SUBJECT: URD Design Process - Overview
SECTION: URD Design

Scope

An overview of the planning and design process of URD subdivisions.

Procedures in this Section

SPO 21610.1	URD Design Process - Detail
SPO 21610.2a	URD Voltage Drop/Flicker Program
SPO 21610.3	Conduit Only Construction
SPO 21610.4	Customer Installed Conduit
SPO 21610.4a	Customer Installed Conduit
SPO 21610.4b	Customer Installed Conduit -Testing & Acceptance Guidelines

Process Overview

1. Obtain construction prints and load information from customer/developer:
   - size of homes (sq ft), A/C size in tons, heat strip size in kW
   - lift station information (voltage and HP)
   - community facility information (pools, buildings, tennis courts, sprinkler pumps, etc.)
   - request CAD disk from developer for TRS, if available

2. Examine existing FPL facilities in the area to determine points of service, and if additional overhead lines will be required. Give special consideration to existing feeders which will be used, and future feeder needs in the area.

3. Conduct preliminary negotiations with the customer/developer:
   - discuss scheduling - utilities, paving, models, lift station testing, easement clearing, etc. Discuss any permits that may be required, and their impact on the schedule
   - discuss temporary power needs for construction and sales trailers
   - explain FPL URD Tariff, all applicable charges and credits
   - inform customer of charges for installing any underground feeder, and of easements required for feeder switch cabinets
   - discuss who will trench, install backbone conduit, and install road crossings
   - discuss joint trench option with CATV and Telephone
   - discuss FPL deferral policy / performance deposits
   - discuss easement requirements; sharing with other utilities, staking of easements, width of easements, grade requirements in the easement
   - discuss street lighting system, who will provide and maintain
   - explain the Underground Distribution Facilities Installation Agreement
   - discuss the advantages of TUGs for temporary service

4. Originate a designed work request (job type 79Axxx) in WMS to create the construction schedule

Process Overview (cont'd)

5. Request TRS department to layout the URD design using the APD software if single family homes or duplexes on individual lots. For multi-family buildings the Engineer/Technical Specialist performs the layout. See **SPO 21610.1** for URD Design.

6. Provide drawings and paperwork to the customer / developer:
   - present bill for URD tariff charges, and any other CIAC that may apply
   - submit Underground Distribution Facilities Installation Agreement
   - submit Road Crossing Agreement (if applicable)
   - submit Conduit Installation Agreement (if applicable)
   - submit Street Light Agreement (if applicable)

   (These documents should be inserted into a “Welcome Kit” folder for delivery to the customer).

7. Obtain contributions and executed agreements, and satisfy the easement and site requirements (cleared, staked, and at proper grade). Ensure that permit applications have been approved.
   - have the customer / developer surveyor perform the staking

8. Progress work request to status 50.

9. Build job and provide service. Act as liaison between crews and customers to ensure job is built to satisfaction of all.

Scope

Detailed "step by step" guidelines for URD design.

Design Process

1. Determine base load of the dwellings units.

   Reference: **SPO 21610.2a** - URD Calculation Program
   DERM 5.3.1, Sections C & D

2. Determine number of customers allowed for each size transformer.

   Guideline:

   The allowed number of customers is shown on the DERM URD design charts. Transformers should be sized for summer design load not to exceed 120% of nameplate rating, (2500 ft home or larger not to exceed 100% of name plate rating) or winter design load not to exceed 204% of nameplate rating, based on DERM design criteria. Normally, the summer load will determine the transformer size. Greater winter loading is allowed because of cooler ambient temperatures. Winter loading will determine transformer sizing only when the base winter load exceeds maximum summer loading by 70% (204% of the transformer's nameplate rating), or if the voltage drop for a specified number of customers exceeds 4%.

   Reference: **SPO 21610.2a** - URD Calculation Program
   DERM 5.3.1, Table IA - Base winter load

3. Based on the typical service length and fully loaded transformer, determine the maximum 1/0A TPX and 4/0A TPX secondary cable lengths which will meet voltage drop (regulation) and flicker (voltage drop due to A/C starting current) standards.

   Guidelines:

   a. Design for 1/0A TPX secondary and service cables wherever possible.
   b. Maximum allowable voltage drop from transformer to meter is 4% (this allows for 1% in the primary). Where strip heat is a design variable, use winter factors shown in URD Design Charts to calculate acceptable secondary and service cable lengths.
   c. Maximum allowable voltage flicker is 5%.

   Reference: **SPO 21610.2a** - URD Calculation Program
   DERM 5.3.1, Section G

4. Determine connected subdivision KVA to determine # of loops required.

   Guidelines:

   a. Allowed loop KVA is based on fuse sizes shown in DERM 5.3.1, Table VI. Initial loop loading is to be 80% of the maximum connected KVA for the fuse size selected. When mixing new construction with existing facilities, continue to use connected KVA until build out is complete.

   b. Use the standard fuse size for URD – 80 “K”, contact the Planning Dept. to coordinate with existing protective devices.

Design Process (cont'd)

c. # of loops = $\frac{\text{Ultimate connected KVA [(\# TX) x (TX kVA)]}}{\text{Allowed KVA per loop}}$

d. Additional phases may be required to accommodate 3 phase loads.

e. When deciding between loop and radial construction, reliability must be weighed against initial cost. There are no firm guidelines, but based strictly on reliability targets, the maximum design length for a URD radial should be about 1000 feet with no more than 2 transformers. Maximum design length of each half of a URD loop should be about 3500 feet. Still, consideration must be given to the cost of designing within these guidelines.

Reference: **DERM** 5.3.1, Section I, Table VI Model Feeder Criteria

Example: Steps 1 through 4 Illustrated

156 LOT SUBDIVISION, 2.5 TON A/C, 5 kW HEAT, FULL ELECTRIC HOMES

i. Select URD Design Chart for 2.5 ton A/C, FE homes (**DERM** 5.3.1)

ii. The URD Design Chart shows transformer size for any particular number of customers. For example, for 2.5 ton A/C FE where 5 kW strip heat is a factor, 6 customers will fully load a 25 kVA TX, 10 customers a 37, 15 customers a 50 kVA TX, etc.

iii. Based on lot sizes, determine the typical service length (including make up) of 1/0A TPX. 60' is used for this example. Determine the voltage drop (Vd) in the service cable and transformer. Since winter strip heat is a design criteria, the winter load cable factors apply.
-From URD Design Chart, % Vd in service cable per 100' is 0.584%.
-% Vd in transformer for 12 customers on a 50 kVA is 2.72%.
-Vd in TX and service is 2.72 + 0.60(0.584) = 3.07%

Since 4% total Voltage Drop is allowed, 0.93% (4% - 3.07%) Vd remains for secondary. Calculate permitted lengths:

# customers	1/0A TPX	4/0A TPX	3-350A
1	*	*	*
2	$\frac{0.93}{.992}$ = 94 ft	$\frac{0.93}{.525}$ = 177 ft	$\frac{0.93}{.365}$ = 255 ft
3	$\frac{0.93}{1.382}$ = 67 ft	$\frac{0.93}{.732}$ = 127 ft	$\frac{0.93}{.508}$ = 183 ft
4	$\frac{0.93}{1.720}$ = 54 ft	$\frac{0.93}{.911}$ = 102 ft	$\frac{0.93}{.632}$ = 147 ft

*** use maximum service lengths in URD Design Chart**

(Denominators taken from URD design Chart; for this case, from the winter load cable sizing chart since strip heat is involved. The denominator is the voltage drop factor for the corresponding number of customers associated with the service or secondary)

Design Process (cont'd)

iv. This subdivision to be served with thirteen (13) 50 KVA transformers (12 customers each transformer. Estimated transformer loading in summer is 48.74 KVAd, winter is 63.98 KVAd. Connected transformer KVA must be compatible with the fuse. Since an 80 ”K” fuse will accommodate connected total loop transformer KVA up to 610 (DERM 5.3.1 Table VI, 13KV area), this subdivision requires two loops to be installed (13 X 50 KVA = 650 KVA total load).

********End of Example**********

5. Determine if feeder mains are required to provide termination points for loops

   Guidelines:

   a. Communicate with the Planning and Reliability department on any job which requires feeder work. Both the Engineer/Technical Specialist and the area Planning and Reliability engineer should know what feeder will serve the project, and future feeder plans in the area.

   b. Avoid loops which terminate on different feeders. Preferably there will be no switch on the overhead line between the loop ends. This eliminates the potential of feeder ties in the underground loop. Ensure that normal open points on loops are located on the same side of three phase transformer banks (all phases of the bank are served from the same source point).

   c. Consider feeder phase balance when deciding the phases of the URD loops. Work with the area Planning and Reliability engineer.

6. Locate transformers, handholes, secondary / service conduits in a preliminary design using standard proposed symbols. Use the prints provided by the customer, or use background prints prepared by drafting.

   Guidelines:

   a. The preferred method of design is front lot line design.

   b. Avoid swales, culverts, drains, fire hydrants, sewer taps, retention, and conservation areas for placement of facilities. Transformers located above sewer taps may be undermined in the future when the sewer lateral is installed.

   c. Design to fully load each transformer with the maximum number of customers so that the KVA capacity is fully utilized. Design to use the largest transformer which can be fully utilized. (Don't use 25's if 50's can be used fully). At the same time, minimize the number of handholes used to serve those customers. In general, if an additional cable run out of the TX can eliminate a handhole, it is economical to do so. Familiarity with the installed costs of PVC, cable, and handholes makes

Design Process (cont'd)

it possible to evaluate the cost effectiveness of each handhole. For example, the previous example indicated 12 customers would be served from each 50 KVA transformer, to fully load the transformer. The best design would accomplish this with just 2 handholes for each transformer. The handholes would be as close as practical to the transformer (to minimize voltage drop and flicker), hopefully at a convenient road crossing location.

d. Use 17" handholes with 3-port multi-tap for 2 services and 24" handhole with 5-port multi-tap for 3 to 4 services. Indicate the handhole size on the construction print. (ex. - 17").

e. There is a maximum of 8 secondary / service connections and 1 street light connection per transformer.

f. Avoid using 100 KVA transformers in the initial design. By limiting designs to 75 KVA, the 100 KVA low-style will be available for potential overload conditions.

g. Utilize additional road crossings where an additional crossing will eliminate 125 feet of trenching on the opposite side of the street. This also reduces the amount of easement which the customer must provide and clear.

h. Run the cable pull program to determine if any splice boxes are required for secondary or service.

Reference: **DCS** L-17.0.7 (handholes w/multi-taps)
DCS I-65A (transformer connections)

7. Route primary cable and complete the primary diagram with switch numbers for the entire URD project, not just the current phase.

Guidelines:

a. Try to place primary in the same trench as secondary / service conduits to keep the total trench feet at a minimum. At the same time, design the shortest practical primary route. By limiting exposure of primary cable, service reliability is improved.

b. Primary riser poles should be accessible if possible.

c. Install the proper surge protection on the primary cable. Arrestors are required at all radial ends and normal open points for dual voltage and 23 KV areas, and at all riser locations regardless of voltage.

d. Run the cable pull program to determine if any splice boxes are required for the primary cable. Primary cable pulls should be limited to 800 feet whenever possible.

Design Process (cont'd)

e. Check flicker to be within 5% tolerance on the longest secondary/service combinations using the flicker values on the URD Design Chart.

8. Indicate on record drawing which FPL facilities will be installed and which will be deferred. "Deferral" delays installation of facilities until they are needed. **FPL should install only the facilities necessary to serve the buildings currently planned for construction and install only conduit and TX slabs in areas of future building construction per the Conduit Only Construction guidelines (SPO 21610.3).**

   Guidelines:

   a. The URD Tariff is collected for all contiguous lots the developer wants served. FPL will install PVC to all lots for which the CIAC has been paid. FPL will then install the electric facilities (cable, TXs, etc.) as it deems necessary to provide permanent electric service and defer all other electric facilities.

   b. If primary cable must be installed past a future transformer station, it is more economical to install the transformer if customers are expected in 2 years or less. Install a "dummy" cabinet if load is not expected for 2 years.

   c. Encourage developers, where possible, to build in phases to avoid collection of unnecessary tariff charges and collection of Performance Guaranty Agreements.

   d. Mobile home parks can make deferral difficult because of short notice. Encourage phasing of the project.

   e. This practice does not preclude FPL from installing facilities in time to provide temporary service for construction.

   f. TRS creates the AMS model. Use the street addresses in the model.

   Reference: SPO 21610.3 - Conduit Only Construction

9. Determine street light locations. Combine the URD backbone and street light conduit job into one work request. Install street light conduit with the backbone even if the street light system will not be required until later. Failure to do so will cause future CIAC requirements if street lights are requested afterward and no provisions were made in the URD design (see SPO 21475). A separate work request (job type 79GSL) is required for the street light poles, cable, and luminaries.

   Guidelines:

   a. Avoid additional trench and utilize existing termination points (e.g. handholes and transformers) for street lights as much as possible.

Design Process (cont'd)

b. Street light facilities must be kept separate from backbone facilities in the WMS inventory (use "SL" units to differentiate street light facilities from backbone facilities).

c. Street light options in areas of deferred facilities:
   i. Install and tap lights on a separate 79GSL as distribution facilities are installed. Install street light conduit with backbone conduit even if lights will not be installed until a later time. Municipalities which require developers to install street lighting will generally accept a letter from FPL stating street lights will be installed as distribution facilities are installed, or,

   ii. Collect non-refundable CIAC to install temporary facilities required to provide service to lights.

d. Prepare Street light agreement, form 216, in triplicate.

e. Enter the Street Light Facility Attributes in WMS. Use street number addresses for the lights.

Reference: **SPO 21475** - Street Lighting
DERM - Section 6.0
WMS - Street Lighting job aid(s)

10. Send rough draft print (redline) to Drafting for final preparation. Include addresses for inclusion on the record drawing.

11. Scope the major material in WMS to allow sufficient ordering time for inventory services. It is especially important to scope items that are purchase code 01, 03, or 63, since these have the longest order time.

12. If applicable, proceed with Joint Trenching (the Florida Administrative Code mandates joint trench whenever possible).

Guidelines:

a. Provide FPL layout to CATV / Telephone companies so they can design in accordance with FPL service points.

b. Determine cost to CATV and Telephone.

c. Execute Joint Trench Agreement.

13. Make provisions for road crossings. Materials may be ordered in WMS by inventorying the materials and then adding a "MATL" remark requesting the conduit, plugs, and markers to be issued (specify quantities). For large quantities of PVC, (a bundle or more) provide inventory services with sufficient lead time to ensure adequate PVC will be in stock. Preliminary negotiations determined who would install the

Design Process (cont'd)

crossings. For road crossings installed by FPL in advance of the backbone work request, prepare a related work request in WMS. Normally, the customer / developer will install the crossings for credit.

Guidelines:

a. Prepare print for customer showing location and number of ducts at road crossings. Attach the Road Crossing Specification sheet.

b. Complete Road Crossing agreement.

c. Arrange for delivery or customer pick-up of road crossing materials. .

Reference: **SPO 21462.3** Example 24, for Road Crossing specifications

14. Facilitate customer installed backbone trench and conduit where applicable. Customers who install the backbone trench and conduit for credit are **not** entitled to a separate additional credit for installing road crossings.

Guidelines:

a. Prepare prints for customer showing number/size ducts at each location. Advise customer of depth requirements & specifications.

b. Complete Underground Conduit Installation agreement.

c. Arrange for delivery or customer pick-up of materials.

d. Test and accept customer's installation of backbone conduit (per the agreement) when the customer's installation is complete (**SPO 21610.4b**).

Reference: **SPO 21610.4** - UG Conduit Installation Agreement
SPO 21610.4b – Conduit Testing and Acceptance

15. Obtain easements for FPL facilities per the Underground Distribution Facilities Installation Agreement.

Guideline:

Provide drawings indicating the proposed FPL cable route and have the customer's engineer/surveyor indicate the FPL easements on the preliminary plat, which will ultimately be recorded on the final plat.

16. Apply for any necessary permits; DER, DOT, railroad, transmission, FAA, county, city, etc.

17. Enter WMS inventory in WMS "Design … Specifications" to order materials for the job.

Design Process (cont'd)

Guidelines:

a. It is common for one crew to trench and install conduit, while another pulls cable and terminates. For these situations, the work should be split into 2 distinct jobs. The same print may be used for each job with modified job notes. Both jobs must be worked concurrently, FPL can not place empty conduit into service in our financial systems.

First job - trench, duct, and transformer pads. Qualified installers may also install non-deferred handholes and splice boxes. Transformer pads are normally set when the conduit is installed to protect the exposed conduit ends.

Second job - cable, transformers, and terminations. Non-deferred handholes and splice boxes will be installed on this job if they were not installed on the first job.

b. FPL may want to test and accept the FPL conduit installed by an FPL contractor, customer / developer, or joint utility. For these cases, the designer must inventory accordingly as follows:

i. Inventory two manhours of miscellaneous labor (DB-MISL) per TX location to provide for testing time.

ii. Inventory a 90 degree bend on the end of every conduit. The installer will stub out all conduit ends above grade so that the conduits may be tested with no digging required. (reference the Customer Installed Conduit Agreement)

iii. Inventory a #12 copper locate wire (P-CL-EMS-12C, S-CL-EMS-12C, SL-CL-EMS-12C) in all conduit only locations.