Chapter DDM-3: RESIDENTIAL SUBSYSTEMS

TABLE OF CONTENTS

REVISIONS

2-15-17 3.2E C(b) Duct Bank Conduit Requirements. Communication Conduits Update 4
8-24-17 3.2E.C(b) Communications Conduits Update and Conceptual Schematic addition. 4-5

Chapter DDM-3: RESIDENTIAL SUBSYSTEMS

3.0 SCOPE

This section provides the criteria for designing residential underground distribution facilities. This includes demand estimating, service point guidelines, transformer selection, cable selection and subsystem design examples.

3.1 DESIGN CONCEPT

Residential subsystems are to be designed with 1/0 XLPE primary cable. Subsystems are to be designed as fused loop configuration using pad-mounted switch cabinets (PSE's) and looped pad-mounted transformers. In the midpoint of the loop there will normally be an open to break the loop configuration and create two fused radials with balanced load on each side of that switch. As noted in the previous chapter the maximum kVA in a residential subsystem to be fed off a switched position is 1500 kVA.

3.2 DESIGN CRITERIA

3.2A Design resources for Residential subsystems.

A. Site, grading, elevation, street improvement plans, as appropriate
B. Connected load schedules
C. Service voltage
D. Square feet per unit
E. Primary source voltage
F. Feeder source structure locations
G Meter panel size

3.2B Demand Estimating

Refer to DDM-2, 2.2C for demand estimating.

3.2C Service Point Guideline.

One Service point will normally be provided for each single-family unattached residence, in accordance with rule 11. The meter location should be on the side wall near the front of the garage to allow for the use of a joint trench. Multiple-occupancy buildings will have the meters grouped at one location per building. Additional service points may be provided for the City's operating convenience.

3.2D Equipment Selection

A. Transformer Selection.

1. Padmount transformers are the preferred method of installation for all residential developments. Subsurface transformers can be considered in existing infrastructure or in situations where there is no other acceptable alternative to utilize a padmount with supervisor approval.

2. Minimize the number of transformer locations by maximizing the number of residential customers per transformer, 25, 50, 75 or 100kVA padmount transformers are the preferred sizes.

B. Junctions

Loadbreak Junctions are used in pad-mounted Junction Cabinets (PJC's), underground vaults, and other equipment to sectionalize, establish loops, taps and splices, and to facilitate equipment change-outs. Sectionalizing a cable run to find and isolate a cable fault is made easy when a load break junction is used. The load-break junctions are installed on the system to extend and split phases for operational capability by installing downstream of current-limiting fusing. The preferred method for new installations is in padmounted equipment.

C. Bus Connections.

Secondary connections are made inside 17"x30" (ESB-6) or 2'x3' (ESB-7) pull boxes. The standard Bus 3-6-way, 350MCM set screws shall be the preferred method of installation to feed 120/240 single phase three wire SFR's in residential tracts. Please reference the conduit/cable table DDM-2, 2.2F-5.

3.2E Structure Selection

Substructures should be installed to accommodate anticipated growth and system needs for transformer load capacity.

A. Transformer Type and Size

1. Transformer Pad. Please reference DDM-2, 2.2F-3 for selection of single phase transformers to be used in residential subsystems. Locate the transformer pads as close as practical to the load centers of the lots they are to serve.

B. Junctions

1. PJC Slab box

Two types of PJC Slab Box's are available. Three Phase and Single phase. 3-4 way load break junctions are utilized inside a three phase PJC slab box and 1-4 way junction is utilized inside a single phase PJC slab box. PJC sleeves can be considered in existing infrastructure or in situations where there is no other acceptable alternative to utilize a slab box with supervisor approval.

2. CST

Junctions are utilized inside CST (Commercial Subsurface Transformer Enclosure) for terminating primary conductors. The load break junctions are mounted to the sides of the CST. The load break junctions are a connection point and primary high voltage source for subsurface transformer installations inside the CST. CST's installed in the residential driveway expansion area should be equipped with torsion assist covers.

3. Secondary Pull Box

In residential subsystems the two types of pull boxes that can be used are 17" x 30" (ESB-6) or 2'x3' (ESB-7) as a means for extending or intercepting secondary conductors. Locate the pull boxes as close as practical to the load centers of the lots they are to serve. Pull boxes should be placed at a minimum distance of 10 feet from a secondary riser power pole and shall be used to keep service runs to a minimum of 100 feet or less. Secondary pull boxes installed in the residential driveway expansion area should be equipped with traffic rated lids.

C. Duct and Conduit Requirements.

a) 1-4" conduit will be required for all primary cable to a single phase or three phase residential system.

b) New residential tract developments with a street improvement involving new curb, sidewalk and gutter, 4-5" conduits are required for primary feeders. 2-4" conduits are required for distribution and 2-2" conduits are required for fiber communications running along the frontage. The 2-2" conduits for fiber Communications consists of 1-2" conduit for main trunk line and 1-2" conduit for spare. 2'x3'x2' pull boxes are required for main trunk line, patch panel closure , and to feed a maximum of 12 homes. Pull boxes to be spaced to a maximum of 500 feet from each other. Install 9" round x 10" deep irrigation boxes to feed 2 homes. Install 1-3/4" conduit from pull box to 9" round x 10" deep irrigation box, and 2-3/4" conduits out to feed the two homes. For situations of a single home feed, install 1-3/4" conduit directly from the pull box to the home. Each home to be fed with 1-3/4" conduit stubbed up adjacent to the electric service conduit. The conduits for fiber communications will bypass PJC's and transformer pads so QEW's will not be required in the future. The fiber communication conduits should never enter high voltage, PJC's, vaults, CST's and transformer pads. (See schematic 3.2E.C(b) on next page).

b) For new single family residences 1-2" conduit for fiber optic communications to joint trench with 1-3" secondary conduit and terminate adjacent to electric meter. For upgrades where there is no civil work involved, no fiber communication conduit is required.

d) The equivalent straight pull footage of each secondary/primary conduit run should not exceed the maximum allowable straight pull footage for the cable being used as shown in DDM-5.

e) Service conduits will normally be three-inch for residential services and will be installed to accommodate the expected main switch or pull section capacity in accordance with DDM-2, 2.2F-5.

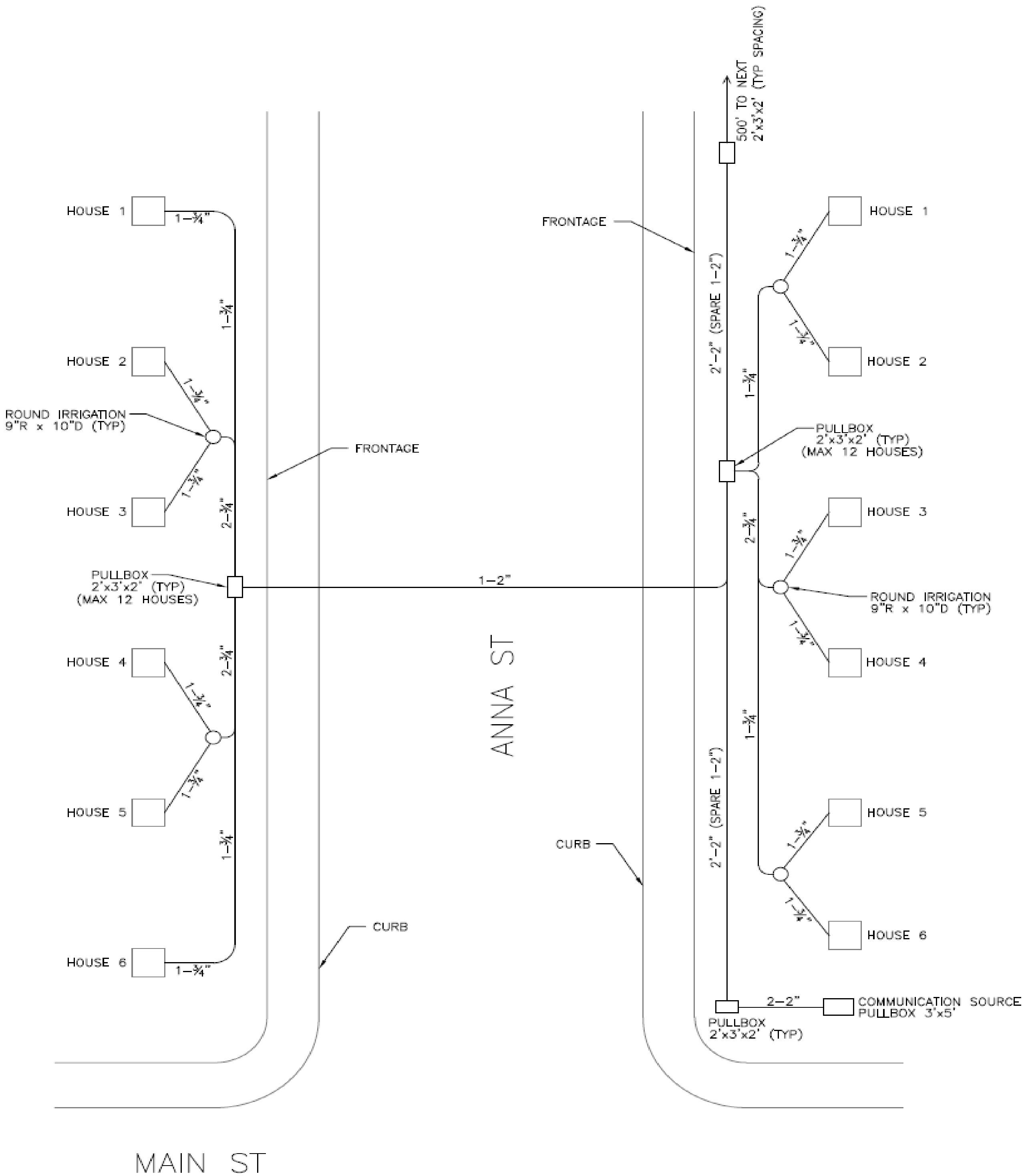
f) The number of bends along the service conduit route should be kept to a minimum to facilitate pulling of cable and to minimize the need for pulling structures. No more than three 90 degree bends shall be allowed in a service run. See DDM-5.

g) Use 12.5 foot radius sweeps for primary conduits and 4 foot radius sweeps for service conduits.

D. Joint Trench

Joint trench construction (with telephone, cable television (CATV), gas, or other utilities should be planned according to good engineering practices and G.O. 128 clearance requirements. Joint trench provides a means to share trenching and paving costs. It can provide savings to the City, other utilities, and the customer. A joint trench agreement will be required and should be reviewed by the City Attorney's office.

SCHEMATIC 3.2EC(b): CONCEPTUAL FIBER COMMUNICATIONS BACKBONE FOR RESIDENTIAL TRACT DEVELOPMENT



3.2F Cable Selection

A. Primary Cable

1. Primary cables shall be 1-1/0 XLPE aluminum in a 1-4" conduit for single phase service(s) and 3-1/0 XLPE aluminum in a 1-4" conduit for three phase service(s).

B. Secondary Cable and Service Cable.

1. The preferred design is planning secondary and services with transformers and pull boxes on one side of the street. The number of subsurface connections (secondary or service connections) in pull boxes should be minimized. This will result in a more reliable system that requires less maintenance. Maximum of 150 feet is allowed in a service run and the pull tension shall always be verified per DDM-5.

2. The customer's meter panel size must be known before sizing the underground service cable. The table below shows the maximum cables to be installed:

Table 3.2F-1: Cables to be installed

Meter Panel Size	Cables to be Installed
100A	1/0 AL Triplex (Residential)
200A	1/0 AL Triplex (Residential) 4/0 AL Triplex (Commercial)
400A	350 Kcmil AL Triplex (Residential & Commercial)

3. Residential secondaries and services shall be installed in conduit.

4. The service and secondary cables must be sized to comply with the maximum allowable voltage drop of four percent (for new installations) from the transformer to the customer's meter. See DDM-7, Table 7.2B-1 and Table 7.2B-2.

5. The maximum allowable flicker through the transformer, secondary and service, is four percent for underground installations.

6. Develop a secondary and service plan that minimizes the cable size and length of runs and meets the percent voltage drop and percent flicker standards.

3.2G Direct Buried Services /Panel Upgrades

A. All direct buried secondary services will require conduit installation for all SFR meter panel change outs.

B. Cable in Conduit (CIC) secondary services will require conduit installation when it is determined that the existing cable's ampacity does not meet our current standards for the meter panel being installed. (i.e. existing #2 cable for a 400A meter panel upgrade.)

3.2H Residential Subsystem Design criteria and Example

The following items use the design criteria outlined above to select and incorporate transformers, cable, and substructures into recommended subsystem designs.

A. Identify the primary source and voltage. The preferred source will be a four-wire system. Each fused loop on each phase should be phase marked on the schematic.

B. The maximum single phase capacity per loop is 500 kVA

C. Subsystems should be planned and cables routed so as to reduce the total length of cable.

D. Looped residential subsystems is the standard.

D. Cables for residential subsystems will be installed in conduit.

E. If an above ground feeder switch is required, utilize a PSE equipped with a 200A fused position as the source to fuse loops.

F. Residential looped subsystems must be able to be de-energized by opening its own dedicated switch at its source.

An example of the conceptual relationship between the Feeder System and Residential subsystem is shown in schematic 3.2H-1

SCHEMATIC 3.2H-1: CONCEPTUAL RELATIONSHIP BETWEEN FEEDER SYSTEM & RESIDENTIAL SUBSYSTEM