**7/15/25:**

DEPARTMENT OF LABOR AND INDUSTRY

# CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

*Author/requestor:* Eric Fowler

*Date:* 5/13/25 Updated 6/25/25

*Email address:* fowler@fresh-energy.org

*Model Code:* 2024 IRC

*Telephone number:* 651-374-1315

*Code or Rule Section:* IRC Chapter 3

*Firm/Association affiliation, if any:* Fresh Energy

*Code or rule section to be changed:* Add Section R333

*Intended for Technical Advisory Group ("TAG"):*

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| **General Information** | **Yes** | **No** |
|---|---|---|
| A. Is the proposed change unique to the State of Minnesota? | ☒ | ☐ |
| B. Is the proposed change required due to climatic conditions of Minnesota? | ☐ | ☒ |
| C. Will the proposed change encourage more uniform enforcement? | ☒ | ☐ |
| D. Will the proposed change remedy a problem? | ☒ | ☐ |
| E. Does the proposal delete a current Minnesota Rule, chapter amendment? | ☐ | ☒ |
| F. Would this proposed change be appropriate through the ICC code development process? | ☒ | ☐ |

**Proposed Language**

1. The proposed code change is meant to:

☒ change language contained the model code book? If so, list section(s).
Appendix NE

☐ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☐ delete language contained in the model code book? If so, list section(s).

☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

☒ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.

   Not directly, however, the State Building Code is established for safety and wellbeing, and to promote the "use of modern methods, devices, materials and techniques." This proposal removes barriers to the safest, most affordable EV charging solution: at home, hard-wired, Level 2 EVSE.

   Preparing buildings for the trend in consumer adoption of EVs (which are charged mostly in the home) is directly responsive to the statutory purpose of the code by increasing safety and adapting to modern technology in a changing market.

   Minimum requirements for EV ready and capable parking spaces in commercial and multifamily buildings passed during the 2023 legislative session.

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

Adopt Appendix NE (Re) Electric Vehicle Charging Infrastructure from the 2024 IRC as amended below, incorporating definitions, and adding remaining content to a new section: R333

Definitions.

**AUTOMOBILE PARKING SPACE.** A space within a building or private or public parking lot, exclusive of driveways, ramps, columns, office and work areas, for the parking of an automobile.

**ELECTRIC VEHICLE (EV).** An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

**Electric Vehicle Capable Space (EV Capable Space).** A designated automobile parking space that is provided with electrical infrastructure ~~such as, but not limited to, raceways, cables, electrical capacity, a panelboard or other electrical distribution equipment space~~ necessary for the future installation of an EVSE load of 6.2 kVA or greater, including electrical panel capacity and space to support a circuit, and raceways, both underground and surface mounted.

**Electric Vehicle Ready Space (EV Ready Space).** ~~An~~ A designated automobile parking space that is provided with a branch circuit terminating in ~~and~~ an outlet, junction box or receptacle that will support an installed EVSE load of 6.2 kVA or greater.

**Electric Vehicle Supply Equipment (EVSE)**. Equipment for plug-in power transfer, including the ungrounded, grounded, and equipment grounding conductors, and the Electric Vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the Electric Vehicle.

**Electric Vehicle Supply Equipment Installed Space (EVSE Space).** An automobile parking space that is provided with a dedicated EVSE connection.

Section R333 Electric Vehicle Charging Infrastructure

**R333.1 ~~NE101.2 (RE101.2)~~ Electric vehicle power transfer infrastructure.**
New residential automobile parking spaces for residential buildings shall be provided with a continuous raceway or cable assembly as required by Sections R333.2 and R333.3 or be provided with EV capable spaces, EV ready spaces, or EVSE spaces in the quantities required by section R333.2. Where provided, EV capable spaces shall comply with section R333.4, EV ready spaces shall comply with section R333.5, and EVSE spaces shall comply with section R333.6.

**R333.2 ~~NE101.2.1 (RE101.2.1)~~ Quantity.**

New one- and two-family dwellings and townhouses with a designated attached or detached garage or other on-site private parking provided for ~~adjacent to~~ the dwelling unit shall be provided with a continuous raceway or cable assembly for each dwelling unit as required by section R333.3 or one EV capable, EV ready or EVSE space per dwelling unit.

**R333.3 Continuous raceway or cable assembly.** A continuous raceway or cable assembly shall be provided that complies with all of the following:

1. A continuous raceway with a minimum of ¾ inch internal diameter or cable assembly shall be installed between a suitable panelboard or other on-site electrical distribution equipment and an enclosure or junction box ~~outlet~~ located within 6 feet (1828 mm) of the automobile parking space.
    a. Exception: the raceway or cable assembly and the enclosure or junction box are not required where the electrical distribution equipment or panelboard is located in the same room as the EV capable space.
2. The installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with section R333.7

**R333.4 ~~NE101.2.2 (RE101.2.2)~~ EV Capable Spaces.**

Where provided, each EV capable space ~~used to meet the requirements of Section R333.2 NE101.2.1~~ shall comply with all of the following:

1. A continuous raceway with a minimum of ¾ inch internal diameter or cable assembly shall be installed between a suitable panelboard or other on-site electrical distribution equipment and an enclosure or junction box ~~outlet~~ located within 6 feet (1828 mm) of the EV capable space.
    1. Exception: the raceway or cable assembly and the enclosure or junction box are not required where the electrical distribution equipment or panelboard is located in the same room as the EV capable space.
2. The installed raceway or cable assembly shall be sized and rated to supply a minimum circuit capacity in accordance with Section R333.7. ~~NE101.2.5.~~
3. The electrical distribution equipment to which the raceway or cable assembly connects shall have sufficient dedicated space and spare electrical capacity for a two-pole circuit breaker or set of fuses.
4. The electrical enclosure or junction box ~~outlet~~ and the electrical distribution equipment directory shall be marked: “For future electric vehicle supply equipment (EVSE).”

**R333.5 ~~NE101.2.3 (RE101.2.3)~~ EV Ready Spaces.**

Where an EV Ready Space is provided, each branch circuit serving EV ready spaces shall comply with all of the following:

1. Termination at an outlet or enclosure located within 6 feet (1828 mm) of each EV ready space it serves and marked “For electric vehicle supply equipment (EVSE).”
2. Service by an electrical distribution system and circuit capacity in accordance with Section R333.7 ~~NE101.2.5~~.
3. Designation on the panelboard or other electrical distribution equipment directory as “For electric vehicle supply equipment (EVSE).”

**R333.6 ~~NE101.2.4 (RE101.2.4)~~ EVSE Spaces.**

An installed EVSE with multiple output connections shall be permitted to serve multiple EVSE spaces. Each EVSE serving either a single EVSE space or multiple EVSE spaces shall comply with the following:

1. Be served by an electrical distribution system in accordance with Section R333.7. ~~NE101.2.5.~~
2. Have a nameplate charging capacity of not less than 6.2 kVA ~~(or 30A at 208/240V)~~ per EVSE space served. Where an EVSE serves three or more EVSE spaces and is controlled by an energy management system in accordance with Section R333.7. ~~NE101.2.5.~~ the nameplate charging capacity shall be not less than 2.1 kVA per EVSE space served.
3. Be located within 6 feet (1828 mm) of each EVSE space it serves.
4. Be installed in accordance with NFPA 70 and be listed and labeled in accordance with UL 2202 or UL 2594.

**R333.7 ~~NE101.2.5 (RE101.2.5)~~ Electrical distribution system capacity.**

Where an EV capable space, EV ready space, or EVSE space is provided, the branch circuits and electrical distribution system serving each space ~~EV capable space, EV ready space and EVSE space used to comply with Section R333.2 NE101.2.1~~ shall comply with one of the following:

1. Sized for a calculated EV charging load of not less than 6.2 kVA per EVSE, EV ready or EV capable space. Where a circuit is shared or managed, it shall be in accordance with NFPA 70.
2. The capacity of the electrical distribution system and each branch circuit serving multiple EVSE spaces, EV ready spaces or EV capable spaces designed to be controlled by an energy management system in accordance with NFPA 70 shall be sized for a calculated EV charging load of not less than 2.1 kVA per space. Where an energy management system is used to control EV charging loads for the purposes of this section, it shall not be configured to turn off electrical power to EVSE or EV ready spaces used to comply with Section R333.2 ~~NE101.2.1~~.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

   Not necessarily, though all installations will also need to be Electric Code compliant.

**Need and Reason**

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)

## Overview

Electric vehicle (EV) adoption is on the rise in Minnesota, and across the country, as options expand, battery technology improves, and upfront prices come closer to gasoline-powered vehicles.[1]

While the simplest option to charge at home for many EV owners will be the NEMA 14-50 outlet common in laundry rooms, such outlets also represent the least safe option. Preparing homes for straightforward retrofits by providing conduit for easy future wiring of EVSE will significantly reduce the barrier to affordable, safe Level 2 charging.

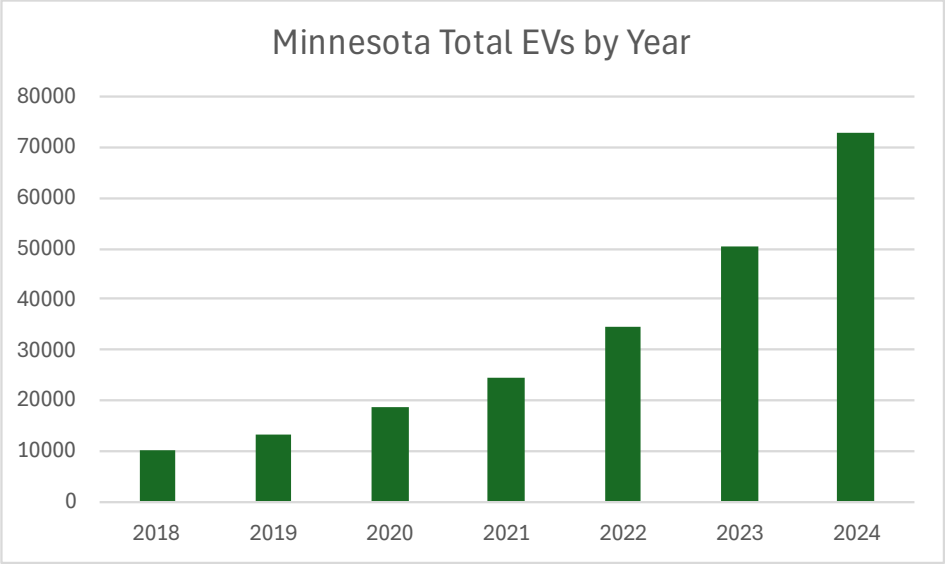


*Figure 1:*

*Registered EVs in Minnesota by year.*

The growth of EVs is exponential, not linear. This shift in transportation also brings an inevitable shift in home energy use. For many, the garage is the new gas station, and Minnesota residents will be less safe and waste more money on retrofits if we do not prepare for this new reality. 80% of EV charging in the US happens at home, not at public chargers.[2]

Last month, Atlas Public Policy published a study finding that in Minnesota alone, failure to adopt EV preparedness measures could cost consumers $143,309,000 through 2035.[3] By preparing new homes with consumer options in mind, the Department will reduce the burden of costly retrofits post-construction, and maintain a code that provides for the "use of modern methods, devices, materials and techniques," as required by statute. It will also reduce the risk of shock, fire, and other hazards from makeshift workarounds such as plugging an EV into a dryer outlet using a NEMA 14-50 extension cord that was not designed for the electrical or physical demands of EV charging.

## Background

6/25/25 Update: Following feedback from the IRC TAG meeting in May, this proposal removes the requirement to provide reserved electrical capacity.

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[1] 73,435 EVs are currently on the road as of 4/1/25 according to EvaluateMN, via MnDOT Electric Vehicle Dashboard: https://www.dot.state.mn.us/sustainability/electric-vehicle-dashboard.html.
Chart and data from the Minnesota Public Utilities Commission, accessed June 24, 2025, https://mn.gov/puc/activities/economic-analysis/electric-vehicles/

[2] "Trends in Electric Vehicle Charging – Global EV Outlook 2024 – Analysis," IEA, accessed April 24, 2025, https://www.iea.org/reports/global-ev-outlook-2024/trends-in-electric-vehicle-charging.

[3] Ben Sharpe, Lucy McKenzie, and James Di Filippo, "Cost Savings From Ev- Enabling Building Codes for Multifamily Housing" (Atlas Public Policy, May 2025).

This is an updated version of a code change proposal first presented to the Residential Energy TAG on January 2, 2024 as a requirement for EV Ready parking. Advocates have since incorporated feedback to allow conduit instead of pre-wiring, reducing the requirement from EV Ready to EV Capable. This version also adds an exemption where the electric panel is already in the garage, as suggested at a previous meeting, and incorporates flexibility to work with a local utility in case of grid constraints, as provided in the newest model language: 2024 IRC Appendix RE.

On February 26, 2024, the Residential Energy TAG voted narrowly (7-6) to approve an updated EV Capable CCP for inclusion in the IECC 2021. On April 7, 2025, the Residential Energy TAG was split (5-5) on the EV Capable CCP, with some indicating they would support a conduit-only version that did not require reservation of electric panel space.

**Safety**

As EV adoption rises so does at home charging. This will continue whether or not the Department requires EV preparedness in new construction.

What the Department can improve is the safety (specifically fire and shock danger) and affordability of EV charging when residents plug in at home. Without preparing modern homes for modern vehicles, many residents will plug their EVs into NEMA 14-50 outlets intended for dryers, which can be unsafe in multiple ways:

1. These outlets are not designed for the hours of uninterrupted, high loads of EV charging
2. These outlets are not designed for the frequency of plugging and unplugging required to manually share one receptacle between a dryer and an EV
3. Unlike hard-wired chargers, these outlets also pose the risk of shock due to the possibility of exposed pins
4. Due to the outlet's location, it will likely be connected to the EV by an extension cord that represents another point of equipment failure, multiplying the above hazards
5. The extension cord also represents a trip hazard

In order to address some of the above issues with standard 14-50 receptacles, Leviton (for example) offers a dedicated EV charging 14-50 receptacle.[4] However, these are unlikely to exist in laundry rooms without specification.

Savvy users may know that reducing the maximum amperage the EV will draw during charging can greatly reduce the risks associated with extension cords and outlets. However, the safest charging option will always be a hard-wired charger, which this code change makes much easier to install.

**Other jurisdictions**

Minnesota would also be following the lead of numerous other jurisdictions who have included EV ready or capable spaces as part of new residential construction, including California, Illinois, Maryland, and cities in Arizona, Colorado, Delaware, Georgia, Hawaii, Missouri, and Washington as well as Vancouver.[5]

[4] https://leviton.com/products/1450r

[5] ICC, "2021 Electric Vehicles and Building Codes: A Strategy for Greenhouse Gas Reduction," published October 2021; see Table 1: Sample EV-Integrated Code Provisions, which lists the jurisdictions that require EV Ready Space(s) for new single-family construction. (https://codes.iccsafe.org/content/ICCEVBCSGGR2021P1/current-approaches-to-ev-integrated-codes).

## Meeting market needs

New EV sales in the United States hovered around a quarter million each year from 2016 to 2020, and has since grown to over 1.7 million new vehicles in 2024.[6] EVs are on track to pass 10% of new vehicle sales soon in the United States.[7]

This trend holds true in Minnesota as well, where 73,435 light-duty EVs were registered as of April 2025, up from around 10,000 in 2018.[8] Additionally, about 7%[9] of all new light-duty vehicle sales in Minnesota were electric in 2024, compared to 1.7% of light-duty vehicle sales in 2020.[10] Minnesota also has a stated goal of electrifying 20% of passenger vehicles by 2030.[11]

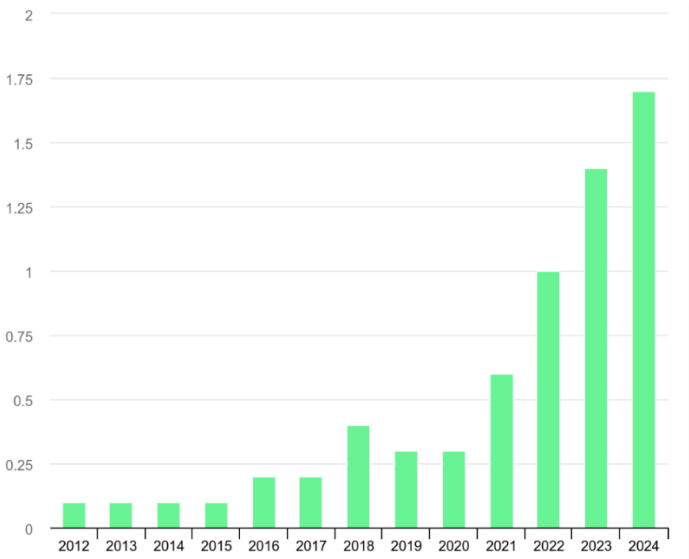


*Figure 2: Millions of EV sales in the United States*

A 2024 Synapse study funded by the MN Department of Commerce forecasts EVs making up between 10% and 20% of passenger vehicles in Minnesota by 2030.[12] Market growth is expected to continue as EV familiarity increases and governments and utilities offer programming to make EV ownership accessible to more market segments. Options continue to expand: in 2025, there are

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MD Public Safety Code § 12-205 (2024)

Corinne Reichert, "Illinois Right to Charge Law Requires New Homes and Apartments to Support EV Charging," *CNET*, June 22, 2023, https://www.cnet.com/home/illinois-right-to-charge-law-requires-new-homes-and-apartments-to-support-ev-charging/; City of Atlanta, "City of Atlanta Passes 'EV Ready' Ordinance into Law," November 21, 2017, https://www.atlantaga.gov/Home/Components/News/News/10258/1338?backlist=/.

Rachel Sawicki, "New Castle County Amends Codes to Expand Electric Vehicle Charging," *Bay to Bay News*, October 27, 2021, https://baytobaynews.com/stories/new-castle-county-amends-codes-to-expand-electric-vehicle-charging,62104.

[6] IEA, Electric car sales, 2012-2024, IEA, Paris https://www.iea.org/data-and-statistics/charts/electric-car-sales-2012-2024, IEA. Licence: CC BY 4.0
[7] IEA, Electric car registrations and sales share in China, United States and Europe, 2018-2022, IEA, Paris https://www.iea.org/data-and-statistics/charts/electric-car-registrations-and-sales-share-in-china-united-states-and-europe-2018-2022, IEA. Licence: CC BY 4.0
[8] Current registration number from EvaluateMN, via MnDOT Electric Vehicle Dashboard: https://www.dot.state.mn.us/sustainability/electric-vehicle-dashboard.html.
Chart and data from the Minnesota Public Utilities Commission, accessed June 24, 2025, https://mn.gov/puc/activities/economic-analysis/electric-vehicles/
[9] Alliance for Automotive Innovation, "Electric Vehicle Quarterly Report: Q3 2024", at page 8. Through Q3 2024.
[10] Sales number from 2020 retrieved from the Electric Vehicle Dashboard hosted by the Alliance for Automotive Innovation.: https://www.autosinnovate.org/EVDashboard
[11] https://www.lrl.mn.gov/docs/2019/other/190972.pdf
[12] "Charging Minnesota's Electric Vehicles-Strategies That Work for the Electric Grid and Consumers" (Synapse Energy Economies, October 11, 2024), https://mn.gov/commerce-stat/energy/data-reports/CARD%20240939_EV%20Adoption_Final%20Report_ADA.pdf.

over 100 EV models available in the US.[13] EV prices continue to fall over time[14] and total cost of EV ownership can be lower than that of gasoline vehicles even if federal tax incentives which have bolstered the market in recent years go away.[15]

This market share has been driven in part by lower prices and expanded options for EVs. In 2024, the average price for an EV cost only $5,800 more than the average price for a new gasoline-powered passenger vehicle, with options starting as low as $29,280.[16] Additionally, as more EVs have entered the new vehicle marketplace, a robust used EV market is growing, which offers access to EVs at a more affordable price for more consumers.

Minnesota residents seeking to charge their electric vehicle at home will face higher costs if builders and designers ignore the need for charging infrastructure. Providing conduit for easy installation of the circuit prevents costly, invasive retrofit work, reduces the number of trades required for future EVSE installation.

This cost is often unexpected for new EV owners, and spurred Xcel Energy to offer a "home wiring rebate"[17] to help defray the cost in its service territory, while also supporting EVs in its service territories getting onto a time-varying electricity rate that optimizes use of the electric grid, to the benefit of both the EV owner and general grid customers. Level 2 charging enables EV owners to participate in utility pricing programs that offer lower electricity prices at times of the day when load is lowest on the electric grid (typically overnight, when wind power is also most prevalent), thereby optimizing use of the electric grid and renewable energy, while also saving the EV owner money. A Level 2 Charger is typically required to participate in these beneficial utility programs, as well as future developments that would enable EVs to power a home or return energy to the grid (vehicle-to-home and vehicle-to-grid applications, respectively)[18].

2. Why is the proposed code change a reasonable solution?

   This proposal will prepare residents for charging at home as a growing number of Minnesotans opt for electric vehicles. The proposal allows flexibility for builders to provide conduit or to pre-wire for a charger, without requiring the installation of Electric Vehicle Supply Equipment, or the dedication of electrical capacity. This proposal also incorporates feedback from multiple stakeholders during the TAG process.

3. What other factors should the TAG consider?

   EVs also give consumers the option to use local sources of energy, including utility scale renewable electricity, or power from a resident's own household or community solar.

**Cost/Benefit Analysis**

[13] www.EVInfoList.com
[14] "EVs May Get Cheaper Than Gas Cars As Early As Next Year. Here's Why," InsideEVs, accessed May 13, 2025, https://insideevs.com/news/729153/ev-price-parity-ice-2025-2026/.
[15] Ryan Mills, "Fleet Electric Vehicle Total Cost of Ownership with and without Federal Tax Credits," *RMI* (blog), February 24, 2025, https://rmi.org/fleet-electric-vehicle-total-cost-of-ownership-with-and-without-federal-tax-credits/.
[16] Kelly Blue Book, "How Much Are Electric Cars?" posted January 15, 2025. https://www.kbb.com/car-advice/how-much-electric-car-cost/
[17] Xcel Energy's Home Wiring Rebate program approved by the Department of Commerce November 2024. *See* Decision in CIP-23-92
[18] Digitaltrends, "EV bidirectional charging: what it is and how to get it," published October 11,2024 (https://www.digitaltrends.com/cars/ev-bidirectional-charging-what-is-it-how-to-get)

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.

   This code change proposal will nominally increase construction costs, in the range of $200-500 per impacted home. Average costs across all homes will be lower, due to the exemption when electric panels are located in the garage. If 50% of homes under this code have electric panels located in the garage, the average cost across all homes drops to $100-$250.

   **Conduit only in Minnesota**

   Fresh Energy asked a handful of electricians in Minnesota for estimates on conduit and EVSE installations to corroborate existing research.

   Assuming a run of 50 feet, one estimated conduit-only installation at $180-$240 (plastic tube at $0.60/ft and labor between 6 and 8 dollars per foot).

   Another estimated conduit-only installation at $498 to $623 for 50 feet of flexible metal (conduit at $4.95/ft and 2-3 hours of labor at $125).

   Given inflation, these numbers are not incongruent with 2022 research by NBI and NRDC estimating the incremental cost per EV-Capable space at $115.[19]

   Conduit only (50 feet): $200-$500

   **Retrofit without conduit in Minnesota**

   Alternatively, retrofitting unprepared homes for Level 2 charging is much costlier. We estimate a retrofit in an existing home in Minnesota averages between $1,500 and $2,000 in electrical work only. Additional trades will add another $500-$1,500, for a conservative average range of $2,000-$3,500.

   Estimates of retrofit EVSE and EV-Ready installations vary widely from $750-$5,000.[20] In Xcel Energy's 2023 Transportation Electrification Plan, they estimated that installing a dedicated 240 V circuit in their Minnesota service territory cost $880 on average, with costs varying by site but reaching a maximum of $5,000 for a single project.[21]

   Our electricians gave estimates in 2025 that fall in similar ranges with Xcel's, if raised a little from inflation seem in line with Xcel's numbers, adjusted for inflation:

   - "We do a fair amount of them running from the basement panel to the garage in an existing home and depending on length of run they usually cost about $1500.00 to $3500.00."

[19] Page 22, "Cost Study of the Building Decarbonization Code," NBI, 2022, https://newbuildings.org/resource/cost-study-of-the-building-decarbonization-code/

[20] "An electric car charging station installation costs $750 to $2,600 for a Level 2 charger, 240-volt outlet, wiring, and wall mounting. Some EV charger installations cost $2,000 to $5,000 for extensive wiring or if the electrical panel needs upgrading." 2023 EV Charging Station Cost | Install Level 2 or Tesla (homeguide.com) updated September 2023
"if you need to mount the system from zero: do the wiring, and install a new service panel and 240 V outlet - add about $1000 - $1500 to your estimate" How Much Does It Cost To Install An EV Charger? (jdpower.com) December 2022

[21] Pg. 52, Xcel Energy, 2023 Integrated Distribution Plan - Appendix H: Transportation Electrification Plan (filed Nov 1, 2023) (link)

- "I can say that avg cost of installing a circuit for a EV charger when the panel is in the basement, $1500.00."
- "For my current customers that have the panel in the finished basement with attached garage I ballpark $1600-$2200."

Without conduit provided, a typical EVSE retrofit project will require additional trades and materials, such as:

- Trenching
- Sod
- Drywall and texturing repair
- Painting, protecting and masking and cleaning of the site

Given that many contractors have minimum charges for showing up no matter how small the job, minor repairs from a retrofit can easily add another $500 to $1,500 to a retrofit cost.

Retrofit without conduit (electrical work only): $1,500-$2,000
Additional trades: $500-$1,500
Total retrofit without conduit: $2,000-$3,500

In our opinion, this is a very conservative range, even in 2025. This part of our estimate has the highest room for upward growth depending on specifics of a given home, with outliers easily exceeding $5,000 and above. Furthermore, since retrofits will take place over time after the date of construction, inflation will also have a larger impact on these costs, and therefore the savings associated with the modest upfront investment.

**Retrofit with conduit in Minnesota**

Since no current requirement for conduit to parking spots exists, electricians surveyed had little to no experience bidding the exact scenario. However, one shared about an EVSE installation earlier in the week: "We charged $3,100 and had to cut 3 holes in the basement ceiling. If there had been conduit I am sure it would have been 1/2 the cost. And no holes in the finished basement."

Assuming this family spends at least another $500 on repair and materials, their total bill will be $3600. A simple conduit could have kept it at $1,550 in electrical work without added repairs, reducing the project cost by over 50%.

Research on commercial projects suggests EV preparedness reduces final EVSE install costs by 59% to 85%.[22] Some of the costs and savings, like digging up and repairing parking lots, will be less relevant in a residential setting; much of the savings will be similar. Southwest Energy Efficiency Project suggests savings of "75 percent or more compared to installing EV chargers during a building retrofit."[23]

Assuming a conservative range of 50% to 75% savings when retrofitting a home with conduit present, Minnesotans can expect to pay between $500 and $1,750 to install EVSE in a prepared home.

Retrofit with conduit: $500-$1,750

[22] "EV Ready Cost Comparison," *The Solar Foundation,* 2022, EV Ready Cost Comparison_The Solar Foundation_for web.docx
[23] "SWEEP Guide to EV Infrastructure Building Codes - Southwest Energy Efficiency Project," *Southwest Energy Efficiency Project (SWEEP)* (blog), May 11, 2023, https://www.swenergy.org/ev-infrastructure-building-codes/.

## Cost/Benefit

Table 3: Cost Estimates for EV Infrastructure in New Construction and Retrofits

| Space type | New Construction* | Retrofit to EV Installed |
|---|---|---|
| **No Building Code Requirements** | - | $13,800 |
| **EV Capable** | $400 | $3,500 |
| **EV Ready** | $1,150 | $2,500 |
| **EV Installed** | $3,650 | - |

Extensive data confirms that EVSE installation is much more expensive without EV preparedness at the time of construction. A 2025 study (see Table 3) by Atlas Public Policy examined economic impacts of EV enabling infrastructure in multifamily housing, estimating for the United States on average that EV Capable spaces cost $400 but make the biggest future cost impact, saving over $10,000.[24]

Our sample of residential estimates for Minnesota finds that these savings hold true in single-family home contexts:

- $100-$250 for conduit-only installation (given an average range of $200-$500 and 50% compliance through panel location in the garage and no added conduit or labor cost)
    - In a 100 home universe, total impact: $10,000-$25,000
- $2,000-$3,500 retrofit without conduit
- $500-$1,750 retrofit with conduit

Given these estimates, a universe of 100 homes will see net economic benefits once 11 owners install EVSE.

If Minnesota achieves its goal of electrifying 20% of passenger vehicles by 2030, then 20% of residents or more are likely to install EVSE, realizing cost savings of $15,000 per 100 homes.

| Code change costs and savings | | | | | | |
|---|---|---|---|---|---|---|
| | Conduit Install Cost per 100 Homes | Conduit Retrofit Cost | Non-Conduit Retrofit Cost | Retrofit Cost Difference | % EVSE Homes Needed to Break Even | Total Savings per 100 Homes at 20% EVSE Homes |
| Low | $10,000 | $500 | $2,000 | $1,500 | 7% | $20,000 |
| High | $25,000 | $1,750 | $3,500 | $1,750 | 14% | $10,000 |
| Average | $17,500 | $1,125 | $2,750 | $1,625 | 11% | $15,000 |

*Figure 4: Costs and Savings Associated with Code Change Proposal*

Given the growth in EV registration in Minnesota, the Department should not leave residents to pay the substantially higher costs of retrofits when the option to prepare ahead of time is so affordable.

[24] Sharpe, McKenzie, and Filippo, "Cost Savings From Ev- Enabling Building Codes for Multifamily Housing."

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.

As detailed above, the safest chargers are hard-wired. Without this code change, many more Minnesotans will turn to a NEMA 14-50 outlet that was never intended for 8 or more hours of uninterrupted, high amp load. This setup is a significant fire, shock, and when combined with extension cords, trip hazard. This code change will significantly lower the barrier to installation of safe, hard-wired, purpose built charging equipment.

Additionally, there are economic benefits to homeowners not represented above: higher energy efficiency of Level 2 charging, and access to utility time of use rates.

Without dedicated Level 2 EVSE or a 240v dryer outlet, the other most available charging method is "trickle" charging, also known as Level 1: a standard 120v outlet. Not only are these slower, but more wasteful and costly. Level 1 charging can be 5-20% less efficient.[25] Given that EV charging can consume as much power as the rest of the household combined, facilitating efficient Level 2 charging can lead to meaningful savings.

Level 2 chargers also allow straightforward programming for time of use rates, as well as special EV charging rates, which may be unavailable or impractical with a "dumb" Level 1 charger or makeshift Level 2 dryer plug charging setup.

In Minnesota Power territory, for example, super-off-peak charging can save consumers about 50%.

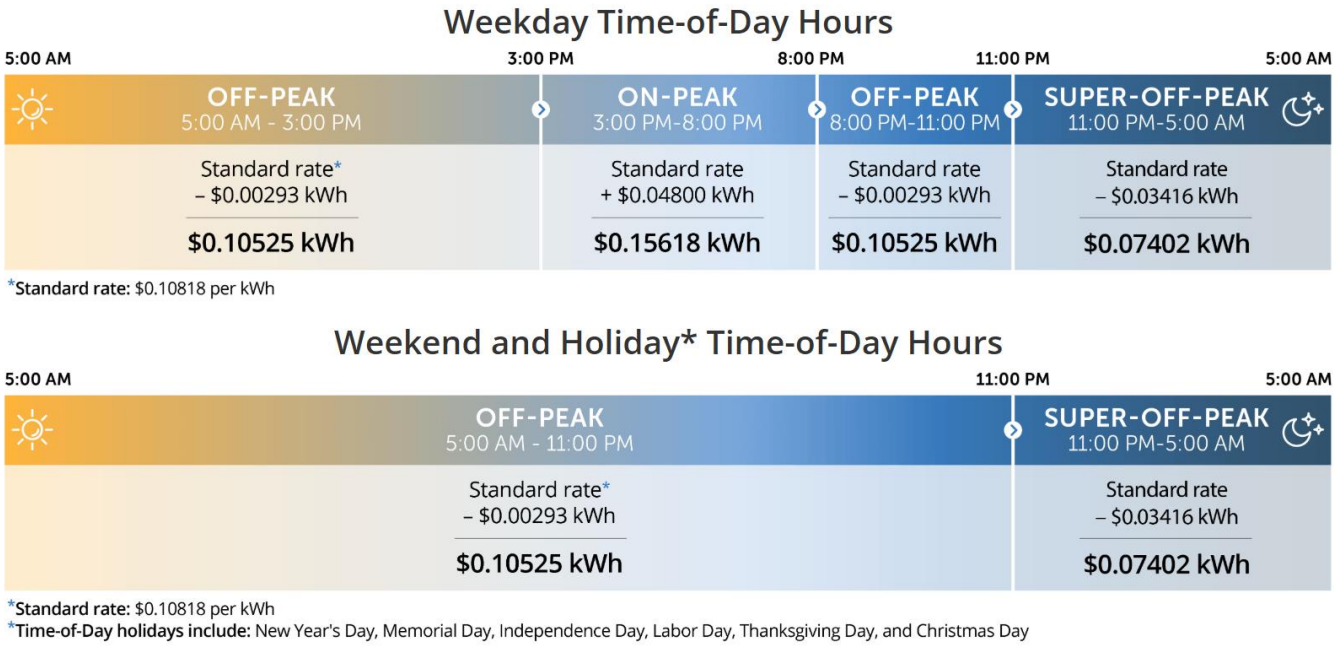


*Figure 5: Minnesota Power EV Charging Rate*

[25] E. V. Guides, "EV Charging Efficiency – 120V vs. 240V," *EV Guides* (blog), February 6, 2025, https://evguides.net/ev-charging-efficiency-120v-vs-240v/; Justine Sears, David Roberts, and Karen Glitman, "A Comparison of Electric Vehicle Level 1 and Level 2 Charging Efficiency," in *2014 IEEE Conference on Technologies for Sustainability (SusTech)*, 2014, 255–58, https://doi.org/10.1109/SusTech.2014.7046253.

Some utilities offer even steeper discounts. In Xcel territory, residents can save over 80% by charging during off peak hours. This program requires a Level 2 charger.[26]

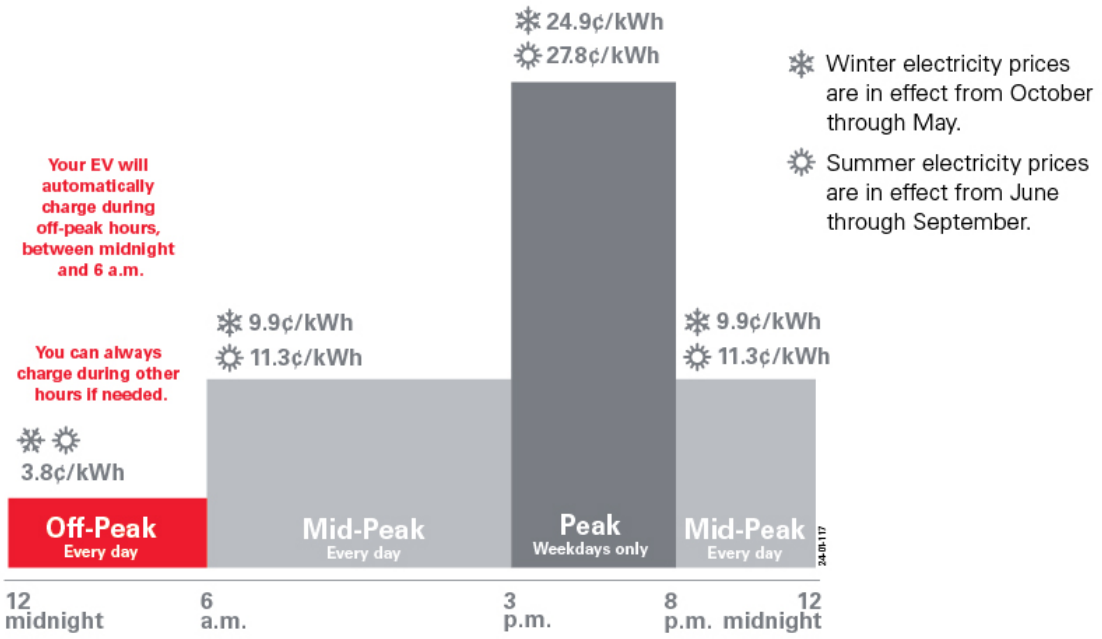


*Figure 6: Xcel Energy EV Charging Rate*

To learn about rates in any utility territory, the EV consulting organization Shift2Electric maintains a list of Minnesota utility EV charging incentives and special rates at MNCharging.org.

A small investment during new construction will save homeowners substantial future costs, potential shock and fire hazards, and give them more options. Given the market trends identified above, it is not a question of whether Minnesotans will plug in EVs at home, but how safely and affordably they will be able to when they do.

Failing to adopt this proposal would mean saddling future homeowners with substantial, avoidable costs and risks. Instead, the Department should ensure "use of modern methods, devices, materials and techniques" in new residences by adopting this proposal.

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.

Cost will be passed to homeowner and will improve safety, and save cost over a retrofit.

[26] "With the EV Accelerate at Home Pay As You Go, you can take advantage of electricity pricing that saves you money on charging. Your Level 2 charger will be set to charge only during off-peak hours, from midnight to 6 a.m. daily. This means your EV will automatically charge during the lowest cost period, but you still have the flexibility to charge at other times if needed.
Local taxes and fees are not included in the monthly prices and will be applied upon billing.
For information on cancellation options and costs, please refer to the FAQ." https://ev.xcelenergy.com/ev-accelerate-at-home

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   This system can be inspected during normal electrical inspection and will increase the cost of compliance.

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

   No, see cost estimates above.

**Regulatory Analysis**

1. What parties or segments of industry are affected by this proposed code change?

   This proposed code change would require additional laborer work.

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.

   There is no other clear policy tool to prepare Minnesota homes for EV charging and avoid steep retrofit costs.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

   This proposal will prevent fires, shock hazards, and save homeowners the costly burden of upgrading their homes to provide electric vehicle charging.

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.

   No, although legislation passed in the 2023 Minnesota legislative session requiring the addition of electric vehicle charging to the commercial code.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

7/15/25:

DEPARTMENT OF LABOR AND INDUSTRY

# CODE CHANGE PROPOSAL FORM

(Must be submitted electronically)

*Author/requestor:* Staff

*Date:* 07/07/2025

*Email address:* chris.rosival@state.mn.us

*Model Code:* 2024 IRC

*Telephone number:* 651-284-5510

*Code or Rule Section:* 703.4

*Firm/Association affiliation, if any:* DLI

*Code or rule section to be changed:* IRC 703.4

*Intended for Technical Advisory Group ("TAG"):* Residential Building

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| **General Information** | **Yes** | **No** |
|---|---|---|
| A. Is the proposed change unique to the State of Minnesota? | ☐ | ☒ |
| B. Is the proposed change required due to climatic conditions of Minnesota? | ☒ | ☐ |
| C. Will the proposed change encourage more uniform enforcement? | ☒ | ☐ |
| D. Will the proposed change remedy a problem? | ☒ | ☐ |
| E. Does the proposal delete a current Minnesota Rule, chapter amendment? | ☐ | ☒ |
| F. Would this proposed change be appropriate through the ICC code development process? | ☒ | ☐ |

**Proposed Language**

1. The proposed code change is meant to:

   ☐ change language contained the model code book? If so, list section(s).

   ☒ change language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s). IRC Section 703.4

   ☐ delete language contained in the model code book? If so, list section(s).

   ☐ delete language contained in an existing amendment in Minnesota Rule? If so, list Rule part(s).

   ☐ add new language that is not found in the model code book or in Minnesota Rule.

2. Is this proposed code change required by Minnesota Statute? If so, please provide the citation.
   No

3. Provide *specific* language you would like to see changed. Indicate proposed new words with underlining and ~~strikethrough~~ words proposed for deletion. Include the entire code (sub) section or rule subpart that contains your proposed changes.

   **R703.4 Flashing.** Approved corrosion-resistant flashing shall be applied in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Overlapped flashing shall be applied in shingle fashion. Self adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Flashing shall be installed above deck ledgers in accordance with Section R507.9.1.5.
   Approved corrosion-resistant flashings shall be installed at the following locations:
   1. Exterior window and door openings. Flashing at exterior window and door openings shall be installed in accordance with Section R703.4.1.
   2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
   3. Under and at the ends of masonry, wood or metal copings and sills.
   4. Continuously above all projecting wood trim.
   5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
   6. At wall and roof intersections.
   7. At built-in gutters.
   8.Where the lower portion of a sloped roof stops within the plane of an intersecting wall cladding in such a manner as to divert water away from the assembly in compliance with Section R903.2.1.
   9.At the intersection of the foundation and rim joist framing when the exterior wall covering does not lap the foundation insulation.

4. Will this proposed code change impact other sections of a model code book or an amendment in Minnesota Rule? If so, please list the affected sections or rule parts.

## Need and Reason

1. Why is the proposed code change needed? Please provide a general explanation as well as a specific explanation for any changes to numerical values (heights, area, etc.)

   The 2024 model code changed language to the majority of the section minus ammeded numbers 8 and 9. Those two additions are still needed to maintain the type of flashings needed that are not addressed in the model code and adding a reference to section R903.2.1. The sill plate cannot be cantilevered to be flush with the exterior foundation insulation, so a flashing is necessary to flash the offset at the sill plate and exterior face of the foundation insulation. Contractors often want to cantilever the foundation sill plate to align it with the foundation insulation. This cantilever is not recommended from a structural standpoint. An R-15 foundation insulation installed on the exterior of the foundation could be up to three or more inches in thickness, depending on the product manufacturer. A typical sill plate is a 2 by 6-inch treated plate, which actually measures 5 ½ inches in width. A sill plate cantilevered to align with a 3-inch foundation insulation leaves only 2 ½ inches of sill plate to bear on the foundation. Wall framing studs need to be supported by the foundation, not the insulation. This amendment acknowledges that there may be a misalignment between the exterior surface of the foundation insulation and the exterior surface of the wall framing (including the sill plate). In this case, the location must be properly flashed. It is necessary and reasonable to coordinate the amendments to section R703 with changes made to the 2012 IRC to provide consistency to the rule. It is also necessary to incorporate the new language to clarify the requirements for flashing and to provide uniform enforcement of these requirements. There will be no cost increase to residential builders and designers related to locations one through nine, which

simply clarify existing rule language. There will be a cost increase for residential builders that do not currently install the flashing required in location number ten of this section. Many residential builders are currently installing some form of flashing with respect to this condition because they have already been placing the foundation insulation on the exterior of the foundation. The practice of installing the foundation insulation on the exterior of the foundation has been encouraged for several years by energy and sustainability experts, even though the current Energy Code permits interior and exterior foundation insulation installation.

2. Why is the proposed code change a reasonable solution?

   This code change fixes language and keeps the 2 additional items .

3. What other factors should the TAG consider?

**Cost/Benefit Analysis**

1. Will the proposed code change increase or decrease costs? Please explain and provide estimates if possible.

   Increase costs. Minor increases but savings regarding building durability.

2. If there is an increased cost, will this cost be offset by a safety or other benefit? Please explain. If the benefit is quantifiable (for example energy savings), provide an estimate if possible.

3. If there is a cost increase, who will bear the costs? This can include government units, businesses, and individuals.

   The costs will be incurred by the installer, passed on to the building owner

4. Are there any enforcement or compliance cost increases or decreases with the proposed code change? Please explain.

   None

5. Will the cost of complying with the proposed code change in the first year after the rule takes effect exceed $25,000 for any one small business or small city (Minn. Stat. § 14.127)? A small business is any business that has less than 50 full-time employees. A small city is any statutory or home rule charter city that has less than ten full-time employees. Please explain.

**Regulatory Analysis**

1. What parties or segments of industry are affected by this proposed code change?

   Contractors, building owners, and enforcement individuals

2. Can you think of other means or methods to achieve the purpose of the proposed code change? What might someone opposed to this code change suggest instead? Please explain what the alternatives are and why your proposed change is the preferred method or means to achieve the desired result.

3. What are the probable costs or consequences of not adopting the code change, including those costs or consequences borne by identifiable categories of affected parties, such as separate classes of government units, businesses, or individuals?

4. Are you aware of any federal or state regulation or requirement related to this proposed code change? If so, please list the federal or state regulation or requirement and your assessment of any differences between the proposed code change and the federal regulation or requirement.

***Note: Incomplete forms may be returned to the submitter with instruction to complete the form. Only completed forms can considered by the TAG.

DEPARTMENT OF LABOR AND INDUSTRY
CONSTRUCTION CODES AND LICENSING

# Division opinion: Insulation and curb heights at replacement rooftop HVACR

Code Reference: Minnesota Rules, Chapter 1323, Sections 5.5.3.1 and 6.1.1.3.6

Requested by: Gary Thaden

Issued by: Greg Metz, State Building Official

Date received: April 24, 2024

Date issued: April 30, 2024

Division opinions are interpretations provided by the department to facilitate uniformity of code application throughout the state. They are not rulemaking (not code) and non-binding to building officials. Division opinions are intended to provide guidance in areas where interpretations have been inconsistent from one jurisdiction to another.

## Interpretation of the 2024 Minnesota Commercial Energy Code

**5.5.3.1 Roof insulation.** All roofs shall comply with the insulation values specified in Tables 5.5-0 through 5.5-8. Skylight curbs, mechanical curbs, and other roof curbs shall be insulated to the level of roofs with insulation entirely above the deck or R-10, whichever is less.

Exception: Historical buildings with roof slopes two units vertical in 12 units horizontal (2:12) or less.

**6.1.1.3.6 Rooftop HVACR.** Unless technically infeasible, new and replacement rooftop equipment shall be provided with new insulated curbs in accordance with Section 5.5.3.1. The replacement curbs shall be of sufficient height to permit the installation of insulation that complies with Tables 5.5-6 and 5.5-7 when roof replacement occurs.

## Background

Prior to these amendments, there were no insulation requirements at all for roof curbs supporting rooftop HVAC equipment. Contractors have been installing roof curbs with R-5 insulation because there was guidance given for skylight curbs and the application is similar. For roofs with above the deck insulation, changes in the energy code require the installation of more insulation when the roof covering is replaced. Designers have frequently used an exception to the R-value requirement if positive drainage on the roof can't be maintained. Low curb heights for rooftop mechanical equipment have been a limiting factor to achieving greater energy code compliance for the entire roof assembly. Since additional insulation will be required the next time the roof is replaced, it is most

effective to upgrade the roof curb when equipment is added, moved, or replaced in preparation for the additional insulation thickness.

## Intent

The intent and purpose of these amendments are to address two aspects: One, Section 5.5.3.1 provides an insulation standard for mechanical curbs installed on roofs because the requirement does not exist in the 2019 ASHRAE 90.1 model standard. Two, Section 6.1.1.3.6 elevates the equipment to provide the physical space for additional insulation that will be required when the roof is next replaced. Minnesota Statute 326B.101 states that amendments to the state building code shall "*...provide basic and uniform performance standards...*". Setting a performance standard with a curb insulation resistance of R-10 and a curb height requirement to support roof covering replacement with code-compliant insulation depth and sufficient freeboard to facilitate positive drainage is that performance criteria.

## Division opinion

1. The application of these code sections is limited to curbs on roofs where the insulation is located above the roof deck, because there is no reason to insulate a curb above an unconditioned attic space.
2. Because the building code's charging statement in Minnesota Statutes 326B.101, subpart 1 pertains to establishing performance standards, the requirement for a "new" curb is not necessary if the existing conditions meet or can be modified to achieve the insulation performance requirements without creating other code violations.
3. Technical infeasibility due to structural capacity of the existing roof will need to be demonstrated and certified by a licensed structural engineer for that roof portion which establishes curb height for the rooftop mechanical equipment being replaced.
4. Curb extensions and supplemental insulation are acceptable for modifying existing curbs to comply with the requirements provided that positive drainage can be maintained.