



Residential Code Requirements Summary

The intent of this handout is to summarize code requirements and regulations to assist in the planning of projects and preparation of construction documents. Refer to the entire building code for a complete list of building code requirements.

1. Background on the Building Code and Definitions

The State of Minnesota requires that construction of and improvements to one and two family dwellings and townhouses are in accordance with the 2020 Minnesota Building Code (MSBC), which includes the 2020 Minnesota State Residential Code, Minnesota Residential Energy Code and Minnesota Plumbing, Mechanical, and Electrical codes. Zoning, land use, stormwater, and other development standards are regulated through the City of Duluth Unified Development Chapter (UDC).

Building codes can be viewed online at the MN Department of Labor and Industry website [here](#).

Building code books can be purchased from the International Code Council [here](#).

The Duluth Unified Development Chapter is available for viewing [here](#).

A detailed and complete set of plans will show the plan reviewer that the work will comply with applicable codes and will minimize problems during construction. For a list of Items needed in order for us to perform a complete code review, see our Residential Plan Review Checklist.

The MSRC classifies four occupancy categories: R300

1IRC-1 Single Family Dwelling; IRC-2 Two Family Dwelling; IRC-3 Townhouse; IRC – 4 accessory structures

Residences (also see UDC regulations regarding types of residences)

Dwelling: Single Family

Any building that contains one dwelling unit used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or occupied for living purposes.

Dwelling: Two Family

Any building that contains two separate dwelling units with separation horizontal or vertical on one lot that is used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or occupied for living purposes.

Dwelling: Townhouse

A single family dwelling unit constructed in a group of two or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides of each unit.

Each single family dwelling unit shall be considered to be a separate building. Separate building service utilities shall be provided to each single family dwelling unit when required by other chapters of the *Minnesota State Building Code*.

Duluth Unified Development Chapter UDC Information

Find information about your building site. Find the zone district by using the Community Planning Zoning Map [here](#).

After finding what zone district the property is in, you can find out setback information, other lot standards and permitted uses [here](#).

Using the information found above, determine the buildable area of the site. Zoning setbacks are from property lines.

2. Building Location on Lot Information

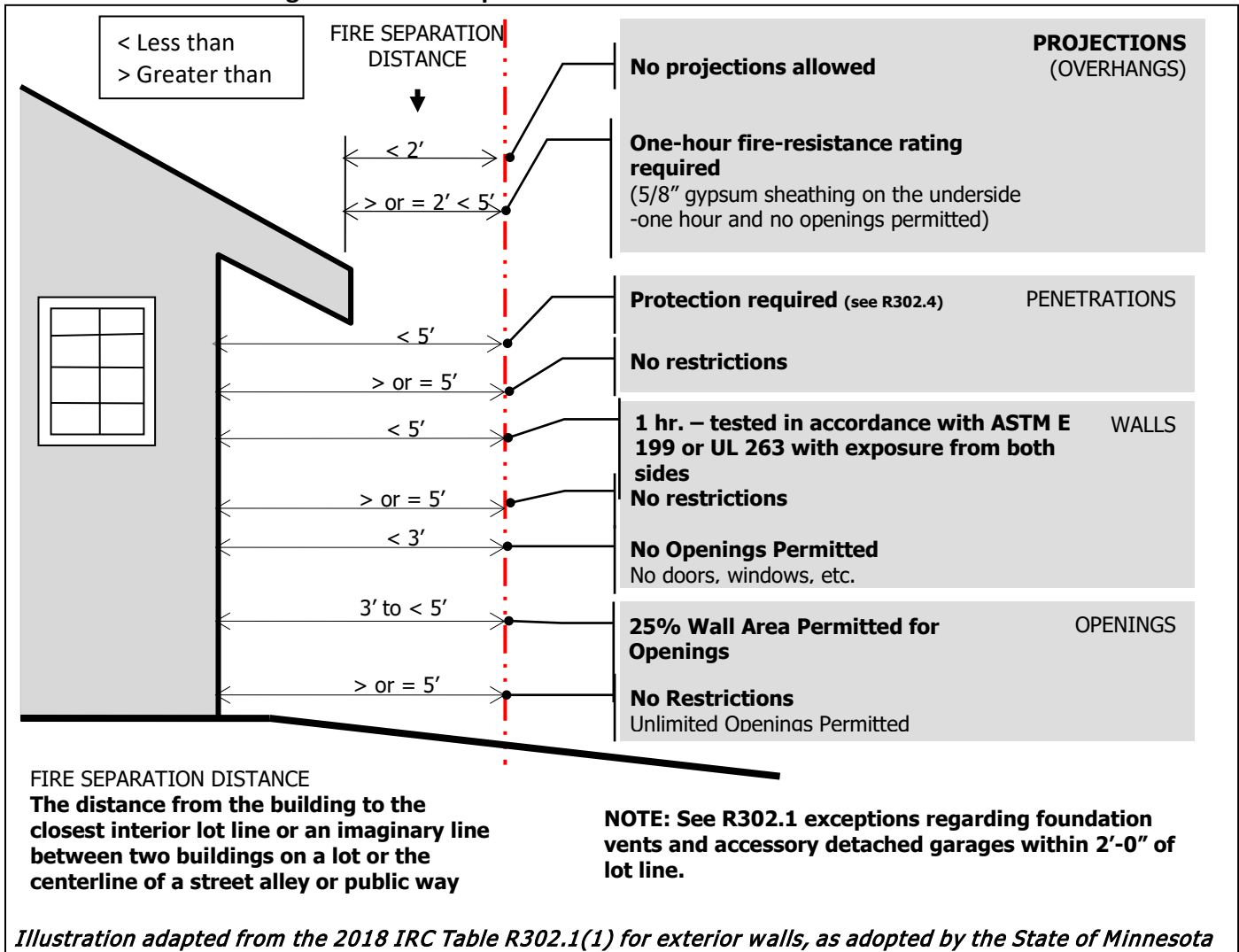
Site Plans Show size and location of new construction and existing structures, distance from all property lines, streets, alleys and easements, in addition to the proposed slope of the property. Site plans must be based on a boundary survey or an established plat.

Surveys. Needed for new buildings, additions, and decks. Please refer to this office's [Survey and Site Plan Drawing Requirements](#) for more information. MSBC 1300.0130, Subp. 4

Fire separation distance is the distance measured from the building face to the closest interior lot line, to the centerline of a street, alley or public way, or to an imaginary line between two buildings on the property. The distance shall be measured at right angles from the lot line.

Exterior wall – distance to property line (per diagram below). Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings not equipped with an automatic sprinkler system shall comply with Table R302.1(1). Detached garages accessory to a dwelling located within 2 feet of a lot line are permitted to have roof eave projections not exceeding 4 inches.

Exterior Walls – Dwellings without Fire Sprinklers



3. Building Planning Information

Minimum Design Live Loads

The following structural design live loads are minimum values. Dead loads for structures depend on the materials that are used. Care should be taken in the design to meet the following requirements:

Exterior balconies and decks	40 psf
Fire escapes	40 psf
Passenger vehicle garages	50 psf, except elevated garage floors shall support 2,000 lbs. over 20 sq. in.
Uninhabitable attics without storage	10 psf
Uninhabitable attics with storage	20 psf
Rooms other than sleeping rooms	40 psf
Sleeping rooms	30 psf
Stairs	40 psf or 300 lbs. concentrated over 4 sq. in., whichever produces greater stresses
Guards in handrails	200 lbs. in a single concentrated load applied in any direction at any point along the top

Climatic and Geographic Design Criteria

Ground Snow Load	60 psf
Roof Snow Load	42 psf
Wind Speed	90 mph
Wind Exposure Category	Determined on a site specific basis
Seismic Design Category	A (Not Applicable)
Frost depth	60 inches
Winter Design Temperature	-20 degrees F
Subject to Damage From:	
Weathering	Severe
Termites	Slight to moderate
Decay	None to slight

Habitable space is a space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces. R202

4. Minimum Room Sizes

Minimum area. Every dwelling unit shall have at least one habitable room that shall have not less than 120 sf of gross floor area. R304.1

Minimum for other rooms: Except kitchens, habitable rooms shall have a floor area of not less than 70 sf, except every kitchen shall have not less than 50 sf of gross floor area. R304.2

Minimum dimensions. Except kitchens, habitable rooms shall not be less than 7 feet in any horizontal dimension.

Minimum Ceiling Height New Building: Habitable space, hallways, bathrooms, toilet rooms, laundry rooms, and portions of basements containing these spaces shall have a ceiling height of not less than 7 feet. The required height shall be measured from the finish floor to the lowest projection from the ceiling. R305.1

Exceptions:

1. For rooms with sloped ceilings, at least 50 percent of the required floor area of the room shall have a ceiling height of at least 7 feet and no portion of the required floor area may have a ceiling height of less than 5 feet.

2. Bathrooms shall have a minimum ceiling height of 6 feet 8 inches at the center of the front clearance area for the water closets, bidets, or sinks.

5. Light, Ventilation and Heating

Habitable rooms, adjoining rooms and bathrooms all require both ventilation and lighting. Both natural and artificial methods are permitted. As a general rule, if natural lighting and ventilation is to be provided, window openings shall be 8% of the floor area for lighting and 4% of the floor area for ventilation. R303

Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building. R303.9

Required heating. Every dwelling unit shall be provided with heating facilities capable of maintaining a minimum room temperature of 68°F at a point 3 feet above the floor and 2 feet from exterior walls in all habitable rooms at the design temperature. R303.10

6. Windows

Glazing Hazardous Locations— AKA Safety Glass or Tempered Glass

Identification. Each pane of glazing installed in hazardous locations shall be provided with a manufacturer's or installer's label, designating the type and thickness of glass and the safety glazing standard with which it complies, which is visible in the final installation. R308.1

Hazardous locations. The following are considered specific hazardous locations for the purposes glazing:

Glazing in doors. Glazing in all fixed and operable panels of swinging, sliding and bi-fold doors shall be considered a hazardous location. R308.4.1

Glazing adjacent doors. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches above the floor or walking surface shall be considered a hazardous location. R308.4.2

Glazing in windows. Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered a hazardous location:

1. The exposed area of an individual pane is larger than 9 square feet;
2. The bottom edge of the glazing is less than 18 inches above the floor;
3. The top edge of the glazing is more than 36 inches above the floor; and
4. One or more walking surfaces are within 36 inches, measured horizontally and in a straight line, of the glazing.

Glazing in guards and railings. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered a hazardous location. R308.4.4

Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches measured vertically above any standing or walking surface shall be considered a hazardous location. This shall apply to single glazing and all panes in multiple glazing. R308.4.5

Glazing adjacent stairs and ramps. Glazing where the bottom exposed edge of the glazing is less than 36 inches above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered a hazardous location. R308.4.6

Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches above the landing and within 60 inches horizontally of the bottom tread shall be considered a hazardous location. R308.4.7

Emergency Escape Basements, habitable attics, and every sleeping room shall have at least one openable emergency escape and rescue opening. Emergency escape and rescue openings shall open directly into a public way, or to a yard or court that opens to a public way. R310.1

Minimum opening area. All emergency escape and rescue openings shall have a minimum net clear opening of 5.7 sf, except grade floor openings shall have a minimum net clear opening of 5 sf (see window well handout). Most window manufacturers list this information. R310.2.1

Minimum opening height and width. The net clear opening height shall be 24 inches minimum. The net clear opening width shall be 20 inches minimum. R310.2.2, R310.2.3 (NOTE: 24" x 20" does not meet the required 5.7 sq. ft of area needed they are just minimum dimension sizes).

Operational constraints. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools or special knowledge. R310.1.1

Replacement windows. Replacement windows installed in buildings regulated by the International Residential Code shall be exempt from the maximum sill height requirements of Sections R310.2.2, including subsections R310.2.1, the replacement window is the manufacturer's largest standard size rough opening. The replacement window shall be the same operating style as the existing window or style that provides for an equal or greater window opening area than the existing window.

Window wells. Window wells required for emergency escape and rescue shall have horizontal dimensions that allow the door or window of the emergency escape and rescue opening to be fully opened. The horizontal dimensions of the window well shall provide a minimum net clear area of 9 sf with a minimum horizontal projection and width of 36 inches, and shall provide at least 36 inches vertically under decks and porches. The required ladder or steps shall be permitted to encroach a maximum of 6 inches into the required dimensions of the window well. Footing depth below grade must be maintained at window well locations. Provide horizontal rigid insulation at the bottom of the window well in retrofit applications. See Construction Services' [Window Well handout](#) for more information. R310.2.3

Ladder and steps in window wells. Window wells with a vertical depth greater than 44 inches below the adjacent ground level shall be equipped with a permanently affixed ladder or steps usable with the window in the fully open position. Ladders or rungs shall have an inside width of at least 12 inches, shall project at least 3 inches from the wall and shall be spaced not more than 18 inches on center vertically for the full height of the window well. R310.2.3.1

Drainage. Window wells shall be designed for proper drainage by connecting to the building's foundation drainage system or by an approved alternate method. R310.2.3.2

Bars, grills, covers and screens. Bars, grills, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosures, or window wells that serve such openings, provided the minimum net clear opening size equals that required for egress windows. Release or removal shall be from the inside and shall not require the use of a key, tool, special knowledge or force greater than that which is required for normal operation of the escape and rescue opening. R310.4

Window Fall Protection. Window sills in dwelling units, where the lowest part of the opening of an operable window is located more than 72 inches above the finished grade or surface below, the lowest part of the window opening shall be a minimum of 36 inches above the finished floor of the room in which the window is located. Operable sections of windows shall not permit openings that allow passage of a 4-inch diameter sphere where such openings are located within 36 inches of the finished floor. R312.2.1

Window Opening Control Devices. Window opening control devices shall comply with ASTM F 2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section R310.1.1. R312.2.2

7. Means of Egress

All dwellings shall be provided with a means of egress as provided in this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the dwelling to the exterior of the dwelling at the required egress door without requiring travel through a garage.

Egress door. At least one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a minimum clear width of 32 inches when measured between the face of the door and the stop, with the door open 90 degrees. The minimum clear height of the door opening shall not be less than 78 inches in height measured from the top of the threshold to the bottom of the stop. R311.2

Hallways. The minimum width of a hallway shall not be less than 3 feet. R311.6

Egress facilities. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal. R311.5.1

Ramps shall have a maximum slope of one unit vertical in 12 units horizontal. Handrails shall be provided on at least one side of all ramps exceeding a slope of one unit vertical in 12 units horizontal. A minimum 3' x 3' landing shall be provided at the top and bottom of ramps, where doors open onto ramps and where ramps change direction.

Stairways. Stairways shall not be less than 36 inches in clear **width** at all points above the permitted handrail height and below the required headroom height. **Handrails** shall not project more than 4½ inches on either side of the stairway and the minimum clear width of the stairway at and below the handrail height, including treads and landings, shall not be less than 31½ inches where a handrail is installed on one side and 27 inches where handrails are provided on both sides. The maximum **riser height** shall be 7¾ inches and the minimum tread depth shall be 10 inches. The riser height shall be measured vertically between leading edges of the adjacent treads. The **tread depth** shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The walking surface of treads and landings of a stairway shall be sloped no steeper than one unit vertical in 48 units horizontal (2%). The greatest riser height within any flight of stairs shall not exceed the smallest by more than ¾ inch. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ¾ inch. Open risers are permitted, provided that the opening between treads does not permit the passage of a 4 inch diameter sphere. The minimum **headroom** in all parts of the stairway shall not be less than 6'-8" measured vertically from the sloped plane adjoining the tread nosing or from the floor surface of the landing or platform.

Winder treads. Winder treads shall have a minimum tread depth of 10 inches measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walk line. Winder treads shall have a minimum tread depth of 6 inches at any point within the clear width of the stair. R311.7.5.2.1

Spiral stairways. Spiral stairways are permitted, provided the minimum clear width at and below the handrail shall be 26 inches with each tread having a 7½ -inch minimum tread depth at 12 inches from the narrower edge. All treads shall be identical, and the rise shall be no more than 9½ inches. A minimum headroom of 6 feet 6 inches shall be provided. R311.7.10.1

Stairway illumination. All interior and exterior stairways shall be provided with a means to illuminate the stairs, including the landings and treads. R303.7

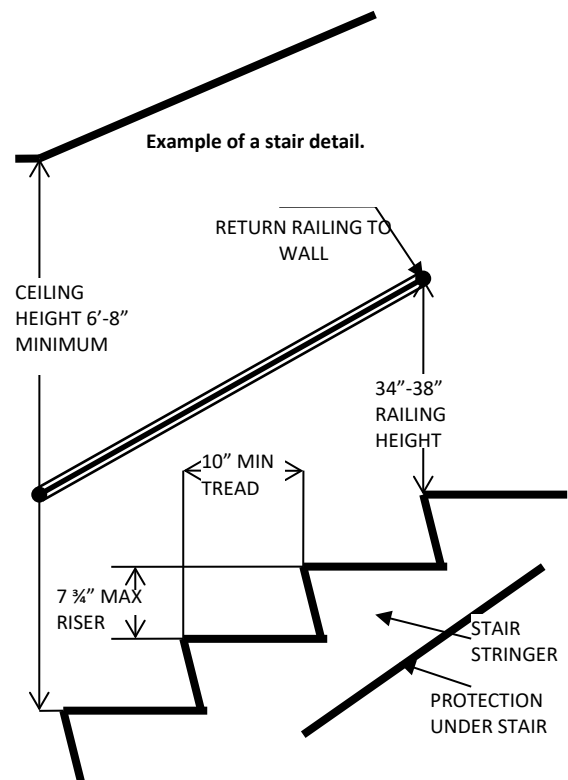
Under stair protection. Enclosed accessible space under stairs shall have walls, under stair surface, and soffits protected on the enclosed side with ½ inch gypsum board. R302.7

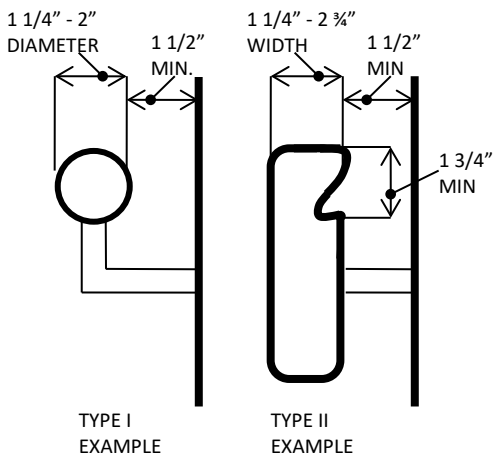
Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall not be less than the door served. Every landing shall have a minimum dimension of 36 inches measured in the direction of travel. R311.3

Floor elevations at the required egress doors. Landings or finished floors at the required egress door shall not be more than 1½ inches lower than the top of the threshold. R311.3.1

Exception: The landing or floor on the exterior side shall not be more than 7¾ inches below the top of the threshold provided the door does not swing over the landing or floor.

Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway. The minimum width perpendicular to the direction of travel shall be no less than the width of the flight served. Where the stairway has a straight run, the minimum depth in the direction of travel shall be not less than 36 inches. R311.7.6





Handrails – It is what you hang on to when you go up and down the stairs

Handrails. Handrails having minimum and maximum heights of 34 inches and 38 inches, respectively, measured vertically from the nosing of the treads (to the top of the gripping surface), shall be provided on at least one side of stairways. All required handrails shall be continuous the full length of the stairs with four or more risers from a point directly above the top riser of a flight to a point directly above the lowest riser of the flight. Ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inches between the wall and the handrail. Handrails may be interrupted by a newel post at a turn. The use of volute, turnout, or starting easing is allowed over the lowest tread. Design live load of 200 pounds applied in any direction is required. MSRC R311.7.8

8. Guards

Guards required. Guards shall be located along the open sides of floors, stairs, ramps, and landings that are located more than 30 inches measured vertically to the floor or grade below. Insect screening shall not be considered a guard. Guards and handrails shall be designed to withstand a single 200 pound concentrated load applied in any direction at any point along the top. R312.1.1

Height. Required guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 36 inches high measured vertically above the adjacent walking surface, adjacent fixed seating or the line connecting the leading edges of the treads. R312.1.2

Guard opening limitations. Required guards shall not have openings from the walking surface to the required guard height which allow passage of a sphere 4 inches in diameter, except the triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches in diameter. Guards on the open side of stairs shall not have openings which allow passage of a sphere 4³/₈ inches in diameter. R312.1.3

9. Smoke and CO Alarms

Smoke alarms shall be installed in each sleeping room, outside of each separate sleeping area in the immediate vicinity of the bedrooms, as well as each additional story of the dwelling, including basements and habitable attics, but not including crawl spaces and uninhabitable attics. When more than one smoke alarm is required to be installed, the alarm devices shall be interconnected in such a manner that all devices will activate if one is activated. All smoke alarms shall be hardwired with battery back-up and installed in accordance with the provisions of this code and the household fire warning equipment provisions of NFPA 72.

Alterations, Repairs and Additions. An individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings when alterations, repairs (including installation or replacement of windows or doors), or additions requiring a permit occur; or one or more sleeping rooms are added or created in existing dwellings. R314.3.1

CO Carbon monoxide alarms. For new construction, every one-family dwelling unit, two-family dwelling unit, and each townhouse dwelling unit shall have an approved and operational carbon monoxide alarm installed when one of the following conditions occur: R315.1

- 1. Fuel-fired appliances are installed; or
- 2. Have attached garages.

Installation. Carbon monoxide alarms shall be installed outside and not more than 10 feet from each sleeping area or bedroom. Alarms shall be installed on each level containing sleeping areas or bedrooms.

Where required in existing dwellings. Where work requiring a permit occurs in existing dwellings that have attached garages or in existing dwellings within which fuel-fired appliances exist, carbon monoxide alarms shall be provided in accordance with Section 315.1. R315.3

10. Sanitation

Toilet facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower. R306.1

Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink. R306.2

Sewage disposal. All plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system. R306.3

Water supply to fixtures. All plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water. R306.4

Toilet, Bath and Shower Spaces

2020 MN Plumbing Code Chapter 4714

Setting. Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet or bidet shall be set closer than 15 inches from its center to a side wall or obstruction nor closer than 30 inches center to center to a similar fixture. The clear space in front of a water closet or bidet shall not be less than 24 inches. No urinal shall be set closer than 12 inches from its center to a side wall or partition nor closer than 24 inches center to center.

Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed showerheads and in shower compartments shall be finished with a nonabsorbent surface. Such nonabsorbent wall surfaces shall extend to a height of not less than 6 feet above the floor. R307.

Plumbing Considerations for Residential Additions. The holder of the building permit is responsible for the items listed here, ensuring that existing water and sewer lines are not compromised.

Any work to a sewer or water line requires a separate plumbing permit and must be completed by either a licensed master plumber or a pipelayer qualified and bonded to do such work.

Questions regarding plumbing requirements can be directed to:

East Plumbing Inspector 522-0891

West Plumbing Inspector 481-5326

11. Foam Plastic

Spray foam Thermal barrier. All foam plastic or foam plastic cores in manufactured assemblies used in building construction shall have a flame-spread rating of not more than 75 and shall have a smoke-developed rating of not more than 450 and, except where otherwise noted, shall be separated from the interior of a building by minimum ½ inch gypsum board or an approved finish material equivalent to a thermal barrier. R316.3, R316.4

Attics and crawlspaces. Within attics and crawlspaces where access is required by other sections of the code and entry is made only for purposes of repairs or maintenance, foam plastics shall be protected against ignition by 1½ inch thick mineral fiber insulation, ¼ inch-thick wood structural panels, ¾ inch particleboard, ¼ inch hardboard, ¾ inch gypsum board, or corrosion-resistant steel having a base metal thickness of 0.016 inch or 1½ inch thick cellulose insulation. R316.5.3.

Foam plastic in the rim joist area. Foam plastic shall be permitted to be spray applied to a sill plate and header without the thermal barrier subject to all of the following: R316.5.11

1. The maximum thickness of the foam plastic shall be ¾ inches.
2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot.
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723.

12. Garages and Carports

Detached Garage A Garage Packet is available for standard residential garages only, and can be found online [here](#).

Floor Drains may connect to the storm sewer if the garage has a frost protected foundation or may drain to daylight. Detached garage floor drains in a garage with a non-frost protected foundation may drain to daylight.

Carports. Carports shall be open on at least two sides. Carport floor surfaces may be concrete, asphalt, sand, gravel, crushed rock, or natural earth. Carports not open on at least two sides shall be considered a garage and shall comply with the provisions of this section for garages. R309.2

Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1³/₈ inches in thickness, solid or honeycomb core steel doors not less than 1³/₈ inches thick, or 20-minute fire-rated doors. R302.5.1

Duct penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage sheet steel or other approved material and shall have no openings into the garage. R302.5.2

Dwelling/garage fire separation. The garage shall be separated as required by Table R302.6.

TABLE R302.6 DWELLING/GARAGE SEPARATION

SEPARATION	MATERIAL
From the residence and attics	Not less than ½ -inch gypsum board or equivalent applied to the garage side. Vertical separation between the garage and the residence attic shall extend to the roof sheathing or rafter blocking.
From all habitable rooms above the garage	Not less than 5/8 -inch Type X gypsum board or equivalent
Structural members supporting floor/ceiling assemblies or garage ceiling used for separation required by this section	Not less than ½ -inch gypsum board or equivalent applied to the garage side of structural members supporting the floor/ceiling assemblies or garage ceiling. Structural members include, but are not limited to: walls, columns, beams, girders, and trusses.
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than ½ -inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area. This provision does not apply to garage walls that are perpendicular to the adjacent dwelling unit wall.

Garage floors. Attached garage floor drains must drain to daylight or connect to the storm sewer. Concrete floor slabs in unheated garages can be moved by the effects of frost. Pour the garage floor separate from the foundation and place walls directly on the foundation to allow this movement to be independent so it does not affect other elements of the structure.

13. Foundations

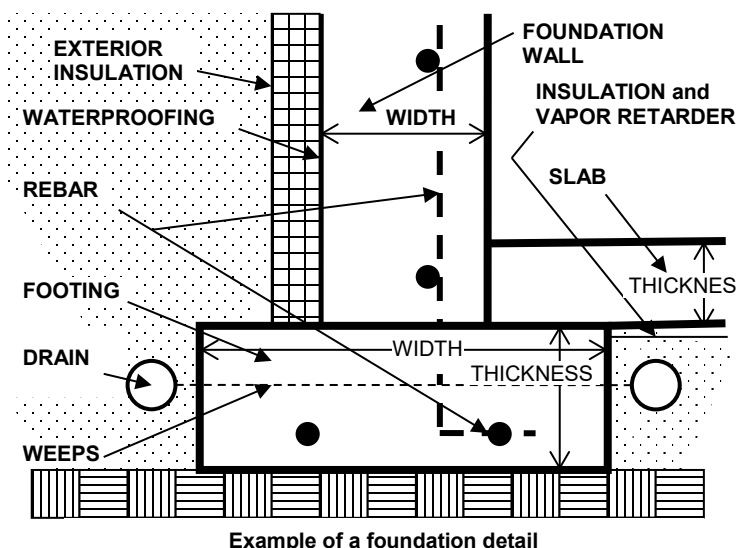
Footings

Minimum footing size is 24" x 7", reinforced with (2) - #4 rebar placed 3 inches (cover) above the footing bottom. This will suffice for most conventional light frame residence with 1 story and a full basement. See Table R403.1 for buildings with other configurations and brick or masonry construction. In the City of Duluth we assume 1,500 psf soil bearing as a default value. To determine a higher bearing capacity, a report from a geotechnical engineer will need to be provided. A minimum of (1) - #4 rebar vertical shall be provided in piers.

Frost depth. Minimum depth from grade to bottom of footing in Duluth is 60 inches. 1303.1600

Reinforcing bars as a ground for Electrical

in footings in contact with earth may be used to ground buildings per NEC 250.50 and 250.52. Residences are required to be grounded.



Foundation Walls

Rebar. See section R404 for numerous tables that show minimum reinforcing steel requirements. Both vertically spaced rebar and horizontally spaced rebar are required, depending upon the type of wall that is being proposed.

Plans. Wall thickness, height of backfill, type of soil used for backfill, reinforcing of concrete and anchorage must be clearly shown on plans for all foundation types. Plans must be fully descriptive of the work that is being proposed. Code tables are based on wall height and back fill height. Please include these items on submitted plans.

Foundation anchorage. Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs, and all wood sill plates shall be anchored to the foundation with anchor bolts spaced a maximum of 6 feet on center. Bolts shall be at least ½ inch in diameter and shall extend a minimum of 7 inches into concrete or grouted cells of concrete masonry units. A nut and washer shall be tightened on each bolt. There shall be a minimum of two bolts per plate section with one bolt located not more than 12 inches or less than 7 bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay where required by Section R317. When vertical reinforcing is required by other sections of this code, the foundation anchor bolts shall align with the reinforcing. All anchor bolts installed in masonry shall be grouted in place with at least 1 inch of grout between the bolt and masonry. R403.1.6

Masonry foundations (Block Foundations) must comply with the MSRC Chapter 4 or have plans certified by a Minnesota licensed structural engineer. To minimize damage from freezing of block below grade, it is recommended to use three-core block. all cores must be fully filled.

Poured concrete foundations must comply with the MSRC Chapter 4 or have plans certified by a Minnesota licensed structural engineer.

Insulated concrete form (ICF) foundations shall comply with the published manufacturer's data, the MSRC Chapter 4 or be designed by a Minnesota licensed structural engineer. May use manufactures specifications for reinforcing bars or the code tables. If using manufacturers specifications, please submit with permit application.

Wood foundations must comply with the MSRC Chapter 4 or have plans certified by a Minnesota licensed structural engineer. Complete plans, sections and details are required clearly showing compliance with the building code, detailing waterproofing and backfill.

Frost protected shallow foundations must comply with the MSRC Chapter 4 and the 2020 Minnesota Residential Energy Code. See Construction Services' Exterior foam to equal 5' for energy code compliance (Usually 1'6" vertically on side of foundation and 3'-6" horizontal)

Exterior foam insulation installed vertically must be protected above grade and to 6 inches below grade, for both standard and shallow frost protected foundations. When installed horizontally, (for shallow frost protected foundations) protection is required where foam is less than 12 inches below the ground surface or that portion of horizontal insulation extending outward more than 24 inches. 1322.0303.2.1, R403.3.2

Waterproofing. Concrete and masonry basements must be waterproofed as per R406.2. Any product proposed that is not prescribed in this section requires Building Official approval and must be specified on the construction documents.

Surface drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded so as to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches within the first 10 feet. R401.3

Foundation drainage. Drains shall be provided around all concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the area to be protected and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend at least 1 foot beyond the outside edge of the footing and 6 inches above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper, and the drainage tiles or perforated pipe shall be placed on a minimum of 2 inches of washed gravel or crushed rock at least one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches of the same material. R405.1

Drain tiles shall be installed around the perimeter of all footings, both inside and outside of the building for foundations that retain earth and enclose habitable or useable spaces located below grade. Perimeter drain tiles shall be connected by cross tiles through the footings (weeps). Cross weeps shall be a minimum 2 inch diameter PVC (or approved equal). They shall be located flush with the top of the footing. Cross weep spacing shall not exceed 10 foot on center, with a minimum of one cross weep per length of footing.

Radon mitigation systems may be tied into the foundation drainage system when approved by the building official.

Perimeter drain tiles shall discharge into a sealed sump pit that will allow the subsurface ground water to be discharged by gravity to daylight or by a sump pump.

Backfill. Backfill for buildings to be of a material which will convey water to the drainage system. The drainage system to have a sump pump on the interior of the building and a drain to daylight at exterior

Crawl spaces

There are two separate ways to address a crawl space under the main floor of a home. These are distinct and separate ways of addressing the space. The two systems cannot be mixed and matched with each other. A minimum of an 18" x 24" access is required for any crawl space. Any foundation which is under 6'-4" would be considered a crawl space.

Unvented crawl space

In this system the thermal envelope is at the exterior walls of the foundation. R-15 is required at wall and R-10 under the slab (if there is a slab). The space must have heat and ventilation. Think of it as similar to a really short basement. Access to an unvented crawl space is usually from the interior. It could be a hatch, ladder or even a stairway.

Vented crawl space.

In this system the thermal envelope is at the floor system. R-38 is required at the floor. A plan on how to protect any water and sewer lines from freezing needs to be provided at permit submission. Ventilation is required. The amount of ventilation depends on if the ground is covered or not and what it's covered with. The ventilation in this system is required to prevent mold and the decay of the floor system. Access to a vented crawl space is usually on the exterior.

14. Floors

Fire protection of floors. Floor assemblies not required to have a fire-resistance rating must be provided with a ½ inch gypsum wallboard membrane, 5/8-inch wood structural panel membrane, or equivalent on the underside of the floor framing members. There are exceptions such as providing an automatic sprinkler system or if the floor framing is 2x10 or larger. R302.13

Concrete floors. A 6-mil poly vapor retarder is required under concrete floors except in unheated structures. R10 under slab insulation, per energy code, is required for basement floors (Not applicable for shallow frost protected floors) Fill material shall be free of vegetation and foreign material, compacted to ensure uniform support and, except where approved, shall not exceed 24 inches for clean sand or gravel and 8 inches for earth. A 4-inch-thick base course of clean graded sand, gravel or crushed stone shall be placed on the prepared sub-grade when the slab is below grade. R506 **Floor framing plans** must be submitted with construction documents for plan review. Show size and spacing on floor plans see table R502.3.1 for joist size and spacing requirements.

Engineered lumber If engineered products are used, please provide shop drawings indicating all trusses, I-joists, beams, columns, required placement and bracing.

15. Walls

A wall section must be submitted with construction documents depicting all components of the proposed wall assembly. R317 requires the use of treated or decay resistant wood in some situations. See [sample drawing](#).

Vapor retarder. A Class I or Class II vapor retarder is required on the interior (Warm) side of frame walls in Climate Zones 6 and 7. Class II vapor retarders are permitted only when specified on the construction documents. It need not be sealed unless it also serves as the air barrier required by the energy code. A 6-mil polyethylene or approved vapor retarder with joints lapped not less than 6 inches shall be placed between the concrete floor slab and the base course or the prepared subgrade where no base course exists. The vapor retarder may be omitted from garages, utility buildings, unheated storage rooms having an area less than 70 square feet, carports and from driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date. R702.7

- Class I: Sheet polyethylene, unperforated aluminum foil.
- Class II: Kraft-faced fiberglass batts.

Wall sections. Basically show and list the construction of each wall in your project. Please provide information for each different wall to be built, such as interior, plumbing wall, exterior walls. Wall sections must be provided, to determine if proposed project complies with the minimum code requirements. see MSRC Chapters 5 and 6.

Headers and beams. Indicate, on the plans, all required headers (over window and door openings) and beams. See [residential header table](#) (Tables R602.7) or provide engineering.

Wall bracing. See R602.10 for complete design requirements. A braced wall panel has to be within 10' of a corner and must be a maximum of 20' apart.

16. Roof and Ceiling

Ventilation. Typically, a 1-inch minimum gap is required from the soffit ventilation to roof or ridge vents. See IRC Section 806 for specific roof ventilation requirements. Unvented attic assemblies (hot roof) are now allowed when constructed as per the requirements of R806.5.

Eave baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation. The baffle shall be permitted to be any solid material. 1322.0402.2.3

Attic Access. In attics which have 30 square feet of area and a vertical height of 30" or greater, a minimum opening of 22" x 30", is needed and it shall be gasketed to prevent heat loss. Locate attic access in a hall, or other accessible location. R807.1

Ice Barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier that consists of a least two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet, shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point at least 24 inches inside the exterior wall line of the building. On roofs with a slope of 8/12 or greater, the ice barrier shall be applied not less than 36" from exterior wall R905.1.2

Truss uplift resistance. Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the truss design drawings. Uplift forces shall be permitted to be determined as specified by Table R802.11, if applicable, or as determined by accepted engineering practice. R802.11.1.2

17. Flashing

Approved corrosion-resistive flashing shall be provided in the exterior wall envelope in such a manner as to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Typical locations include deck ledger boards and other horizontal projections, among other conditions addressed by the code. The flashing shall extend to the surface of the exterior wall finish and shall be installed to prevent water from reentering the exterior wall envelope. Flashing shall be installed in the locations required in

Window and door flashing shall be according to manufacturer's instructions. Instructions shall be available on job site for inspectors.

Pan flashing is required at all exterior windows and doors unless another flashing method is provided by the product manufacturer. Typically, pan flashing is installed so that it slopes to the exterior and has a sealed back dam to prevent water from entering the wall cavity or interior spaces. Refer to the code section for approved methods.

Step flashing is required at locations such as wall to roof intersections and chimneys.

Kick-out flashing is required to be installed so as to divert water away from where the eave of a sloped roof intersects a vertical sidewall. The kick-out flashing on the roof must be a minimum of 2½ inches long. Where flashing is of metal, the metal must be corrosion resistant with a thickness of not less than 0.019 inch (No. 26 galvanized sheet). R903.2.1

18. Energy Code

New detached one- and two family dwellings and townhouses shall comply with the 2020 Minnesota Residential Energy Code. Some of the most common tabular R-values are as follows: Ceiling R-49, Walls and Rim R-21, Foundation Walls R-15, Floors R-38, Slab R-10. Windows and doors shall have a U-factor no greater than .32. See handout and the Minnesota Residential Energy Code for additional information, including air barrier and foundation insulation requirements.

19. Decks

For more information regarding decks, please refer to the [Residential Decks Application Packet](#).

20. Radon Control Systems

Radon mitigation is required in all new residential structures listed below: 1303.2401, 1303.2402, 1303.2403

One-family dwellings; Two-family dwellings; Townhouses; Apartment buildings; Condominiums; Multistory buildings that include any residential occupancy; Any addition to an existing dwelling that currently has a radon control system incorporated into the existing building.

Passive System Relies on stack effect to provide an upward flow of air from beneath the soil-gas membrane.

Ground Prep. Area below the soil-gas membrane needs preparation to channel the radon gas into the system. A four-inch base of clean aggregate or sand allows the gas to migrate to the sub grade piping system. The piping system starts by connection into the drainage system for the foundation or a “T” fitting connected to a minimum of a ten-foot perforated pipe at two locations. For a total of twenty feet of perforated pipe.

Soil-Gas Membrane System Sealing the ground from the living space directs the radon gas to the path of least resistance, which is the radon control system. 6mil. poly or 3mil cross laminated poly must have a twelve-inch lap that is sealed to reduce leakage of soil gases. Any punctures, tears, or openings in this membrane are to be addressed with tape, caulk, or other sealants. Floor openings, concrete joints, sump pits and the connection where the slab meets the foundation wall must also be sealed.

Vent Pipe The vent pipe shall be primed and glued and extend from the sub-floor to a minimum of twelve-inches above the roof. This pipe must be a minimum of ten-feet from any openings or intake pipes. The pipe must have at least one label on every story and have enough room in the attic to convert from a passive to an active radon system if needed. In unconditioned spaces only, the vent pipe needs a minimum of R-4 insulation.

Electrical Power an electrical circuit terminating in the attic needs to be provided during construction in the event that the radon system needs to be converted from a passive to an active system in the future.

Active Radon System In addition to the requirements above the active system also needs the following items.

Vent Pipe Fan Rated for continuous operation providing 50cubic feet per minute at ½” water column. This is not to be installed in conditioned space. and cannot positively pressurize the pipe located in conditioned space.

System Monitoring an audible alarm or other similar device shall be installed to indicate when the fan is not operating.

Light and Outlet a switch controlled luminaire and the receptacle outlet near the fan to be install per the Minnesota electrical code

21. Construction Documents

Now that you have the basic building code requirements for your residential permit application, it is up to you to provide complete drawings and any other information that describes exactly what you intend to do. The more information you provide, the easier it will be to understand by both plan reviewers and building inspectors. This will greatly help speed your project along, which will help everyone avoid unexpected delays.