



**ENGINEERING DEPARTMENT**  
**SEPTEMBER, 2007**

# GUIDELINES FOR UTILITY INSTALLATIONS

## Part 1 - Wire Lines and Communications Cables

### *General Requirements*

This section applies to all public and private utilities, including electric power, telephone, fiber optics, telegraph, cable television, and other communication and data transmission facilities, both overhead and underground.

Installations crossing Metra property shall be, to the extent feasible, perpendicular to the right of way. Utilities shall not be placed within culverts or under railroad bridges, buildings or other structures.

Wire lines and cables shall be located so as to provide a safe environment and shall conform to the current *National Electric Safety Code* and the *American Railway Engineering and Maintenance Association Specifications*. Where local laws or authorities prescribe a more stringent specification, that specification shall supersede the specification in this manual.

Metra may request that an Inductive Interference study be performed, at the expense of the utility owner, for the proposed crossing. Inductive interference has the potential to disrupt railroad signal systems causing failures in track signals and grade crossing warning devices and safety concerns for people working on or near the tracks. Metra's Chief Engineer will determine the need for such a study on a case by case basis.

All wire line applications shall include a plan and cross section view, at a clear and legible scale, of the proposed installation. Plan views shall include the following:

- Date of plan, scale and north arrow
- Centerline of all railroad tracks
- Distance (in feet) to nearest railroad milepost or grade crossing (centerline of road)
- Right of way dimensions
- Angle of crossing relative to right of way
- Location of all railroad signal facilities and pole lines
- Location of all existing utility pole lines and above ground utilities
- Location of all existing underground utility markers
- Location of proposed poles and distance from centerline of nearest track to edge of pole
- Length of wire line span across tracks from pole to pole

Cross section views shall include the following:

- Date of plan, scale
- All railroad tracks
- Right of way dimensions
- Vertical clearance from bottom of sag to top of rail on all tracks
- Location of poles and distance from centerline of nearest track to edge of pole
- Length of span across tracks from pole to pole
- Location of all existing railroad pole lines and utility lines
- Location of all grade crossing signal equipment (gates, flashers, masts, cantilevers, etc.) if located near or within a road crossing

## Specifications for Overhead Wire Line Crossings

1. These specifications shall apply to overhead electric power line crossings over railroad rights of way, tracks, and signal and communication wires.
2. The Crossing Company shall submit plans showing proposed construction for review and approval with its application. A signed easement agreement, formal approval of plans, and subsequent contractor right of entry (see right of entry application) is required prior to commencement of construction.
3. The poles or towers supporting the line shall preferably be outside Metra's right of way
4. The poles or towers shall preferably be in a straight line.
5. Crossing poles and towers shall be located as far as possible from combustible structures. The space around the poles and towers shall be kept free from underbrush, grass, and other combustible material.
6. The side clearance from the pole or tower from the nearest rail may not be less than 12 feet I, with a minimum distance of 8.5 feet from the nearest rail to any cross arm, guy, or other attachment. Unguyed poles must be located a minimum distance equal to the height of the pole above the ground line plus 10 feet from the centerline of the nearest track.
7. Where necessary for unobstructed view of wayside signals, signs, etc., Metra may require greater clearances than specified above.
8. Wooden poles supporting the crossing span shall be side-guyed in both directions, if practicable, and be head-guyed away from the crossing span. Braces may be used instead of guys. **All down guys shall have high visibility guarding.**
9. The poles or towers shall be plainly marked with the name, initials, or trademark and the pole numbers, if used, of the Crossing Company. When required by Metra, the Crossing Company shall place, on all crossing structures located on Metra property, warning signs of approved design.
10. In general, lines shall be arranged in the order of their operating voltages, conductors of the greatest voltage occupying the highest position. Where lines of lower voltage are permitted to cross over circuits of higher voltage, their mechanical strength shall conform to that required for the higher voltage lines.
11. Where the wires or cables of the crossing span are supported on both crossing supports by pin type insulators, or by suspension type insulators in a suspended position or in a strain position, the vertical clearance between the wires or cables of the crossing span and the top of rail, at 60° Fahrenheit and no wind, shall not be less than the following:
  - a. Where the distance from the nearer crossing support to the point where the line crosses the farthest rail is 75 feet or less, the minimum clearance above the top of rail shall be:

- i. 28 feet for lines carrying 0 – 15,000 volts
  - ii. 30 feet for lines carrying 15,000 – 50,000 volts
  - iii. Lines over 50,000 volts – 30 feet plus 0.4 inches for each 1,000 volts above 50,000.
- b. Where the distance from the nearer crossing support to the point where the line crosses over the farthest rail is more than 75 feet, the clearance of (a) above shall be increased by 0.2 feet for each 10 feet in excess of 75 feet in length.
- c. For the protection of railroad crane and pile driver operations, and the protection of the wire line crossing, it is preferred that any wire or cable crossing be located at least 1,000 feet from any railroad bridge, trestle or large culvert. When it is necessary to locate less than 1,000 feet from such a structure, the vertical clearance shall not be less than 50 feet.

12. The clearance between any two wires crossing each other and carried on different supports shall be not less than the following:

- a. Where the upper conductor or wire has fixed supports, the sum of the distances from the point of intersection of the two crossing wires to the nearer supporting structure of each span does not exceed 100 feet:

| NATURE OF WIRES<br>CROSSED OVER   | Communication | Supply cables having permanently grounded metal sheath – all voltage |               | Open supply wires: |                      | Guys, Messengers, span wires, lightning protection wires, service drops 0 - 750 volts |
|---|---------------|--|---------------|--------------------|----------------------|---|
|   |               | Line Wires   | Service Drops | 0 – 8,700 volts    | 8,700 – 50,000 volts |   |
|   | Feet          | Feet   | Feet          | Feet               | Feet                 | Feet  |
| Communication   | 2             | 4  | 2             | 4                  | 6                    | 2   |
| Supply cables having permanently grounded metal sheath – all voltage                  | 4             | 2  | 2             | 4                  | 4                    | 2   |
| Open supply wires:  |               |  |               |                    |                      |   |
| 0 - 750 volts   | 4             | 2  | 2             | 2                  | 4                    | 2   |
| 750 – 8,700 volts   | 4             | 2  | 4             | 2                  | 4                    | 4   |
| 8,700 – 50,000 volts  | 6             | 4  | 6             | 4                  | 4                    | 6   |
| Guys, Messengers, span wires, lightning protection wires, service drops 0 - 750 volts | 2             | 2  | 2             | 4                  | 4                    | 2   |

Note: for voltage exceeding 50,000, the clearances given above shall be increased at the rate of 0.4 inches for each 1,000 volts in excess of 50,000.

- b. Where the upper conductor or wire has fixed supports, and the sum of the distances from the point of intersection of the two crossing wires to the nearer supporting structure of

each span exceeds 100 feet, the clearances listed in the above table shall be increased by 0.10 feet for each 10 feet in excess of the 100 feet.

- c. Conductors supported by suspension type insulators at crossings over communication wires shall be increased by such an amount that the values specified in the above table will be maintained in the event of a broken conductor in either adjacent span, provided such conductor is supported as follows:
  - At one support by suspension type insulators in a suspended position, and at the other support by insulators not free to swing (including semi-strain type insulator).
  - At one support by a strain insulator, and at the other support by a semi-strain type insulator.
13. Splices shall not be made in the crossing span, and preferably not in the adjacent spans, which are depended upon for withstanding the longitudinal tension of the crossing conductors. Taps shall not be made in the crossing span. If a splice or tap is made in any conductor in the span adjacent to the crossing span, it shall, where practicable, be placed at a point nearer to the crossover support than is the nearest conductor crossed over.
14. Cradles, baskets, and overhead bridges are generally not acceptable and shall not be used except under unusual conditions where it is economical to build such a structure of sufficiently substantial nature and when approved by Metra. Drop outs shall not be used.
15. The crossing construction shall be subject at all times to the inspection and approval of Metra.
16. All parts of the supporting structures of the crossing span shall be inspected annually by the owner and all defective parts shall be promptly restored to a safe condition.
17. The details of construction and maintenance of the crossing, unless otherwise specified herein, shall be in accordance with the current specifications of the National Electrical Safety Code, except when modified construction is permitted by Metra.

## Specifications for Overhead Communication Line Crossings

1. These specifications shall apply to the construction of overhead communication lines crossing or paralleling the right of way. Wires covered by these specifications shall not carry more than 400 volts.
2. Spans crossing the right of way shall preferably have the supporting poles located outside the right of way. The crossing span, where practicable, shall not exceed 175 feet. Where practicable, the adjacent spans shall not exceed the length of the crossing span by more than 50%. Where practicable, the poles supporting the crossing span and the adjacent spans shall be in a straight line.
3. Pole lines paralleling the right of way shall have the poles located not less than 12 feet from the nearest rail, with a minimum distance of 8.5 feet from the nearest rail to any cross arm, guy, or other attachment. When necessary to provide safe operating conditions which require unobscured view along the track for signal, signs, etc., Metra may require clearances greater than those specified above.
4. Wood poles shall be new and structurally sound. If guys are omitted, poles shall be located a minimum distance from the centerline of any track equal to the height of the pole above the ground line plus 10 feet. Gains shall not be cut to a depth of more than one-half inch. Spliced poles shall not be used in the crossing span.

The following table specifies the minimum depth of setting for un-guyed poles in average soil and in rock.

| <b>MINIMUM DEPTH OF SETTING FOR UN-GUYED POLES</b>                  |                |                      |                |  |
|---|----------------|----------------------|----------------|--|
| <b>Depth in feet in average soil for different classes of poles</b> |                |                      |                |  |
| <b>Length of Pole (feet)</b>  | <b>Class 4</b> | <b>Class 5 and 6</b> | <b>Class 7</b> | <b>Depth in Feet in Rock for all Classes</b> |
| <b>16</b>   |                | 4.00                 | 3.75           | 3.00   |
| <b>18</b>   |                | 4.25                 | 4.00           | 3.25   |
| <b>20</b>   | 4.25           | 4.25                 | 4.00           | 3.25   |
| <b>22</b>   | 4.75           | 4.50                 | 4.25           | 3.50   |
| <b>25</b>   | 5.25           | 4.75                 | 4.50           | 3.75   |
| <b>27</b>   | 5.50           | 5.00                 | 4.75           | 4.00   |
| <b>30</b>   | 5.75           | 5.25                 | 5.00           | 4.25   |
| <b>35</b>   | 6.00           | 5.50                 | 5.25           | 4.50   |
| <b>40</b>   | 6.25           | 5.75                 | 5.50           | 4.75   |
| <b>45</b>   | 6.50           | 6.00                 | 5.75           | 5.00   |
| <b>50</b>   | 6.75           | 6.25                 | 6.00           | 5.25   |
| <b>55</b>   | 7.00           | 6.50                 |                | 5.50   |
| <b>60</b>   | 7.25           | 6.75                 |                | 5.75   |

Where soil conditions are such that the above depths of setting will not develop the strength of the pole, the pole shall be set to a greater depth, or other means shall be used to properly support the pole.

- Wood crossarms supporting the crossing span shall be of fir, treated yellow pine, or other suitable timber. They shall have a nominal cross-section of not less than the value given in the table below. Galvanized or painted steel or iron crossarms of equal or greater strength than those of the wood crossarms specified in the table may also be used.

| DIMENSIONS OF WOOD CROSSARMS |                |        |                                |
|------------------------------|----------------|--------|--------------------------------|
| Number of wires              | Nominal Length |        | Nominal Cross Section (Inches) |
|                              | Feet           | Inches |                                |
| 2                            | 1              | 4 ½    | 2 5/16 X 3 5/16                |
| 4                            | 3              | 4 ½    | 2 5/16 X 3 5/16                |
| 6                            | 6              | 0      | 2 ¾ X 3 ¾                      |
| 10                           | 8              | 6      | 2 ¾ X 3 ¾                      |
| 10                           | 10             | 0      | 3 X 4                          |

- All pole line hardware shall be galvanized.
- Insulator pins shall have strength sufficient to withstand the loads to which they will be subjected. Iron or steel pins shall have a shank diameter of not less than ½ inch. Wood pins shall be sound and straight grained with a shank diameter of not less than 1 ¾ inch.
- Each insulator shall be of such pattern, design, and material that, when mounted on its pin, it will withstand, without damage, and without being pulled off its pin, the ultimate strength of the conductor which it supports.

| MINIMUM WIRE SIZES |                        |                   |                       |                   |
|--------------------|------------------------|-------------------|-----------------------|-------------------|
| Conductor          | Spans 125 feet or less |                   | Spans 125 to 150 feet |                   |
|                    | Gauge                  | Diameter (inches) | Gauge                 | Diameter (inches) |
| Copper, hard drawn | 10 AWG                 | 0.102             | 9 AWG                 | 0.114             |
| Steel, galvanized  | 10 BWG                 | 0.134             | 8 BWG                 | 0.165             |

**Note:** If spans in excess of 150 feet are necessary, the size of the conductors specified above, or the sags of the conductors shall be increased accordingly.

9. Conductors shall be of material, or combination of materials, which will not corrode excessively under the prevailing conditions. The minimum allowable sizes of conductors in a span crossing over a railroad which does not, in the same span, cross over supply conductors exceeding 750 volts shall be as listed in the following table. Conductors of material other than those specified in the table below shall be of such size and so erected as to have mechanical strength not less than the sizes of the copper conductors specified.
10. Poles supporting the crossing span shall be guyed in both directions, if practicable, and shall be head guyed away from the crossing span when the crossing span places undue stress on the crossing poles. Guys shall be of galvanized steel or stainless steel **and shall have high visibility guarding.**
11. Suspension strands shall be of galvanized steel or other material that will not corrode excessively under the prevailing conditions.
12. The construction shall be subject to the inspection of Metra and shall comply with the requirements of these specifications. Defective material shall be rejected and replaced with acceptable material.
13. The crossing shall be maintained in a safe condition. The poles, crossarms, guys, wires, and other parts and materials used in the structure of the crossing shall be periodically inspected, and all defects shall be promptly repaired by the owner of the line. The guys and anchors shall be maintained so that the guys are kept taut and serve the purpose for which they are intended. The line wires shall be kept to the proper sag. Underbrush, grass, or other combustible material shall be kept removed, by the crossing owner, from the poles for a sufficient distance to reduce fire hazard to a minimum.



14. The following table lists minimum required vertical clearances:

### Wire Line Clearance Chart

| <b>VOLTAGE (to ground)</b>  | <b>MINIMUM CLEARANCE<br/>REQUIRED ABOVE TOP<br/>OF RAIL</b> |
|---|---|
| Insulated Communication Wirelines   | 23.5 ft.  |
| Non-insulated Communication Wirelines   | 24 ft.  |
| Shielded or insulated power wirelines 0-750 volts                                       | 24 ft.  |
| Shielded or insulated power wirelines (Lashed to bare ground messenger)<br>751V to 22kV | 24.5 ft.  |
| Open supply conductors<br>0-750 volts   | 24.5 ft.  |
| Open supply conductors<br>751V – 22kV   | 26.5 ft.  |
| 50kV  | 27.5 ft.  |
| 100kV   | 29.2 ft.  |
| 150kV   | 30.8 ft.  |
| 200kV   | 32.5 ft.  |

## Specifications for Underground Electric Power Lines

1. Wire lines located within the right of way must be located as far as possible from existing tracks and other railroad facilities and as close to the right of way line as possible due to the fact that Metra occupies the right of way for the purpose of operating a commuter railroad. All installations shall be designed and constructed so the railroad operations and facilities are not interfered with. Additionally, the proposed installation shall be located to minimize encumbrance to the right of way in order that Metra will have unrestricted use of the property for current and future operations.
2. Wire lines shall be located to cross tracks at approximately right angles where conditions permit.
3. A Metra signal department employee must locate any buried signal cables prior to construction.
4. The tops of ducts and cable systems structures of underground cable crossings shall be located at a depth of not less than 5 feet - 6 inches below base of rail and not less than 36 inches below bottoms of ditches or 48 inches below natural ground, with the lowest depth governing. Deeper installations may be required to avoid underground railroad facilities.
5. Underground crossings of power supply cables with maximum voltage of 750 volts and communication cables of low voltage may be installed by pushing a galvanized steel pipe under the tracks at a depth specified above to serve as a conduit, provided such pipe extends the full width of the right of way. All ducts and/or encasements beneath the tracks must be capable of withstanding E-80 loading and conform to AREMA Specifications. Any conduits and/or encasements larger than four inches will be governed entirely by those specifications which normally cover pipelines (see "Specifications for Pipelines). Jacking or boring installation is preferred, and no water is to be used in the installation of the encasement. Plastic casing pipe is not permitted.
6. Underground crossings of power supply cables operating above 750 volts will be installed at depths specified above and in addition, between the points where the underground crossing enters and leaves METRA property, the cable is to be enclosed in galvanized steel pipe or approved concrete encased duct for mechanical protection of the cable. No unprotected cable of this potential will be permitted.
7. All underground installations must be located a minimum of 50 feet from the end of any railroad bridge, centerline of any culvert or switch area to the centerline of the wire line crossing.
8. If the proposed location of the wire line crosses existing culverts, the top of the buried wire line must be installed a minimum of 5' below the culvert invert. If the location crosses a ditch beyond the end of the culvert (field side) then the top of the buried encroachment must be installed 5' below the bottom elevation of the ditch.

9. Manholes must be capable of withstanding H-20 highway loading requirements and must be installed so as not to create a stumbling hazard.
10. All underground installations carrying power or communication wires and cables shall be constructed and properly marked with signs.
11. In addition to the requirements of these specifications, the underground crossing is to conform to the requirements of the National Electrical Safety Code, current edition. The crossing is also to conform to the requirements of any local or state laws or regulations of any local code enforcing authority that may be in effect at the time of the installation.