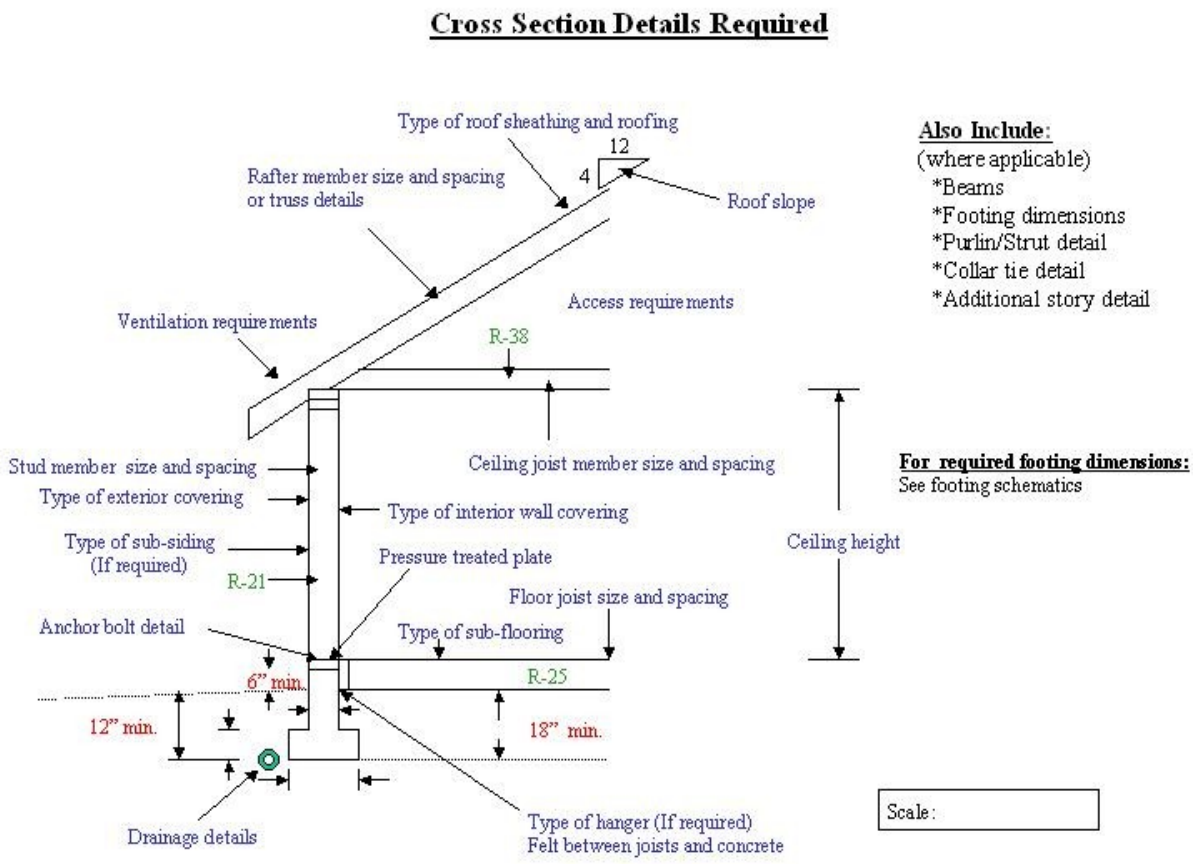
The new Michigan code has combined climate zones splitting the state into three sections--slightly different from the 2003 zones.



Plans and specifications must show sufficient detail regarding the building features and equipment systems as they pertain to Michigan code. This includes detail pertinent to:

- Thermal insulation and their R-values
- Exterior envelope component materials and U-factors

- Design criteria
- Sizes and types of equipment and systems



Insulation products (blown and sprayed) must be documented and posted with the date and name of the installer, manufacturer, R-value, type and thickness (settled) of the material at the attic entry. A Building Certificate for New Construction is also required to be posted at the site. Ventilation systems must be labeled as well.

The new prescriptive envelope requirements are basically the same as the 2003 IRC table. (see below) For homes with higher glazing area percentages, the IRC recommends using the 2003 IECC -- which has more stringent requirements.

Prescriptive Requirements in the Michigan Code

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[a] *U*-FACTOR	CEILING *R*-Value	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[f]	FLOOR *R*-VALUE	BASEMENT[b] WALL *R*-VALUE	SLAB[c] *R*-VALUE AND DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
5A	0.35	0.60	38	20 or 13 + 5[e]	13/17	30[d]	10/13	10, 2ft	10/13
6A	0.35	0.60	49	20 or 13 + 5[e]	15/19	30[d]	15/19	10, 4ft	10/13
7	0.35	0.60	49	21	19/21	38[d]	15/19	10, 4ft	10/13

a. The fenestration *U*-factor column excludes skylights.
b. The first *R*-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
c. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less, in zones 1-3 for heated slabs.
d. Or insulation sufficient to fill the framing cavity, R-19 minimum.
e. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
f. The second *R*-value applies when more than half the insulation is on the interior.

Table 402.1.3
Equivalent U-Factors[a]

Climate Zone	Fenestration *U* -Factor	Skylight *U* -Factor	Ceiling *U*-Factor	Frame Wall *U* -Factor	Mass wall *U* -Factor[b]	Floor *U* -Factor	Basement Wall *U* -Factor[d]	Crawl Space Wall *U* -Factor[c]
5A	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6A	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7	0.35	0.60	0.026	0.057	0.057	0.026	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation, or an approved source.
b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be the same as the frame wall *U*-factor in Zones 5 to 7.
c. Basement wall *U*-factor requirements shown in Table 402.1.3 include wall construction and interior air films, but exclude soil conductivity and exterior air films.
d. Foundation *U*-factor requirements shown in Table 402.1.3 include wall construction and interior air films, but exclude soil conductivity and exterior air films. *U*-factors for determining code compliance in accordance with section 402.1.4 (total UA alternative) of section 405 (simulated performance alternative) shall be modified to include soil conductivity and exterior air films.

There are **three** options to compliance paths:

1. PRESCRIPTIVE MEASURES:

This is considered the most simple route. The requirements do not change by building size, shape, window area or other features. The IECC has one single table of requirements for insulation R-values and window/door U-factors and SHGC. (Table 402.1.1) There is a corresponding U-factor table (Table 402.1.3) that allows for compliance when using less common components.

2. U-FACTOR AND UA ALTERNATIVES:

This includes the total building envelope UA (U-factor multiplied by area). This path uses the REScheck™ software. (The 2009 IECC will be implemented into REScheck and is expected to be available later this year). This alternative is similar to the Prescriptive R-value, but uses U-factors instead. (Table 402.1.3) It allows for innovative or less common construction techniques such as structural insulated panels or advanced framing. Based on the prescriptive U-factor table, trade-offs are allowed when one energy efficient measure cannot meet code--as long as one of the other measures in the project can EXCEED code--balancing out the requirements.

3. SIMULATED PERFORMANCE (requires software programs with specified capabilities):

This path allows compliance if the home has an annual energy consumption that is equal or less than standard code. This path is the most flexible, and allows for crediting energy efficient measures that are not accounted for in other paths, such as renewable energy. This path includes both envelope and some systems, but the changes in the 2009 code do NOT allow credit for space heating, cooling or water heating equipment. (Section 405)

Progress Check

- What types of buildings are exempted from the new IECC/MUEC?
- List at least 5 changes in the 2009 IECC that pertain to Michigan Code.
- Are Michigan's climate zones the same as they were in 2003?

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The Building Envelope

All new energy codes focus on the building envelope (ceilings, walls, windows, floors and foundations). The building envelope includes all of the components of a residential structure that separate the indoor conditioned space from the outdoor environment. The ability of the building envelope to function properly is what allows the entire building project to operate as an efficient system. Without an exterior shell that protects the home from weather, pests, too much sunlight etc-- measures taken to increase energy efficiency within the home are wasted.

The building envelope consists of ceilings, walls (above grade, below grade, and mass walls), fenestrations, floors, slabs, and crawl spaces that must be caulked and sealed. A number of thermal envelope requirements have changed in the 2009 IECC. These are highlighted below.

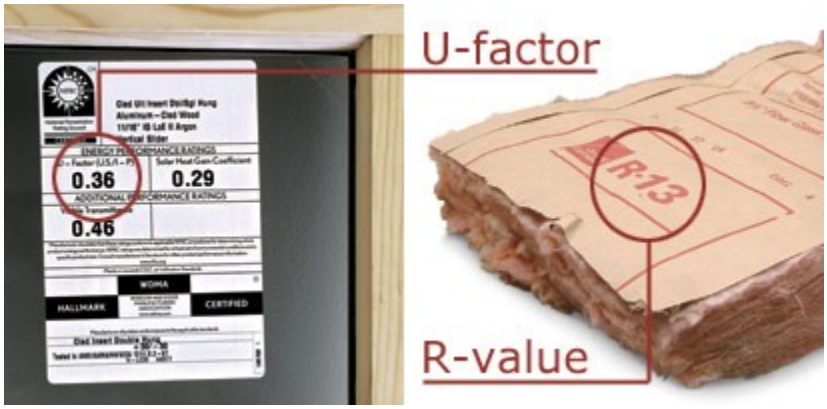
Ceilings

Requirements are based on assembly type, continuous insulation and the insulation between the framing (cavity insulation). Ceilings **with** attics require the insulation R-value to assume standard truss systems. The Prescriptive R-value path encourages raised heel trusses. Insulation must be full height over the exterior wall top plate--R-38 complies where R-49 is required. This can be accomplished by either using an oversized truss, a raised heel truss, or by installing insulation with a higher R-value per inch thickness such as rigid board insulation. Typically fiberglass batt insulation can be installed over the exterior wall plate line to the desired R-value and the remaining attic can utilize blown-in insulation.

Note: This allowance ONLY applies to the R-value prescriptive path, NOT the U-factor or Total UA alternatives.

Climate Zone	Ceiling R-Value
5A	38
6A	49
7	49

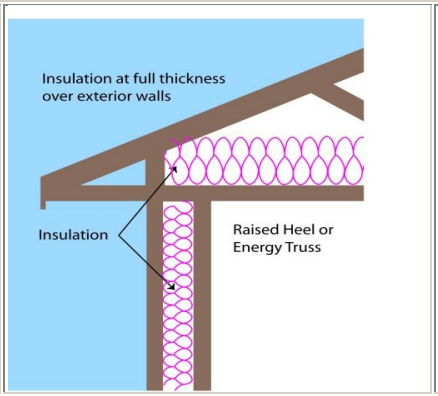
-Roof insulation in buildings with attics must be installed to allow for free circulation of air through the attic eave vents.
-R-values for roofs represent either cavity insulation (between framing) or insulating sheathing (continuous insulation).
-The first thing to look for is whether the attic access hatch is insulated to the same R-value as the plans and that weather-stripping has been installed around the hatch door to reduce infiltration.
-R-values are to be printed on the batt insulation or rigid foam board.



-Blown-in insulation shall have a insulation certificate at or near the opening of the attic. The certificate should include:

- R-value of installed thickness
- initial installed thickness
- installed density
- settled thickness/settled R-value
- coverage area
- number of bags installed

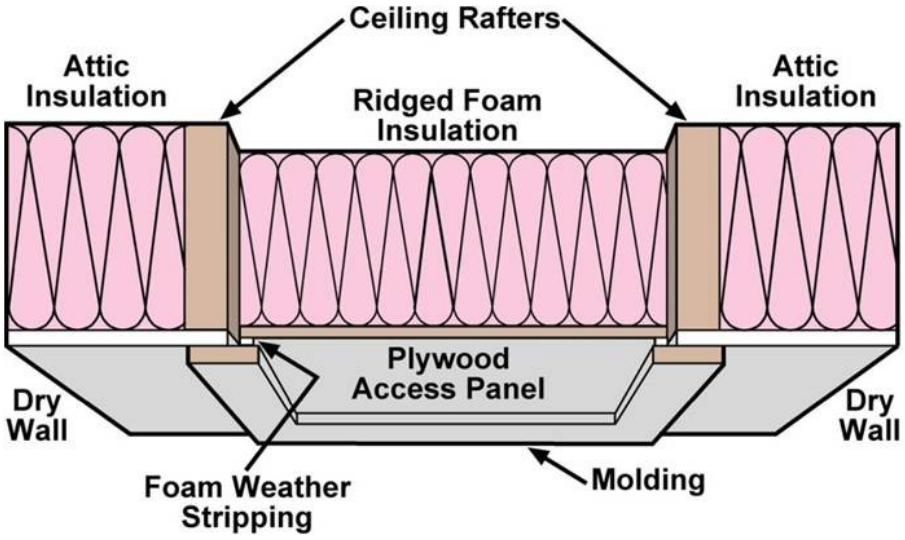
-Insulation markers must be installed every 300 square feet and are marked with the minimum installed thickness and affixed to the trusses or joists.
-Check that insulation is installed uniformly to an even thickness throughout the attic and extends over the top of the exterior wall.
-If needed, baffles should be installed at each soffit, cornice or eave vent to direct vent air up and over the top of the insulation.



In climates where insulation requirements are greater than R-30, and there is not sufficient amount of space in the roof assembly design to meet required higher levels, R-30 is allowed, but limited to 500 square feet, (or 20% total insulated ceiling area) whichever is less, for ceilings **without** attics (vaulted).

Access Hatches and Doors

-Weather strip and insulate doors form conditioned spaces to unconditioned spaces (i.e., attics and crawl spaces). The insulation level must be equivalent to surrounding surfaces--for example if the required ceiling insulation is R-38, then the attic hatch must be insulated to R-38 as well.
-Provide access to all equipment that prevents damaging or compressing the insulation.
-Install a wood framed or equivalent baffle or retainer when loose fill insulation is installed.

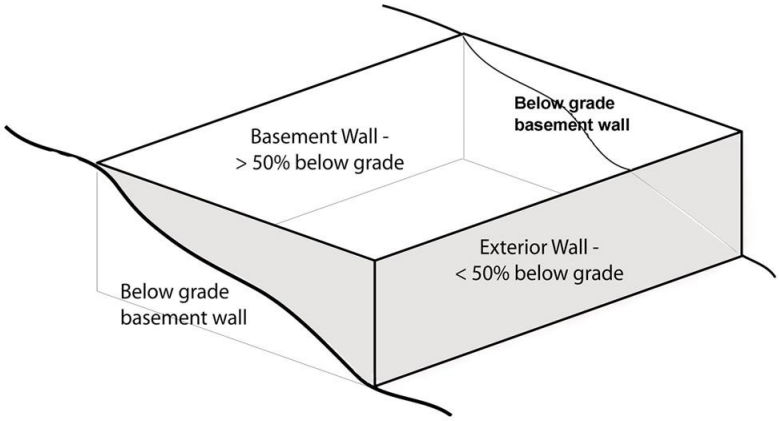


Mass Walls

1. **Above Grade Walls**--Insulate walls including those next to unconditioned spaces, including rim joists. Insulation should not be compressed behind the wiring or plumbing; this reduces the R-value of insulation. Be sure the insulation has filled the entire cavity, batts that are cut too short will leave voids. For continuous insulation make sure there are no voids and the insulation is well bonded to the outside framing. Perimeter joists between floors must be insulated. While not a requirement, in some climates it is important to insulate exterior corners; and, on, or in headers over doors and windows to eliminate heat transfer through the surfaces.

2. **Below Grade Walls**--Any part of the house or structure that is underground or beneath ground level. More specifically, are defined as being >/=50% below grade, below the grade of the basement wall, and if there is an exterior wall, it is <50% below grade. Define each wall individually--if the grade is sloping, the average height of the grade over the wall would be used to determine whether it's a below-grade or above-grade wall. Below grade walls are insulated from the top of the basement wall down to 10 ft below grade, or the basement floor, whichever is less. Walls associated with

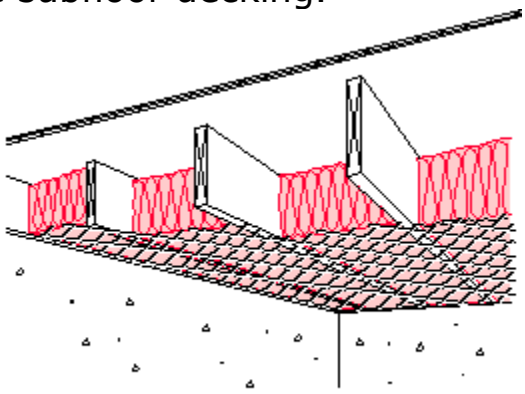
unconditioned basements must meet the requirements unless the floor above the basement is insulated accordingly.



Climate Zone	*Basement R-Value*
5A	10/13
6A	15/19
7	15/19

Floors

-Unconditioned space includes unheated basements, vented crawlspace, or outdoor air.
-Insulation must maintain permanent and continuous contact with the underside of the subfloor decking.



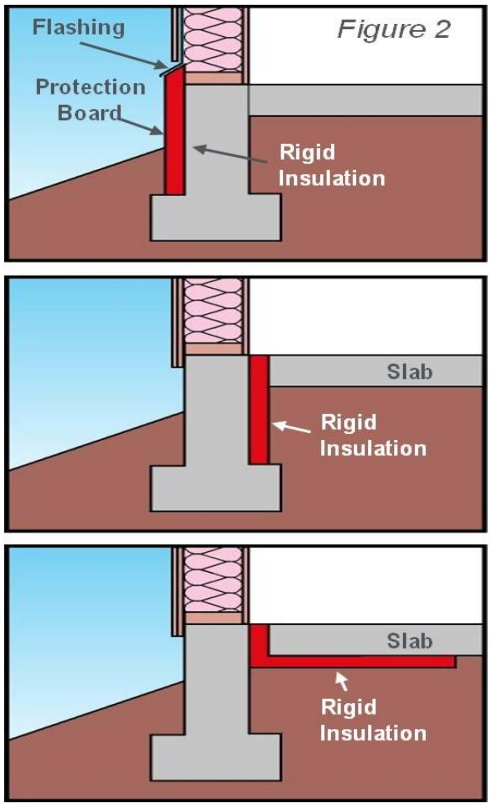
Climate Zone	*Floor R-Value*
5A	30*
6A	30*
7	38*

Exception: R-19 is permitted if the cavity is completely filled.

Slabs

Slab Edge Insulation

-Applies to slabs with a floor surface above grade and up to 12" below grade
-Slab-edge insulation may be installed vertically or horizontally on the inside or outside of foundation walls. If installed vertically, it must extend downward from the top of the slab to the top of the footing. If installed horizontally, it must cover the slab edge and then extend horizontally (to the interior or exterior).
-An additional R-5 is required for heated slabs.
-Exposed insulating material applied to the exterior of foundation walls shall be protected to a minimum depth of 6 inches below the finished grade.



Climate Zone	*Slab Edge R-Value*	*Depth of Insulation*
5A	10	2 ft.
6A	10	4 ft.
7	10	4 ft.

Crawlspace

Crawlspace Wall Insulation:

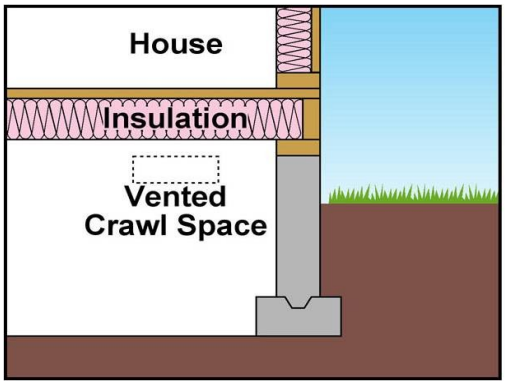
• The crawlspace may not have ventilation openings that communicate directly with outside air
• The crawlspace must be mechanically ventilated or supplied with conditioned air (this is not directly stated in the IECC).
• The crawlspace floor must be covered with an approved Class 1 vapor retarder material, the joints must overlap 6” and be sealed, the edges should extend at least 6” up the stem wall and attached to the stem wall.

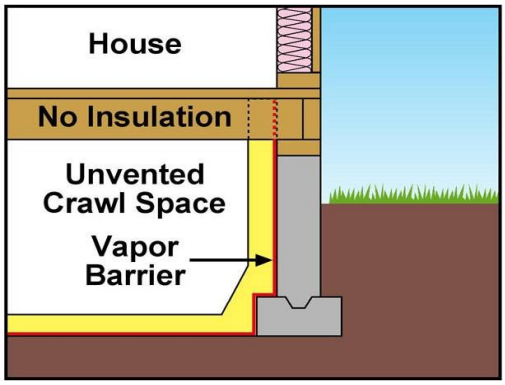
The IRC allows the construction of unventilated crawlspaces. To meet the requirements, the crawlspace walls must be insulated to the R-value specified in the energy code. The crawlspace must either be provided with conditioned air or with mechanical ventilation. The code does not specify the quantity of conditioned air to supply the crawlspace.

If mechanical ventilation is selected, the crawlspace must be ventilated at 1 CFM per 50 square feet. The ground surface must also be covered with an approved vapor retarder material. To eliminate moisture from the crawlspace the sill plate and perimeter joist must be sealed. Also, while not a code requirement, all joints in the vapor retarder should be overlapped and taped. This includes the connection between the vapor retarder and crawlspace wall.

Climate Zone	*Crawlspace R-Value*

5A	10/13
6A	10/13
7	10/13





Fenestration

Doors and Windows:

U-Factor is a measure of how well the assembly conducts heat. The lower the number, the better the assembly acts as an insulator. A window U-factor is based on the interior surface area of the entire assembly, including glazing, sash, curbing, and other framing elements

-The code requires windows, glass doors, and skylights to be rated by the National Fenestration Rating Council (NFRC) and to have labels that show the rated U-factor and SHGC values for the glazing unit, but allows default values (see appropriate table)
-There are no glass area limits
-Exemptions (prescriptive path only) are:

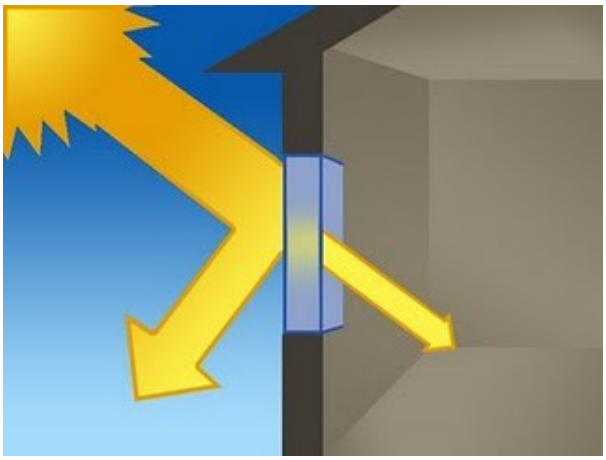
- Up to 15 square feet of glazing per dwelling unit (Section 402.3.3)
- One side-hinged opaque door assembly up to 24 square feet (Section 402.3.4)

Climate Zone	*Fenestration U-Factor*	*U-Factor HardLimits Vertical Fenestrations*
5A	.35	10/13
6A	.35	15/19
7	.35	15/19

Area Weighted Average:

The area weighted average is the combined Solar Heat Gain Coefficient of all the glazed fenestration products in the building.

-Can be used to satisfy U-factor and SHGC (Solar Heat Gain Coefficient) requirements. SHGC is a measure of how much solar gain is transmitted through the window by solar radiation. The lower the SHGC value of a window the less sunlight and heat can pass through the glazing.
-Are subject to hard limits, even in trade offs
-U-0.75 for skylights in Zones 5-7
-These are based on building average; U-factors of individual windows or skylights can be higher if the maximum area-weighted average is below these limits.



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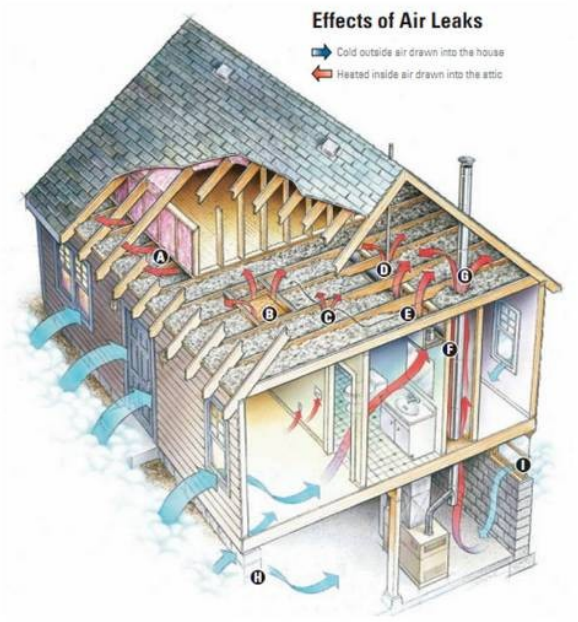
Air Leakage

Air leakage is the rate of air infiltration in the presence of a

specific pressure differential. It is expressed in units of cubic feet per minute per square foot of area. Heat loss and gain occur by infiltration through cracks in the envelope assemblies.

There are several places where air leakage (infiltration) can occur:



- Site built windows, doors, and skylights.
- Openings between window and door assemblies and their respective jambs and framing.
- Utility penetrations.
- Dropped ceilings or chases adjacent to the thermal envelope.
- Recessed light fixtures—must be Type IC and labeled in a sealed or gasketed enclosure. It should be sealed with a gasket or caulk between the housing and interior wall or ceiling covering.
- Walls, floors, and ceilings separating a garage from conditioned spaces.
- Behind tubs and showers on exterior walls.
- Common walls between dwelling units.
- Attic access hatches.

Two options that can demonstrate compliance with air sealing and insulation are:

• **Whole-house pressure test**--testing may occur any time after rough in and installation of building envelope penetrations

• **Field verification** of items by an approved party independent from the installer of the insulation shall inspect the air barrier and insulation per Section 402.4.2.

Fenestration Air Leakage

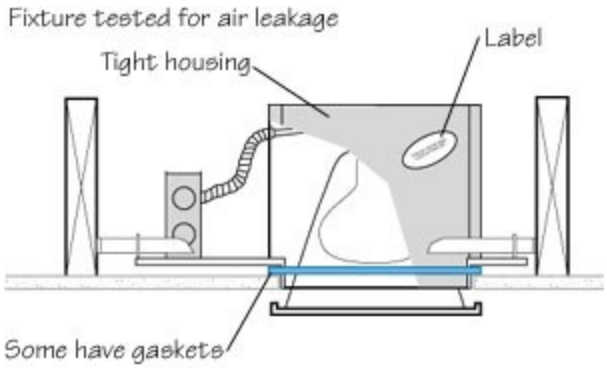
Energy efficiency of doors and windows are defined in terms of heat loss and gain—depending on whether heating or cooling is the goal. Michigan code requires that windows, skylights, and sliding glass doors must have an air infiltration rate of no more than 0.3 cubic foot per minute per square foot [1.5(L/s)/m2)], and swinging doors no more than 0.5 cubic foot per minute per square foot [2.5(L/s)/m2)].

Controlling air leakage in the building envelope can be achieved by sealing with caulking materials, gasket systems, weather stripping, and sealing joists and seams with tape or a moisture vapor-permeable wrapping material.

Recessed Lighting

According to the Department of Energy, a home loses costly heat and cooling through these ceiling openings. The energy losses from recessed lights often account for 50% of the total thermal losses of a ceiling. Improper installation of recessed lighting can result in uncontrolled air movement—allowing moisture, condensation and mold. Recessed lighting fixtures must be airtight. This can be accomplished by:

- IC (insulation contact permitted) rated—sealed and gasketed
- IC rated—in accordance with ASTM E283 where the fixture meets pressure testing requirements
- IC rated-installed in an airtight box with specific clearances from insulation



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Mechanical Systems

Heating and cooling is a significant piece of a home's overall energy consumption. Up to 40% of a home's energy is used by heating and cooling. Heating and cooling systems in the United States together emit 150 million tons of carbon dioxide into the atmosphere each year, adding to global climate change. They also generate about 12% of the nation's sulfur dioxide and 4% of the nitrogen oxides, the chief ingredients in acid rain. (energysavers.com)

The equipment efficiency for mechanical systems and equipment is set by Federal law, not the I-Codes. Mandatory requirements for systems (Section 403) include:

Controls--if the primary heating system is a forced-air furnace, at least one programmable thermostat per dwelling unit is required. It must have the capability to set back or temporarily operate the system to maintain zone temperatures. It should be programmed with heat no higher than 70° F and cooling no lower than 78° F

Heat pump supplementary heat--heat pumps having supplementary electric resistance heat shall have control, except during defrost, and prevent supplemental heat operation when the heat pump compressor can meet the heating load.

Duct Sealing and Insulation

Leaks in ductwork for heating and cooling systems are huge energy wasters. Leaks involving 20% of the total air flow will cause 50% drop in the efficiency, and a shorter lifespan of the cooling and heating equipment. Bottom line--up to 30% of the energy used to heat and cool a building can be lost through leaky ducts and poor duct design. In buildings using a central furnace--duct design, placement and sealing are crucial for desired performance.

*Sealing (mandatory)--*joints and seams shall comply with MRC, Section M1601.4.1

*Insulation (Prescriptive)--*supply ducts in attics must be insulated to R-8. Return ducts in attics and all ducts in crawlspaces, unheated basements, garages, or otherwise outside the building envelope must be insulated to R-6. The only exemption is duct insulation is not required if all ducts are located completely inside the building thermal envelope.
Building framing cavities shall not be used as supply ducts.

Duct Tightness Tests--All ducts, air handlers, filter boxes and building cavities used as ducts must be sealed and either:

1. *Verified by pressure testing post construction*-the duct system has to be tested and the air leakage out of ducts must be kept at an acceptable maximum level.
-Leakage to outdoors: ≤8cfm/per 100 ft² of conditioned floor area
or
-Total leakage: ≤12cfm/per 100 ft² of conditioned floor area
-All register boots must be taped or otherwise sealed

2. *Installed entirely within the building* thermal envelope.

-Total leakage : ≤6cfm/per 100 ft² of conditioned floor area
-Exemption--testing is not required if all ducts are inside the building thermal envelope (for example in heated basements), though the ducts still have to be sealed.

HVAC Piping Insulation

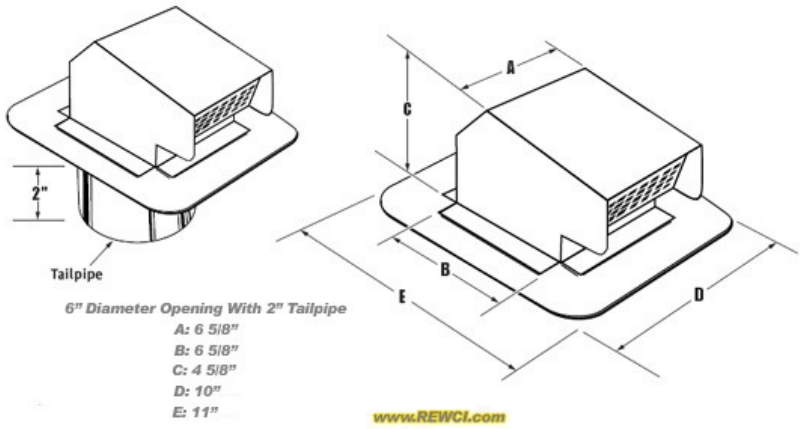
Mechanical system piping capable of carrying fluids above 105 degrees F or below 55 degrees F shall be insulated to a minimum of R-3.

Circulating Hot Water Systems

Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use and be insulated to at least R-2.

Mechanical Ventilation

Mechanical systems or equipment create conditioned air or temperature controlled water—which is then moved through the home via ducts and plenums, or pipes. They automatically regulate the amount to be moved through the system by way of recirculation or exhausting.
Code requires minimum ventilation compliance in all conditioned areas of the building. The mechanical ventilation system shall provide sufficient outdoor air. All outdoor intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.



Oversized HVAC equipment has a higher initial cost, a higher operating cost, provides less comfort, and the short-cycling reduces the equipment life expectancy. Any one of these is a good reason not to oversize. Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with the procedures described in **Section M1401.3 of the International Residential Code** calculated in accordance with the **ACCA Manual J**, or other approved method.

Systems serving multiple dwellings must comply with Section 503 and 504 in lieu of Section 403.

Snow melt controls-controls for driveway/sidewalk snow melting systems must include controls capable of shutting off the system when the pavement temperature is above 50 degrees F.

Pools--pool controls and covers are required for heated pools.

Electrical Power and Lighting Systems

A conventional incandescent bulb produces only about 5 to 10% of the consumed energy into light, the rest goes out as heat. According to the U.S. Environmental Agency, if every American replaced just one light with a bulb that has earned the Energy Star designation we would save enough energy to light 3 million homes for a year, save about $600 million in annual energy costs, and prevent 9 billion pounds of greenhouse emissions per year.

Incandescent light bulbs are, however, gradually being replaced by newer technologies that improve the ratio of visible light to heat generation. New light sources, such as the fluorescent lamp, high intensity discharge lamps, and LED lamps offer higher efficiency, and can generally be fit into existing fixtures. These devices light by luminescence, instead of heating a filament to incandescence.

50% of the lighting lamps (bulbs, tubes, etc.) in a building must be high efficiency. Compact fluorescents qualify, standard incandescent bulbs do not.

Certificate

The 2009 IECC requires a permanent certificate posted on the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. It should list the R-values of insulation installed for the building envelope, U-factors and SHGC for fenestration, HVAC efficiencies and types, and service water heating equipment. This certificate must not cover or obstruct the visibility of other required labels.

Progress Check

- List and describe the differences between the three options to compliance.
- What constitutes a building envelope?
- What should an insulation certificate include?
- What is the definition of a "below grade"wall?
- What are the two options that Can demonstrate compliance with air sealing and insulation?

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INSULATION AND ENERGY REVIEW QUESTIONS

Answer can be found on Page 900 in the Carpentry and Building Construction book.

1. Where should a vapor barrier be placed on an exterior wall?

a. warm side in the winter
b. cool side in the winter
c. exterior side
d. both sides

Answer can be found on Page 897 in the Carpentry and Building Construction book.

2. What is the paper backing on insulation used for?

a. as a vapor barrier
b. to hold the fiberglass together
c. to help hold the insulation in place
d. none of the above

Answer can be found on Page 898 in the Carpentry and Building Construction book.

3. Loose or fill type of insulation can be:

a. poured in place
b. blown in

c. troweled in
d. a and b

Answer can be found on Page 908 in the Carpentry and Building Construction book.

4. Although insulation is installed to control heat loss, a well-insulated wall also:
a. stops the spread of fire
b. acts as a sound deadener
c. discourages termites
d. is always 24" o.c.

Answer can be found on Page 894 in the Carpentry and Building Construction book.

5. What does R-value represent?
a. heater efficiency
b. the indication of the material ability to reduce heat transmission
c. resistance to cold air
d. resistance to the wind

Answer can be found on Table 402.1.1 in the Michigan Uniform Energy Code above.

6. What is the minimum R-Value for basement walls with continuous insulation in Zone 5A.
a. R-5
b. R-7
c. R-8
d. R-10

Answer can be found on Page 894 in the Carpentry and Building Construction book.

7. Wood that is one inch in thickness has approximately what R-value?
a. R1
b. R2
c. R3
d. R4

Answer can be found on Page 899 in the Carpentry and Building Construction book.

8. In rigid insulation, extruded polystyrene (blueboard) what is the R-value per inch of thickness?

a. R5
b. R6
c. R7
d. R8

Answer can be found in the Michigan Uniform Energy Code above.

9. When spraying or blowing insulation in attic spaces, markers that indicate the depth of the insulation shall be placed for every _____ square feet of area.

a. 150
b. 250
c. 30
d. 350

Answer can be found in the Michigan Uniform Energy Code above.

10. Exposed insulating material applied to the exterior of foundation walls shall be protected to a minimum depth of _____ below the finished grade.

a. 6”
b. 8”
c. 10”
d. 12”

Answer – Found on Table 402.1.1 of the Michigan Uniform Energy Code above.

11. The minimum R-value for ceilings in Zone 6A is:

a. R-30
b. R-38
c. R-49
d. no minimum required

Answer can be found on Page 661 in the Carpentry and Building Construction book.

12. Housewrap is a special infiltration barrier on the outside surface of the wall sheathing that is installed before the siding is installed. It's high tech design prevents air infiltration while still allowing:

a. the house to breathe
b. siding to bond
c. ventilation
d. moisture to escape

Answer - See information at the front of this section.

13. What are the three methods of heat transmission?

a. conduction, convection and radiation
b. induction, convection and radiation
c. conduction, convection and production
d. microwave, convection and radiation

Answer can be found on Page 899 in the Carpentry and Building Construction book.

14. Closed-cell spray foam insulation is made from:

a. polyurethane
b. liquid styrofoam
c. foam fibers
d. none of the above

Answer can be found on Page 898 in the Carpentry and Building Construction book.

15. What type of insulation would be placed around the perimeter of a monolithic slab.

a. polystylene sheets
b. unfaced batt
c. faced batt
d. blown fiberglass

Answer can be found in the Appendix and page 903 of the Carpentry & Bldg. Const. Book.

16. If a building material has a high emissivity, it would improve the energy efficiency of an attic space.
a. True
b. False

Answer can be found on Page 903 in the Carpentry and Building Construction book.

17. Materials with a high reflectivity have a low emissivity.
a. True
b. False

Answer can be found on Page 895 in the Carpentry and Building Construction book.

18. The continuous insulation layer that separates the outside from the inside and unheated spaces from heated spaces are referred to as the:
a. indoor space
b. heating load area
c. thermal envelope
d. all of the above

Answer can be found on Page 897 in the Carpentry and Building Construction book.

19. Unfaced fiberglass batt insulation is also referred to as friction fit insulation.
a. True
b. False

Answer – Found on 402.4.2.1

20. To confirm the air tightness of a building thermal envelope, what would be a method of testing this?
a. blower door
b. vacuum screen
c. visual confirmation
d. both a and c

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Answers to Insulation Review

1. a
2. a
3. d
4. b
5. b
6. d
7. a
8. a
9. c
10. a
11. c
12. d
13. a
14. a
15. a
16. b
17.a
18. c
19. a
20. d

Overview of Building Trades

VENTILATION

Calculating Ventilation for Attic Spaces

If the required ratio is 1 square foot of ventilation opening for 300 square feet of attic floor space, first we need to find the factor to multiply the number of square feet by:

1 ÷ 300 = .0033

If the required ratio is 1 square foot of ventilation opening for 150 square feet of attic floor space, the factor to multiply the number of square feet by:

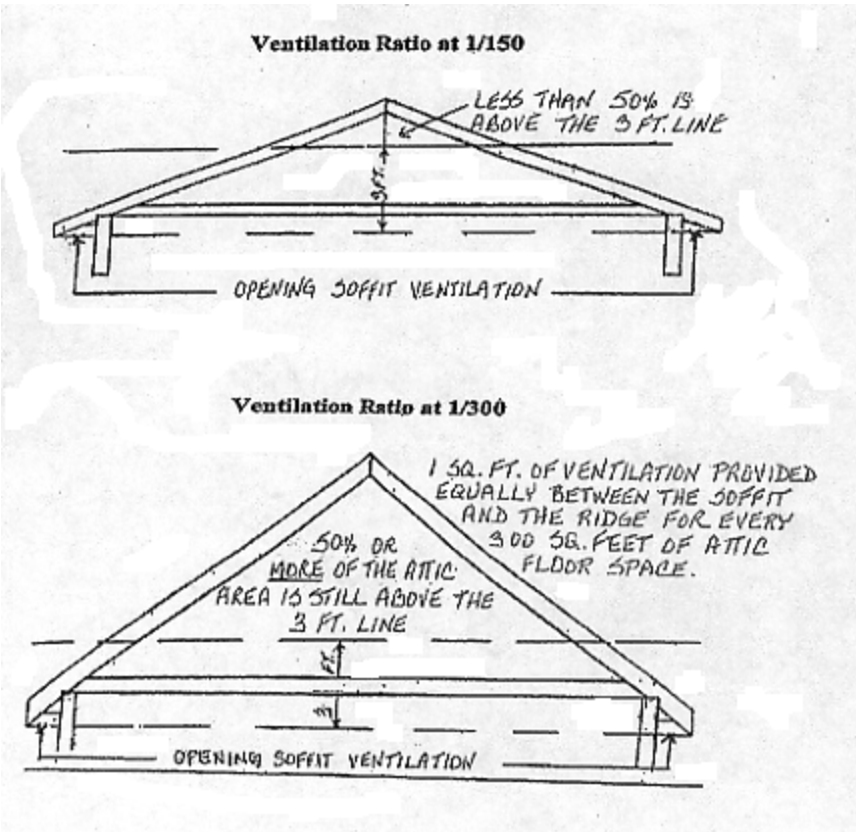
1 ÷ 150 = .0066

Example: A home with 2750 square feet of attic space with a needed ventilation ratio of 1/150

2750 x .0066 = 18.15 square feet

This home needs to have 18.15 square feet of ventilation. This should be equally divided between intake and exhaust. (Intake is soffits / Exhaust is ridge or gable vents)

Code R806.2



NOTE: As the pitch of the roof becomes steeper, the amount of required ventilation decreases.

VENTILATION REVIEW QUESTIONS

Answer can be found in R408.1.

1. Each 150 square feet of crawl space requires how much vent area?

a. 0.1 sq. ft.
b. 0.5 sq. ft.
c. 1 sq. ft.
d. 2. sq. ft.

Answer can be found on Page 632 in the Carpentry and Building Construction book.

2. The purpose of attic ventilation is to_____.
a. Prevent ice dams
b. Remove moisture
c. Keep attic space cooler
d. All of the above

Answer can be found in the Ventilation Text.

3. How many square feet of ventilation would be needed for a home that requires a 1 to 300 ventilation ratio with 1560 sq. ft. of attic floor space?
a. 4.5 sq. ft.
b. 5.15 sq. ft.
c. 6.7 sq. ft.
d. 7.5 sq. ft.

Answer can be found on Page 887 in the Carpentry and Building Construction book.

4. Heat recovery ventilators provide clean air from outside that is warmed up before it enters the home. It uses the heat from the exhaust air to temper the incoming air.
a. True
b. False

Answer can be found on Page 887 in the Carpentry and Building Construction book.

5. Heat recovery ventilators have become necessary to provide clean indoor air as homes are built to have very little air infiltration.
a. True
b. False

Answer can be found on Page 902 in the Carpentry and Building Construction book.

6. Crawl space ventilation is needed to prevent:
a. decay of wood framing members
b. insulation from becoming saturated with moisture
c. heat gain
d. both A and B

Answer can be found on Page 632 in the Carpentry and Building Construction book.

7. Attic ventilation is needed to:
a. remove moisture that could damage roof sheathing
b. remove hot air from the attic that could damage the shingle
c. keep the attic space more comfortable
d. both A and B

Answer can be found in R806.2.

8. The attic space that would require a 1 to 150 ventilation ratio could be allowed to use a 1 to 300 ratio if a vapor barrier of not more than _____ is installed on the warm side of the ceiling.
a. 1 perm
b. .5 perm
c. .3 perm
d. .1 perm

Answer can be found R806.3

9. A minimum of _____ air space shall be provided between the insulation and the roof sheathing.
a. ½”
b. ¾”
c. 1”
d. 2”

NOTE: Class II vapor retarder is 1 perm or less and Class I is .1 or less.

Answer can be found R 303. 3

10. If a bathroom has no mechanical ventilator it must have a window a minimum size of _____, half of which must be able to be opened.

a. 3 square feet
b. b. 3 ½ square feet
c. 4 square feet
d. 4 ½ square feet

Answers to Ventilation Review

1. c
2. d
3. b
4. a
5. a
6. d
7. d
8. a
9. c
10. a

Overview of Building Trades

Windows, Doors and Skylights

WINDOWS, DOORS AND SKYLIGHTS REVIEW QUESTIONS

Answer can be found in R310.

1. The main reason for properly sized windows in a bedroom area is:

a. ventilation
b. emergency escape
c. minimizes moisture buildup
d. aesthetics

Answer can be found in R310.1.1.

2. All egress windows above or below the grade floor must have:

a. a net clear opening of 5.7 sq. ft.

b. a minimum net clear opening of 20” width or 24” height
c. a sill height not more than 44 inches above the floor or ground
d. all of the above

NOTE: The minimums at 20” in width and 24” in height cannot be combined because of the square footage requirement.

Answer can be found in R311.2

3. All households shall have one egress door that is side hinged providing a minimum of _____ when the door is opened 90 degrees. The measurement is between the face of the door and the stop.
a. 30 inches
b. 32 inches
c. 34 inches
d. 36 inches

Answer can be found in R310.1.1.

4. An egress window has an opening 20 inches wide by 24 inches high with the bottom of the opening 44 inches above the floor. Does this window meet code for the first floor?
a. yes
b. no
c. depends on the locale
d. yes, if it is used in a child's bedroom

NOTE: The required square footage is not met.

Answer can be found on Page 620 in the Carpentry and Building Construction book.

5. What is the recommended distance from the bottom of the door to the bottom of the bottom hinge?
a. 7”
b. 8”

c. 10”
d. 11”

Answer can be found on Page 620 in the Carpentry and Building Construction book.

6. What is the recommended distance from the top of the door to the top of the top hinge?

a. 7”
b. 8”
c. 10”
d. 11”

Answer can be found on Page 620 in the Carpentry and Building Construction book.

7. What is the recommended height of the door knob off the floor?

a. 34" to 36"
b. 36" to 38"
c. 38" to 40"
d. 40" to 42"

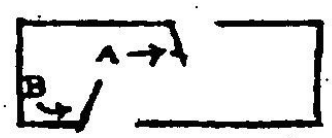
Answer can be found on R311.7.5

8. A floor or landing is not required at the top of an interior flight of stairs provided the door does not swing over the stairs.

a. True
b. False

Answer can be found on Page 602 in the Carpentry and Building Construction book.

9. What door does figure B represent?



a. right hand door
b. left hand door

c. right hand inverted
d. left hand inverted

Answer can be found on Page 602 in the Carpentry and Building Construction book.

10. When the finish carpenter hangs a door, how does he know if it is a left or right hand door?
a. when facing the door and the knob is on the left hand side, it is left hand
b. when facing the door and the knob is on the right hand side, it is a right hand
c. door swing is determined by the lumber company
d. The carpenter stands with his back to the hinge side of the door jamb and if the door swings left it is a left hand door

Answer can be found on Page 577 in the Carpentry and Building Construction book.

11. The part of the window that holds the glass is called the _____.
a. pane
b. casing
c. frame
d. sash

Answer can be found on Page 590 in the Carpentry and Building Construction book.

12. What are the two basic types of skylights?
a. fixed and ventilating
b. double glazed and triple glazed
c. domed and flat
d. glass and plastic

Answer can be found in R311.2.

13. Minimum height of an egress door is _____when measured from the bottom of the threshold to the bottom of the stop.
a. 76”
b. 78”
c. 80”
d. 82”

Answer can be found in R311.3.1.

14. The large required egress door must have a landing on the exterior side. This landing shall not be more than _____ below the top of the threshold.
a. 1-1/2”
b. 2”
c. 2-1/2”
d. 3”

Answer can be found on Page 591 in the Carpentry and Building Construction book.

15. The two methods that skylights are flashed to prevent leaks are step flashing and _____ flashing.
a. pan
b. sheet metal
c. perimeter
d. back angle

Answer can be found in R308.4.

16. All glass in hazardous areas that require safety glazing must be able to be identified by the manufacturers’ designation. Safety glazing is not required in a door where a _____ sphere is unable to pass.
a. 2"
b. 3"
c. 4"
d. 5"

Answer can be found in R308.4.

17. Glazing enclosing a shower stall where the bottom exposed edge is 60” or more measured vertically above any standing or walking surface, does not have to be safety glazed.

a. True
b. False

Answer can be found in R308.4.

18. Safety glazing is required within _____ of a vertical edge of a door.

a. 20"
b. 21"
c. 23"
d. 24"

Answer can be found on Page 578 in the Carpentry and Building Construction book.

19. What kind of window is this?

a. hopper
b. casement
c. double hung
d. gliding

Answer can be found on Page 578 in the Carpentry and Building Construction book.

20. What kind of window is this?

a. hopper
b. casement
c. double hung
d. gliding

↑TOP OF PAGE

Answers to Windows, Doors and Skylights Review

1. b
2. d
3. b
4. b
5. d
6. a
7. b
8. a
9. b
10. d
11. d
12. a
13. a
14. a
15. a
16. b
17. a
18. d
19. c
20. b

Overview of Building Trades

SIDING INSTALLATION

A backer board is the smooth sheathing that siding is installed over. This could be, but is not limited to, OSB, plywood or extruded polystyrene.

VINYL SIDING

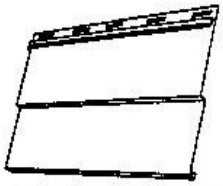
Below are the most common vinyl and aluminum sidings and installation accessories. Some variations exist between manufacturers. The basic rules for installation are universal, however:

- Nail in the center of slots.
- Do not nail too tightly.
- Leave at least 1/4-inch clearance at all stops.
- Do not pull horizontal sidings up tight.
- Strap and shim all uneven walls.

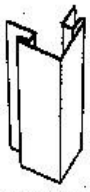
STARTER STRIP

DOUBLE 4" HORIZONTAL

SINGLE 8" HORIZONTAL



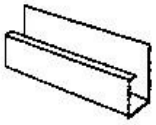
DOUBLE 6" HORIZONTAL



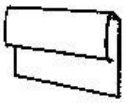
OUTSIDE CORNER

INSIDE CORNER

H DIVIDER

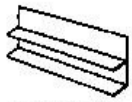


J CHANNEL

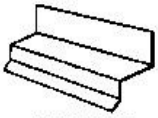


UNDERSILL TRIM

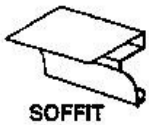
QUARTER-ROUND SOFFIT MOLDING



F CHANNEL



DRIP CAP



SOFFIT COVE TRIM

SIDING INSTALLATION REVIEW QUESTIONS

Answer can be found on Page 660 in the Carpentry and Building Construction book.

1. Flashing is used to seal the joints where siding meets a _____.

a. Vertical surface
b. Obstacle
c. Horizontal surface
d. All of the above

Answer can be found on Page 663 in the Carpentry and Building Construction book.

2. When installing plain bevel wood siding, the back of the siding should be _____ before it is installed.

a. Primed
b. Sealed with a water repellant
c. Rabbeted
d. Either a. or b.

Answer can be found on Page 665 in the Carpentry and Building Construction book.

3. What must be done before the installation of horizontal beveled siding?

a. Install corner strips
b. Install window trim
c. Install door trim
d. All of the above

Answer can be found on Page 676 in the Carpentry and Building Construction book.

4. When installing vinyl or aluminum siding, what is the minimum diameter of the head for nails?

a. 3/16”
b. 1/4”
c. 5/16”
d. 3/8”

Answer can be found on Page 676 in the Carpentry and Building Construction book.

5. When installing vinyl or aluminum siding, the nails should be driven tight to the sheathing.

a. True
b. False

Answer can be found on Page 677 in the Carpentry and Building Construction book.

6. Where aluminum and vinyl siding meet the accessories, you should always leave an expansion gap of _____

a. 1/8”
b. 1/4”
c. 1/2”
d. 3/4”

NOTE: When the temperature is 40°F or below, the expansion gap should be increased to 3/8”.

Answer can be found in R703.3.2

7. Horizontal lap siding requires that the end joints be caulked or sealed.

a. True
b. False

Answer can be found in R703.5.2

8. When siding with 24’’ wood shingles, what is the maximum exposure?

a. 7-1/2”
b. 8-1/2”
c. 11-1/2”
d. 15-1/2

Answer can be found in R703.5.3.1

9. Staples used for exterior shakes or shingles shall be at least 16 gage with a crown width of at least _____.

a. 3/8”
b. 7/16”
c. 1/2”
d. 9/16”

Answer can be found in R703.10.2

10. When installing horizontal lap fiber cement siding, what is the minimum lap?

a. 3/4″
b. 1″
c. 1 1/4″
d. 1 ½″

↑TOP OF PAGE

Answers to Siding Installation Review

1. c
2. d
3. d
4. c
5. b
6. b
7. a
8. c
9. b
10. c

Overview of Building Trades

INTERIOR AND EXTERIOR FINISHING

Terra Cotta Tile Floors

Terra-cotta, which is Italian for "cooked earth," is actually semi-cooked. Terra cotta tile is made from raw clay and is usually unglazed. The colors range from natural earth tones such as gray and brownish yellow to various shades of red.

When used indoors, terra cotta tile floors can be left raw, but more often, terra cotta is finished with a top coat sealer. Some terra-cotta tiles are purported to be waterproof. To the contrary, all raw clay tiles are like sponges when it comes to soaking up water.

Slate

Slate is a fine-grained metamorphic rock. It's main constituents are quartz, chlorite, mica and calcite. Slate is formed when ocean or riverbed sediments are compressed and heated by the earth's crust. Slate is a very durable and hard wearing product and is suitable for use on the floor.

The back of the slate tile has been machined to either a flat or grooved finish, depending on the factory of origin. The top is a natural-split face surface because the face is split and not machined.

There can be up to 1/4" difference in the heights on the top surface of a slate tile. Slate tile is usually installed with a medium-bed mortar, which allows for the variation on adjoining tile edges to be minimized. Order an additional 10-15% to allow for waste, cuts and thickness variation.

There is no PEI rating for slate. PEI ratings were developed for the ceramic and porcelain tile industries. However, slate is very hard and durable and can be used where a long-wearing product is required.

When applying waterbased, waterproof paint to a basement wall, the paint should be brushed on.

INTERIOR AND EXTERIOR FINISHING REVIEW QUESTIONS

Answer can be found on Page 918 in the Carpentry and Building Construction book.

1. There are two types of drywall screws. Type S used for steel and Type W is used for wood.

a. True
b. False

Answer can be found on Page 919 in the Carpentry and Building Construction book.

2. What protects the outside corners of drywall?

a. Corner beads
b. J-Trim
c. Tape and compound
d. Wood molding

Answer can be found on Page 924 in the Carpentry and Building Construction book.

3. If the long dimension of a sheet of ½" drywall is running parallel to the ceiling framing, can the ceiling framing be 24" o.c.?

a. Yes
b. No

Answer can be found on Page 926 in the Carpentry and Building Construction book.

4. Always fasten drywall beginning at the ends of the panel and then work toward the center.

a. True
b. False

Answer can be found on Page 940 in the Carpentry and Building Construction book.

5. When installing the grid system for a suspended ceiling, the top edge of the grid must be at least _____ below the bottom of the ceiling framing.

a. 1"
b. 2"
c. 3"
d. 4"

Answer can be found on Page 939 in the Carpentry and Building Construction book.

6. The three basic parts of the grid system for suspended ceilings are: main runners, cross tees and _____.

a. Side blocks
b. Wall molding
c. End caps
d. Side bars

Answer can be found on Page 947 in the Carpentry and Building Construction book.

7. All paint contains _____.
a. Pigments
b. Binder
c. Carrier
d. All of the above

Answer can be found on Page 948 in the Carpentry and Building Construction book.

8. What makes primer different from standard paint?
a. A higher proportion of binder
b. It blocks UV radiation
c. Better coverage characteristics
d. All of the above

Answer can be found on Page 948 in the Carpentry and Building Construction book.

9. Stain is more durable than paint.
a. True
b. False

Answer can be found on Page 951 in the Carpentry and Building Construction book.

10. How many coats of exterior paint including the primer coat provide the best appearance and maximum durability?
a. 2
b. 3
c. 4
d. 5

Answer can be found on Page 839 in the Carpentry and Building Construction book.

11. What should be used to seal a knot in wood to prevent stain from bleeding through?

a. Primer
b. Shellac
c. Putty
d. Caulk

Answer can be found on Page 953 in the Carpentry and Building Construction book.

12. After a hard rain, it sometimes takes several days to dry enough to paint exterior buildings.

a. True
b. False

Answer can be found on Page 953 in the Carpentry and Building Construction book.

13. The temperature must stay above _____ for at least 24 hours after latex paints are applied.

a. 32 degrees F
b. 40 degrees F
c. 50 degrees F
d. 55 degrees F

Answer can be found on Page 954 in the Carpentry and Building Construction book.

14. The technique of mixing paint by pouring it from one can to another is called_____.

a. Box
b. Jug
c. Blend
d. Ren

Answer can be found on Page 960 in the Carpentry and Building Construction book.

15. To paint window trim, what brush should be used?

a. 1” utility brush
b. 1-1/2” sash brush

c. 3” sash brush
d. Foam brush

Answer can be found on Page 967 in the Carpentry and Building Construction book.

16. When painting a raised panel door, paint from the center out, and paint the rails before the stiles.
a. True
b. False

Answer can be found on Page 991 in the Carpentry and Building Construction book.

17. Ceramic tile is classified according to its permeability.
a. True
b. False

Answer can be found on Page 991 in the Carpentry and Building Construction book.

18. The four types of tile are non-vitreous, semi-vitreous, vitreous and _____.
a. Super-vitreous
b. Solid
c. Impervious
d. Opaque

Answer can be found on Page 992 in the Carpentry and Building Construction book.

19. Tile that are made to provide the correct spacing when laid are called _____.
a. Barbed
b. Lugged
c. Jointed
d. Tipped

Answer can be found on Page 993 in the Carpentry and Building Construction book.

20. What ceramic tile adhesive is the least expensive and easiest to use?

a. Mastic
b. Thin set
c. Dry set
d. Quick bond

↑**TOP OF PAGE**

Answers to Interior and Exterior Finishing Review

1. a
2. a
3. b
4. b
5. c
6. b
7. d
8. a
9. b
10. b
11. b
12. a
13. c
14. a
15. b
16. a
17. a
18. c
19. b
20. a

Overview of Building Trades

SPECIALTIES

MIOSHA-STD-1316 (11/05)
3 Pages

DEPARTMENT OF LABOR & ECONOMIC GROWTH

DIRECTOR'S OFFICE

CONSTRUCTION SAFETY STANDARDS

Filed with the Secretary of State on August 31, 1976 (as amended March 6, 1981)
(as amended September 3, 1996) (**as amended December 27, 2000**)

These rules take effect 7 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 19 and 21 of 1974 PA 154 and Executive Reorganization Order No. 1996-2, MCL 408.1019, 408.1021, and 445.2001)

R 408.42023 and R 408.42031 of the Michigan Administrative Code are amended as follows:

Visit our web site at: www.michigan.gov/mioshastandards

PART 20. DEMOLITION

TABLE OF CONTENTS

R 408.42001 Scope.

Rule 2001. This part pertains to the demolition of structures by manual or mechanical means and to the safeguarding of the employees of this operation.

R 408.42023 Definitions.

Rule 2023. (1) "Balling" means to demolish by mechanically swinging a weighted ball.

(2) "Clamming" means to demolish by use of a clam bucket.

(3) "Competent person" means a person who is experienced and capable of identifying an existing or potential hazard in surroundings, or under working conditions, that are hazardous or dangerous to an employee and who has the authority and knowledge to take prompt corrective measures to eliminate the hazards.

(4) "Demolition" means to dismantle, tear down, or raze.

(5) "Hazardous substance" means a substance that is toxic, corrosive, a strong sensitizer, flammable, or explosive.

(6) "Manual demolition" means stripping or demolition by hand labor.

(7) "Mechanical demolition" means demolition by powered equipment other than hand-held tools.

R 408.42031 Demolition generally.

Rule 2031. (1) Before the start of a demolition operation, an employer shall ensure that all of the following are done:

(a) An engineering survey of the structure and equipment is conducted by a competent person knowledgeable in demolition to determine all of the following:

(i) The condition of the foundation, roof, walls, and floors.

(ii) Whether any adjacent structure will be affected by the demolition.

(iii) The utility service entering the building.

(iv) Any other conditions and equipment affecting the safety of an employee.

(b) An employer shall ensure that there is a written report of the survey at the field office until the completion of the job. The report shall include information such as the name of the person conducting the survey, date of the survey, and hazardous substances and dangerous conditions found and their location. In an emergency situation, a survey is not required. If a field office does not exist at the demolition site, then an employer shall file the written report of the survey at the employer's main office.

(c) An employer shall inform utility companies of the planned demolition. An employer shall ensure that utility services are shut off, capped, or otherwise protected from damage, except as specified in subrule (2) of this rule.

(d) An employer shall ensure that glazed sash and doors and other glass that might cause an injury shall be protected or removed before demolition starts.

(2) During demolition, an existing standpipe system shall remain in service as long as possible, and any sprinkler or standpipe system in a portion of a

PAGE TWO:

structure that is not subject to demolition shall remain in service.

(3) If an employee is required to work in a structure that has been damaged by fire, flood, or explosion, then an employer shall ensure that the affected walls and floors are shored or braced before manual demolition starts.

(4) If an area or item, such as a pipe, tank, or bin, is known or suspected to contain a hazardous substance, then an employer shall ensure that testing is performed and the hazard eliminated before demolition is permitted to begin.

(5) An employer shall ensure that manual demolition of structural components starts at the top of the structure and proceeds downward so that each level is completely dropped before the next lower wall and floor is dropped, except that if a connection portion is a different level, then that portion may be removed first. This requirement does not prohibit the cutting of a floor for the removal of materials if the requirements of R 408.42044 are complied with.

(6) An employer shall ensure that an employee shall not be exposed to weather conditions during demolition work if weather conditions constitute a hazard.

(7) During manual demolition of a structure of skeleton steel construction, the steel framing may be left in place, but an employer shall ensure that all structural supports are cleared of loose material as the demolition proceeds downward.

(8) An employer shall ensure that an employee is not permitted to work on a floor below a floor opening when demolition is conducted on the upper level, unless the employee is protected by a solid barricade not less than 42 inches high and located not less than 6 feet back from the projected edge of the opening above.

(9) During demolition, an employer or his or her designated representative shall make daily inspections to detect hazards and unsafe conditions. An employer shall ensure that an employee is not permitted to work where hazards exist until the hazards are corrected by shoring, bracing, or other effective means.

R 408.42032 Guarding floor and wall openings.

Rule 2032. The provisions of Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code, shall be complied with for all portions of the structure where there is employee exposure to the conditions covered by that part.

R 408.42033 Means of egress.

Rule 2033. (1) When an employee is required to be inside a structure being demolished, only a means of egress designated by the employer shall be used and maintained. All other means of egress shall be closed off.

(2) The means of egress shall be free of hazards. During manual demolition, the means of egress shall be supplied with an illumination intensity of not less than 10 candlepower.

(3) A means of egress shall be guarded to protect an employee from falling material.

(4) An employee entrance to a multistory structure to be demolished shall be protected by a roof canopy for a distance of not less than 8 feet from the structure. The canopy shall be not less than 1 foot wider on each side than the entrance and shall be capable of sustaining a load of 150 pounds per square foot.

R 408.42034 Material chutes and drops.

Rule 2034. (1) The area onto and through which material is to be dropped shall be completely enclosed with barricades not less than 42 inches high and not less than 6 feet back from the opening and the area receiving the material. Signs warning of the hazard of falling materials shall be posted on the barricades at each level containing the barricades.

(2) Where material is dropped through more than 1 level, the opening shall be enclosed between the upper and lower levels, an enclosed chute shall be provided, or the intermediate levels shall be barricaded as prescribed in subrule (1) of this rule. If the drop is more than 40 feet inside the building, only an enclosed opening or chute shall be used. The chute or enclosure shall extend through the ceiling of the receiving level.

(3) A material chute shall be constructed to withstand any impact load imposed on it without failure.

(4) A material chute, or section thereof, at an angle of more than 45 degrees from the horizontal shall be entirely enclosed, except for an opening equipped with a closure at or about each floor level for insertion of materials. The opening shall not be more than 48 inches in height measured along the wall of the chute. At all stories below the top floor, the openings shall be kept closed when not in use. The chute shall fit the floor or wall opening or the open space shall be closed.

(5) Where material is dumped from mechanical equipment or a wheelbarrow, a toeboard or bumper not less than 4 inches thick by 6 inches high nominal size secured to the floor shall be provided at each material chute opening.

(6) Where the drop is more than 20 feet outside the exterior of the building, a chute as prescribed in subrules (3) to (5) of this rule, shall be used and shall extend to within 8 feet of the lower level.

(7) Removal of material, barricades, and chutes shall not be permitted until material handling by use of a chute ceases.

R 408.42041 Removal of chimneys, stacks, and walls.

Rule 2041. (1) During manual demolition, a wall or ceiling shall not be permitted to fall on a floor of a building unless the floor is capable of sustaining the impact.

(2) A chimney, stack, or wall shall not be permitted to stand alone without lateral bracing unless it can withstand the force of the wind and other uncontrolled forces. A chimney, stack, or wall shall be left in a stable condition at the end of each shift.

(3) During manual demolition, a wall serving as a retaining wall to support earth shall not be demolished until the load against the wall has been removed.

(4) A wall serving as a retaining wall for debris shall be capable of supporting the imposed load.

(5) A wall serving as a bearing wall for an adjoining structure shall not be demolished until the adjoining structure has been underpinned.

(6) The materials from a brick or masonry chimney or stack that is manually demolished shall be dropped inside the chimney or stack, unless an area around the chimney or stack that is equal in radius to 1/4 the height can be sealed off by a guardrail or

PAGE THREE:

barricade to prevent employee entry during the drop operation. If material is dropped inside the chimney or stack, any opening shall be closed or barricaded when material is being dropped.

(7) Safety access to and from the top of the chimney or stack shall be provided during manual demolition.

(8) Safety belts, lanyards, and lifelines, as prescribed in Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code, shall be used to protect an employee on the chimney or stack during manual demolition.

R 408.42043 Removal of structural steel.

Rule 2043. (1) During manual demolition, structural steel shall be removed column length by column length and tier by tier without overstressing any member.

(2) Scaffolds, as prescribed in Part 12. Scaffolds and Scaffold Platforms, being R 408.41201 et seq. of the Michigan Administrative Code, shall be provided for the employee to stand on while removing the structural steel or else the personal protective devices as prescribed in R 408.42041(8) shall be worn and used.

(3) Structural steel members shall be lowered from an upper level by mechanical means.

R 408.42044 Manual removal of ceiling and floor systems.

Rule 2044. (1) A floor upon or above which an employee is working and which will be weakened by manual demolition shall be shored to support the intended load.

(2) An opening that is cut into a floor for disposal of materials shall not be more than 25% of the total floor area, unless the lateral supports of the removed flooring remain in place.

(3) An opening that is cut into a floor shall extend the full span of the floor between supports.

(4) Before a floor is demolished, debris and other material shall be removed from the area and adjacent areas for a distance of not less than 20 feet.

(5) Before demolishing a floor arch, debris and other material shall be removed from the arch and other adjacent floor area. Planks that are not less than 2 inches by 10 inches in cross section, full size undressed, shall be provided for, and used by, an employee to stand on while breaking down a floor arch between beams. The planks shall be located so as to provide a safe support for the workmen if the arch between the beams collapses. The open space between planks shall not be more than 16 inches.

(6) A safe walkway, not less than 18 inches wide, formed of planks not less than 2 inches thick if wood, or of equivalent strength if metal, shall be provided for, and used by, employees when necessary to enable them to reach any point without walking upon exposed beams.

(7) Planks shall be laid together over solid bearings with the ends overlapping at least 1 foot.

(8) A floor arch to an elevation of not more than 25 feet above grade may be removed to provide storage area for debris, if the removal does not endanger the stability of the structure.

R 408.42045 Mechanical demolition.

Rule 2045. (1) Mechanical equipment shall not be used on a floor or other working surface unless the floor or surface is capable of supporting the imposed load of the equipment and the anticipated material loads.

(2) Equipment used in mechanical demolition shall comply with both of the following:

(a) It shall only be operated by a qualified and authorized employee.

(b) It shall meet the requirements prescribed in the applicable rules of Part 10. Lifting and Digging Equipment, and Part 13. Mobile Equipment, being R 408.41001 et seq. and R 408.41301 et seq. of the Michigan Administrative Code.

(3) A floor or wall opening shall have curbs or stop logs, as prescribed in R 408.42034 to prevent mechanical equipment from running over the edge.

(4) Only those employees necessary to the operation of mechanical demolition equipment shall be permitted in the demolition area at any time.

(5) The weight of a demolition ball shall not be more than 50% of the crane's rated load based on the boom length and the maximum angle of operation that the ball will be used, or the weight shall not be more than 25% of the nominal breaking strength of the line and connection by which it is suspended, whichever is the lesser.

(6) The crane boom and load line shall be as short as possible to accomplish the job.

(7) The ball shall be positively connected to the load line with a swivel connector to prevent accidental disconnection and to prevent twisting of the line.

(8) When it is necessary to restrict the swing of a ball, a drag line or tag line between the ball and the crane shall be provided.

(9) Roof cornices and other ornamental stonework shall be removed before pulling a wall over, except when balling or clamming.

R 408.42046 Demolition by use of explosives.

Rule 2046. (1) Explosives handled, transported, stored, and used in demolition shall be as prescribed in Part 27. Blasting and Use of Explosives, being R 408.42701 et seq. of the Michigan Administrative Code.

(2) Before firing of the explosive blast, employers and employees shall be removed from the area that might be affected by the blast.

R 408.42047 Storage of debris.

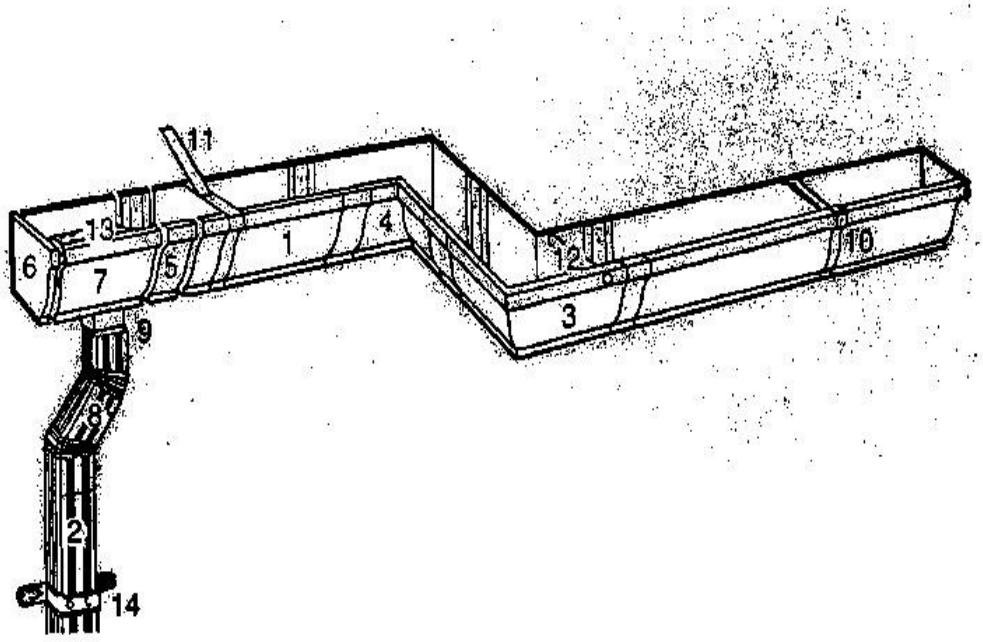
Rule 2047. (1) Storage of debris or salvaged material on a floor shall not exceed the allowable floor load.

(2) Storage space into which material is placed shall be blocked off by a barricade or wall when hazardous to an employee, except for an opening used to place or remove the material. The opening to the storage space shall be kept closed at all times when not in use.

(3) When mechanical equipment is used to place or remove stored material, all unnecessary employees shall be removed from the area.

(4) In a building having wooden floor construction, the flooring boards may be removed from not more than 1 floor above grade to provide storage space for debris, if falling material is not permitted to endanger the stability of the structure.

Metal Gutter Systems



KEY	DESCRIPTION	KEY	DESCRIPTION
1	5" K GUTTER	9	K OUTLET TUBE (With Flange)
2	3" SQUARE CORRUGATED DOWNSPOUT	10	5" K FASCIA HANGER
3	5" K MITER (Outside)	11	5" K STRAP HANGER
4	5" K MITER (Inside)	12	7" SPIKE (Aluminum) 5" FERRULE (Aluminum)
5	5" K SLIP JOINT CONNECTOR	13	5" K STRAINER
6	5" K END CAP LEFT OR RIGHT	14	3" PIPE BAND (Ornamental)

SPECIALTIES REVIEW QUESTIONS

R408.42031 Demolition generally

1. Before the start of demolition, the employer shall ensure that utility services have been shut off, capped or otherwise protected from damage.

a. True
b. False

R408.42031 Demolition generally

2. An employer shall ensure that an employee is not permitted to work on a floor below a floor opening when demolition is conducted on the upper level unless the employee is protected by a solid barricade not less than _____ high and located not less than 6 feet back from the projected edge of the opening above.

a. 36"
b. 38"
c. 40"
d. 42"

R408.42033 Means of egress

3. How many means of egress shall be provided for employees working inside a building being demolished?

a. 1
b. 2
c. 3
d. 4

R408.42034 Material chutes and drops

4. At what angle from horizontal are material chutes required to be completely enclosed?

a. 30 degrees
b. 45 degrees
c. 60 degrees
d. 65 degrees

R408.42034 Material chutes and drops

5. When material is being dumped in a material chute by use of a wheelbarrow or other mechanical equipment, a toe board not less than 4” thick and _____ high nominal size secured to the floor must be provided at each chute.

a. 2"
b. 4"
c. 6"
d. 8"

R408.42034 Material chutes and drops

6. At what drop height for material removal are material chutes required?

a. 10'
b. 15'
c. 16'
d. 20'

NOTE: the material chute shall extend to within 8’ of the lower level.

R408.42041 Removal of chimneys, stacks, and walls

7. During manual demolition, a wall or ceiling shall not be permitted to fall on a floor of a building unless the floor is capable of sustaining the impact.

a. True
b. False

R408.42044 Manual removal of ceiling and floor

8. An opening that is cut into a floor for disposal of materials shall not be more than _____ of the total floor area unless the lateral supports of the removed flooring remain in place.

a. 15%
b. 20%
c. 25%
d. 30%

Answer found in the Michigan Residential Code Book, Appendix, Code 102

9. What is the deepest the water can be in a swimming pool that does not have a fence surrounding it.

a. 1 foot
b. 2 feet
c. 3 feet

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

10. The space between the wires of a chain link fence (without slats) around a swimming pool must be not more than:

a. 2 ¼”
b. 2 ½”
c. 1”
d. 4”

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

11. When slats are attached at the top and bottom of a chain link fence around a swimming pool, what is the maximum size opening allowed by code?

a. 1 ½”
b. 1 ¾”
c. 2”
d. 2 ¼

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

12. Pedestrian access gates must open outward away from a pool, must be self-closing and self-latching. The latch location shall be on the pool side of the gate a minimum of _____ below the top of the gate (so child cannot reach over top and open gate).

a. 2"
b. 3"
c. 4"
d. 6"

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

13. A solid masonry barrier for a swimming pool shall not contain indentations or protrusions except for normal construction tolerances and tooled masonry joints.

a. True
b. False

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

14. Opening in the barrier for a swimming pool shall not allow the passage of a _____ sphere.

a. 4”
b. 4-1/2”
c. 5”
d. 6”

Answer found in the Michigan Residential Code Book, Appendix G, Code 105.2

15. The maximum vertical distance between grade and the bottom of a pool barrier shall be _____.

a. 1”
b. 2”
c. 3”
d. 4”

↑TOP OF PAGE

Answers to Specialties Review

1. a
2. d
3. a
4. b
5. c
6. d
7. a
8. c
9. b

10. a
11. b
12. b
13. a
14. a
15. b

Overview of Building Trades

SPECIALTIES

MIOSHA-STD-1316 (11/05)
3 Pages

DEPARTMENT OF LABOR & ECONOMIC GROWTH

DIRECTOR'S OFFICE

CONSTRUCTION SAFETY STANDARDS

Filed with the Secretary of State on August 31, 1976 (as amended March 6, 1981)
(as amended September 3, 1996) (**as amended December 27, 2000**)

These rules take effect 7 days after filing with the Secretary of State

(By authority conferred on the director of the department of consumer and industry services by sections 19 and 21 of 1974 PA 154 and Executive Reorganization Order No. 1996-2, MCL 408.1019, 408.1021, and 445.2001)

R 408.42023 and R 408.42031 of the Michigan Administrative Code are amended as follows:

Visit our web site at: www.michigan.gov/mioshastandards

PART 20. DEMOLITION

TABLE OF CONTENTS

R 408.42001 Scope.

Rule 2001. This part pertains to the demolition of structures by manual or mechanical means and to the safeguarding of the employees of this operation.

R 408.42023 Definitions.

Rule 2023. (1) "Balling" means to demolish by mechanically swinging a weighted ball.

(2) "Clamming" means to demolish by use of a clam bucket.

(3) "Competent person" means a person who is experienced and capable of identifying an existing or potential hazard in surroundings, or under working conditions, that are hazardous or dangerous to an employee and who has the authority and knowledge to take prompt corrective measures to eliminate the hazards.

(4) "Demolition" means to dismantle, tear down, or raze.

(5) "Hazardous substance" means a substance that is toxic, corrosive, a strong sensitizer, flammable, or explosive.

(6) "Manual demolition" means stripping or demolition by hand labor.

(7) "Mechanical demolition" means demolition by powered equipment other than hand-held tools.

R 408.42031 Demolition generally.

Rule 2031. (1) Before the start of a demolition operation, an employer shall ensure that all of the following are done:

(a) An engineering survey of the structure and equipment is conducted by a competent person knowledgeable in demolition to determine all of the following:

(i) The condition of the foundation, roof, walls, and floors.

(ii) Whether any adjacent structure will be affected by the demolition.

(iii) The utility service entering the building.

(iv) Any other conditions and equipment affecting the safety of an employee.

(b) An employer shall ensure that there is a written report of the survey at the field office until the completion of the job. The report shall include information such as the name of the person conducting the survey, date of the survey, and hazardous substances and dangerous conditions found and their location. In an emergency situation, a survey is not required. If a field office does not exist at the demolition site, then an employer shall file the written report of the survey at the employer's main office.

(c) An employer shall inform utility companies of the planned demolition. An employer shall ensure that utility services are shut off, capped, or otherwise protected from damage, except as specified in subrule (2) of this rule.

(d) An employer shall ensure that glazed sash and doors and other glass that might cause an injury shall be protected or removed before demolition starts.

(2) During demolition, an existing standpipe system shall remain in service as long as possible, and any sprinkler or standpipe system in a portion of a

PAGE TWO:

structure that is not subject to demolition shall remain in service.

(3) If an employee is required to work in a structure that has been damaged by fire, flood, or explosion, then an employer shall ensure that the affected walls and floors are shored or braced before manual demolition starts.

(4) If an area or item, such as a pipe, tank, or bin, is known or suspected to contain a hazardous substance, then an employer shall ensure that testing is performed and the hazard eliminated before demolition is permitted to begin.

(5) An employer shall ensure that manual demolition of structural components starts at the top of the structure and proceeds downward so that each level is completely dropped before the next lower wall and floor is dropped, except that if a connection portion is a different level, then that portion may be removed first. This requirement does not prohibit the cutting of a floor for the removal of materials if the requirements of R 408.42044 are complied with.

(6) An employer shall ensure that an employee shall not be exposed to weather conditions during demolition work if weather conditions constitute a hazard.

(7) During manual demolition of a structure of skeleton steel construction, the steel framing may be left in place, but an employer shall ensure that all structural supports are cleared of loose material as the demolition proceeds downward.

(8) An employer shall ensure that an employee is not permitted to work on a floor below a floor opening when demolition is conducted on the upper level, unless the employee is protected by a solid barricade not less than 42 inches high and located not less than 6 feet back from the projected edge of the opening above.

(9) During demolition, an employer or his or her designated representative shall make daily inspections to detect hazards and unsafe conditions. An employer shall ensure that an employee is not permitted to work where hazards exist until the hazards are corrected by shoring, bracing, or other effective means.

R 408.42032 Guarding floor and wall openings.

Rule 2032. The provisions of Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code, shall be complied with for all portions of the structure where there is employee exposure to the conditions covered by that part.

R 408.42033 Means of egress.

Rule 2033. (1) When an employee is required to be inside a structure being demolished, only a means of egress designated by the employer shall be used and maintained. All other means of egress shall be closed off.

(2) The means of egress shall be free of hazards. During manual demolition, the means of egress shall be supplied with an illumination intensity of not less than 10 candlepower.

(3) A means of egress shall be guarded to protect an employee from falling material.

(4) An employee entrance to a multistory structure to be demolished shall be protected by a roof canopy for a distance of not less than 8 feet from the structure. The canopy shall be not less than 1 foot wider on each side than the entrance and shall be capable of sustaining a load of 150 pounds per square foot.

R 408.42034 Material chutes and drops.

Rule 2034. (1) The area onto and through which material is to be dropped shall be completely enclosed with barricades not less than 42 inches high and not less than 6 feet back from the opening and the area receiving the material. Signs warning of the hazard of falling materials shall be posted on the barricades at each level containing the barricades.

(2) Where material is dropped through more than 1 level, the opening shall be enclosed between the upper and lower levels, an enclosed chute shall be provided, or the intermediate levels shall be barricaded as prescribed in subrule (1) of this rule. If the drop is more than 40 feet inside the building, only an enclosed opening or chute shall be used. The chute or enclosure shall extend through the ceiling of the receiving level.

(3) A material chute shall be constructed to withstand any impact load imposed on it without failure.

(4) A material chute, or section thereof, at an angle of more than 45 degrees from the horizontal shall be entirely enclosed, except for an opening equipped with a closure at or about each floor level for insertion of materials. The opening shall not be more than 48 inches in height measured along the wall of the chute. At all stories below the top floor, the openings shall be kept closed when not in use. The chute shall fit the floor or wall opening or the open space shall be closed.

(5) Where material is dumped from mechanical equipment or a wheelbarrow, a toeboard or bumper not less than 4 inches thick by 6 inches high nominal size secured to the floor shall be provided at each material chute opening.

(6) Where the drop is more than 20 feet outside the exterior of the building, a chute as prescribed in subrules (3) to (5) of this rule, shall be used and shall extend to within 8 feet of the lower level.

(7) Removal of material, barricades, and chutes shall not be permitted until material handling by use of a chute ceases.

R 408.42041 Removal of chimneys, stacks, and walls.

Rule 2041. (1) During manual demolition, a wall or ceiling shall not be permitted to fall on a floor of a building unless the floor is capable of sustaining the impact.

(2) A chimney, stack, or wall shall not be permitted to stand alone without lateral bracing unless it can withstand the force of the wind and other uncontrolled forces. A chimney, stack, or wall shall be left in a stable condition at the end of each shift.

(3) During manual demolition, a wall serving as a retaining wall to support earth shall not be demolished until the load against the wall has been removed.

(4) A wall serving as a retaining wall for debris shall be capable of supporting the imposed load.

(5) A wall serving as a bearing wall for an adjoining structure shall not be demolished until the adjoining structure has been underpinned.

(6) The materials from a brick or masonry chimney or stack that is manually demolished shall be dropped inside the chimney or stack, unless an area around the chimney or stack that is equal in radius to 1/4 the height can be sealed off by a guardrail or

PAGE THREE:

barricade to prevent employee entry during the drop operation. If material is dropped inside the chimney or stack, any opening shall be closed or barricaded when material is being dropped.

(7) Safety access to and from the top of the chimney or stack shall be provided during manual demolition.

(8) Safety belts, lanyards, and lifelines, as prescribed in Part 45. Fall Protection, being R 408.44501 et seq. of the Michigan Administrative Code, shall be used to protect an employee on the chimney or stack during manual demolition.

R 408.42043 Removal of structural steel.

Rule 2043. (1) During manual demolition, structural steel shall be removed column length by column length and tier by tier without overstressing any member.

(2) Scaffolds, as prescribed in Part 12. Scaffolds and Scaffold Platforms, being R 408.41201 et seq. of the Michigan Administrative Code, shall be provided for the employee to stand on while removing the structural steel or else the personal protective devices as prescribed in R 408.42041(8) shall be worn and used.

(3) Structural steel members shall be lowered from an upper level by mechanical means.

R 408.42044 Manual removal of ceiling and floor systems.

Rule 2044. (1) A floor upon or above which an employee is working and which will be weakened by manual demolition shall be shored to support the intended load.

(2) An opening that is cut into a floor for disposal of materials shall not be more than 25% of the total floor area, unless the lateral supports of the removed flooring remain in place.

(3) An opening that is cut into a floor shall extend the full span of the floor between supports.

(4) Before a floor is demolished, debris and other material shall be removed from the area and adjacent areas for a distance of not less than 20 feet.

(5) Before demolishing a floor arch, debris and other material shall be removed from the arch and other adjacent floor area. Planks that are not less than 2 inches by 10 inches in cross section, full size undressed, shall be provided for, and used by, an employee to stand on while breaking down a floor arch between beams. The planks shall be located so as to provide a safe support for the workmen if the arch between the beams collapses. The open space between planks shall not be more than 16 inches.

(6) A safe walkway, not less than 18 inches wide, formed of planks not less than 2 inches thick if wood, or of equivalent strength if metal, shall be provided for, and used by, employees when necessary to enable them to reach any point without walking upon exposed beams.

(7) Planks shall be laid together over solid bearings with the ends overlapping at least 1 foot.

(8) A floor arch to an elevation of not more than 25 feet above grade may be removed to provide storage area for debris, if the removal does not endanger the stability of the structure.

R 408.42045 Mechanical demolition.

Rule 2045. (1) Mechanical equipment shall not be used on a floor or other working surface unless the floor or surface is capable of supporting the imposed load of the equipment and the anticipated material loads.

(2) Equipment used in mechanical demolition shall comply with both of the following:

(a) It shall only be operated by a qualified and authorized employee.

(b) It shall meet the requirements prescribed in the applicable rules of Part 10. Lifting and Digging Equipment, and Part 13. Mobile Equipment, being R 408.41001 et seq. and R 408.41301 et seq. of the Michigan Administrative Code.

(3) A floor or wall opening shall have curbs or stop logs, as prescribed in R 408.42034 to prevent mechanical equipment from running over the edge.

(4) Only those employees necessary to the operation of mechanical demolition equipment shall be permitted in the demolition area at any time.

(5) The weight of a demolition ball shall not be more than 50% of the crane's rated load based on the boom length and the maximum angle of operation that the ball will be used, or the weight shall not be more than 25% of the nominal breaking strength of the line and connection by which it is suspended, whichever is the lesser.

(6) The crane boom and load line shall be as short as possible to accomplish the job.

(7) The ball shall be positively connected to the load line with a swivel connector to prevent accidental disconnection and to prevent twisting of the line.

(8) When it is necessary to restrict the swing of a ball, a drag line or tag line between the ball and the crane shall be provided.

(9) Roof cornices and other ornamental stonework shall be removed before pulling a wall over, except when balling or clamming.

R 408.42046 Demolition by use of explosives.

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(2) Before firing of the explosive blast, employers and employees shall be removed from the area that might be affected by the blast.

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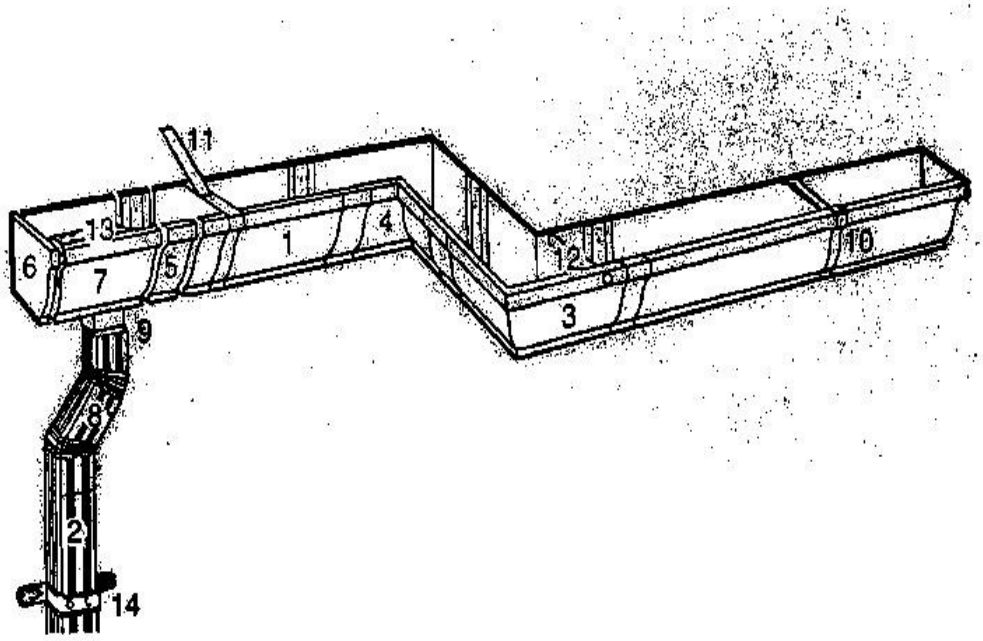
(3) When mechanical equipment is used to place or remove stored material, all unnecessary employees shall be removed from the area.

(4) In a building having wooden floor construction, the flooring boards may be removed from not more than 1 floor above grade to provide storage space for debris, if falling material is not permitted to endanger the stability of the structure.

Metal Gutter Systems



KEY	DESCRIPTION	KEY	DESCRIPTION
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6	5" K END CAP LEFT OR RIGHT	14	3" PIPE BAND (Ornamental)

Overview of Building Trades

Features of a Blueprint

IT IS VERY IMPORTANT THAT YOU REVIEW THE FOLLOWING INFORMATION WHEN PREPARING FOR THE TRADES EXAM.

Floor Plan - Sectional view of each floor taken on a horizontal plane above the floor. The plane may be offset if the building involves a split level floor. The floor plan shows the following features:

- Floor finishes
- Walls
- Doors (sizes and type)
- Stairways

- Fireplaces
- Built-in cabinets
- Mechanical equipment
- Windows (size and type)
- Room dimensions

In a floor plan, there is a separate drawing for each floor, including the basement. More detailed drawings can be referenced from the floor plan drawings.

Foundation Plan - View of the structural members of the building that transfer the weight of the building to the earth. The foundation plan shows the following features:

- Footings. Dimensions are determined by soil type and weight of the building. Footings are recognized by hidden dashes lines.
- Foundation Walls (type and size). Foundation walls are recognized by solid lines.
- Materials used (symbols).
- Size and placement of steel.
- Placement of column footings.
- Anchoring details for framing.
- Waterproofing details.

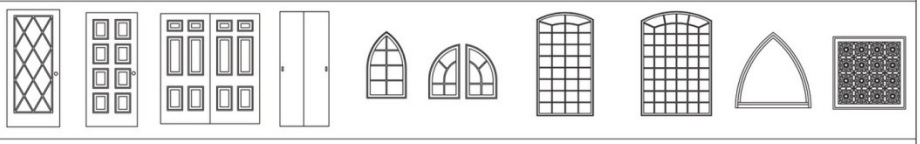
Section Drawings - View of the construction detail provided by an imaginary cut to show the inside of a wall, root structure or other part of the building. The section drawing identifies construction materials and procedures used in building the structure. This drawing provides more information on the actual materials used than any other drawing.

Elevation Drawings - View of the exterior features of a building. A minimum of four elevations are needed to show the design of all sides of the structure. More drawings are needed for unusual designs.

Elevations of a building interior are called *Interior Elevations*.

Schedules - Door and window schedules give the number and size of all doors and windows in the building. Units listed in the schedule are referenced to the plan view with a letter or number. Some architects provide the rough opening size in the schedules to speed construction and ensure a correct fit. If rough opening sizes for doors and windows are not provided, the construction worker must calculate them.

Door & Window Schedule



Symbol	Quantity	Manufacturer	Height	Width	Material	Remarks
A	5	Custom	6'-0"	3'-0"	Wood, Iron, Glass	
B	22	Geldwin Doors	6'-0"	3'-0"	Wood	
C	12	Custom	6'-0"	6'-0"	Wood	
D	1	Custom	6'-0"	5'-0"	Wood	
E	8	Anderson Windows	3'-0"	2'-4"	Wood, Iron, Glass	
F	10	Anderson Windows	2'-4"	4'-0"	Wood, Iron, Glass	
G	2	Anderson Windows	5'-0"	4'-0"	Wood, Iron, Glass	
H	4	Anderson Windows	5'-0"	5'-0"	Wood, Iron, Glass	
I	2	Anderson Windows	1'-6"	3'-8"	Wood, Iron, Glass	
J	2	Anderson Windows	2'-4"	3'-8"	Wood, Iron, Glass	Musharabia Screen

Measuring Blueprints--You may also need to be able to use a ruler to measure a blueprint using a particular ratio--1/8" to 1 foot for example. Drawings in a set of blueprints are drawn to scale--for example 1/4" or 1/8" equals 1 foot in actual size. The simplest way to translate these ratios is to

measure the plan feature with a ruler and convert the given ratio to your calculation. For example, if the plan gives a ratio of 1/8"=1ft. and you measure 3 inches from point to point, the actual dimension is 24 ft. (8 x 3=24) You may need to double check the scale against a known dimension, i.e. a wall labeled at 10 feet (in a blueprint with a 1/8" to 1 ft. ratio) should read 1-1/4" on the ruler. This is important because drawings that are copied can be reduced or enlarged--it's important to be aware of that possibility. Most builders will say the easiest and surest way to get an accurate measurement is to go ahead and purchase an architect's scale, which can be found for a reasonalbe price at most office supply stores. See pages **44-45 in the Carpentry and Building Construction** book.

We highly recommend that you open the PDF link below for a clearer view of the following plans. Once you have the PDF opened, increase the zoom percentage to enlarge the picture. The PDF will open in a separate screen which allows you to refer to the plan while answering the quiz questions. You may also find it helpful to print a copy of the

plans.

/webclass/UploadedLesson/House Plan Final.pdf

NOTE:
RENDERINGS ARE NOT TO SCALE; ALL RENDERINGS ARE FOR ARTISTIC DEPICTION ONLY. PLAN UPDATES MAY NOT BE REFLECTED IN RENDERINGS. RENDERINGS SHALL NOT BE USED FOR CONSTRUCTION.

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Contact: Scott Corbat

Project:
Builders License Training Institute
licensetobuild.com
1.800.727.7104

Sheet Title:
RENDERING

#	Date	Issue Description
1	3/6/2012	Construction Final
2		

Scale: 1/8" = 1

Sheet # 1

CARPENTRY:

SAWN LUMBER DESIGN IS BASED ON THE NATIONAL DESIGN SPECIFICATION, LATEST EDITION. SAWN LUMBER SHALL CONFORM TO WEST COAST LUMBER INSPECTION BUREAU OR WESTERN WOOD PRODUCTS ASSOCIATION GRADING RULES. ALL LUMBER NOT SPECIFICALLY NOTED TO BE D.F. #2 OR BETTER. ALL WOOD IN PERMANENT CONTACT WITH CONCRETE OR CMU SHALL BE PRESSURE TREATED UNLESS AN APPROVED BARRIER IS PROVIDED. FRAMING ACCESSORIES AND STRUCTURAL FASTENERS SHALL BE MANUFACTURED BY SIMPSON STRONG-TIE COMPANY (OR ENGINEER APPROVED EQUAL) AND OF THE SIZE AND TYPE SHOWN ON THE DRAWINGS. HANGERS NOT SHOWN SHALL BE SIMPSON HU OF SIZE RECOMMENDED FOR MEMBER. ALL HANGERS AND NAILS IN CONTACT WITH PRESSURE TREATED LUMBER SHALL BE SIMPSON Z-MAX HANGERS OR STAINLESS STEEL. ALL SHEAR WALL SHEATHING NAILS SHALL BE COMMON NAILS. ALL FRAMING NAILS SHALL BE COMMON NAILS. OR HOT DIPPED GALVANIZED BOX NAILS. FRAMING NAILS SHALL BE PER IBC TABLE 2304.9.1 OR IRC TABLE R602.3(1).

PLYWOOD PANELS SHALL CONFORM TO THE REQUIREMENTS OF "U.S. PRODUCT STANDARD PS 1 FOR CONSTRUCTION AND INDUSTRIAL PLYWOOD" OR APA PRP-108 PERFORMANCE STANDARDS. UNLESS NOTED, PANELS SHALL BE APA RATED SHEATHING, EXPOSURE 1, OF THE THICKNESS AND SPAN RATING SHOWN ON THE DRAWINGS. PLYWOOD INSTALLATION SHALL BE IN CONFORMANCE WITH APA RECOMMENDATIONS. ALLOW 1/8" SPACING AT PANELS ENDS AND EDGES, UNLESS OTHERWISE RECOMMENDED BY THE PANEL MANUFACTURER.

ALL ROOF SHEATHING AND SUB-FLOORING SHALL BE INSTALLED WITH FACE GRAIN PERPENDICULAR TO SUPPORTS, EXCEPT AS INDICATED ON THE DRAWINGS. ROOF SHEATHING SHALL EITHER BE BLOCKED, TONGUE-AND-GROOVE, OR HAVE EDGES SUPPORTED BY PLYCLIPS. SHEAR WALL SHEATHING SHALL BE BLOCKED WITH 2X FRAMING AT ALL PANEL EDGES. NAILING NOT SPECIFICALLY IDENTIFIED ON THE DRAWINGS TO CONFORM WITH IRC TABLE R602.3(1).

PROVIDE BRIDGING IN CONFORMANCE WITH THE MANUFACTURERS RECOMMENDATIONS. JOISTS AND BRIDGING SHALL BE CAPABLE OF RESISTING THE WIND UPLIFT NOTED ON THE DRAWINGS. THE JOIST MANUFACTURER SHALL VISIT JOB SITE AS REQUIRED AND VERIFY THE PROPER INSTALLATION OF JOISTS IN WRITING TO THE ARCHITECT/ENGINEER. PREMANUFACTURED WOOD JOIST ALTERNATES WILL BE CONSIDERED, PROVIDED THE ALTERNATE IS COMPATIBLE WITH THE LOAD CAPACITY, STIFFNESS, DIMENSIONAL, AND FIRE RATING REQUIREMENTS OF THE PROJECT, AND IS ICBO APPROVED.

LUMBER SPECIES:
A. POSTS, BEAMS, HEADERS, JOISTS, AND RAFTERS TO BE SPF# 2 OR BETTER

B. SILLS, PLATES BLOCKING, AND BRIDGING TO BE SPF-#2.

C. ALL STUDS TO BE SPF#2 OR BETTER.

D. PLYWOOD SHEATHING SHALL BE AS FOLLOWS:
ROOF SHEATHING SHALL BE 1/2" OSB.
WALL SHEATHING SHALL BE 7/16" OSB.
FLOOR SHEATHING SHALL BE 3/4" T & G INT-APA RATED OSB.

E. 'I' JOISTS SHALL BE MANUFACTURED BY TRUS JOIST OR ENGINEER APPROVED EQUAL.

F. ALL WOOD IN CONTACT WITH CONCRETE SHALL BE PRESSURE TREATED.

ROOF FRAMING / TRUSS NOTES:

TRUSS DRAWING IS FOR ILLUSTRATION ONLY. ALL TRUSSES SHALL BE INSTALLED & BRACED TO MANUFACTURERS DRAWINGS & SPECIFICATIONS.

ALL TRUSSES SHALL CARRY MANUFACTURERS STAMP.

ALL TRUSSES WILL NOT BE FIELD ALTERED WITHOUT PRIOR BUILDING DEPT. APPROVAL OF ENGINEERING CALCULATIONS.

ALL TRUSSES SHALL HAVE DESIGN DETAILS & DRAWINGS ON SITE FOR FRAMING INSPECTION.

ALL CONNECTIONS OF RAFTERS, JACK OR HIP TRUSSES TO MAIN GIRDER TO BE PROVIDED BY TRUSS MANUFACTURER.

ALL ROOF FRAMING 24" O.C.

ALL OVERHANGS 16".

INSTALL POLYISOCYANURATE FOAM TYPE INSULATION AT FLOOR AND PLATE LINES, OPENINGS IN PLATES, CORNER STUD CAVITIES AND AROUND DOOR AND WINDOW ROUGH OPENING CAVITIES.

ATTIC VENTILATION: REQUIRED ABOVE HOUSE.

MIN. SNOW LOAD 50 LBs PER SQUARE FOOT.

WALL HEADERS: (2) 2 X 10 SPF 2 TYP. UNO

ROOF & FLOOR TRUSS MANUFACTURER:

EXTERIOR FINISH NOTES:

EXTERIOR FINISH TO BE DOUBLE 6" VINYL SIDING OVER 7/16 OSB. WINDOW & DOOR TRIM PAINTED MIRATEC. MATERIAL AND COLOR BY OWNER.

DUAL LAYER FIEBERGLASS MAT ASPHALT ALGE RESISTANT ARCHITECTURAL SHINGLES TO MEET OR EXCEED R905.2.4

DECKING TO BE PRESURE TREATED WOOD. FINAL COLOR BY OWNER.

CHIMNEYS ARE DECORATIVE AND PROVIDE FOR VENTING OF GAS FIREPLACES ONLY

DOWNSPOUTS TO BE COLLECTED AND ROOF RUN OFF TO BE DIRECTED AWAY FROM STRUCTURE PER THE SITE PLAN.

FINISH GRADE SHALL SLOPE AWAY FROM STRUCTURE MIN. 6" IN FIRST 10'

RETAINING WALLS AS NECESSARY AND INSTALLED BY LANDSCAPE DESIGN APPROVED BY HOMEOWNER

DOOR AND WINDOW NOTES:

EVERY BEDROOM SHALL BE PROVIDED WITH AN EGRESS WINDOW WITH FINISH SILL HEIGHT NOT GREATER THAN 44" ABOVE THE FINISH FLOOR HEIGHT AND SHALL HAVE A MINIMUM OPENABLE AREA OF 5.7 SQ. FT. EGRESS WINDOWS SHALL NOT HAVE AN OPENABLE AREA LESS THAN 20" WIDE OR 24" HIGH.

INTERIOR DOORS SHALL BE PAINTED. ENTRY DOOR TO BE DEFINED BY HOME OWNER PRIOR ORDERING

DOORS BETWEEN GARAGE AND LIVING AREA SHALL BE 1-3/4" TIGHT FITTING SOLID CORE DOORS

EXTERIOR EXIT DOORS WILL BE 36" MIN. NET CLEAR DOORWAY SHALL BE 32" MIN. DOOR SHALL BE OPENABLE FROM INSIDE WITHOUT THE USE OF A KEY OR ANY SPECIAL KNOWLEDGE OR EFFORT. GLAZING IN DOORS SHALL BE DUAL PANE SAFETY GLASS WITH MIN. U-VALUE OF 0.60

GARAGE DOORS TO BE SECTIONAL, OVERHEAD DOORS

MISCELLANEOUS NOTES:

EACH BEDROOM TO HAVE A MINIMUM WINDOW OPENING OF 5.7 SQ. FT. WITH A MINIMUM WIDTH OF 20 IN. AND A SILL LESS THAN 44" ABOVE FIN. FLR.

ALL GLAZING WITHIN 18 IN. OF THE FLOOR AND/OR WITHIN 24 IN. OF ANY DOOR (REGARDLESS OF WALL PLANE) ARE TO HAVE SAFETY GLAZING. ALL GLAZING WITHIN 60 IN. OF TUB OR SHOWER FLOOR, 60 IN. OF A STAIR LANDING OR GREATER THAN 9 SQUARE FEET ARE TO HAVE SAFETY GLAZING

ALL TUB AND SHOWER ENCLOSURES ARE TO BE GLAZED WITH SAFETY GLASS.

ALL EXTERIOR WINDOWS ARE TO BE DOUBLE GLAZED AND ALL EXTERIOR DOORS ARE TO BE SOLID CORE WITH WEATHERSTRIPPING. PROVIDE 1/2 IN. DEADBOLT LOCKS ON ALL EXTERIOR DOORS, AND LOCKING DEVICES ON ALL DOORS AND WINDOWS WITHIN 10 FT. (VERTICAL) OF GRADE.

PROVIDE ONE SMOKE DETECTOR IN EACH ROOM AND ONE IN EACH CORRIDOR ACCESSING BEDROOMS. CONNECT SMOKE DETECTORS TO HOUSE POWER AND INTER-CONNECT SMOKE DETECTORS TO HOUSE POWER AND INTERCONNECT SO THAT, WHEN ANY ONE IS TRIPPED, THEY ALL WILL SOUND. PROVIDE BATTERY BACKUP FOR ALL UNITS.

PROVIDE COMBUSTION AIR VENTS (W/SCREEN AND BACK DAMPER) FOR GAS FIRE-PLACE AND ANY OTHER APPLIANCES WITH AN OPEN FLAME.

BATHROOMS AND UTILITY ROOMS ARE TO BE VENTED TO THE OUTSIDE WITH A FAN CAPABLE OF PRODUCING A MINIMUM OF 5 AIR EXCHANGES PER HOUR.

RANGE HOODS ARE ALSO TO BE VENTED TO THE OUTSIDE.

ELECTRICAL RECEPTACLES IN BATHROOMS, KITCHENS AND GARAGES SHALL BE G.F.I. OR G.F.I.C. PER NATIONAL ELECTRICAL CODE REQUIREMENTS.

INSULATE ALL ACCESS DOORS/ HATCHES TO CRAWL SPACES AND ATTICS TO THE EQUIVALENT RATING OF THE WALL, FLOOR OR CEILING THROUGH WHICH THEY PENETRATE AND SEAL TO STOP AIR LEAKS

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Sheet # 2

General Notes:

Local Design Criteria Assumptions

1. Ground Snow Load: 50 psf per figure R301.2(5)
2. Wind Speed: 90 mph per figure R301.2(4)
3. Wind Exposure Category: B per R301.2.1.4
4. Seismic Category: A per figure R301.2(2)
5. Weathering: Severe per figure R301.2(3)
6. Frost Line Depth: 42" per R403.1.4
7. Termite: Slight to Moderate per figure R301.2(6)
8. Winter Design Temp.: 0℉ per figure R301.2(1)
9. Ice Shield Under-Layment: Yes per R905.2.7.1
10. Flood Hazards: N/A
11. Air Freezing Index: 1000 – 1500 per figure R403.3(2)
12. Mean Annual Air Temp.: 50℉ per www.ncdc.noaa.gov/fpsf.html
13. Site Soil Group & Class: Group 1 & Class SP/SM per table R405.1
14. Soil Bearing Capacity: 2000 lbs/sqft per table R401.4.1
15. Climate Zone: 5A

Site Address

1. Premise to be identified per R319

Public Utilities

1. Natural gas, 220V/200A electricity, 4 line telephone, and cable TV are to be underground and installed per the site plan/Main floor, floor plan

Windows

1. All windows must comply with R303, R308, R310, R612, 2009 MUEC 303.1.3, 2009 MUEC 402.3
2. All windows shall meet the following:
   a. Construction: Wood frame and sash
   b. Exterior cladding: Vinyl or Aluminum
   c. Glass: Dual pane, High Performance, Low-E, Insulated
   d. Exterior color: White
   e. Interior color: Pre-finished White
   f. Style: Double hung, Tilt wash
   g. Size and swing: Per plan and schedule
   h. Hardware: Include, color: white
   i. Screens: Include, color: white
   j. Extension jambs: Include, Pre-finished White
3. Top of all windows are to be 80" from floor
4. Extension jambs (if needed) are to be factory applied 6 9/16" jamb width

Doors

Exterior doors

1. All doors must comply with R311, MUEC 303.1.3, 2009 MUEC 402.3
2. All exterior doors shall meet the following:
   a. Construction: Insulated steel
   b. Style: 4 Panel (no glass)
   c. Appearance: Smooth surfaces
   d. Hardware finish Brushed Nickel
   e. Size and swing: Per plan and schedule
   f. Factory finish: Pre-primed
   g. Field finish: 100% acrylic latex paint
   h. Handles Supplied by homeowner
3. Garage to house door must be per R302.5.1
4. Main entrance door (3'-0") is to have two 12" full height glass side lights, on a factory assembly one piece continuous sill.
5. All garage doors shall meet the following:
   a. Construction: Insulated steel
   b. Style: Raised panel (no glass)
   c. Exterior appearance: Textured surface
   d. Size: Per plan and schedule
   e. Factory finish: Pre-finished white
   f. Field finish: None
   g. Opener: Screw drive, 1/2 HP

Interior doors

1. All doors must comply with Section R311
2. All interior passage doors shall meet the following:
   a. Construction: Molded, solid core
   b. Style: 2 Panel
   c. Appearance: Smooth surfaces
   d. Hardware finish Brushed Nickel
   e. Size and swing: Per plan and schedule
   f. Factory finish: Pre-primed
   g. Field finish: White Acrylic Latex paint, semi-gloss
   h. Handles Schlage Georgian Brushed Nickel
3. All interior bi-fold doors shall meet the following:
   a. Construction: Molded, hollow core
   b. Style: 2 Panel
   c. Appearance: Smooth surfaces
   d. Hardware finish Brushed Nickel
   e. Size and swing: Per plan and schedule
   f. Factory finish: Pre-primed
   g. Field finish: White Acrylic Latex paint, semi-gloss
   h. Handles Schlage Georgian Brushed Nickel

Exterior Coverings

1. All siding is to be vinyl double 6" exposure. The siding must comply with R703.1, R703.11, and table R702.3.7
2. All siding shall meet the following:
   a. Type: Lap
   b. Exterior appearance: Cedar wood siding
   c. Exposure: 6"
3. Weather resistive barrier shall be installed per R703, all joints must be taped and all penetration must be sealed to prevent water intrusion and air leakage
4. Flashing shall be installed per R708.3 to prevent water intrusion

Exterior Trim

1. All exterior trim is to be a composite wood material resistant to decay.
2. All exterior trim shall meet the following:
   a. Exterior appearance: Cedar wood siding
   b. Size and exposure: 5/4" x 6" or supplier spec. x 6"
   c. Factory finish: Pre-primed
   d. Field finish: 100% acrylic latex paint
   e. Joint treatment: Caulk all joints
   f. Fastening method: Face nailing
3. All doors and windows shall be wrapped with exterior trim. All outside exterior corners shall have exterior trim.
4. Flashing shall be installed per R708.3 to prevent water intrusion

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Sheet # 3

Interior Trim

1. All interior trim is to be pre-primed paint grade MDF.
2. All interior trim shall meet the following:
   a. Base size: 4 1/4" x 7/16"
   b. Case size: 3 1/4" x 11/16"
   c. Style: Colonial
   d. Factory finish: Pre-primed
   e. Field finish: White Acrylic Latex paint, semi-gloss
   f. Joint treatment: Caulk all joints and nail holes
   g. Fastening method: Face nailing

Smoke and CO Alarms

1. All smoke alarms must comply with Section R314
2. All CO alarms must comply with Section R315
3. All smoke and CO alarms will be interconnected, AC powered with battery back-up
4. See floor plan for alarm locations

Fire blocking

1. All fire blocking must comply with R302.11
2. All fire blocking materials must comply with R302.11.1 and R30211.1.1 thru R302.11.1.3
3. Fire blocking must be provided at the following locations:
   a. In concealed spaces of stud walls and partitions, including furred at the ceiling and floor levels and at 10' intervals both horizontal and vertical.
   b. At all interconnections between horizontal and vertical spaces such as occur at soffits over cabinets, drop ceilings, cove ceilings and similar locations.
   c. In concealed spaces between stair stringers at the top and bottom of the run
   d. At openings around vents, pipes, ducts, chimneys, and fireplaces at ceiling and floor levels with noncombustible materials.

Garage/Driveway/Porch Floors

1. All concrete floors must comply with R309.1, R402.2, R506
2. All garage and porch floors shall be 4" thick slab of minimum 3500psi compressive strength air entrained concrete constructed over a clean sand base course.
3. The driveway portion as specified on the site plan shall be 4" thick slab of minimum 3500psi compressive strength air entrained concrete constructed over a clean sand base course.

Deck and Upper Floor Porch

Deck and upper floor porch shall constructed to meet or exceed American Wood Council, Design for Code Acceptance #6 (DCA 6), Prescriptive Residential Wood Deck Construction Guide

Energy Efficiency

Insulation

1. All insulation must comply with the 2009 MUEC prescriptive approach and Section R316
2. All insulation shall meet the following:
   a. Basement Wall: R-10, 2.5" thick cellulose board
   b. Walkout Basement slab: R-10, 2" thick XPS on interior of frost wall, down 2' - top of XPS cut at 45 degree angle to allow basement floor to meet foundation wall
   c. Wall cavities: R-20, Dense packed dry applied Cellulose.
   d. Flat ceiling cavities: R-49, loose fill Cellulose
   e. Attic hatch: R-38 + R-11 batts, for 24" O.C, securely fastened in place
   f. Fenestrations: U Factor of 0.35 or lower

Air Sealing

1. All air sealing must comply with the 2009 MUEC, Section 402.4
2. Air sealing verification shall be a visual inspection per Section 402.4.2.2
3. Building Envelope, all of the following will be caulked, gasketed, weatherstripped, or otherwise sealed with an air barrier material:
   a. All joints, seams, and penetrations
   b. Window and door rough openings
   c. Utility penetrations
   d. Knee walls
   e. Wall and ceilings separating a garage from a conditioned space
   f. Behind tubs and showers on exterior walls
   g. Attic hatch will sealed with foam rubber weather strip tape per 402.2.3
   h. Fireplace shall have door gasket per 402.4.3
4. All recessed lighting will be of type IC air tight construction

Electrical/Lighting

1. All lighting will be high efficiency per Section 404 of the 2009 MUEC

Mechanical/HVAC

1. 95% efficient natural gas forced air furnace with a 2 stage burner and a variable speed blower
   a. Furnace shall be sized per M1401.3
2. 13 SEER air conditioner
3. A programmable thermostat shall be installed to control HVAC system
4. All duct joist must be sealed with foil peel and stick tape or duct mastic conforming to UL181

Exhaust Fan

1. All exhaust fans must comply with Section R303, Section M1507, MUEC section 403.5, and manufactures installation instructions.
2. All bathroom exhaust fans are to be fan/light combination units with each function switched individually. The exterior color is to be white. The fan is to be rated at 110 CFM or greater, with the exhaust ducting terminated at the exterior of the structure. The fan will have an integrated gravity damper to close the system when on in use.

Electrical Panel Certification

1. A permanent certificate shall be posted on or in the electrical distribution panel per 2009 MUEC Section 401.3

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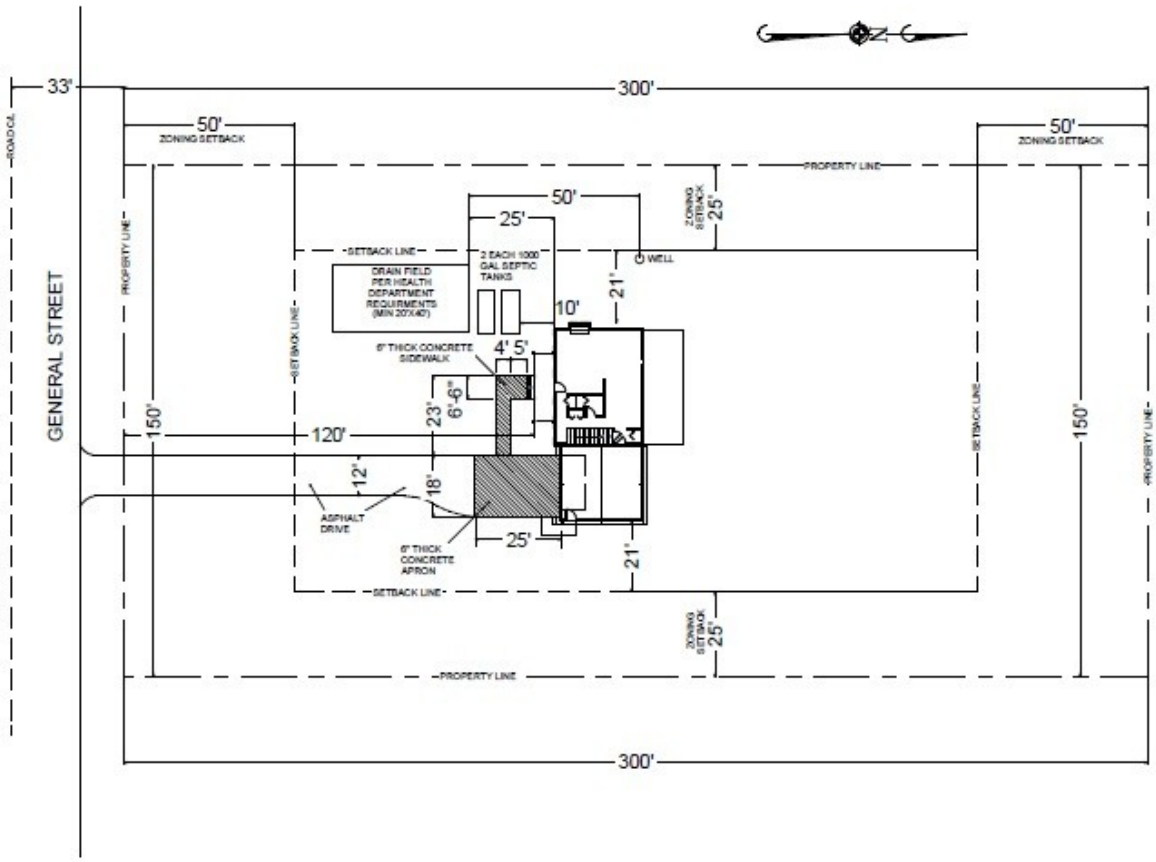

SITE PLAN (SCALE 1" = 40')

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SITE PLAN

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EROSION CONTROL NOTES:

INSTALL SILT FENCE PRIOR TO ANY EXCAVATION OR CONSTRUCTION

MINIMIZE SITE DISTURBANCE BY TIGHT CONTROL OF EXCAVATION LIMITS.

ALL EXPOSED SOIL SHALL BE MULCHED WITH STRAW OR WOOD CHIPS TO MINIMIZE SOIL EROSION. NO SOIL SHALL BE LEFT IN AN EXPOSED CONDITION. IT IS RECOMMENDED THAT THE CONTRACTOR MAINTAIN A STOCKPILE OF THIS MATERIAL ON SITE FOR QUICK APPLICATION.

DISPERSION TRENCHES SHALL OVERFLOW ONTO NATIVE UNDISTURBED GROUND. NO SITE DISTURBANCE BELOW TRENCHES.

FOUNDATION NOTES:

ALL FOOTINGS TO REST ON CLEAN, FIRM UNDISTURBED SOIL. STEP FOOTINGS AS REQUIRED TO MAINTAIN REQUIRED DEPTH BELOW FINISH GRADES.

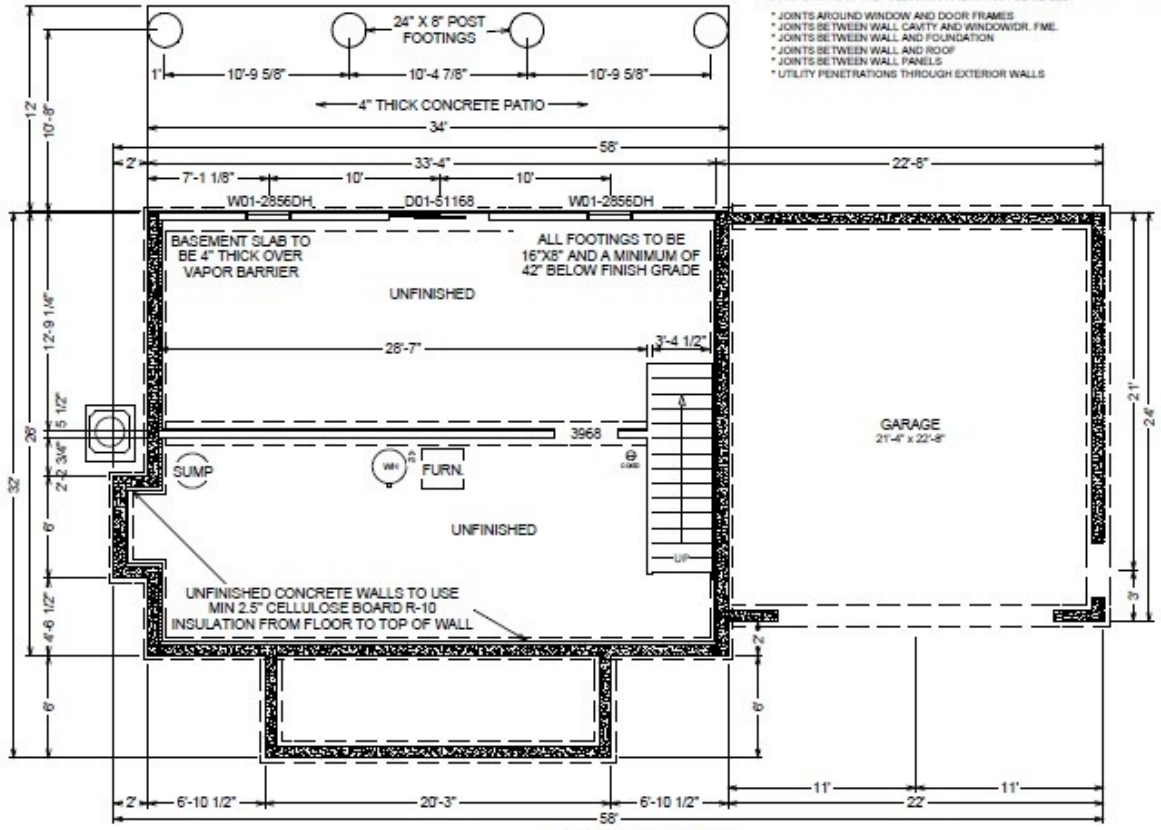
CONCRETE STRENGTH.
3,000 PSI AT 28 DAYS FOR ALL SLABS. (FOUNDATION DESIGN BASED ON 2,500 PSI).
3,000 PSI AT 28 DAYS FOR ALL OTHER CONDITION.
MAXIMUM SLUMP, 4"

USE ASTM A-615 GRADE 60 DEFORMED REINFORCING BARS UNLESS NOTED OTHERWISE

CONCRETE EXPASION ANCHORS SHALL BE 'SIMPSON WEDGE-ALL STUD ANCHORS' OR ENGINEER APPROVED EQUAL. EPOXY TO BE SIMPSON "SET" ADHESIVE OR APPROVED EQUAL.

INFILTRATION, ALL OPENINGS IN THE EXT. BLDG. ENVELOPE SHALL BE SEALED AGAINST AIR INFILTRATION. THE FOLLOWING AREAS MUST BE SEALED.

* JOINTS AROUND WINDOW AND DOOR FRAMES
* JOINTS BETWEEN WALL CAVITY AND WINDOWDR. FME.
* JOINTS BETWEEN WALL AND FOUNDATION
* JOINTS BETWEEN WALL AND ROOF
* JOINTS BETWEEN WALL PANELS
* UTILITY PENETRATIONS THROUGH EXTERIOR WALLS



FOUNDATION PLAN

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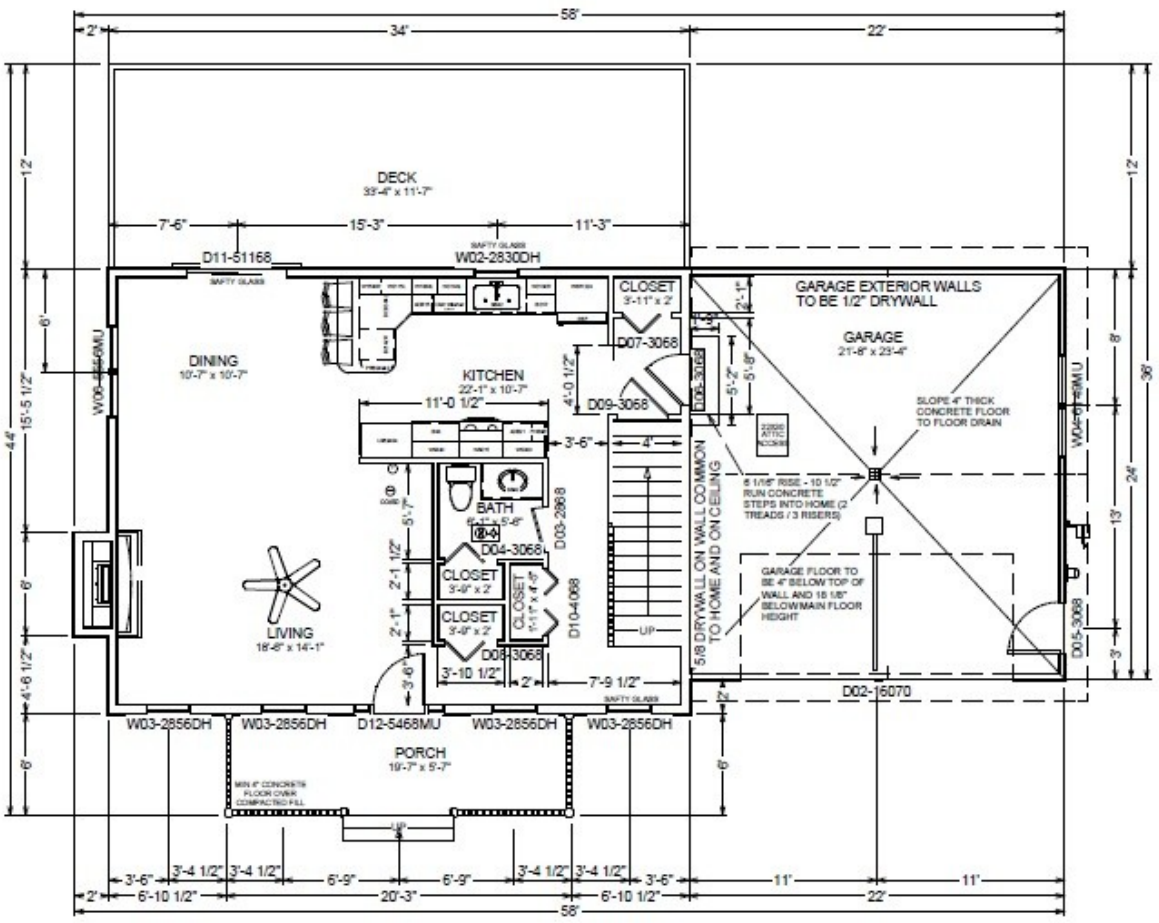

MAIN FLOOR PLAN

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MAIN FLOOR

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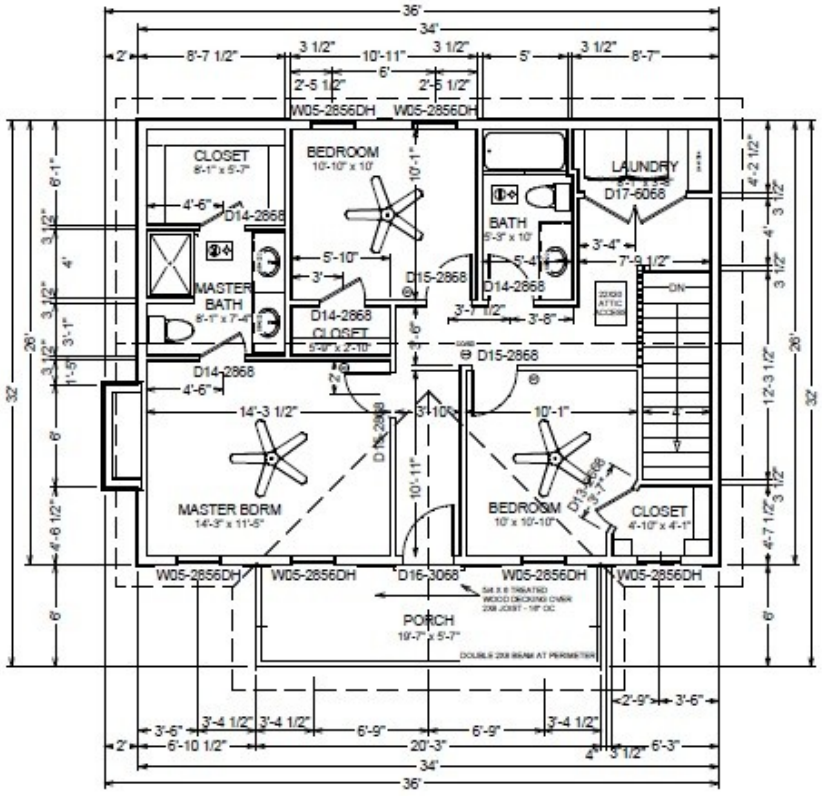

SECOND FLOOR PLAN

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SECOND FLOOR

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FRONT ELEVATION

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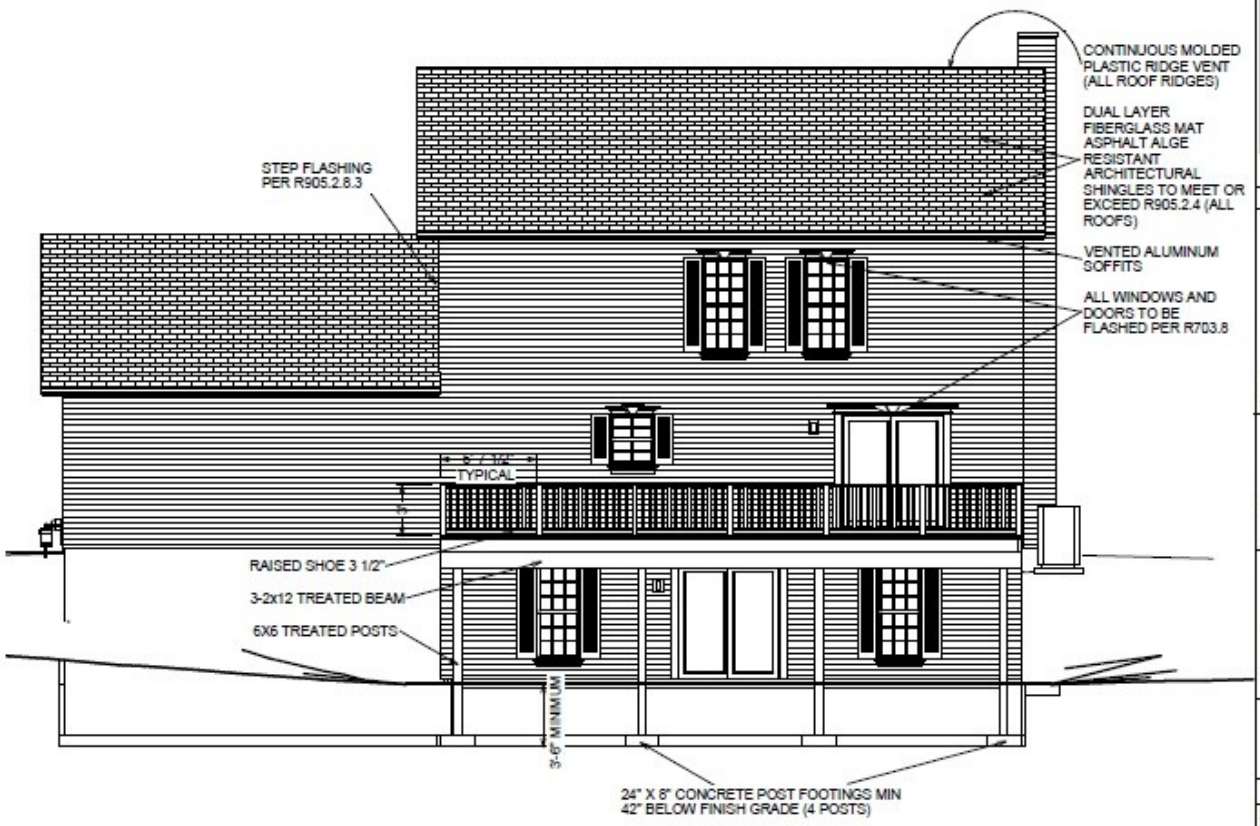

REAR ELEVATION

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REAR ELEVATION

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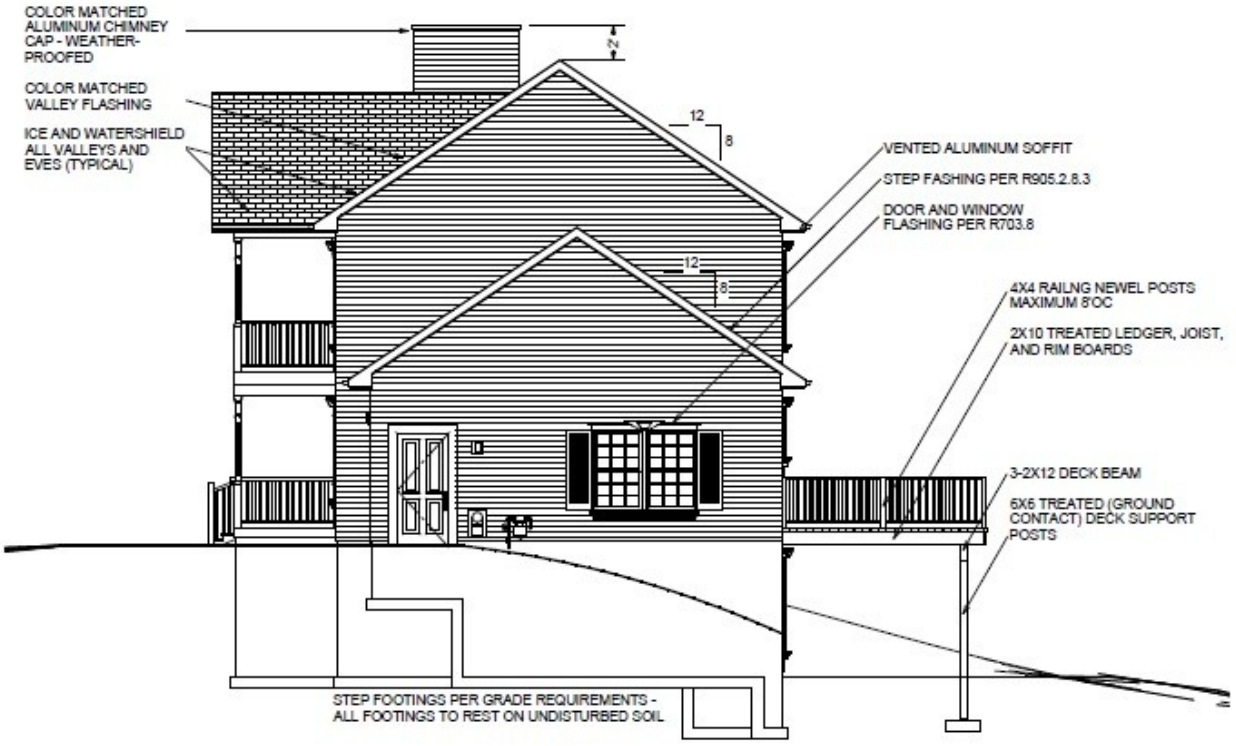

RIGHT ELEVATION

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RIGHT ELEVATION

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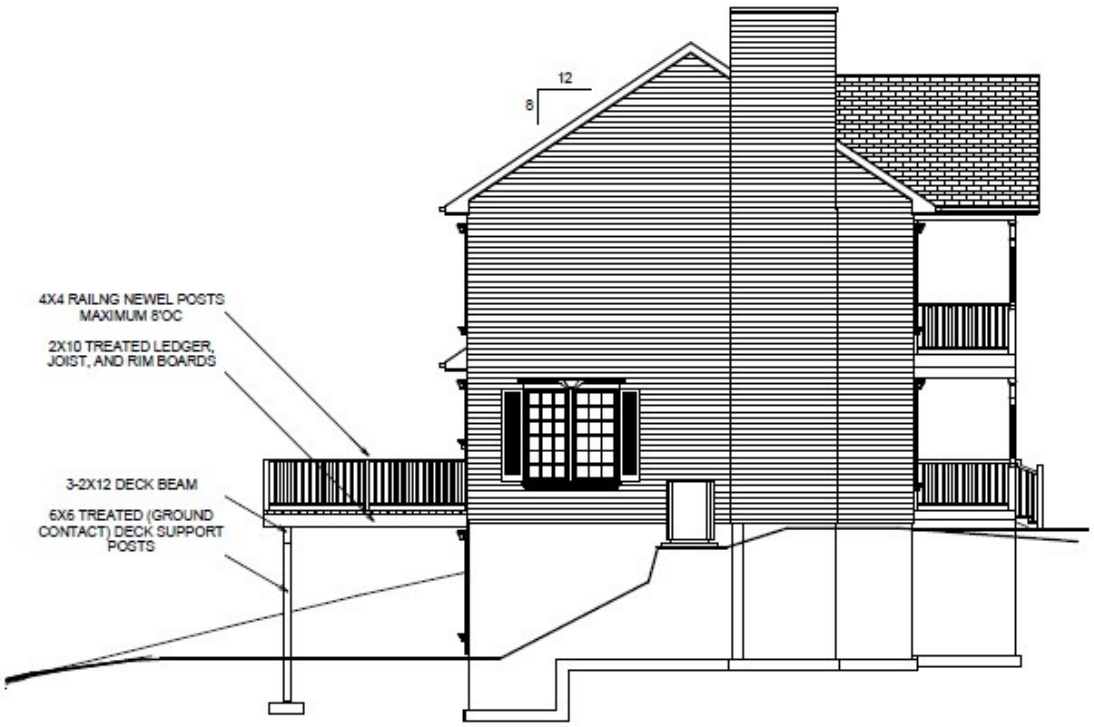

LEFT ELEVATION

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LEFT ELEVATION

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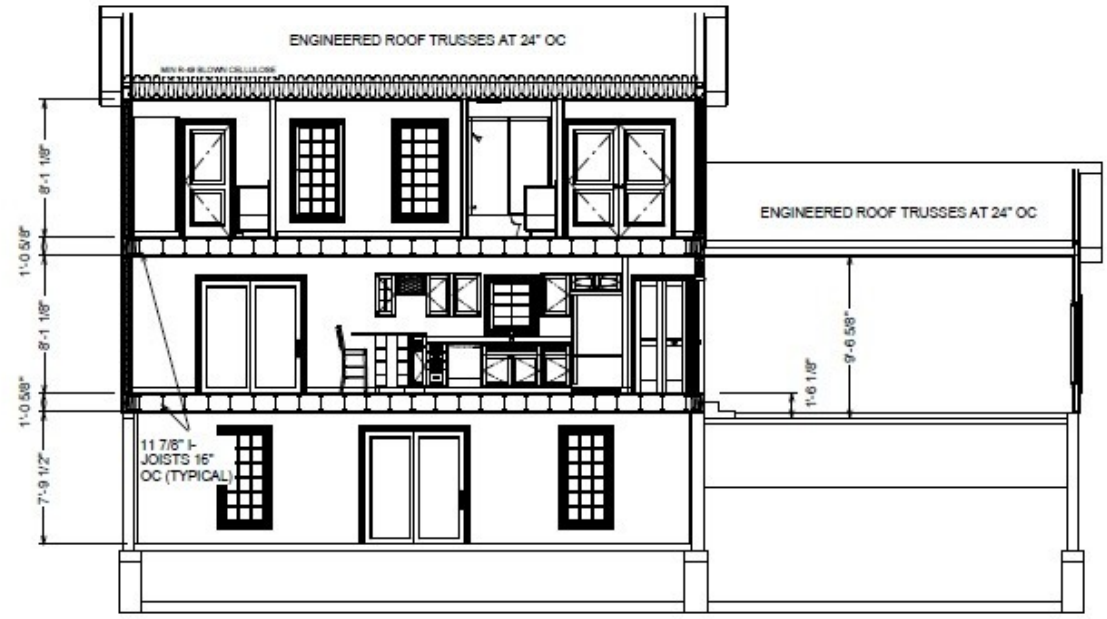

RIGHT TO LEFT CROSS SECTION

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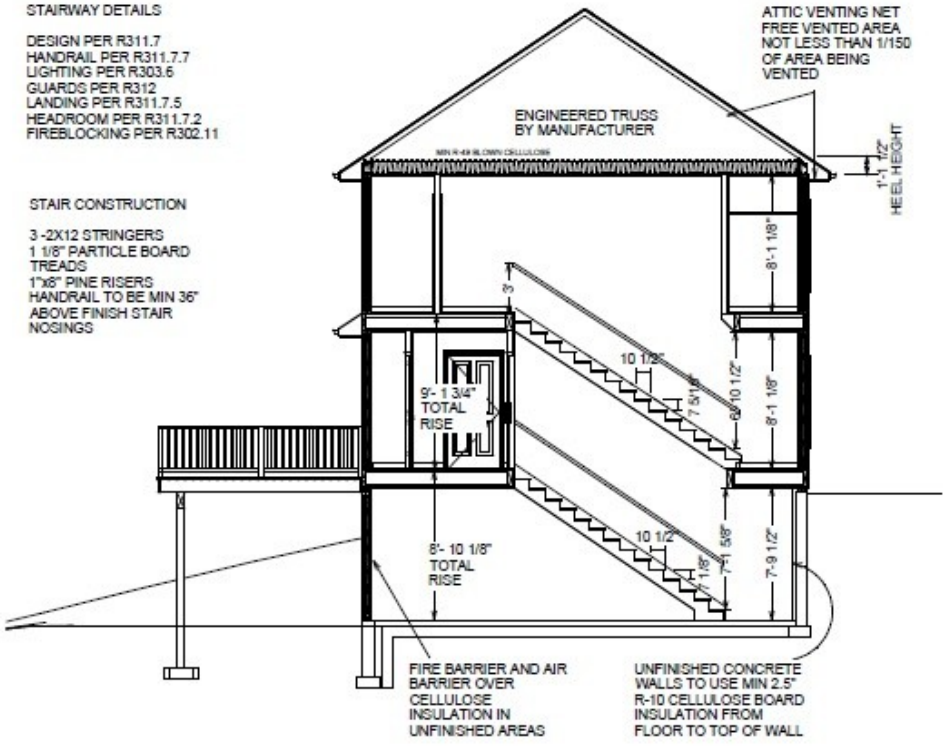
STAIRWAY DETAILS

DESIGN PER R311.7
HANDRAIL PER R311.7.7
LIGHTING PER R303.6
GUARDS PER R312
LANDING PER R311.7.5
HEADROOM PER R311.7.2
FIREBLOCKING PER R302.11

STAIR CONSTRUCTION

3 -2X12 STRINGERS
1 1/8" PARTICLE BOARD TREADS
1"x8" PINE RISERS
HANDRAIL TO BE MIN 36" ABOVE FINISH STAIR NOSINGS



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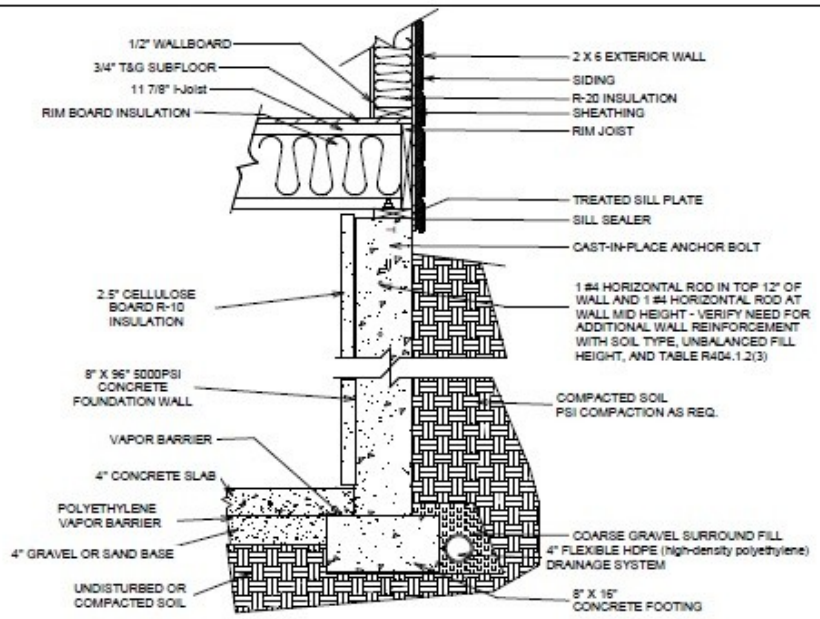
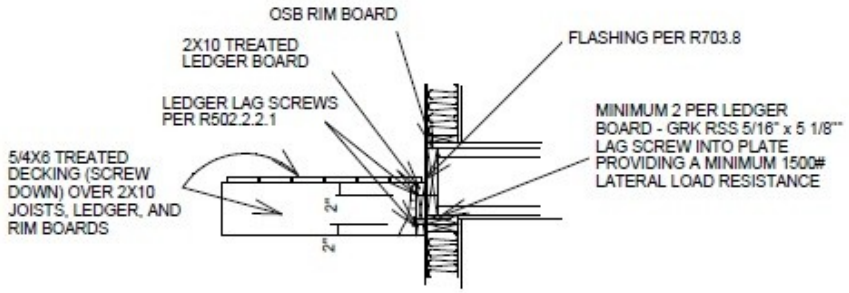


BASEMENT FOUNDATION DETAIL



DECK ATTACHMENT DETAIL (TYPICAL ALL DECKS)

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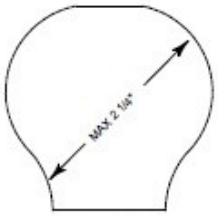
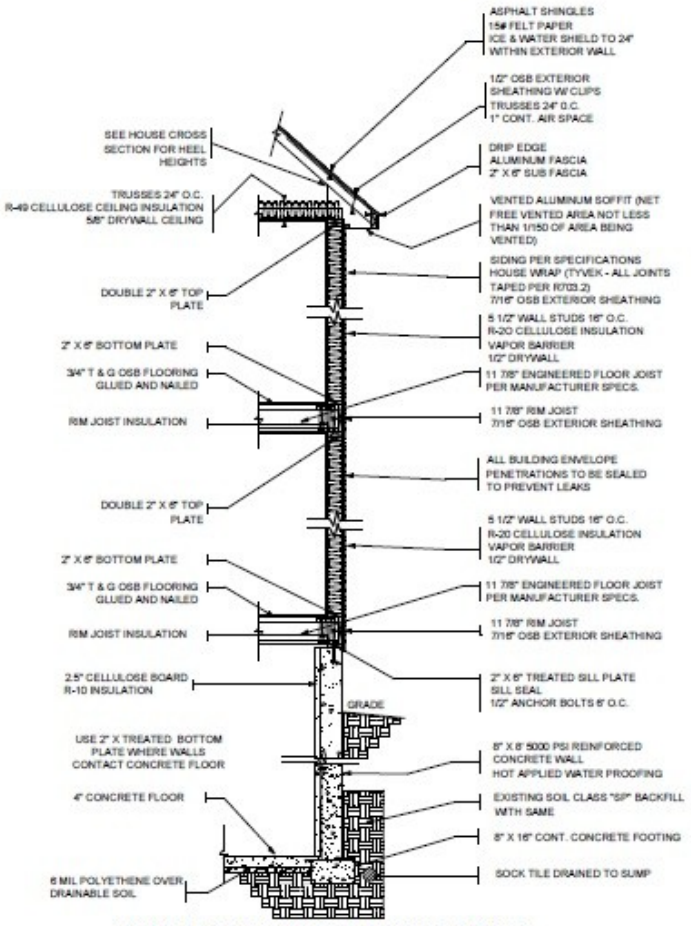
Sheet # 15



PER R311.5.6.3 ALL HANDRAILS SHAL BE GRASPABLE WITH A PERIMETER NOT LESS THAN 4" AND NOT GREATER THAN 6 1/4" AND A MAXIMUM CROSS SECTION OF 2 1/4"



WALL SECTION NOTES (NOT TO SCALE)

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Sheet Title: NOTES AND DETAILS

#	Date	Issue Description
1	3/6/2012	Construction Final
2		

Scale: 1/8" = 1

Sheet # 16

DOOR SCHEDULE						
NUMBER	QTY	FLOOR	SIZE	R/O	DESCRIPTION	HEADER
D01	1	0	51168 R EX	71 1/4"X80"	EXT. SLIDER-GLASS - COLOR - WHITE	2X10X74 1/4" (2)
D02	1	1	16070 R	195"X85 1/2"	GARAGE 4-PANEL (LONG) - COLOR - WHITE	2X12X204" (2)
D03	1	1	2868 L IN	34"X82 1/2"	HINGED 2 PANEL - COLOR - WHITE	2X10X37" (2)
D04	1	1	3068 L	38"X82 1/2"	2 DR. BIFOLD-SLAB	2X10X41" (2)
D05	1	1	3068 L EX	38"X82 1/2"	EXT. HINGED 4 PANEL	2X10X41" (2)
D06	1	1	3068 L EX	38"X82 1/2"	EXT. HINGED 4 PANEL - COLOR - WHITE	2X10X41" (2)
D07	1	1	3068 R	37 11/16"X82 1/2"	2 DR. BIFOLD 2-PANEL - COLOR - WHITE	2X10X40 11/16" (2)
D08	1	1	3068 R	38"X82 1/2"	2 DR. BIFOLD-SLAB	2X10X41" (2)
D09	1	1	3068 R IN	38"X82 1/2"	HINGED 2 PANEL - COLOR - WHITE	2X10X41" (2)
D10	1	1	4068	50"X82 1/2"	4 DR. BIFOLD-SLAB	2X10X53" (2)
D11	1	1	51168 R EX	71 1/4"X80"	EXT. SLIDER-GLASS - COLOR - WHITE	2X10X74 1/4" (2)
D12	1	1	5468	66"X82 1/2"	MULLED UNIT	2X10X69" (2)
D13	1	2	2668 R IN	32"X82 1/2"	HINGED 2 PANEL - COLOR - WHITE	2X10X35" (2)
D14	4	2	2868 L IN	34"X82 1/2"	HINGED 2 PANEL - COLOR - WHITE	2X10X37" (2)
D15	3	2	2868 R IN	34"X82 1/2"	HINGED 2 PANEL - COLOR - WHITE	2X10X37" (2)
D16	1	2	3068 R EX	38"X82 1/2"	EXT. HINGED-GLASS - COLOR - WHITE	2X10X41" (2)
D17	1	2	6068 IN	74"X82 1/2"	DOUBLE HINGED 2 PANEL - COLOR - WHITE	2X10X80" (2)

WINDOW SCHEDULE								
NUMBER	QTY	FLOOR	SIZE	DIMENSIONS	R/O	EGRESS	DESCRIPTION	HEADER
W01	2	0	2856DH	31 1/2"X65 5/8"DH	32"X66 1/8"	YES	DOUBLE HUNG	2X10X35" (2)
W02	1	1	2630DH	31 1/2"X35 1/2"DH	32"X36"	YES	DOUBLE HUNG	2X10X35" (2)
W03	4	1	2856DH	31 1/2"X65 5/8"DH	32"X66 1/8"	YES	DOUBLE HUNG	2X10X35" (2)
W04	1	1	6149	73"X56 5/8"	73 1/2"X57 1/8"		MULLED UNIT	2X10X79 1/2" (2)
W05	6	2	2856DH	31 1/2"X65 5/8"DH	32"X66 1/8"	YES	DOUBLE HUNG	2X10X35" (2)
W06	1	1	5556	65"X65 5/8"	65 1/2"X66 1/8"		MULLED UNIT	2X10X68 1/2" (2)

CABINET SCHEDULE						
NUMBER	LABEL	QTY	FLOOR	DIMENSIONS	HEIGHT	DESCRIPTION
C01	4DB15	1	1	15X24X36 "	36 "	BASE CABINET
C02	4DB21	1	1	21X24X36 "	36 "	BASE CABINET
C03	B2142R	1	1	21X24X42 "	42 "	BASE CABINET
C04	B21R	1	1	21X24X36 "	36 "	BASE CABINET
C05	B33	1	1	33X24X36 "	36 "	BASE CABINET
C06	DCB3642R	1	1	36X36X42 "	42 "	CORNER BASE CABINET
C07	FHB9R	1	1	9X24X36 "	36 "	BASE CABINET
C08	PRB24942	1	1	24X9X42 "	42 "	PENINSULA RADIUS BASE CABINET
C09	SB42	2	1	42X24X36 "	36 "	BASE CABINET
C10	SB4222	2	2	42X22X36 "	36 "	BASE CABINET
C11	SB5422	1	2	54X22X36 "	36 "	BASE CABINET
C12	U362484	1	1	36X24X84 "	84 "	UTILITY CABINET
C13	U441584	1	2	44X15X84 "	84 "	UTILITY CABINET
C14	W1530R	1	1	15X12X30 "	30 "	WALL CABINET
C15	W1830L	1	1	18X12X30 "	30 "	WALL CABINET
C16	W2115L	1	1	21X12X15 "	15 "	WALL CABINET
C17	W2130L	1	1	21X12X30 "	30 "	WALL CABINET
C18	W2130R	1	1	21X12X30 "	30 "	WALL CABINET
C19	W3015	1	1	30X12X15 "	15 "	WALL CABINET
C20	W3030	1	1	30X12X30 "	30 "	WALL CABINET
C21	W3330	1	1	33X12X30 "	30 "	WALL CABINET
C22	W361224	1	1	36X24X12 "	12 "	WALL CABINET

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Sheet Title:
SCHEDULES

#	Date	Issue Description
1	3/6/2012	Construction Final
2		

Scale: 1/8" = 1

Sheet # 17

ROOM FINISH SCHEDULE						
ROOM NAME	FLOOR	WALL MATERIAL	FLOOR FINISH	BASE MOLDING	WINDOW CASING	DOOR CASING
BATH	1	DRYWALL	SANDSTONE1 TILE	CA-28		CA-04
CLOSET	1	DRYWALL	CARPET-A2	CA-28		CA-04
CLOSET	1	DRYWALL	MEDIUM - MP PLANK	CA-28		CA-04
DINING	1	DRYWALL	MEDIUM - MP PLANK	CA-28	CA-04	CA-04
GARAGE	1	DRYWALL			CA-04	CA-04
HALL	1	DRYWALL	MEDIUM - MP PLANK	CA-28	CA-04	CA-04
KITCHEN	1	DRYWALL	CARPET-A2	CA-28	CA-04	CA-04
LIVING	1	DRYWALL	CARPET-A2	CA-28	CA-04	
OPEN BELOW	1	DRYWALL	MEDIUM - MP PLANK			CA-04

ROOM FINISH SCHEDULE						
ROOM NAME	FLOOR	WALL MATERIAL	FLOOR FINISH	BASE MOLDING	WINDOW CASING	DOOR CASING
BATH	2	DRYWALL	SANDSTONE1 TILE	CA-28		CA-04
BEDROOM	2	DRYWALL	MEDIUM - MP PLANK	CA-28	CA-04	CA-04
CLOSET	2	DRYWALL	MEDIUM - MP PLANK	CA-28		CA-04
CLOSET	2	DRYWALL	MEDIUM - MP PLANK	CA-28	CA-04	CA-04
HALL	2	DRYWALL	MEDIUM - MP PLANK	CA-28		CA-04
LAUNDRY	2	DRYWALL	SANDSTONE1 TILE	CA-28		CA-04
MASTER BATH	2	DRYWALL	SANDSTONE1 TILE	CA-28		CA-04
MASTER BDRM	2	DRYWALL	MEDIUM - MP PLANK	CA-28	CA-04	CA-04
OPEN BELOW	2	DRYWALL	MEDIUM - MP PLANK			

STRUCTURE LOADING SCHEDULE	
AREA	LOAD
FLOOR	40 PSF LIVE
	10 PSF DEAD
ROOF	50 PSF LIVE
	10 PSF DEAD
DECKS	40 PSF LIVE
	10 PSF DEAD

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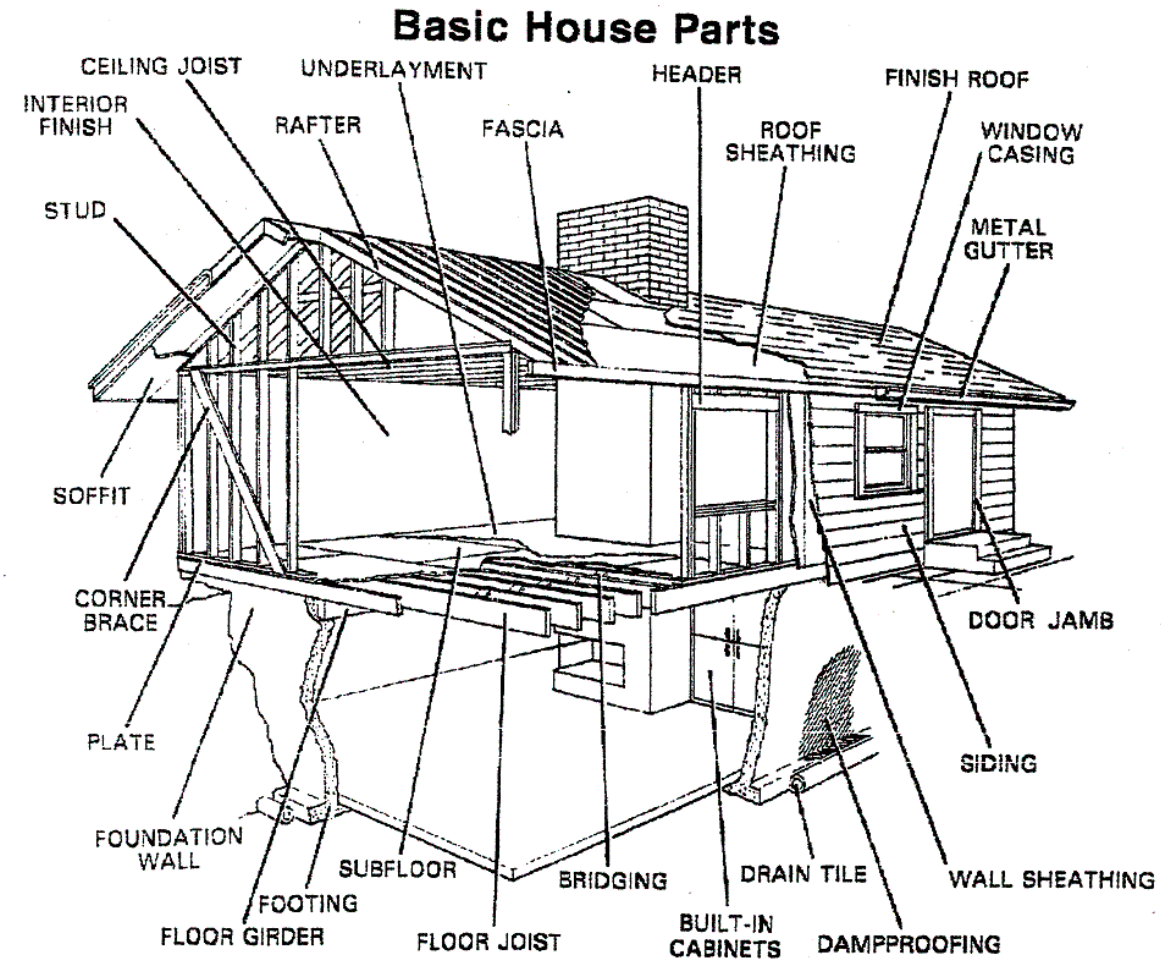
Sheet Title:
SCHEDULES

#	Date	Issue Description
1	3/6/2012	Construction Final
2		
3		

Scale: 1/8" = 1

Sheet # 18



PLANS, SPECIFICATIONS AND ESTIMATING QUESTIONS

Question #1

From the blueprint, find the linear feet of ridge vent needed. Do not include overhangs.

Logic: Look at the main floor plan. The overall length of the home, not including the chimney, is 56 feet. Now look at the second floorplan. The light dashed lines indicate how the porch roof intersects with the main roof. There is no measurement given for the length of that ridge, but look at the measurements given for the

left side of the print. The porch width dimension is 6'. The distance from the corner to the chimney is 4'6 ½". The chimney width is 6'. The corner of the chimney lines up perfectly with the point that the porch ridge intersects with the roof.

56' + 6' + 4.5' + 6' = 66.5'. You can't bring the vent right up to the point where the two roofs intersect.

Answer: 65' to 66'.

Question #2

How many cubic yards of concrete will it take to pour the garage floor slab?

Logic: Find the length and width dimensions from the Foundation Plan at 21' 4" X 22' 8". Now find the thickness of the concrete from the specifications on Sheet #4. Under Garage/Drive/Porch Floors, which call for a 4" slab?

The Math: All units of measurement need to be converted to feet so that all of the math is calculated in the same unit of measurement.

4" ÷ 12" = .33' **8" ÷ 12" = .666'**
rounded up to .67'

21.33 x 22.67 x .33 = 159.57 cubic feet. To convert cubic feet to cubic yards, divide the cubic feet by 27. 159.57 ÷ 27 = 5.91 cubic yards.

Answer: 5.91 cubic yards

Question #3

How many linear feet of 2" x 8" floor joist is needed to construct the second floor covered porch/deck?

Logic: The dimensions of the deck are found on the second floorplan at 20’ 3” x 6’. The perimeter of the deck is to be made of the same material as the joist, but these 2” x 8” boards are doubled and they span to connect two columns, make makes them **beams.** They will not be counted as joist. The length of the deck should be calculated at 20’ because of the doubled 2” x 8” beams. 3” is lost between the two outside 2” x 8”s.

The Math for Question #3:

20 x 12 = 240”. 240” ÷ 16” = 15.

Subtract 1 joist because the beam accounts for the last joist.

14 joists are needed.

The span of the joist will be 4.5” less than 6’. Because the ledger board connected to the house is 1 ½” wide and the beam is 3” wide.

4.5” ÷ 12 = .375’

6’ - .375’ = 5.625’ per joist

14 x 5.625’ =

Answer: 78.75’ linear feet of joist material

Question #4

What is between the siding and the wall sheathing?

Logic: Look for a section drawing with wall details (Drawing #16). The fifth note starting at the top right provides the answer:

Answer: House wrap (Tyvek with all joints taped)

Question #5

How many cubic yards of concrete is needed to pour the concrete portion of the driveway?

Logic: Look at the site plan to get the dimensions.

25’ x 18’ x 6” (6” is .5’) = 225 cubic feet

Convert to cubic yards

225 ÷ 27 = 8.33 cubic yards

Answer: 8.33 cubic yards

Question #6

Which rooms have tile floors?

Logic: There is no mention of floor surface finishing on the floorplan drawing. Look for a Room Finishing Schedule. Information is on Sheet #18.

Answer:

1st Floor Bath

2nd Floor Bath

Laundry Room

Master Bath

Question #7

How many smoke detectors are in the building?

Logic: Each of three bedrooms on the second floor have one, plus one more combo in the hallway outside of the bedrooms. There is one in the living room and one in the basement

Answer: six

NOTE: Smoke detectors are required in bedrooms, in the vicinity outside of bedrooms and on all floor levels.

Question #8

How many carbon monoxide detectors are in the building?

Logic: There is one outside of the bedrooms in the hallway.

Answer: one

NOTE: Carbon monoxide detectors must be installed in areas directly outside of bedrooms for all new homes with attached garages or fuel fired devices.

Question #9

What is the required side setbacks for this property?

Logic: This can be found on the Site Plan, Sheet #5.

Answer: 25 feet.

Question #10

How close can the rear of the building be to the rear of the property?

Logic: This can be found on the Site Plan, Sheet #5.

Answer: 50 feet.

Question #11

How many acres is this site?

Logic: The Site Plan provides the lot dimensions at

150’ x 300’ = 45,000 square feet

1 acre is equal to 43,560 square feet

45,000 ÷ 43,560 = 1.033 acres

Answer: 1.033 acres

NOTE: Remember 43,560

Question #12

What is this building floor live load?

Logic: The information isn’t provided in the Specification Sheets. Look for the Loading Schedule on the last page, Sheet #18.

Answer: 40 lbs. per square foot

NOTE: It is a good idea to spend some time before starting the exam getting familiar with **ALL PAGES** in the Plans and Specs (blueprints and specification pages).

Question #13

What type of roof shingles are used on this building?

Logic: The Elevation Drawings often provide information about the exposed materials that finish an exterior.

This information is also found on Sheet #2, Exterior Finishing Notes (Specifications).

Answer: Dual layer fiberglass material asphalt, algae resistant architectural shingles.

Question #14

What is the scale of the Main Floor Plan?

Logic: Always look to the drawing that is mentioned. In this case, it's the Main Floor Plan.

The scale of the drawing is usually spelled out somewhere near the title.

Answer: Scale 1/8" to 1'.

Question #15

What is the total rise of the basement stairway?

Logic: The Cross Section drawings provide the best opportunity to note this information because all of the floors are exposed in each drawing. See Sheet #14.

Answer: 8' to 1/8"

Question #16

What is the rise of each individual step in the basement stairway?

Logic: This is found on Cross Section Drawings, Sheet #14.

Answer: 7 1/8”

Question #17

What is the tread depth of an individual step in the basement stairway?

Logic: This is found on Cross Section Drawings, Sheet #14

Answer: 10 1/5”

Question #18

How many linear feet of 1” x 8” material is needed to complete the risers on the basement stairway?

Logic: Find the number of risers by taking the total number of **inches** between the finished floors and divide them by the height of each individual rise.

8 x 12 = 96” + 10” + 1/8”

1 ÷ 8 = .125 = 106.125 inches

106.125 ÷ 7.125 = 14.89

At 14.89, we are within 1/8” of being an even 15 risers.

Find the width of the stairway. Look at the Main Floor Plan to find the stairway going down to the basement. The stairway is at 4’ wide.

Answer: 15 x 4’ = **60 linear feet**

Question #19

How many board feet is the header above the main front door?

Logic: The door schedule provides for header lengths. Go to the Main Floor Drawing to find the door number.

Header for Door is #12 is 2” x 10” x 69”

69” ÷ 12 = 5.75 feet

The formula to find board feet is width in inches x height in inches x length in feet ÷ 12.

2 x 10 x 5.75 = 115 ÷ 12

Answer: 9.58 board feet

Question #20

What is the size of the front door assembly?

Logic: The door is coded D12-5468 MU. Following is the code breakdown.
D12-5468 MU
D12 – Schedule Number

54 – 5’4” Width
68 – 6’8” Height
MU – Mulled

Look at the front door in the Front Elevation Drawing #9. The front door has lights (windows) on either side of the door.

Question #21

What is the swing of the front door? The door swings inward.

Logic: Look at the Front Elevation Drawing #9. Notice the diagonal lines that start at the top and bottom corners and meet at mid height of the door on the opposite side. Think of this as an arrow head pointing to the side with the hinges. Now pretend you are standing in the door opening with your back to the hinges. You would have to use your right hand to simulate the swing.

Answer: It’s a right hand door

NOTE: Casement windows have the lines that form an arrow head also indicating the hinged side.

Question #22

How many cubic yards of concrete are needed to pour the front port slab.

Logic: Find the porch dimensions from the Foundation Plan. Confirm the thickness of the slab in the specification providedon Sheet #4. The thickness is 4”.

The dimensions are 20’ 3” x 6’ x 4”

Math:

20.25 x 6 x .33 (4 ÷ 12 = .33) = 40.095

40.095 ÷ 27 =

Answer: 1.51 Cubic Yards

Question #23

What is the size of the garage door?

Logic: Look at the Main Floor Plan Sheet #7. Find the code for the door in the middle of the opening, D02-16070.

D02 – Door #2 on the Schedule
160 – 16’ 0” Width
70 – 7’0” Height

NOTE: Width is always the first dimension with windows and doors.

Question #24

What is the height of the floor joist?

Logic: This information will be found on the Cross Section drawings.

Answer: 11 7/8”

Question #25

What is the distance from the floor to the top of all windows?

Logic: Look for the specification under Windows Sheet #3.

Answer: 80”

Question #26

What is efficiency rating of the air conditioner?

Logic: Find the specifications for the air conditioning unit under Mechanical/HVAC.

Answer: 13 SEER

NOTE: The higher the SEER number, the more efficient the unit.

Question #27

What type of wall insulation is to be installed in wall cavities?

Logic: Find the specifications on insulation.

Answer: Dense Packed dry applied cellulose. R-20

Question #28

What is the size of the steel reinforcement in the foundation walls?

Logic: Look for a Cross Section Drawing on foundation detail, Drawing #15.

Answer: #4 = 4/8” or ½”

NOTE: The English measurement for thickness of reinforcement bar is measured in 1/8th of an inch. Example: #4 is 4/8 or ½", #5 is 5/8".

Question #29

What type of exterior trim is required for finishing around windows and doors?

Logic: Look for specifications on exterior trim, Sheet #3.

Answer: Composite wood material 5/4" x 6" (cedar appearance)

Question #30

What is the height and width of the basement foundation walls measured from the footings?

Logic: Look for a Section Drawing of the walls, Sheet #16

Answer: 8' x 8"

Answers to the following questions can be found in the Carpentry and Building Construction book. (Pages 41-58)

31. On a blueprint, what should you look for to determine whether a room has a sunken floor or is on a different level?

a. cross section
b. steps
c. floorplan
d. doors

32. On a blueprint, what is the symbol for a hot water heater?

a. WH
b. HW
c. HWH
d. WHH

33. A letter above a window on the plans indicates what?

a. rough hole opening
b. glass size
c. window schedule
d. exterior window dimensions

34. Residential building plans are usually drawn to a scale of:

a. 1” per foot
b. 1/2” per foot
c. 1/4” per foot
d. 1/8” per foot

35. A set of plans usually includes:

a. plot plan
b. foundation plan
c. floor plans and elevations
d. all of the above

36. The terms: Dimension line, extension line, broken line, and center line are terms used in:

a. surveying
b. blueprint reading
c. cost accounting
d. roofing

37. On a blueprint what shows the size and outline of a building and its rooms?

a. elevation drawings
b. floor plans
c. plot plans
d. section drawings

38. This page of the blueprint indicates the location of the structure and the distances from it to the property lines:

a. foundation plan
b. all exterior elevations
c. cross section
d. plot plan

39. A line on a blueprint drawing with a scale of 1/4” per foot will:

a. be shorter than the line on a print with a scale of 1/8”
b. be longer than the line on a print with a scale of 1/8”
c. be too short to be seen on a 1/8’’ scale
d. be too long to draw on a 1/8’’ scale

40. How are windows listed on a blue print?
a. H x W
b. W x H
c. H x W divided by two
d. W x H, plus two

NOTE: the width is always first.

41. The contoured lines on the elevation drawings are used as note reference lines.
a. True
b. False

42. What are the long broken lines parallel to the property lines on a site plan?

a. lot line
b. shared access
c. easement limits
d. none of the above

Answers:

31. a

32. a
33. c
34. c
35. d
36. b
37. b
38. d
39. b
40. b
41. a
42. c

Overview of Building Trades

CONSTRUCTION MATH

MATH FORMULAS

1. To **convert fractions into decimals**, divide the numerator (the top number) by the denominator (bottom number).

Example: 1/3 is 1 divided by 3 equals 0.33

---

2. To **convert inches into the decimal equivalent** of a foot, divide the number of inches by 12.

---

3. **To convert the decimal equivalent of a foot back into the number of inches,** multiply the decimal number by 12.
Also, to convert the decimal equivalent of an inch into 16ths of an inch, multiply the decimal by 16.

Example: While calculating for a length dimension, the display on the calculator reads 21.865 feet. We know it is 21' and 86.5% of a foot. We have to solve for what 86.5% is to be able to measure it on a tape measure.

.865 X 12 = 10.38

10 inches is the maximum amount of whole inches in 86.5% of a foot, but there is still area left that is less than one inch at .38 or 38% of an inch. To solve for this in 16ths, multiply .38 x 16 = 6.08. Rounding to the nearest 16^{th} is 6.

The .08 is the area that is 8% of a 1/16 of an inch. This is close enough in the construction trades.

---

4. **Volume**: multiply the length times the width times the height.

Example: 1 cubic yard equals (3 ft. X 3 ft. X 3 ft. or 27 cubic feet)

Example: 1 cubic yard equals (36" X 36" X 36" = 46,656 cubic inches)

---

5. **Board foot**: one board foot equals a board that is 12" X 12" x 1".
The formula to compute board feet is: Thickness (in inches) X Width (in inches) X Length (in feet) divided by 12.

Example: a 2" X 6" X 12' board is equal to (2 X 6 X 12 = 144) divided by 12 = 12 board feet per board.

---

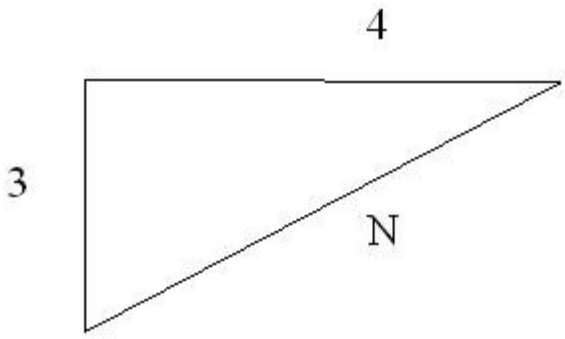
6. **Area of a triangle** is the base times the height divided by two.

Example: a triangle with a base of 24 and a height of 8 has an area of 96 (24 X 8 = 192 divided by 2)

---

7. To **figure the HYPOTENUSE** of a right triangle: A^2 + B2 = C2 3 X 3 = 9

Example: Solve for N of the triangle below, with N being the hypotenuse.



3 X 3 = 9
4 X 4 = 16
Sum = 25 The of 25 is 5. **N = 5.**

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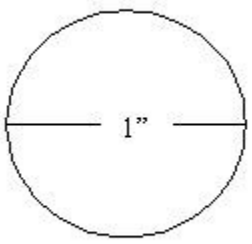
8. To find the **circumference of a circle,** multiply the diameter times 3.14.

Example:



1 X 3.14 = 3.14'
.14 X 12 = 1.68
.68 X 16 = 10.88 16ths.

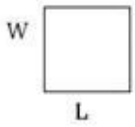
By rounding up, we know that a circle that has a diameter of one foot will have a circumference of 3' 1-11/16".

9. To **convert cubic feet to cubic yards**, divide cubit feet by 27.

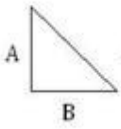
Example: 2463 cubic feet divided by 27 = 91.22 cubic yards

Construction Math Formulas

Area



Area = L × W

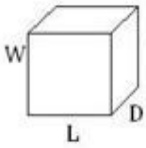


Area = 0.5 × B × A

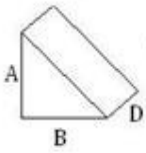
Area = 3.14 × R × R

R = 0.5 × Dia.

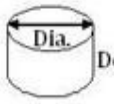
Volume



Vol. = L × W × D



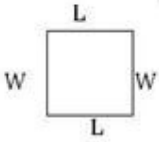
Vol. = 0.5 × B × A × D



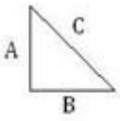
Vol. = 3.14 × R × R × Depth

R = 0.5 × Dia.

Perimeter



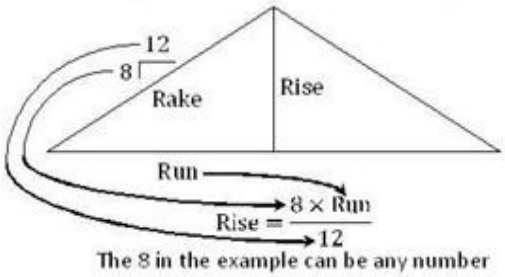
Per. = L + W + L + W



Per. = A + B + C

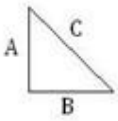
Circ. = 3.14 × Dia.

Roof Rise from Known Pitch



The 8 in the example can be any number

Length of Rake from Known Rise & Run



A is the Rise B is the Run C is the Rake

$A^2 + B^2 = C^2$

$(A \times A) + (B \times B) = C^2$

$(Rise \times Rise) + (Run \times Run) = Rake^2$

Example with Rise = 3 and Run = 4

$(3 \times 3) + (4 \times 4) = C^2$

$9 + 16 = C^2$

$25 = C^2$

$\sqrt{25} = \sqrt{C^2}$

$5 = C$

Construction Math Conversions

A. Fraction ⟶ Decimal

$\frac{5}{8} \rightarrow 5 \div 8 = 0.625$

$\frac{X}{Y} \rightarrow X \div Y = Decimal\ Answer$

B. Decimal ⟶ Fraction in $1/8^{th}$

$0.625 \rightarrow 0.625 \times 8 = 5 \xrightarrow{yields} \frac{5}{8}$

For Fraction in:

a. $1/4^{th} \rightarrow \times 4$
b. $1/8^{th} \rightarrow \times 8$
c. $1/16^{th} \rightarrow \times 16$

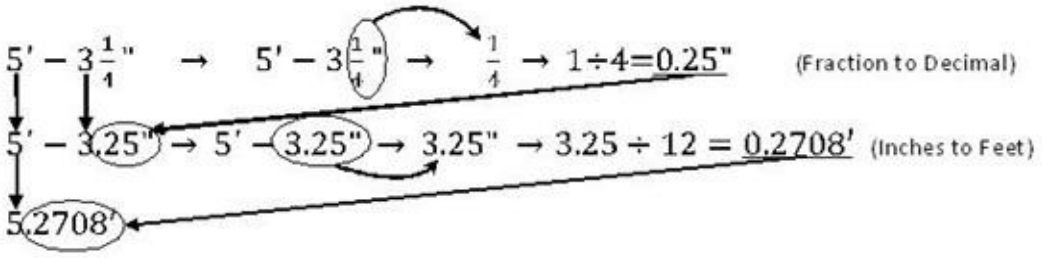
C. Feet $\xrightarrow{\times 12}$ Inches

$2.0' \rightarrow 2 \times 12 = 24"$ $0.5' \rightarrow 0.5 \times 12 = 6"$ $0.1667' \rightarrow 0.1667 \times 12 = 2"$

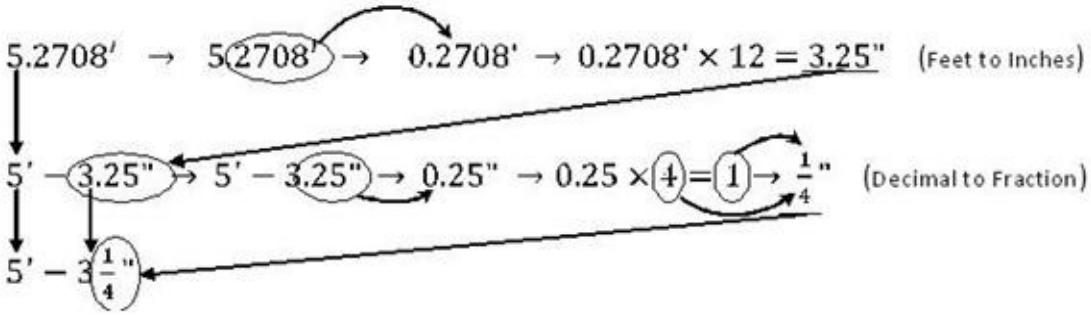
D. Inches $\xrightarrow{\div 12}$ Feet

$24" \rightarrow 24 \div 12 = 2.0'$ $6" \rightarrow 6 \div 12 = 0.5'$ $2" \rightarrow 2 \div 12 = 0.1667'$

E. Feet with Fraction Inches ⟶ Decimal Feet



F. Decimal Feet ⟶ Feet with Fraction Inches in $1/4^{th}$



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The following are 21 typical construction math problems and their solutions. All of these problems are included in the FREE 3-Hour Construction Math Video course that you received with the purchase of this program.

1. How many studs are used to build an 8 ft. wall with the studs spaced 16" on center (o.c.)?

a. 7
b. 8
c. 9
d. 10

Solution to #1:

8 foot x 12 inches = 96 inches
96 inches divided by 16 inches = 6 studs
6 studs + 1 to start = 7 studs

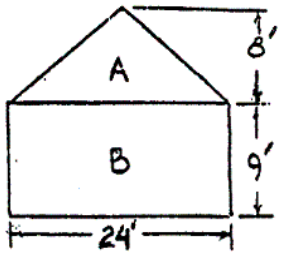
2. How much concrete in cubic yards is needed to fill a wall 8'4" x 8" x 150'?

a. 28 or less
b. more than 28 but less than 33
c. 33 to 38
d. more than 38

Solution to #2:

The wall is 8'4" x 8" x 150'.
To solve the problem you must convert the inches to the decimal equivalent of a foot.
4" divided by 12 = 0.33' and 8" divided by 12 = 0.67'
Therefore 8.33' x 0.67' x 150' = 837.17 cubic feet
837.17 cu. ft. divided by 27 = 31 cubic yards

3. What is the area of A?
    a. 90 sq. ft. or less
    b. more than 90 sq. ft., but less than 100 sq. ft.
    c. 100 sq. ft. to 110 sq. ft.
    d. more than 110 sq. ft.



Solution to #3:
Area of A (triangle) is 8 x 24 divided by 2 = 96 square feet

4. What is the total cost of the following materials with 6 % sales tax added?

100 X - PC @ $2.25 each less 5%
45 X - 15 @ $1.40 each less 5%
10 X - 4 x 8 x 1/2 OSB @ $ 10.40 each less 10%
50 X - 2 x 10 x 16 @ $13.60 each less 10%

    a. $958.60
    b. $1037.95
    c. $1045.30
    d. $1051.85

Solution to #4. Please follow these exact steps with your calculator:

To solve this problem you have to realize that the numbers to the left of the x are a quantity

and that everything between the x and the @ is a description followed by the cost and the discount. Therefore the solution is as follows:

100 x $2.25 = $225.00 – 5% = $213.75

45 x $1.40 = $ 63.00 – 5% = 59.85

10 x $10.40 = $104.00 – 10% = 93.60

50 x $13.60 = $680.00 – 10% = $612.00

$979.20

$979.20 + 6% sales tax = **$1037.95**

5. What is the circumference of #5 rebar?

a. 1-15/16
b. 2-1/8
c. 2-1/4
d. 2-3/8

Solution to #5:

Find the decimal equivalent of 5/8. 5 divided by 8 = .625

Multiply .625 X 3.14 = 1.96

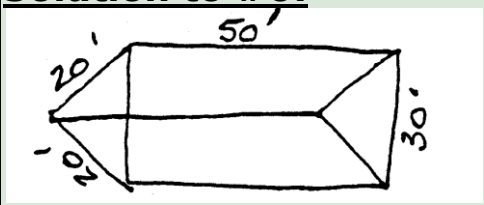
Multiply .96 X 16 = 15.36

Rounding to the nearest 16^{th} is 15. The answer is 1-15/16".

6. If a bundle of shingles contains 33 sq. ft. per bundle, how many bundles are required for a house with dimensions of 30’ x 50’ which has 20’ rafters?

a. 55 or less
b. more than 55, but less than 60
c. 60 to 65
d. more than 65

Solution to #6:



33 square feet/bundle of shingles and the house is 30’ x 50’ with 20’ rafters

Solution may require you to make a diagram to help understand the problem.

A 20’ rafter will not cover a 30’ span nor a 50’ span, therefore you would need two 20’ rafters and the building has a pitched roof with the peak running the 50’ length.

20’ x 50’ x two sides = 2,000 square feet of roof area. 2,000 sq. ft. divided by 33 sq. ft. per bundle = 60.6 bundles.

7. Compute the cost of excavation for a construction project if the size of the excavation is 24 ft. x 40 ft. x 8 ft., at a cost of $4.50 per cubic yard.

a. $1150 or less
b. more than $1150, but less than $1200
c. $1200 to 1250
d. more than $1250

Solution to #7:

The excavated area is 24’ x 40’ x8’ = 7,680 cubic feet
7,680 cu. ft. divided by 27 = 284.44 cu. yds.
284.44 cu. yds. x $4.50 = $1,279.98

8. You need to pour a 4” thick sidewalk, 4 ft wide around the outside perimeter of a rectangular building that has an outside dimension of 24 ft. x 48 ft. At a cost of $65 per cubic yard, how much will this sidewalk cost?

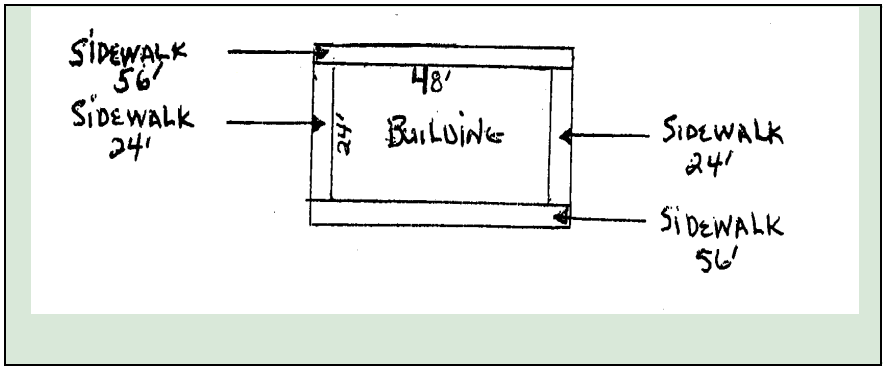
a. $500 or less
b. more than $500, but less than $520
c. $520 to $540
d. more than $540

Solution to #8:

A building is 48’ x 24’ with a 4” thick by 4’ wide sidewalk all the way around the building. The only dimension not given that is needed to be able to figure the volume of concrete is the length. In the illustration below, see how length is easily achieved.

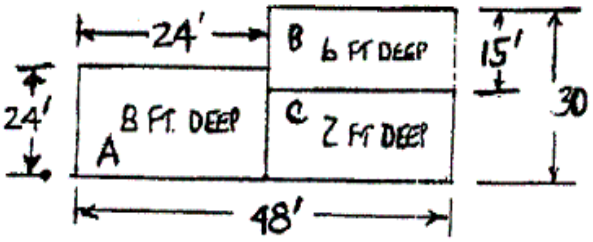
Draw the building and its dimensions. Then draw the sidewalk. Now section off the sidewalk, as is done below, and use the building dimensions to figure the length of each section.

24 + 24 + 56 + 56 = 160’
4” thick x 4’ wide = 160’ length
.33 x 4’ x 160 = 211.2 cubic feet divided by 27 = 7.82 cubic yards x $65.00 = $508.44 total cost



9. You need to excavate the following, at a cost of $4 per cubic yard. How much will it cost?

a. $1,100 or less
b. more than $1,100 but less than $1,120
c. $1,120 to $1,300
d. $1,300 or more



Solution to #9:

Label each area to be excavated as A, B, or C

A = an area that is 8' x 24' x 24' = 4,608 cu. ft.

B = an area that is 6' x 24' x 15' = 2,160 cu. ft.

C = an area that is 2' x 24' x 15' = 720 cu. ft.

7,488 cu. ft.

7,488 cu. ft. divided by 27 = 277.33 cu. yds.

277.33 cu. yds. x $4.00 = $1,109.32

10. If a stairway is 8’ 5 1/2”, and there are 14 risers, what is the height of each riser?

a. 7 1/2”
b. 7 1/32”
c. 7 1/4”
d. 8 1/4”

Solution to #10:

The stairs are 8’5-1/2” high with 14 risers
8 x 12 = 96 inches + 5-1/2” = 101.5 inches
101.5 divided by 14 risers = 7.25”/ riser

11. A contractor needs to purchase fill sand to fill an area that is 4’ X 15’ X 30’. If the fill loses 25% of volume to compaction, how many cubic yards need to be ordered?

a. 83.32 cubic yards
b. 85 cubic yards
c. 88.88 cubic yards
d. 92 cubic yards

Solution to #11:

4 X 15 X 30 = 1800 cubic inches Divided by 27 = 66.66 cubic yards.
66.66 divided by 75% = 88.88 cubic yards.

12. On June 3rd. you received an invoice for material on a 30 day 3% discount basis. The invoiced cost of the materials is $950. If you pay on June 30th., your cost will be?

a. $921.50
b. $950.50
c. $1047.00
d. none of the above

Solution to #12:
$950.00 less 3% ($28.50) = $921.50

13. For a roof job you estimated you will need 50 squares of shingles at a cost of $42.50/ square. You actually used 62 squares at a cost of $39.95/ square. By what amount were you under or over your estimate?

a. $300 to $325
b. $326 to $350
c. $351 to $375
d. none of the above, you were under the estimate

Solution to #13:

50 sq. x $42.50 = $2,125.00
62 sq. x $39.95 = $2476.90
$2,476.90 -$2,125.00 = $351.90
over estimate

14. The material cost for one job is $18,000. Your labor cost will equal 50% of your material cost. Your overhead is $1,800. You want to make a profit of at least 15%. Your minimum bid for this job should be:

a. $23,480
b. $28,800
c. $33,882

d. $37,800

Solution to #14:

Material costs = $18,000.00
Labor costs (1/2 material) = 9,000.00
Overhead costs = 1,800.00
$28,800.00
$28,800.00 ÷ 85% = 5082.35
$33,882.35

15. A builder will hire two carpenters that can hang one interior door every fifteen minutes as a team. Each carpenter earns $16 per hour. How much will it cost the builder to have 32 interior doors hung?

a. $128
b. $224
c. $256
d. $272

Solution to #15:

1 door/15 minutes or 4 doors /hour
4 doors times 8 hours = 32 doors
8 hours times $32.00 = $256.00
(A common mistake is to multiply by one hour wage rate ($16.00)

16. A 7 ½" line on a blue print with a ¼" to foot scale would be how long for the actual building?

a. 25'
b. 27'
c. 30'

d. 32’

Solution to #16:

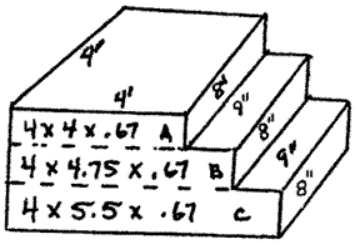
7.5 divided by .25 = 30’

17. You have contracted to pour a three-step concrete structure that has the following measurements. Width of stoop is 4’, each step has a 9” run and a 8” rise. The stoop extends out 4’ from the door. How much will it cost to pour this concrete structure with concrete if concrete costs $65.00/cubic yard and you need to add 6% sales tax?

a. $97.15
b. $192.92
c. $262.64
d. $2,618.20

Solution to #17

To compute the amount of concrete you should make a diagram



label each area as A, B, and C
compute the cu. ft. for each of the three areas

A = 4’x 4’ x 0.67’ =	10.67 cu. ft.
B = 4’ x 4.75’ x 0.67’ =	12.73 cu. ft.
C = 4’ x 5.5’ x 0.67’ =	14.74 cu. ft.
	38.19 cu. ft.

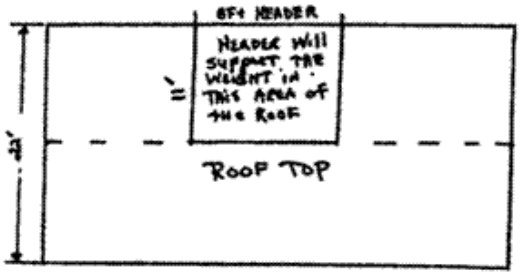
38.19 cu. ft. divided by 27 = 1.41 cu. yds
1.41 cu. yds. x $65.00 = $91.65
$91.65+ 6.5% sales tax ($5.96) = $97.61

18. The builder is to install a 8’ long window in an exterior wall of a flat roof house. The roof span is 22’ and the roof load is 40 lbs per square foot. What size header is needed?

Header Size	Maximum Load in pounds on header
a. 2x4x8’	400
b. 2x6x8’	1600
c. 2x8x8’	2700
d. 2x10x8’	3700

Solution to #18:

A flat roof house with 22’ long rafters.
The rafters will rest equally on both walls therefore the rafter length per wall is 11’ since the window is 8’ wide you must multiply the rafter length times the width of the opening to obtain the square foot of roof resting on the header.
8’ x 11’ = 88 sq. ft. The square foot of roof load times the load per sq. ft. = a load of 3,520 lbs.
The only header which will carry this load is the one of 3,700 pounds (2”x10”x9’)



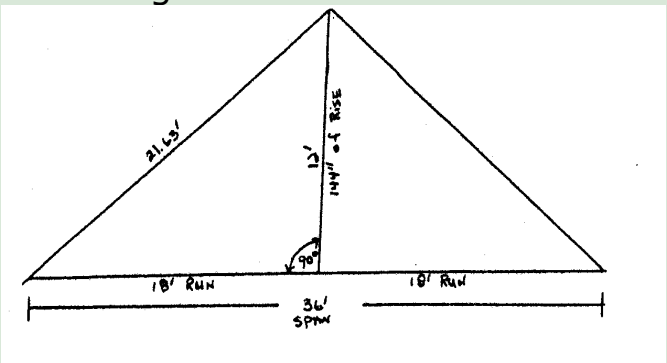
19. How many sheets of 4’x 8’ roof sheathing must the builder order for the following building? The building is 36’ X 64’ and has a gable roof with a 8 in 12 pitch. Do not account for any waste.

a. 87
b. 44
c. 58
d. 29

Solution to #19:

The building is 36’ x 64’ with a 8-12 pitch gable roof

Make a diagram:



First, figure the hypotenuse of the right triangle

$H = A^2 + B^2$

12 x 12 + 18x18

144 + 324 =468

H = 468 = 21.633’ or 21.63’

therefore 21.63’ x 64’ x 2 sides = 2769 sq. ft.

2769 sq. ft. divided by 32sq. ft.(4’x8’)= 86.5 sheets

20. A truss is 36’ long and you have a 7:12 pitch roof. What is the height to the ridge?

a. 5’ 6”
b. 9’ 6”
c. 10’ 6”
d. 12’

Solution to #20

A truss is 36’ long and you have a 7-12 pitch roof. What is the height to the gable peak?

a. 5’6”

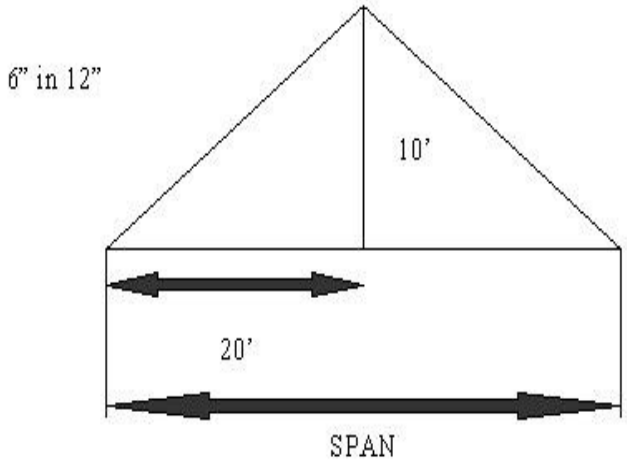
b. 9’6”
c. 10’6”
d. 12’ to the ridge.

The rise 7 x 18 (half the span) = 126" divided by 12" (to convert to feet) = 10.5’ to the ridge.

21. What is the distance between the soffit and the ridge when the roof run is 20 ft. with a 6 -12 pitch?

a. 19’
b. 20’
c. 22.36’
d. 23’

The key to this question is the ability to calculate the distance of rise for this roof. AT a 6 in 12 pitch, there is 6" of rise for every 12" of run. Because we have 20' of run, we are then raising 6" 20 times (6 x 20 = 120").



Next we need to convert 120" to units of feet (120" ÷ 12" = 10'). Now that we have the rise and the run, we can use the Pythagorean theorem to figure the distance needed:

$A^2 + B^2 = C^2 =$ 10 x 10 = 100
20 x 20 = 400
500

500 is the sum of the 2 sides squared. If 500 is the number on display on your calculator, press the square root key ($\sqrt{}$) = 22.36'