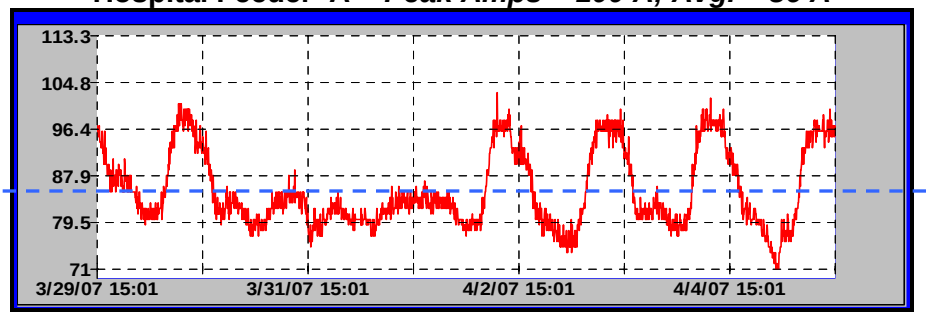
ELECTRICAL SYSTEMS DATA AND CALCULATIONS

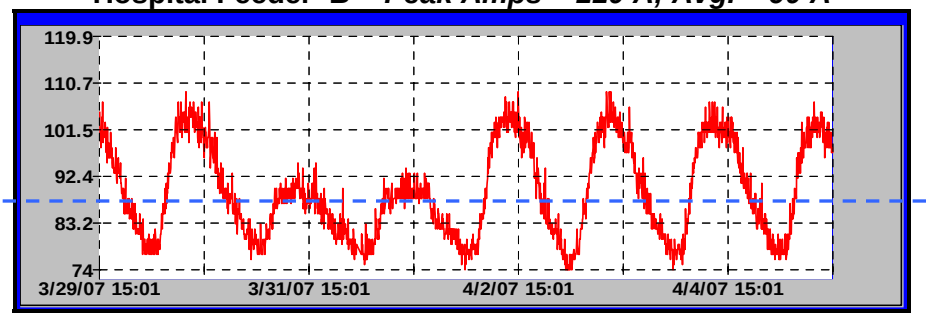
Feeder Data
Recorded from 3/29/07 to 4/4/07 (1 week period)

Amperage Outputs:

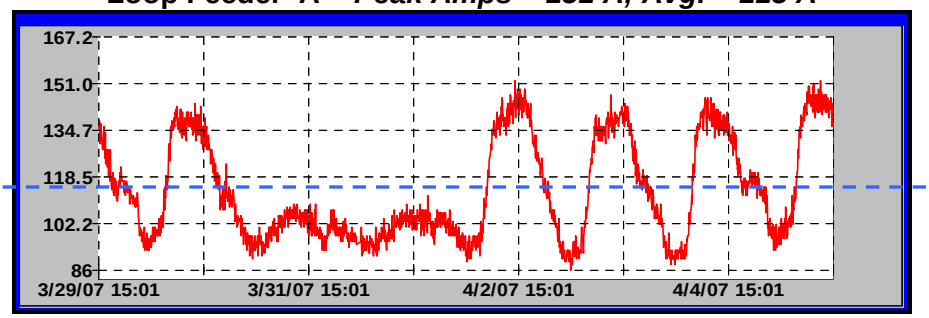
Hospital Feeder 'A' - *Peak Amps = 100 A; Avg. = 86 A*



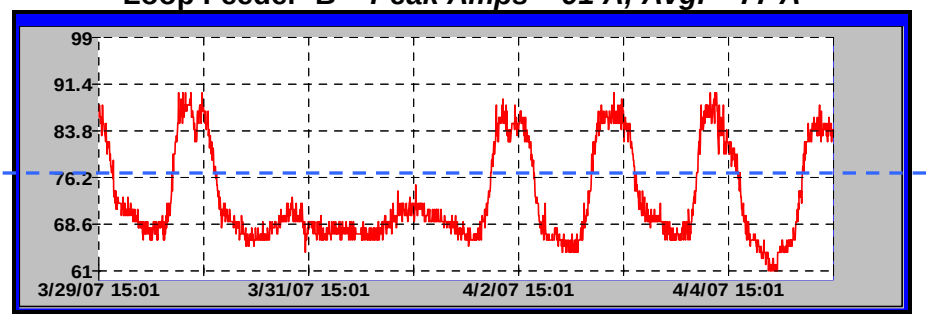
Hospital Feeder 'B' - *Peak Amps = 110 A; Avg. = 90 A*



Loop Feeder 'A' - *Peak Amps = 151 A; Avg. = 115 A*



Loop Feeder 'B' - *Peak Amps = 91 A; Avg. = 77 A*



Summary Usage Data

FEEDER DESIGNATION	PEAK AMPERAGE (A)	AVERAGE VOLTAGE (kV)
Hospital Feeders		
Hospital A	100	14.06
Hospital B	110	14.09
Loop Feeders		
Loop A	151	14.06
Loop B	91	14.09

Feeder Cable Specifications:

Okonite Company Series Conductor-

- 500 kcmil Annealed Coated Copper
- 15kV, 133% Ethylene-propylene Rubber (EPR) Insulation Rating
- DC Resistance @ 25 deg. C→ R = 0.022 Ohms/ 1000 ft

Grounding Conductor-

- 1 #4/0 AWG 600V Copper Ground Conductor

Conductor Components:

A- Uncoated, Okopact (Compact Stranded) Copper Conductor

B- Strand Screen-Extruded Semiconducting EPR

C- Insulation-Okoguard EPR

D- Insulation Screen-Extruded Semiconducting EPR

E- Shield-Copper Tape

F- Jacket-Okoseal

DISTRIBUTION SYSTEM LINE LOSS COMPARISON

	A	B	C	D	E	F	G	H	I	J	K	L
FEEDER DESIGNATION	**LENGTH (linear ft.)**	**RESISTANCE (All Three Phases)**	**AVG. AMPS**	**PEAK AMPS**	**AVG. VOLTS (kV)**	**VOLTAGE DROP (V)**	**AVG. LOSSES (Watts)**	**PEAK LOSSES (Watts)**	**LOAD FACTOR**	**LOSS FACTOR**	**AVG. LOSSES PER YEAR (kWh)**	**ANNUAL COST OF LOSSES ($.0877/kWh)**
Existing Layout												
Hospital A	2496	0.1662	86	100	14.06	14.30	1229.46	1662.34	0.74	0.59	8526.47	$747.77
Hospital B	2496	0.1662	90	110	14.09	14.96	1346.49	2011.43	0.67	0.49	8675.86	$760.87
Loop A	2007	0.1337	115	151	14.06	15.37	1767.74	3047.72	0.58	0.39	10282.51	$901.78
Loop B	2007	0.1337	77	91	14.09	10.29	792.51	1106.89	0.72	0.55	5364.92	$470.50
					Totals	**54.92**	**5136.20**	**7828.38**	**0.66**	**0.48**	**32614.60**	**$2,860.30**
Proposed Layout												
Hospital A	2331	0.1552	86	100	14.06	13.35	1148.19	1552.45	0.74	0.59	7962.83	$698.34
Hospital B	2331	0.1552	90	110	14.09	13.97	1257.48	1878.46	0.67	0.49	8102.34	$710.57
Loop A	1822	0.1213	115	151	14.06	13.95	1604.79	2766.79	0.58	0.39	9334.69	$818.65
Loop B	1822	0.1213	77	91	14.09	9.34	719.46	1004.86	0.72	0.55	4870.40	$427.13
					Totals	**50.62**	**4729.92**	**7202.56**	**0.66**	**0.48**	**30054.60**	**$2,635.79**

Estimated Savings, Proposed Layout:
kWh Savings per Year = 2560.00 kWh
Cost Savings per Year = $224.51

LEGEND OF VALUES

A: Calculated from CAD Drawings, adding 5% to each segment for manhole connections and waste
B: [R] = [L] * [0.0222] / [1000] * [3]; From Feeder Specs, DC Resistance = 0.0222 Ohms/ 1000 ft, Multiplied by 3 to account for all phases
C thru E: Based on OPP Monitoring from 3/29/07 to 4/4/07
F thru M Calculated using *Distribution System Loss Evaluation Manual*
F: [Voltage Drop] = [Avg. Amps] * [Resistance]
G: [Avg. Losses] = [Avg. Amps]^2 * [Resistance]
H: [Peak Losses] = [Peak Amps]^2 * [Resistance]
I: [Load Factor] = [Avg. Losses] / [Peak Losses]
J: [Loss Factor] = (0.2)*[Load Factor] + (0.8)[Load Factor]^2
K: [Avg. Losses per Year] = [Loss Factor] * [Peak Losses] * [8,760 hrs/yr] / [1000 W per kW]
L: [Cost of Losses per Year] = [Losses per Yr] * [Cost per kWh]; Cost of kWh taken from PP&L Website

ELECTRIC INSTALLATION COSTS- EXISTING LAYOUT

CSI Code	Description	Qty.	Daily Output	Labor Hrs	Unit	Materials	Labor	Equipment	Total	Total, incl. O&P
2315-520-0020	Fill, dumped material, spread, by dozer, excludes compaction	1096	1,000	0.008	L.C.Y.	$0.00	$1,008.32	$1,238.48	$2,246.80	$2,626.51
2315-610-0060	Excavating, trench or continuous footing, common earth, 1' to 4' deep, 1/2 C.Y. bucket, hydraulic backhoe, excludes sheeting or dewatering	2193	200	0.08	B.C.Y.	$0.00	$4,144.77	$2,807.04	$6,951.81	$10,000.08
2580-420-0380	Underground marking tape, 6" wide	3111	2,525	0.008	L.F.	$902.19	$808.86	$0.00	$1,711.05	$2,302.14
2580-420-1800	Man holes, precast w/iron racks & pulling irons, C.I. frame and cover, 4' x 6' x 7' deep, excludes excavation, backfill and cast in place concrete	7	1.8	26.667	Ea.	$12,600.00	$4,130.00	$2,415.00	$19,145.00	$23,450.00
2580-420-5840	Underground duct banks, PVC, 4 @ 5" diameter, excludes excavation, backfill and cast in place concrete	1245	70	0.229	L.F.	$11,329.50	$9,275.25	$0.00	$20,604.75	$27,390.00
2580-420-5860	Underground duct banks, PVC, 6 @ 5" diameter, excludes excavation, backfill and cast in place concrete	1866	50	0.32	L.F.	$25,470.90	$19,499.70	$0.00	$44,970.60	$59,712.00
2580-420-7830	Underground duct banks, for cast-in-place concrete, over 5 C.Y., excludes excavation, backfill and cast in place concrete, add	1096	24	2	C.Y.	$106,312.00	$47,676.00	$2,192.00	$156,180.00	$199,472.00
3310-220-0100	Structural concrete, ready mix, normal weight, 2500 psi, includes material only	1096			C.Y.	$87,132.00	$0.00	$0.00	$87,132.00	$95,900.00
16060-800-3820	Insulated ground wire, copper, stranded, 4/0	96	4.4	3.636	C.L.F.	$17,376.00	$11,424.00	$0.00	$28,800.00	$37,440.00
16120-700-2800	Shielded cable, copper, XLP shielding, ungrounded neutral, 15 kV, 500 kcmil, in conduit, excl splicing & terminations	282	3.6	6.667	C.L.F.	$205,597.20	$61,115.88	$0.00	$266,713.08	$323,886.00
Totals						**$466,719.79**	**$159,082.78**	**$8,652.52**	**$634,455.09**	**$782,178.73**

Assumes:
1. Trench sizes are 5' wide by 4' deep
2. Concrete to Backfill ratio is 1:1
3. (8)- and (6)-conduit ductbanks calculated together
4. Cost of road crossing excavation same as typical

ELECTRIC UTILITY INSTALLATION COSTS- PROPOSED LAYOUT

CSI Code	Description	Qty.	Daily Output	Labor Hrs	Unit	Materials	Labor	Equipment	Total	Total, incl. O&P
2315-520-0020	Fill, dumped material, spread, by dozer, excludes compaction	1107	1,000	0.008	L.C.Y.	$232.47	$1,018.44	$1,250.91	$2,501.82	$2,924.63
2315-610-0060	Excavating, trench or continuous footing, common earth, 1' to 4' deep, 1/2 C.Y. bucket, hydraulic backhoe, excludes sheeting or dewatering	2213	200	0.08	B.C.Y.	$0.00	$4,182.57	$2,832.64	$7,015.21	$10,091.28
2580-420-0380	Underground marking tape, 6" wide	2988	2,525	0.008	L.F.	$866.52	$776.88	$0.00	$1,643.40	$2,211.12
2580-420-0800	Hand holes, precast concrete, with concrete cover, 3' x 3' x 3' deep, excludes excavation, backfill and cast in place concrete	1	1.9	10.53	Ea.	$340.00	$335.00	$83.50	$758.50	$1,000.00
2580-420-1800	Man holes, precast w/iron racks & pulling irons, C.I. frame and cover, 4' x 6' x 7' deep, excludes excavation, backfill and cast in place concrete	4	1.8	26.67	Ea.	$7,200.00	$2,360.00	$1,380.00	$10,940.00	$13,400.00
2580-420-5840	Underground duct banks, PVC, 4 @ 5" diameter, excludes excavation, backfill and cast in place concrete	1098	70	0.229	L.F.	$9,991.80	$8,180.10	$0.00	$18,171.90	$24,156.00
2580-420-5860	Underground duct banks, PVC, 6 @ 5" diameter, excludes excavation, backfill and cast in place concrete	1890	50	0.32	L.F.	$25,798.50	$19,750.50	$0.00	$45,549.00	$60,480.00
2580-420-7830	Underground duct banks, for cast-in-place concrete, over 5 C.Y., excludes excavation, backfill and cast in place concrete, add	1107	24	2	C.Y.	$107,379.00	$48,154.50	$2,214.00	$157,747.50	$201,474.00
3310-220-0100	Structural concrete, ready mix, normal weight, 2500 psi, includes material only	1107			C.Y.	$88,006.50	$0.00	$0.00	$88,006.50	$96,862.50
16060-800-3820	Insulated ground wire, copper, stranded, 4/0	82	4.4	3.636	C.L.F.	$14,842.00	$9,758.00	$0.00	$24,600.00	$31,980.00
16120-700-2800	Shielded cable, copper, XLP shielding, ungrounded neutral, 15 kV, 500 kcmil, in conduit, excl splicing & terminations	246	3.6	6.667	C.L.F.	$179,580.00	$53,382.00	$0.00	$232,962.00	$282,900.00
Totals						**$434,004.32**	**$146,879.55**	**$6,510.14**	**$587,394.01**	**$727,479.53**

Assumes 1. Trench sizes are 5' wide by 4' deep
2. Concrete to Backfill ratio is 1:1
3. (8)- and (6)-conduit ductbanks calculated together
4. Cost of road crossing excavation same as typical