WWW.WILCOMM.COM

WILLIAMS COMMUNICATIONS INC. - 512. 328. 2461
5524 BEE CAVE RD. SUITE C1 - AUSTIN, TX 78746
800. 844. 2461 - FAX - 512. 328. 3009

Providing Services in:

- Construction Project Management – (p3-p11)
- Fiber Splicing and Testing – (p12-13)
- System Due Diligence
- Strand/Asbuilt Mapping & Pole Loading – (p14-p20)
- Permitting – (p21-p24)
- HFC Design and Drafting – (p25-p31)
- Optical Network Engineering – (p32-p41)
- Headend and Optical Design Engineering – (p42-p47)
- Digital Video Engineering – (p48-49)
- IP Engineering Support
- Consulting – (p50-53)

Project Management

- We have personnel available for all types of projects
- Aerial Construction Management
- Underground Construction Management
- Fiber Construction Management
- Site buildings
- Headend, CO, Data Center, Amplification and Regeneration Sites

Project Examples

- Long Haul Fiber Build Along the Railroad, Highway and Private ROW
- All Types of Aerial and Underground Construction – QA Inspection
- ROW and Site Acquisition, Permitting
- FTTH Fiber builds – Fiber Splice Management
- Amp Site buildings and Data Centers
- Inside Plant Layout

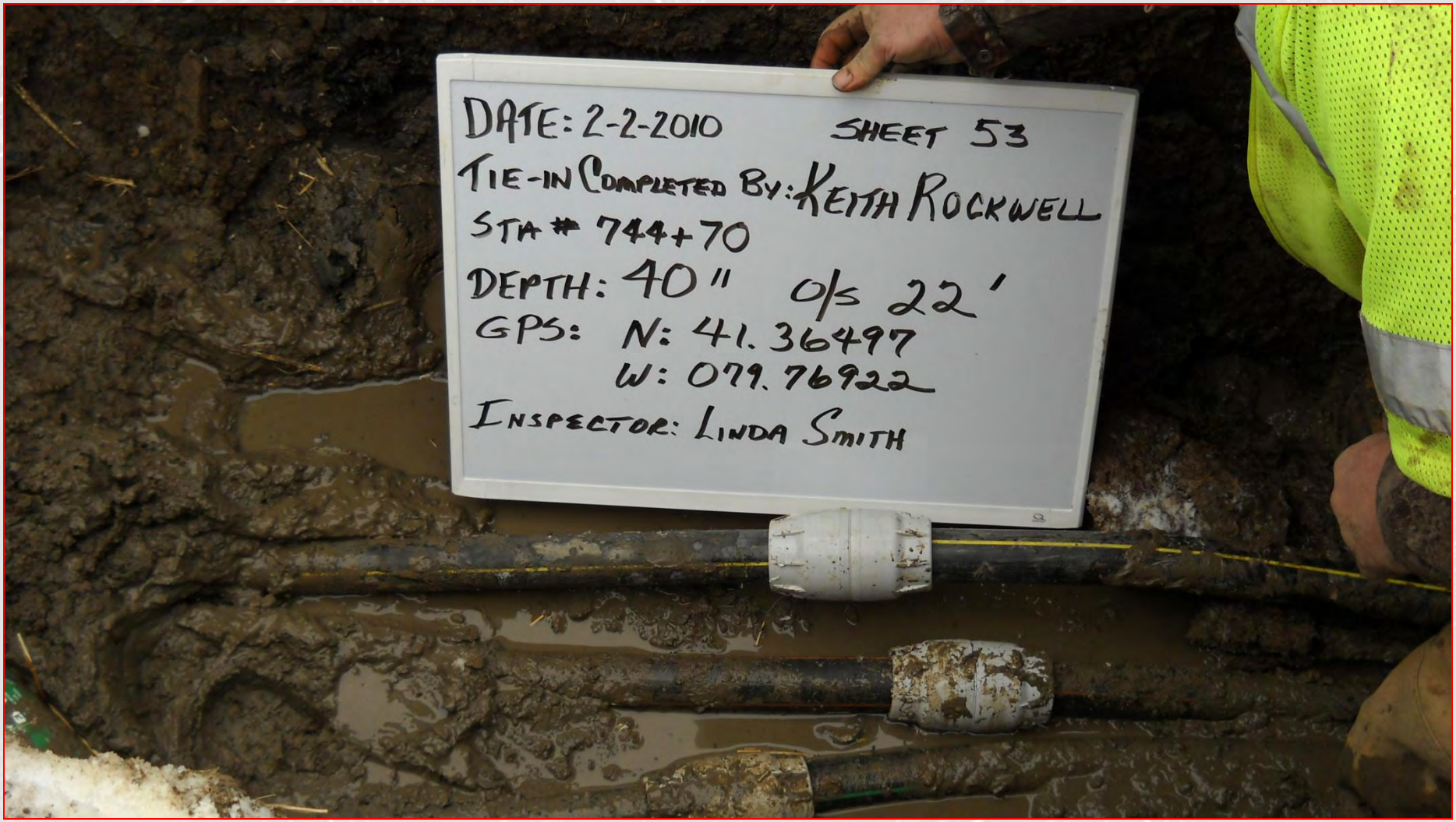
Plowing Duct in Along Railroad ROW

Cat Plowing Duct

Bridge Attachments

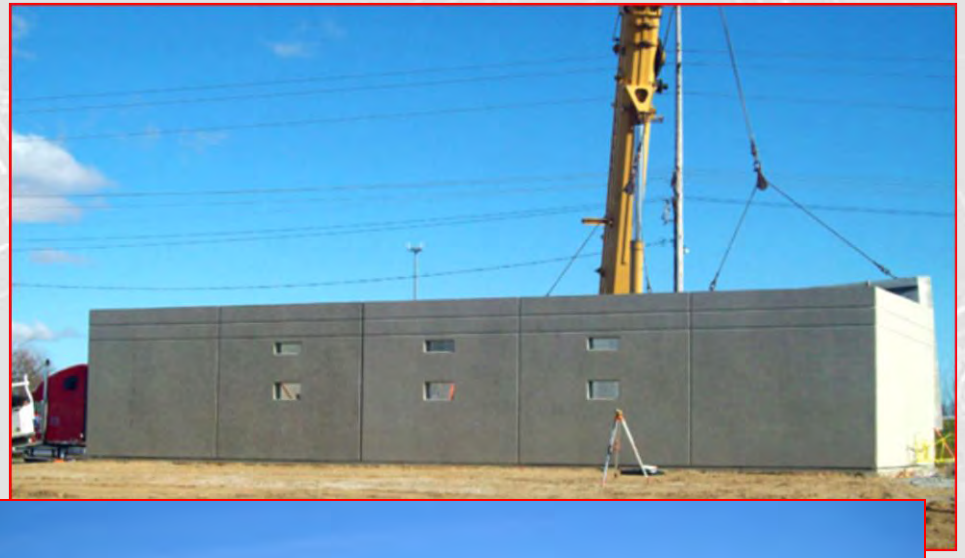
Engineering Hand Hole – Man Hole Locations

Duct Installation Inspection and Coupler Location Documentation

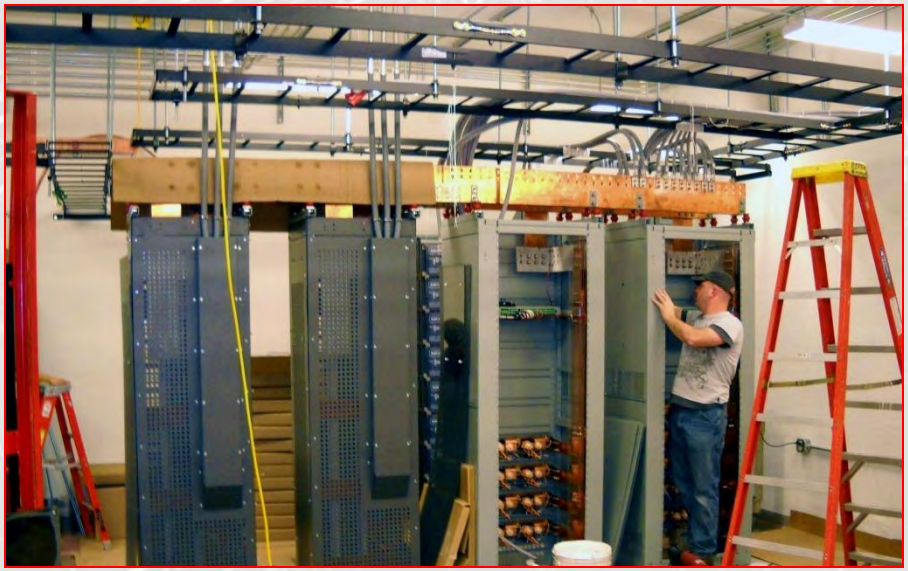


Directional Boring, Rock Saw, Trenching

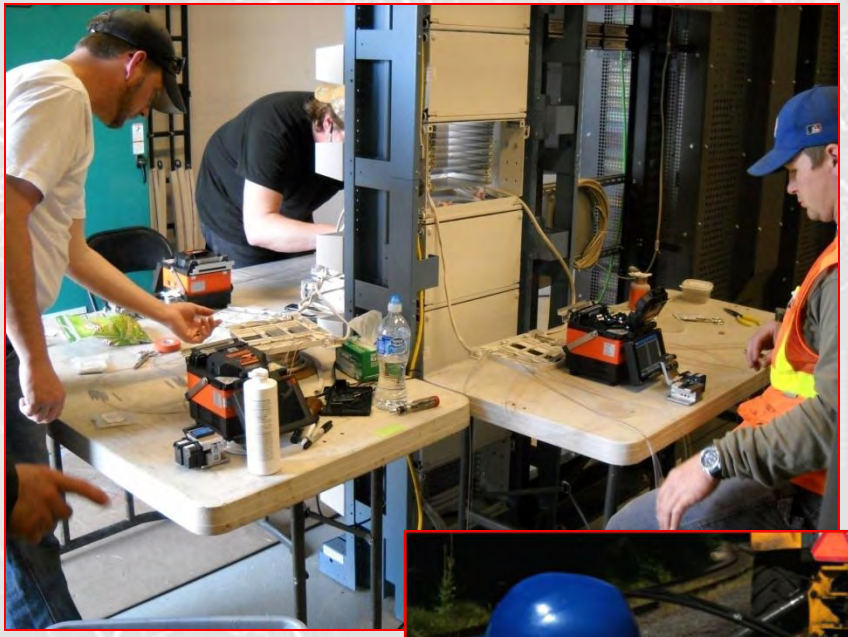
Building a Regeneration Site



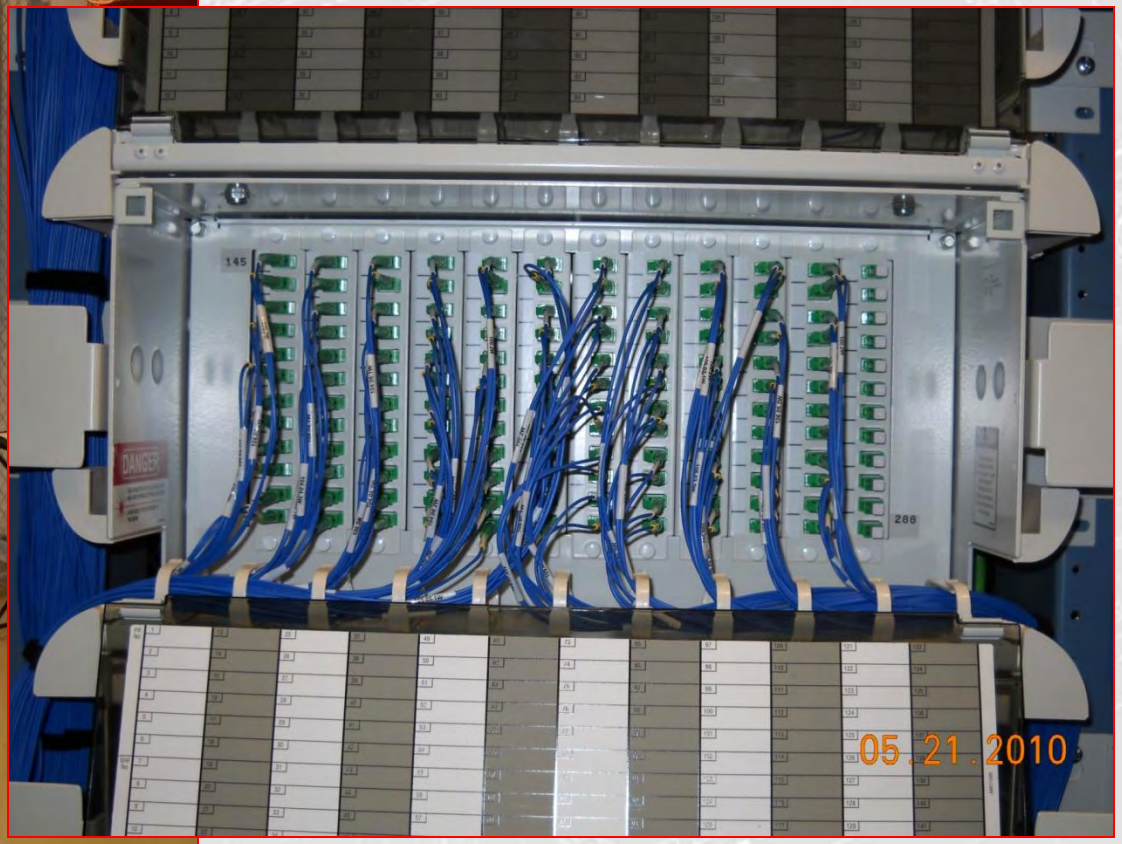
Power Supply Racks, Overhead Ladder Racks & Data Cabinets



Splicing Fiber in Field & at Patch Panel



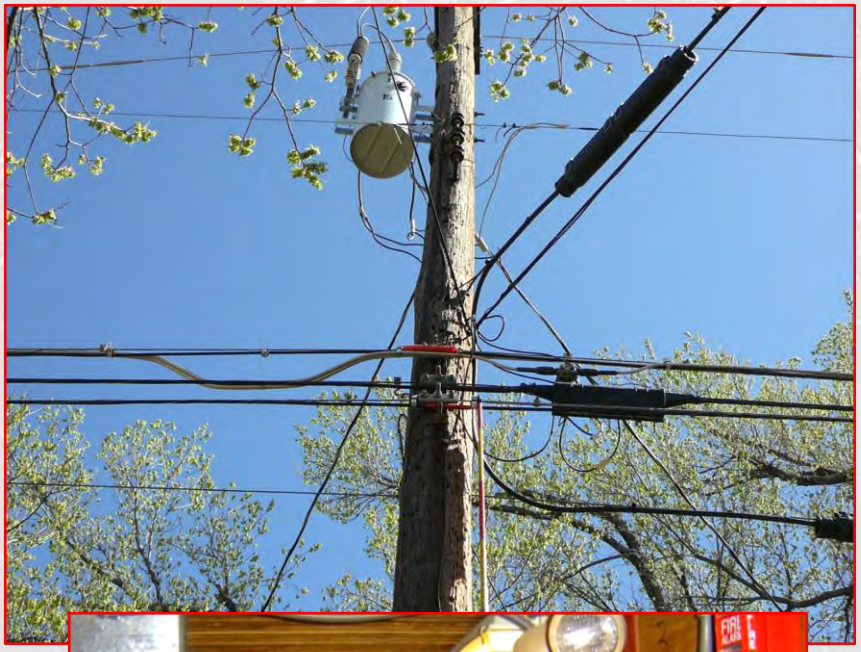
Spliced Up Fiber & Patch Panel Routing



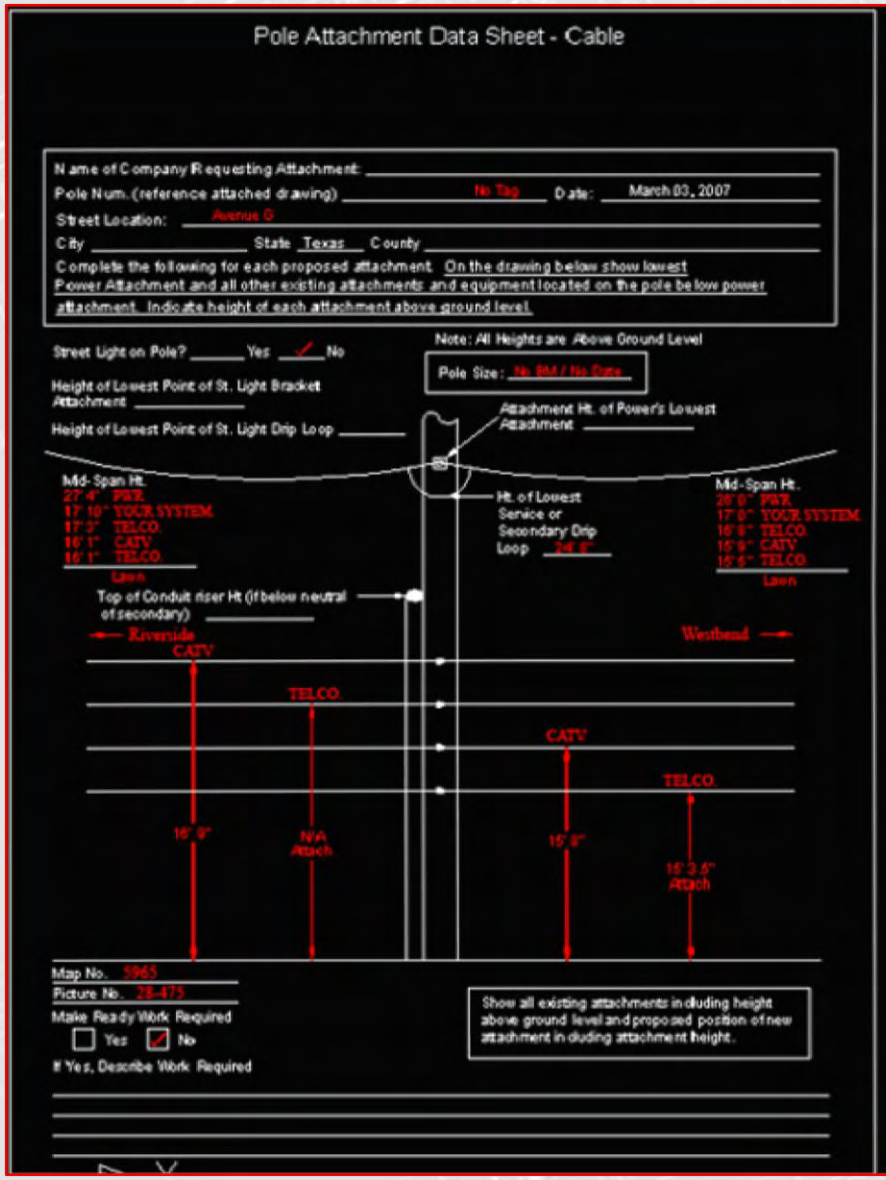
Walkout Examples

- Line Extension Walkouts
- Walkout for Numerous CATV Systems in North America
- Walkout of Long Haul Fiber
- As-Built Verification
- Pole Profile – Pole Permits

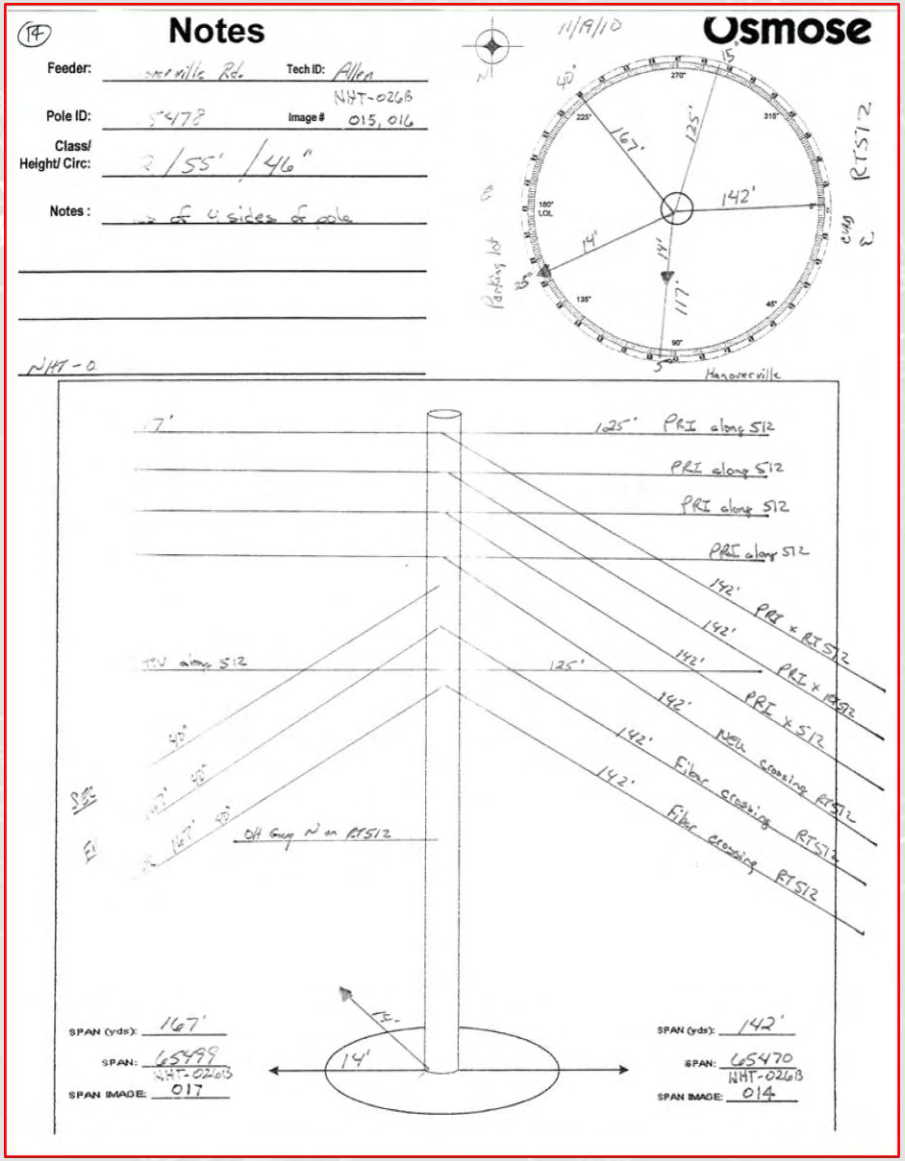
As-Built Cable and Fiber



Pole Attachment Sheet



Pole Permit – Profile and Inspection



O-Calc Pro Analysis on Pole Loading

O-Calc® Pro *Analysis Report*

Friday, December 10, 2010 9:49:51 AM

Pole ID:	65478 Hanoverville	Pole Length / Class:	55 / 2	Code:	NESC	Structure Type:	GuyedTa
Group ID:	N/A	Pole Species:	SOUTHERN PINE	NESC Rule:	Rule 250B	Status:	At Installation
Related To:	N/A	Setting Depth (ft):	8.42	Construction Grade:	C	Strength Factor:	0.85
Aux Data 1:	Unset	G/L Circumference (in):	46.00	Loading District:	Heavy	Transverse Wind LF:	1.75
Aux Data 2:	Unset	G/L Fiber Stress (psi):	8,000	Ice Thickness (in):	0.50	Wire Tension LF:	1.30
Aux Data 3:	Unset	Fiber Stress Ht. Reduction:	No	Wind Speed (mph):	39.53	Vertical LF:	1.90
Aux Data 4:	Unset	Allowable G/L Moment	68,567	Wind Pressure	4.00	Max 250C Wind	75.90

Pole Capacity Utilization		Height	Wind Angle
Groundline:	40.3%	0.0 ft	120.0°
Maximum:	45.3%	27.3 ft	122.8°
Vertical:	10.7%	35.5 ft	0.0°

Pole Moments		Load Angle	Wind Angle
Groundline:	67,255 ft-lb	103.9°	120.0°
Max Capac. Util:	29,122 ft-lb	180.8°	122.8°

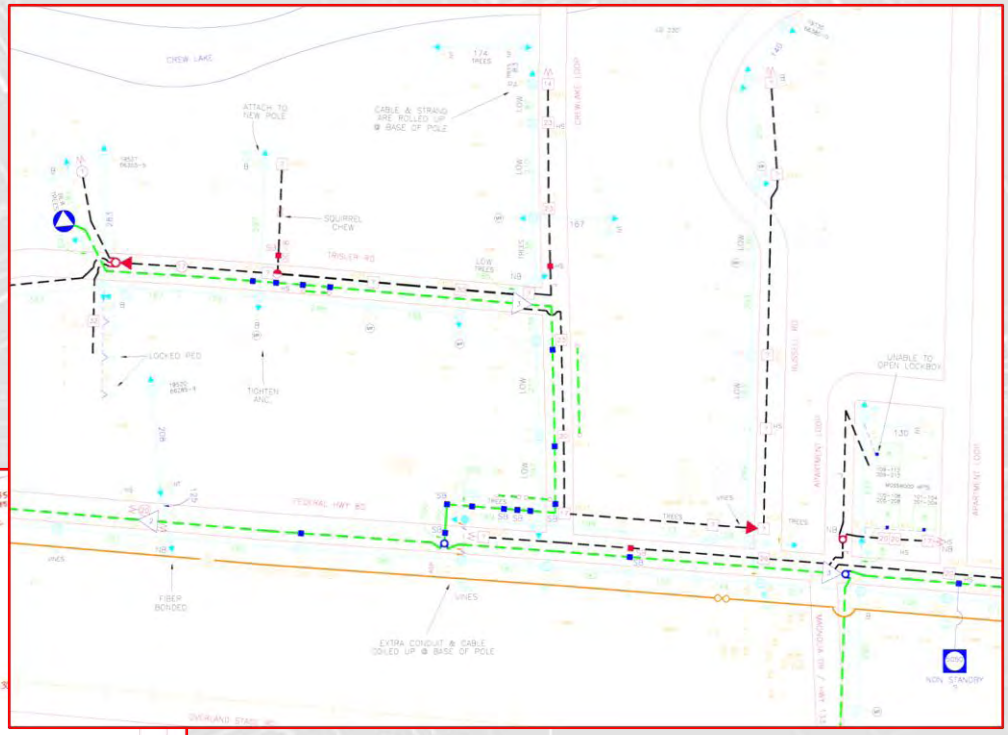
Guy Summary		Guy Tensions		Maximum Guy Tensions	
	Attach Height (ft)	% Allowable Tension	Wind Angle	% Allowable Tension	Wind Angle
Guy 1	44.1	46.8%	122.8°	48.4%	80.0°
Guy 2	34.8	64.3%	122.8°	67.0%	73.4°
Guy 3	26.5	0.0%	122.8°	0.0%	0.0°
Guy 4	25.6	0.0%	122.8°	0.9%	330.0°
Guy 5	14.4	5.0%	122.8°	5.5%	150.0°

Anchor Summary		
	Lead Length (ft)	% Allowable Capacity
Anchor 1	14.0	34.2%
Anchor 2	14.0	0.0%
Anchor 3	125.0	2.7%

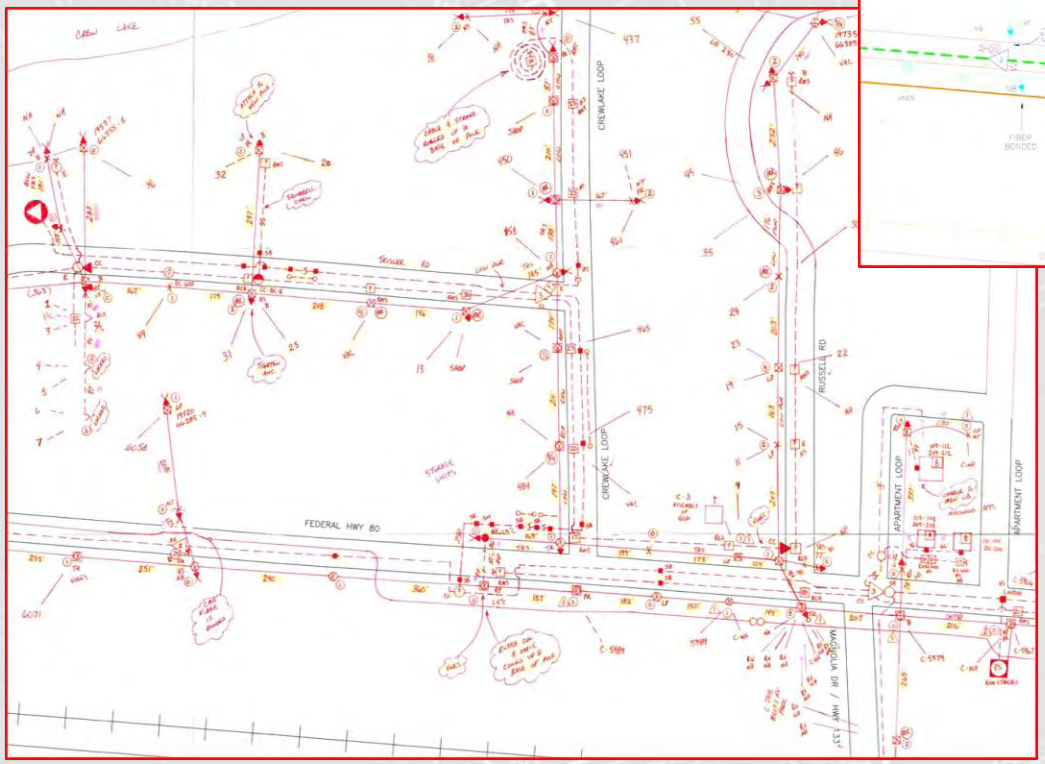
GROUNDLINE LOAD SUMMARY:*Wind at 120.0°, Applied Moment 67,255 ft-lb at 103.9°, Allowable Moment 174,738 ft-lb

	Shear Load (lbs)*	Percent Applied Load	Bending Moment (ft-lb)	Percent of Applied Moment**	Percent of Pole Capacity	Bending Stress (+/-psi)	Vertical Load (lbs)	Vertical Stress (psi)	Total Stress (psi)	Percent of Pole Capacity
Powers:	4,014	168.9	159,041	-4.5	-0.7	6,192	1,667	10	6,202	91.2
Comms:	1,744	73.4	45,889	-0.2	0.0	1,787	915	5	1,792	26.3
Guys/Braces:	-3,711	-156.2	-145,438	-213.3	-35.5	-5,663	14,547	86	-5,576	-82.0
Pole:	295	12.4	6,192	21.3	3.5	241	3,806	23	264	3.9
Streetlights:	23	1.0	1,067	3.7	0.6	42	76	0	42	0.6
Insulators:	12	0.5	505	0.2	0.0	20	188	1	21	0.3
Pole Load:	2,377	100.0	67,255	231.0	38.5	2,619	21,200	126	2,745	40.3
Pole Reserve Capacity:			107,482		61.5	4,185			4,059	59.7

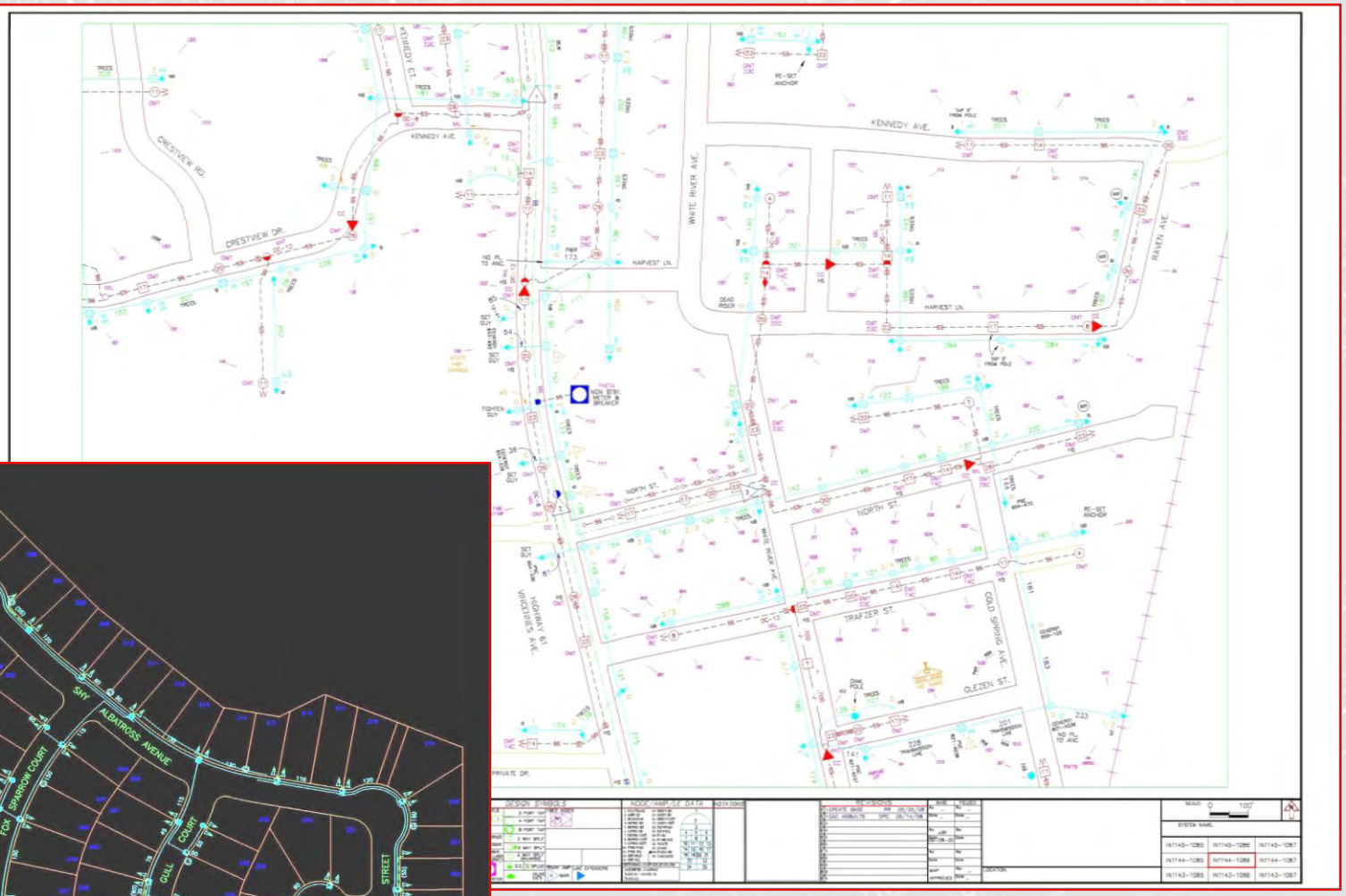
CAD'd Walkout Map



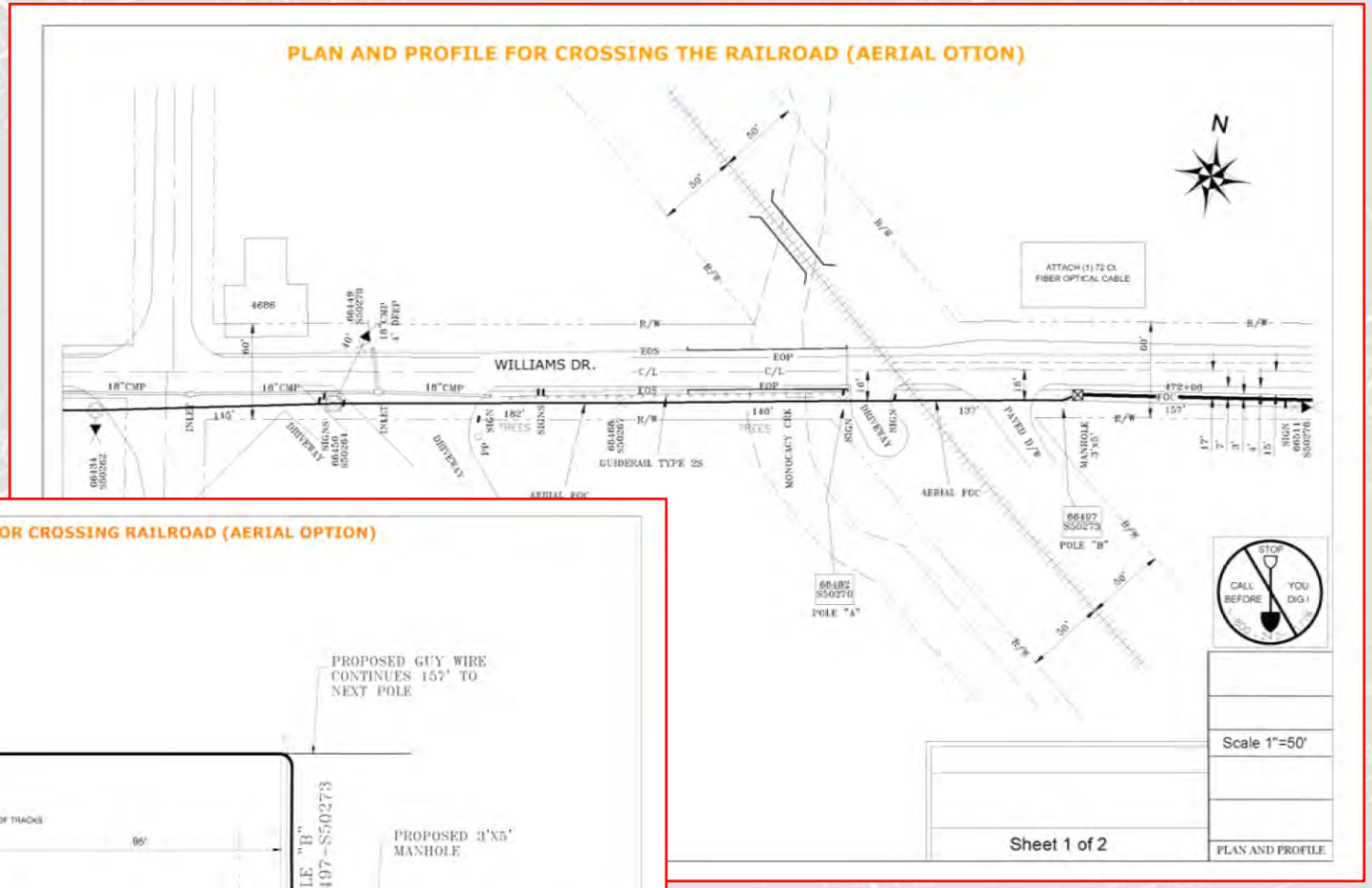
Walkout Map Hand Drawn

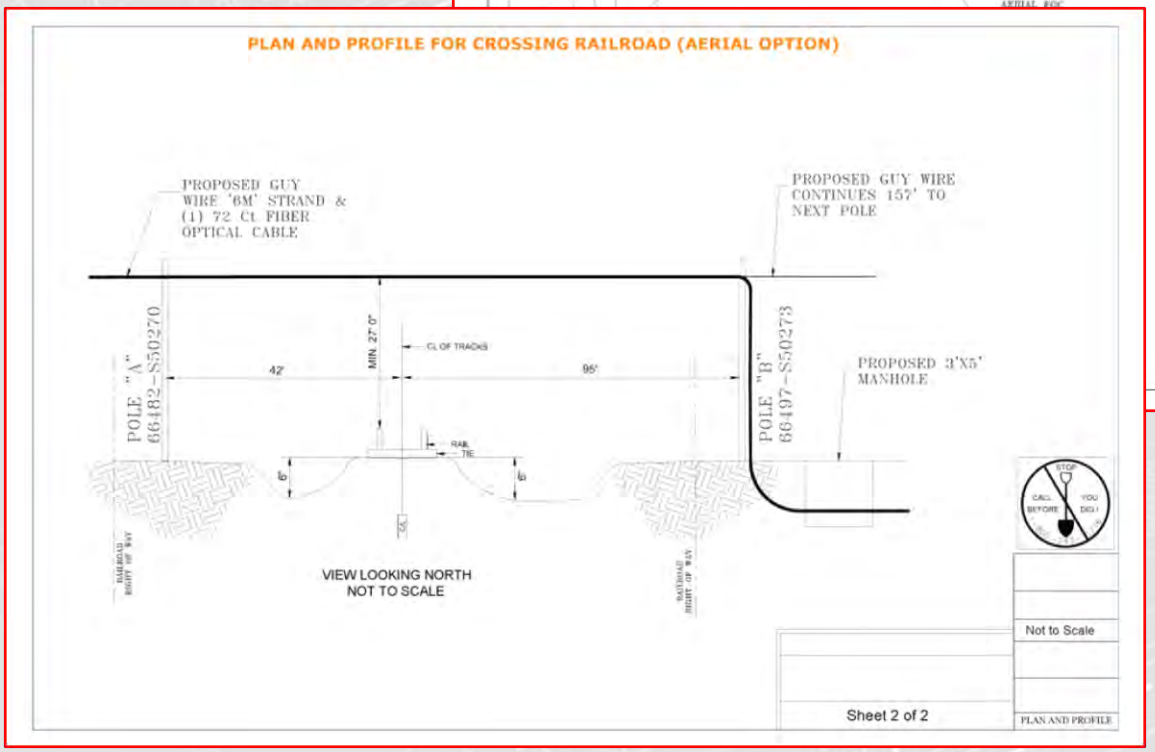


Trench & Substructure and As-Built Mapping

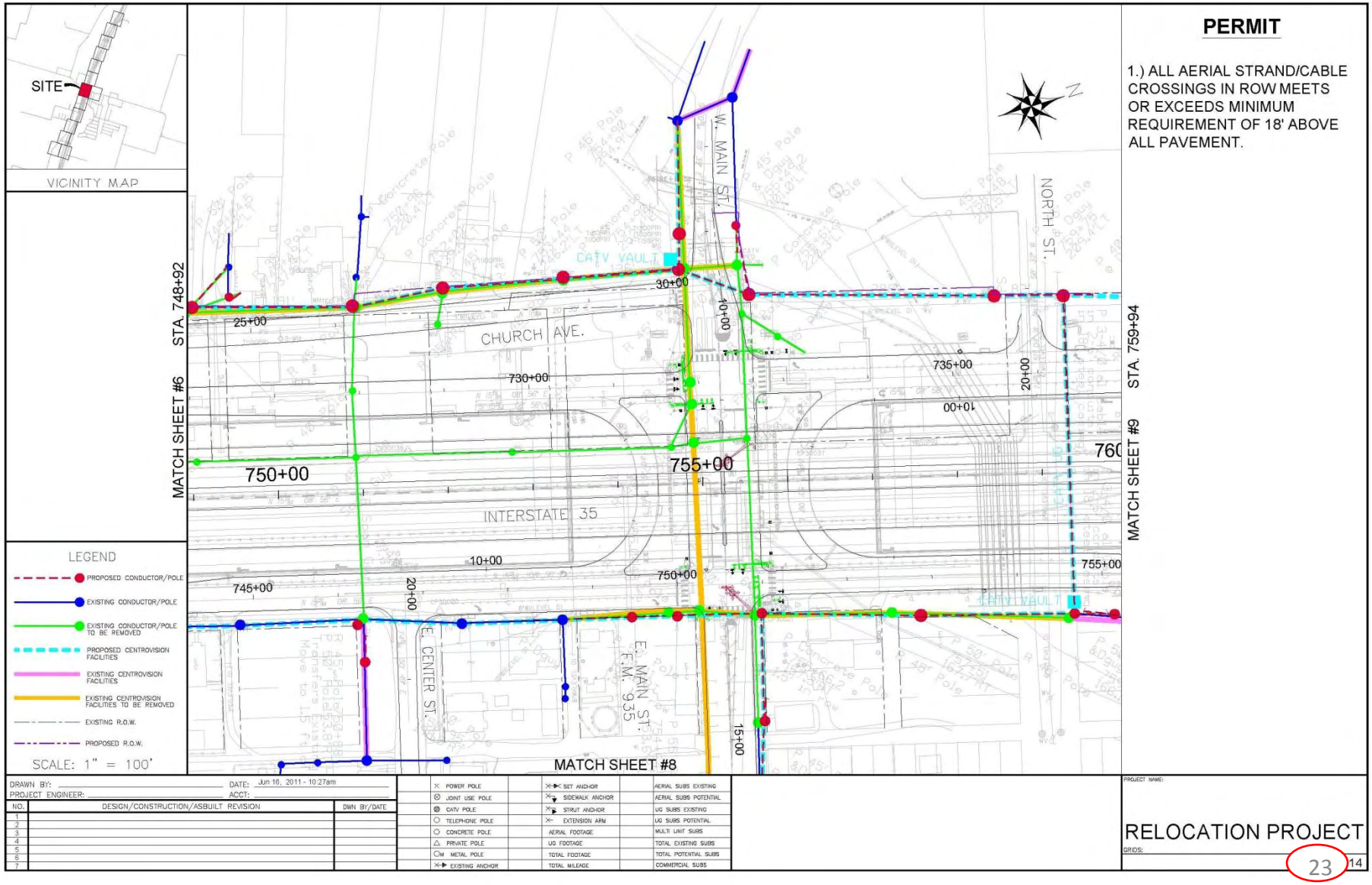


Railroad Aerial Crossing Permit Plan

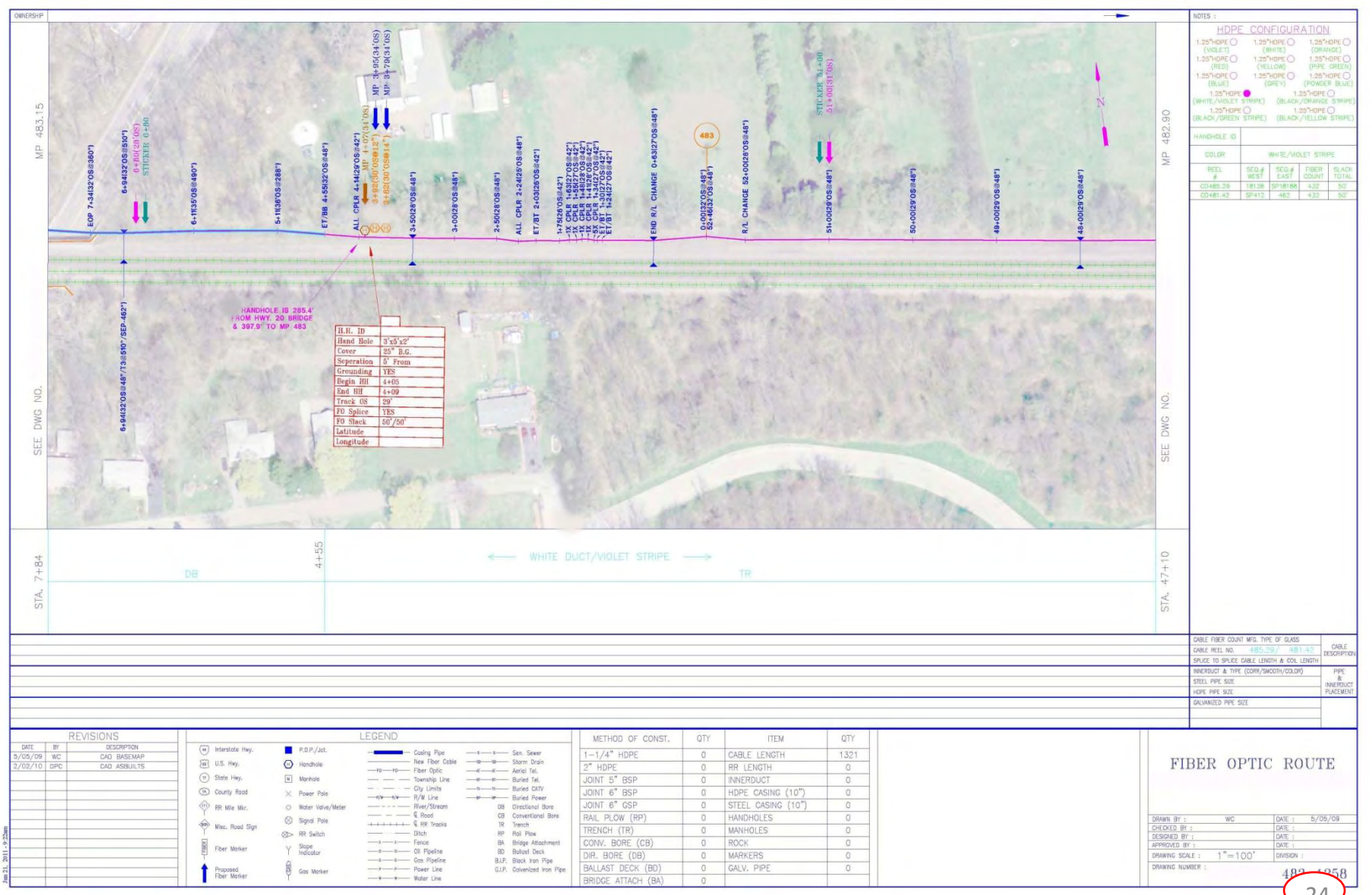




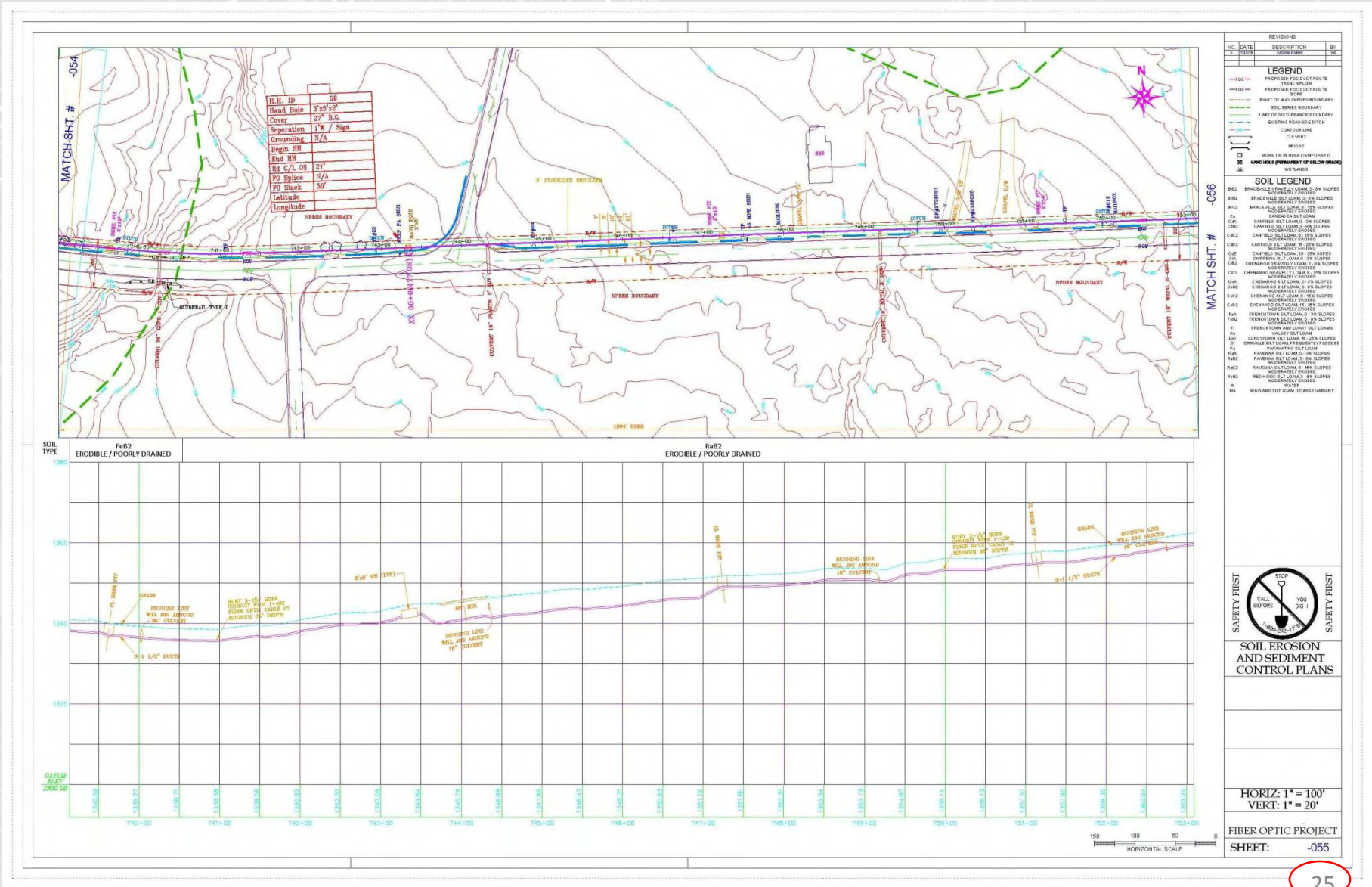
Road Widening Pole Relocation Project



Fiber along Railroad



Fiber along DOT Route

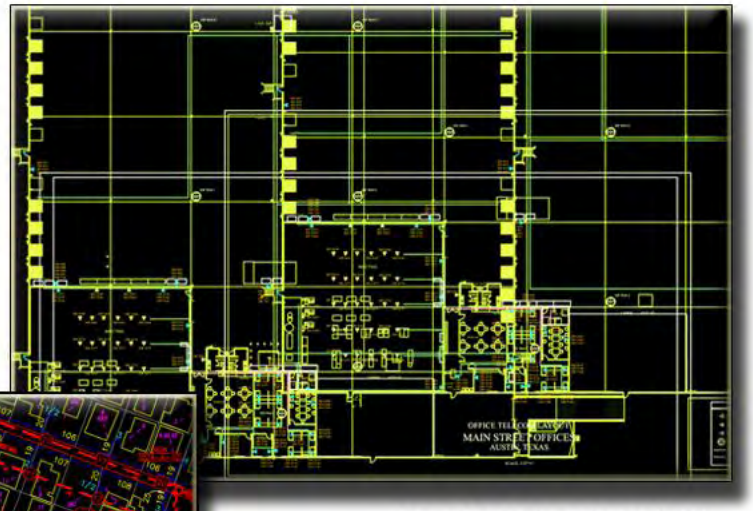


Design/Diagram Software We Use

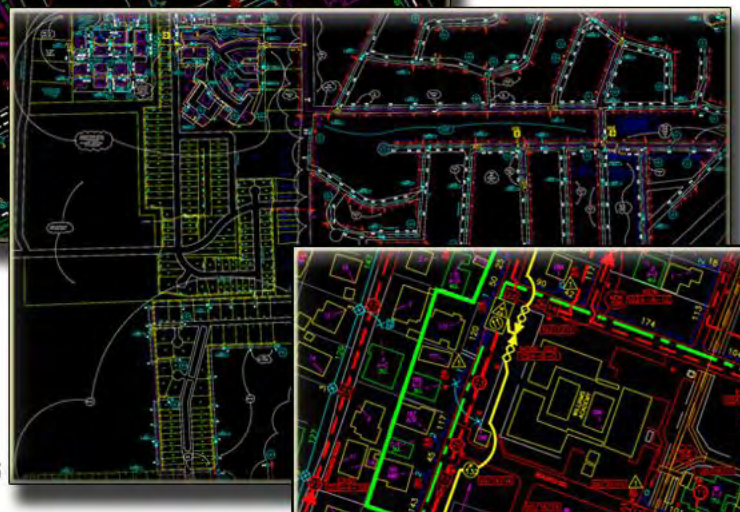
- AutoCAD
- Lode Data (Fiber and Coax)
- Bentley Comms (MicroStation)
- OSPInSight
- MapInfo
- Visio

Telecommunications Design and Drafting

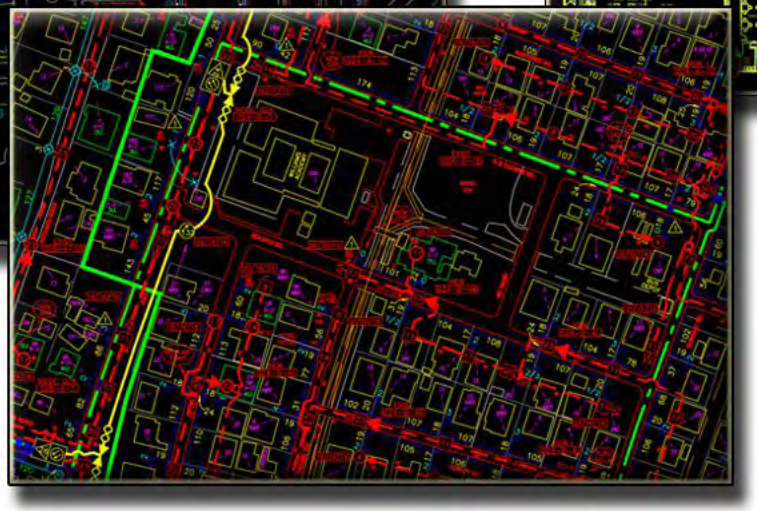
WIRELESS MODEM DIAGRAM



TELECOM OFFICE LAYOUT



COAXIAL DRAFTING

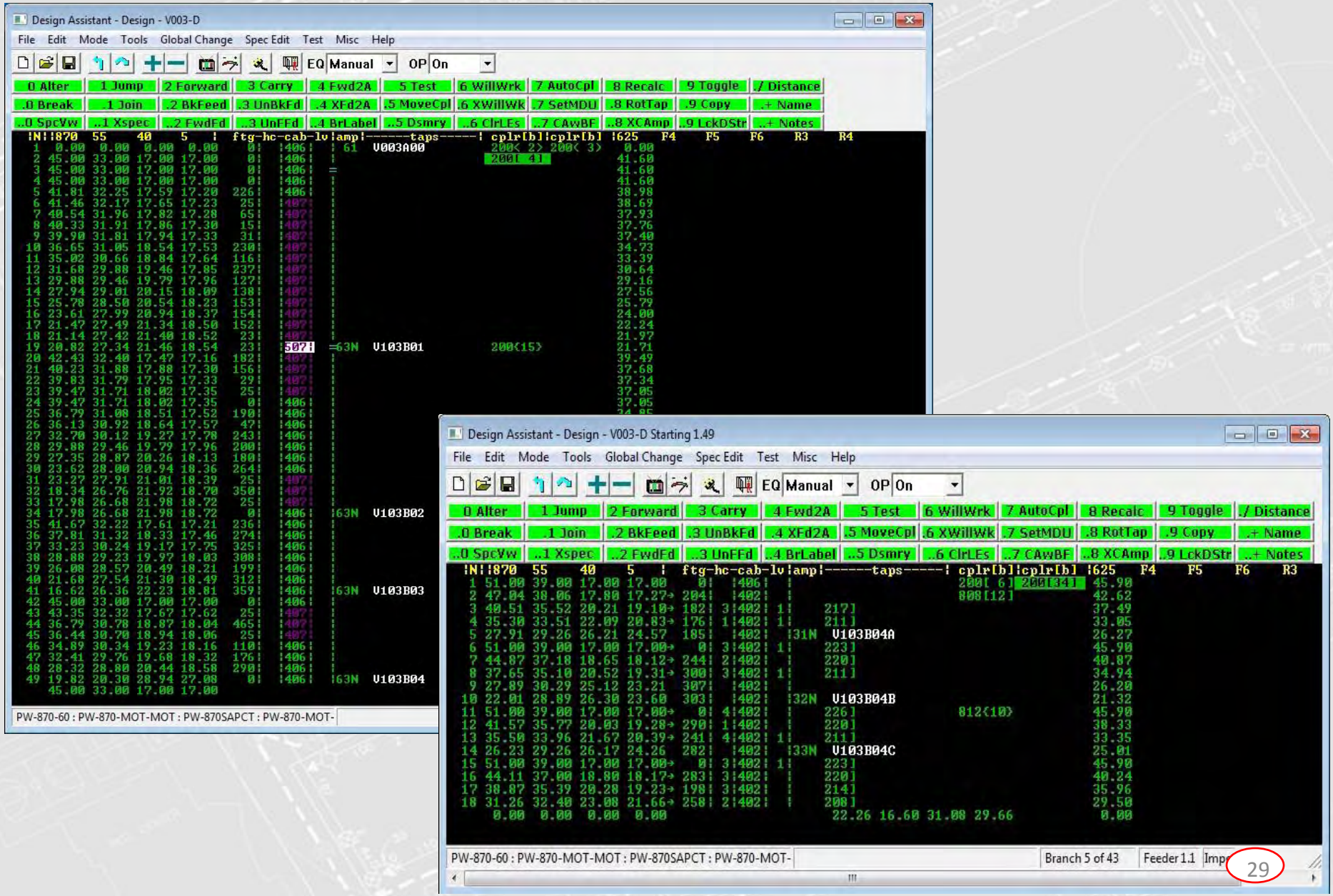


FIBER & COAXIAL DRAFTING

Coax Design Examples

- Upgrade Design for HFC Plant – Retrofits and Re-Builds
- Node Size Reductions and Node outs
- Customer Support After Design For Field Changes

Lode Design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File Edit Mode Tools Global Change Spec Edit Test Misc Help
EQ Manual OP On
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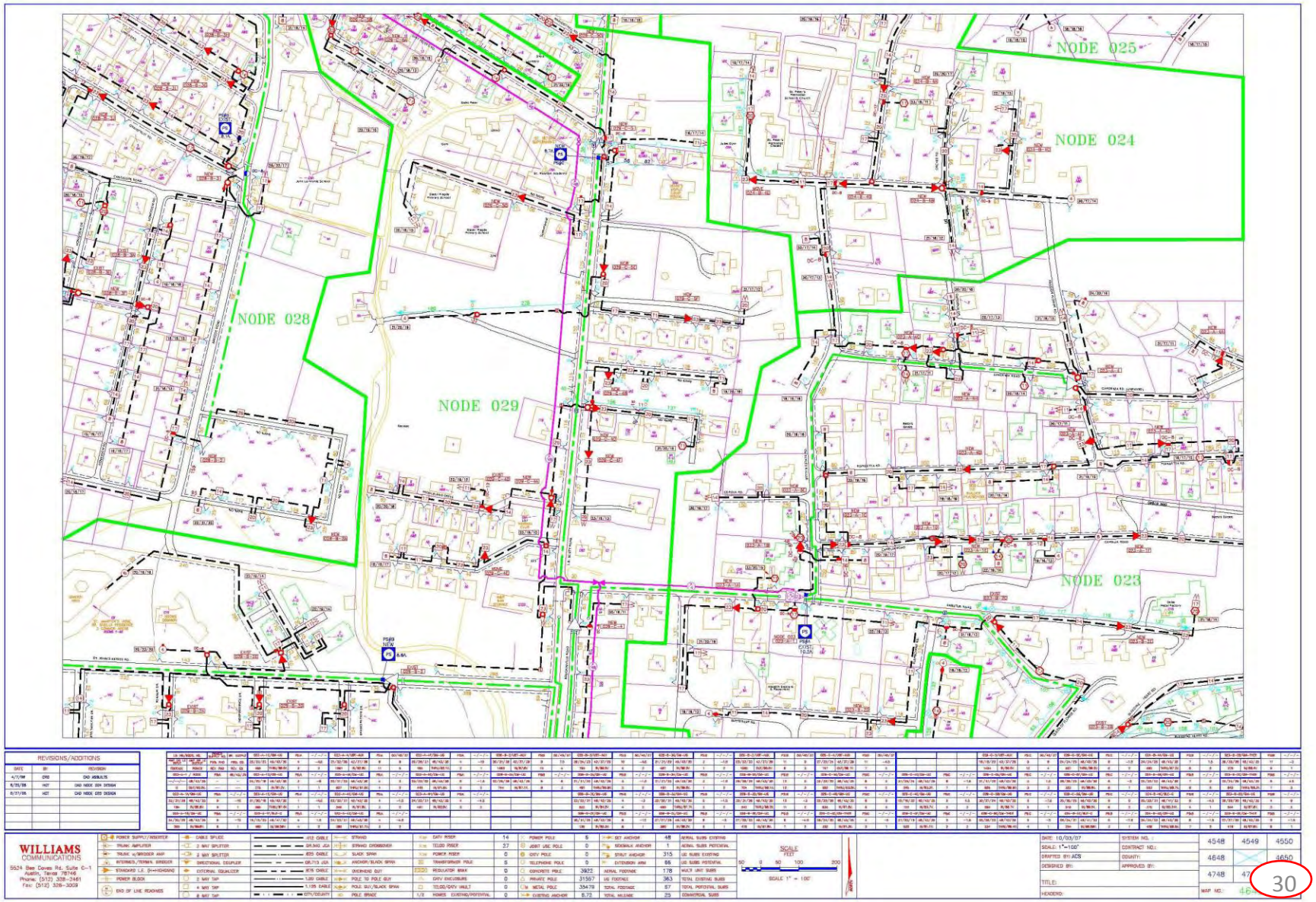
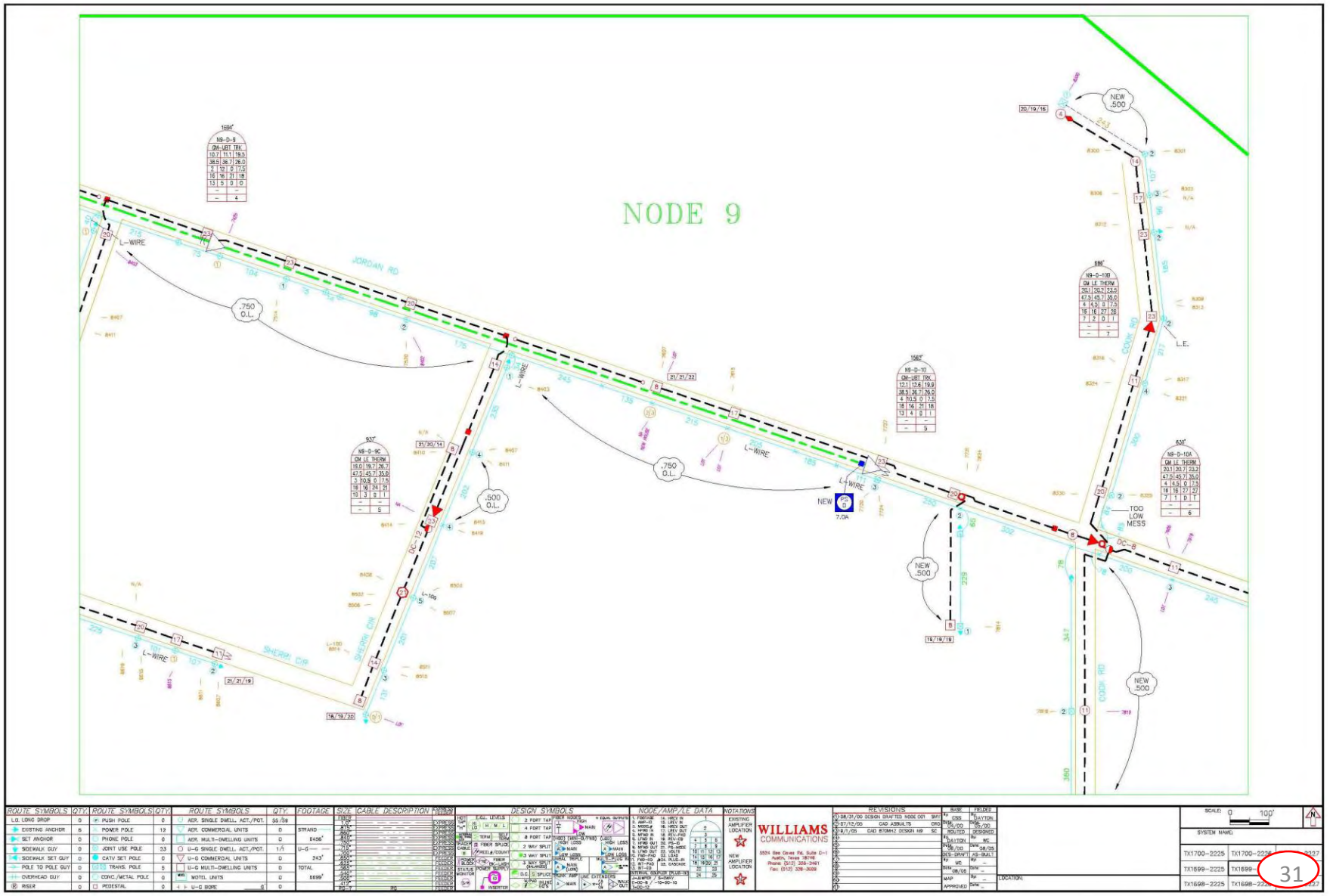
.0 Break .1 Join .2 BkFeed .3 UnBkFd .4 XFd2A .5 MoveCpl .6 XWillWk .7 SetMDU .8 RotTap .9 Copy .+ Name
..0 SpcVw ..1 Xspec ..2 FwdFd ..3 UnFFd ..4 BrLabel ..5 Dsmry ..6 ClrLEs ..7 CAwBF ..8 XCAmp ..9 LckDStr ..+ Notes
V003A00
V103B01
V103B02
V103B03
V103B04
PW-870-60 : PW-870-MOT-MOT : PW-870SAPCT : PW-870-MOT-
Design Assistant - Design - V003-D Starting 1.49
File Edit Mode Tools Global Change Spec Edit Test Misc Help
EQ Manual OP On
0 Alter 1 Jump 2 Forward 3 Carry 4 Fwd2A 5 Test 6 WillWrk 7 AutoCpl 8 Recalc 9 Toggle / Distance
.0 Break .1 Join .2 BkFeed .3 UnBkFd .4 XFd2A .5 MoveCpl .6 XWillWk .7 SetMDU .8 RotTap .9 Copy .+ Name
..0 SpcVw ..1 Xspec ..2 FwdFd ..3 UnFFd ..4 BrLabel ..5 Dsmry ..6 ClrLEs ..7 CAwBF ..8 XCAmp ..9 LckDStr ..+ Notes
V103B04A
V103B04B
V103B04C
PW-870-60 : PW-870-MOT-MOT : PW-870SAPCT : PW-870-MOT-
Branch 5 of 43
Feeder 1.1
29

870mhz Design w/Data Blocks



870mhz Design w/Tombstones

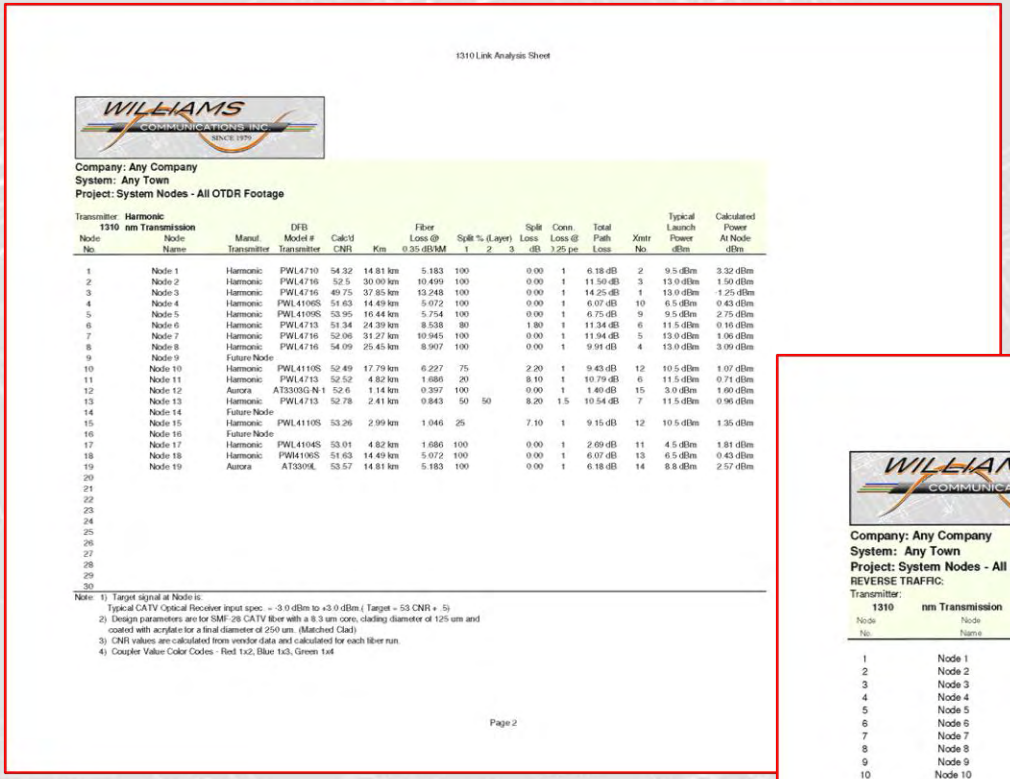


870mhz Design w/EQ Taps

Fiber Design & Layout for FTTH and Long Haul Transport

- Design Layout for Long Haul Fiber Build
- Design FTTH System
- Input Fiber Information for Database - OSPInSight

Fiber Link Analysis Sheet



1310 Link Analysis Sheet

WILLIAMS COMMUNICATIONS INC. SINCE 1979

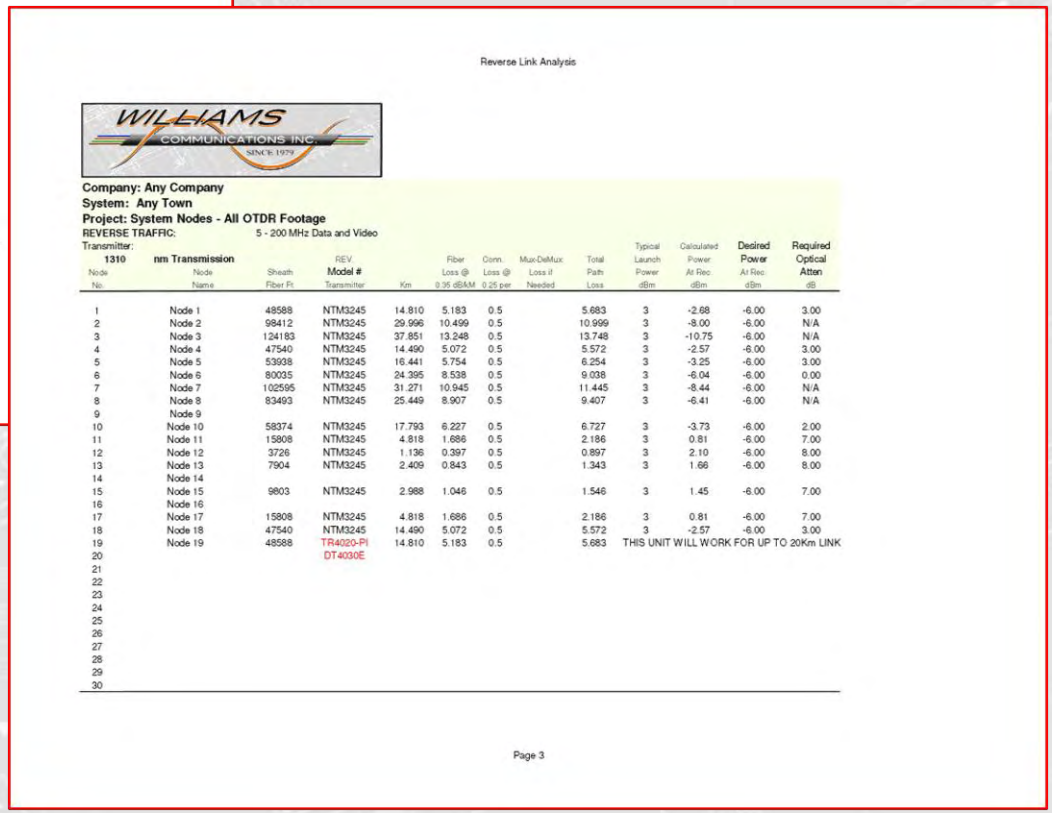
Company: Any Company
System: Any Town
Project: System Nodes - All OTDR Footage

Transmitter: **Harmonic**
1310 nm Transmission

Node No.	Node Name	Manuf. Transmitter	DFB Model # Transmitter	Calc'd CNR	Km	Fiber Loss @ 0.35 dB/KM	Split % (Layer) 1	2	3	Split Loss dB	Conn. Loss @ 0.25 pe	Total Path Loss	Xmtr No.	Typical Launch Power dBm	Calculated Power At Node dBm
1	Node 1	Harmonic	PWL4710	54.32	14.81 km	5.183	100			0.00	1	6.18 dB	2	9.5 dBm	3.32 dBm
2	Node 2	Harmonic	PWL4716	52.5	30.00 km	10.499	100			0.00	1	11.50 dB	3	13.0 dBm	1.50 dBm
3	Node 3	Harmonic	PWL4716	49.75	37.85 km	13.248	100			0.00	1	14.25 dB	1	13.0 dBm	1.25 dBm
4	Node 4	Harmonic	PWL4106S	51.63	14.49 km	5.072	100			0.00	1	6.07 dB	10	6.5 dBm	0.43 dBm
5	Node 5	Harmonic	PWL4109S	53.95	16.44 km	5.754	100			0.00	1	6.75 dB	9	9.5 dBm	2.75 dBm
6	Node 6	Harmonic	PWL4713	51.34	24.39 km	8.538	80			1.80	1	11.34 dB	6	11.5 dBm	0.16 dBm
7	Node 7	Harmonic	PWL4716	52.06	31.27 km	10.945	100			0.00	1	11.94 dB	5	13.0 dBm	1.06 dBm
8	Node 8	Harmonic	PWL4716	54.09	25.45 km	8.907	100			0.00	1	9.91 dB	4	13.0 dBm	3.09 dBm
9	Node 9	Future Node													
10	Node 10	Harmonic	PWL4110S	52.49	17.79 km	6.227	75			2.20	1	9.43 dB	12	10.5 dBm	1.07 dBm
11	Node 11	Harmonic	PWL4713	52.52	4.82 km	1.686	20			8.10	1	10.79 dB	6	11.5 dBm	0.71 dBm
12	Node 12	Aurora	AT3303G-N-1	52.6	1.14 km	0.397	100			0.00	1	1.40 dB	15	3.0 dBm	1.60 dBm
13	Node 13	Harmonic	PWL4713	52.78	2.41 km	0.843	50	50		8.20	1.5	10.54 dB	7	11.5 dBm	0.96 dBm
14	Node 14	Future Node													
15	Node 15	Harmonic	PWL4110S	53.26	2.99 km	1.046	25			7.10	1	9.15 dB	12	10.5 dBm	1.35 dBm
16	Node 16	Future Node													
17	Node 17	Harmonic	PWL4104S	53.01	4.82 km	1.686	100			0.00	1	2.69 dB	11	4.5 dBm	1.81 dBm
18	Node 18	Harmonic	PWL4106S	51.63	14.49 km	5.072	100			0.00	1	6.07 dB	13	6.5 dBm	0.43 dBm
19	Node 19	Aurora	AT3309L	53.57	14.81 km	5.183	100			0.00	1	6.18 dB	14	8.8 dBm	2.57 dBm
20															
21															
22															
23															
24															
25															
26															
27															
28															
29															
30															

Note: 1) Target signal at Node is:
Typical CATV Optical Receiver input spec. = -3.0 dBm to +3.0 dBm (Target = 53 CNR + 5)
2) Design parameters are for SMF-28 CATV fiber with a 8.3 um core, cladding diameter of 125 um and coated with acrylate for a final diameter of 250 um. (Matched Clad)
3) CNR values are calculated from vendor data and calculated for each fiber run.
4) Coupler Value Color Codes - Red 1x2, Blue 1x3, Green 1x4

Page 2



Reverse Link Analysis

WILLIAMS COMMUNICATIONS INC. SINCE 1979

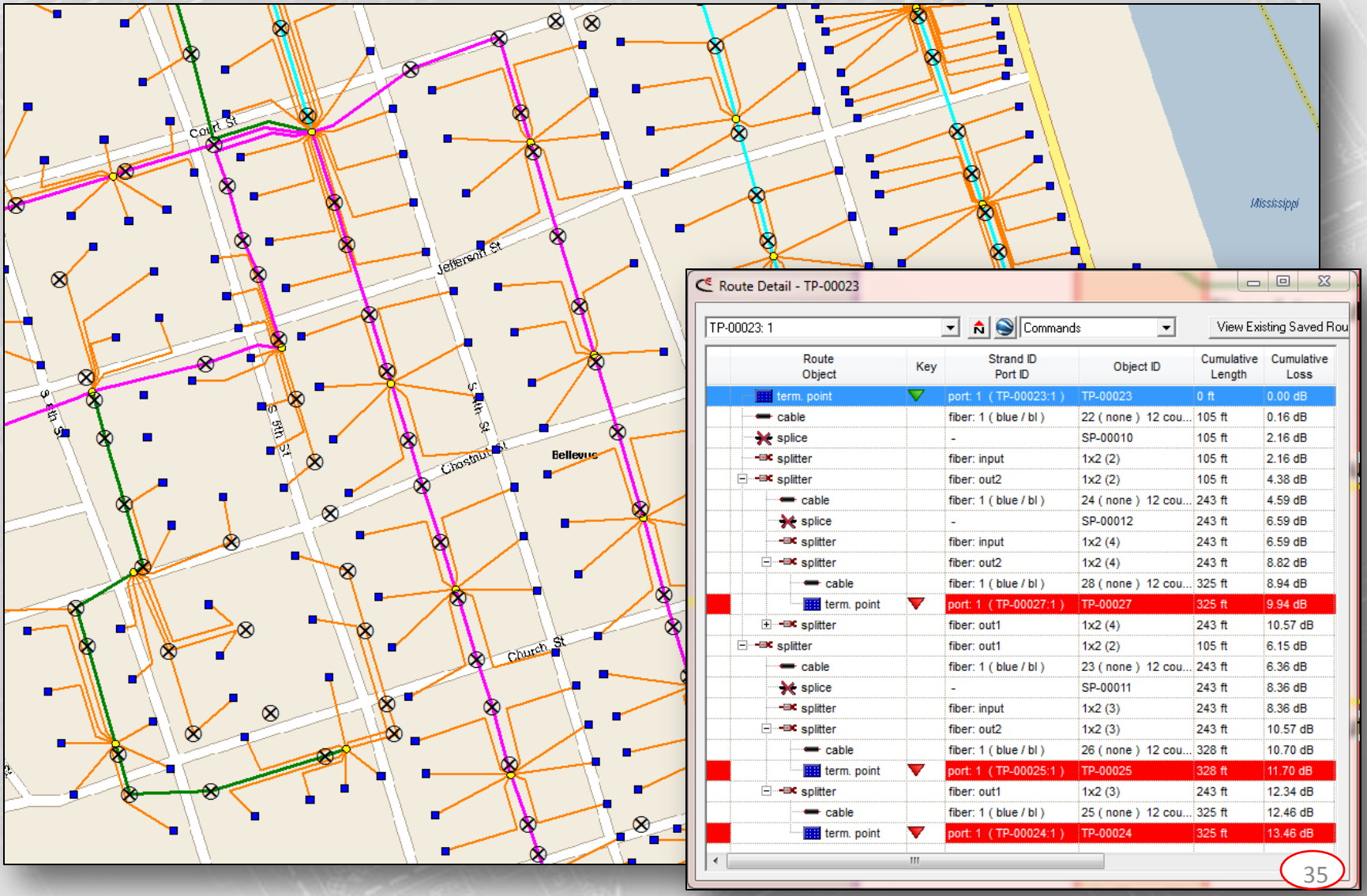
Company: Any Company
System: Any Town
Project: System Nodes - All OTDR Footage
REVERSE TRAFFIC: 5 - 200 MHz Data and Video
Transmitter:
1310 nm Transmission

Node No.	Node Name	Sheath Fiber Pt.	REV. Model # Transmitter	Km	Fiber Loss @ 0.35 dB/KM	Conn. Loss @ 0.25 per	Mux-DeMux Loss if Needed	Total Path Loss	Typical Launch Power dBm	Calculated Power At Rec dBm	Desired Power At Rec dBm	Required Optical Atten dB	
1	Node 1	48588	NTM3245	14.810	5.183	0.5		5.683	3	-2.68	-6.00	3.00	
2	Node 2	98412	NTM3245	29.996	10.499	0.5		10.999	3	-8.00	-6.00	N/A	
3	Node 3	124183	NTM3245	37.851	13.248	0.5		13.748	3	-10.75	-6.00	N/A	
4	Node 4	47540	NTM3245	14.490	5.072	0.5		5.572	3	-2.57	-6.00	3.00	
5	Node 5	53938	NTM3245	16.441	5.754	0.5		6.254	3	-3.25	-6.00	3.00	
6	Node 6	80035	NTM3245	24.395	8.538	0.5		9.038	3	-6.04	-6.00	0.00	
7	Node 7	102595	NTM3245	31.271	10.945	0.5		11.445	3	-8.44	-6.00	N/A	
8	Node 8	83493	NTM3245	25.449	8.907	0.5		9.407	3	-6.41	-6.00	N/A	
9	Node 9												
10	Node 10	58374	NTM3245	17.793	6.227	0.5		6.727	3	-3.73	-6.00	2.00	
11	Node 11	15808	NTM3245	4.818	1.686	0.5		2.186	3	0.81	-6.00	7.00	
12	Node 12	3726	NTM3245	1.136	0.397	0.5		0.897	3	2.10	-6.00	8.00	
13	Node 13	7904	NTM3245	2.409	0.843	0.5		1.343	3	1.66	-6.00	8.00	
14	Node 14												
15	Node 15	9803	NTM3245	2.988	1.046	0.5		1.546	3	1.45	-6.00	7.00	
16	Node 16												
17	Node 17	15808	NTM3245	4.818	1.686	0.5		2.186	3	0.81	-6.00	7.00	
18	Node 18	47540	NTM3245	14.490	5.072	0.5		5.572	3	-2.57	-6.00	3.00	
19	Node 19	48588	TR4020-PI DT4030E	14.810	5.183	0.5		5.683	THIS UNIT WILL WORK FOR UP TO 20Km LINK				
20													
21													
22													
23													
24													
25													
26													
27													
28													
29													
30													

Page 3

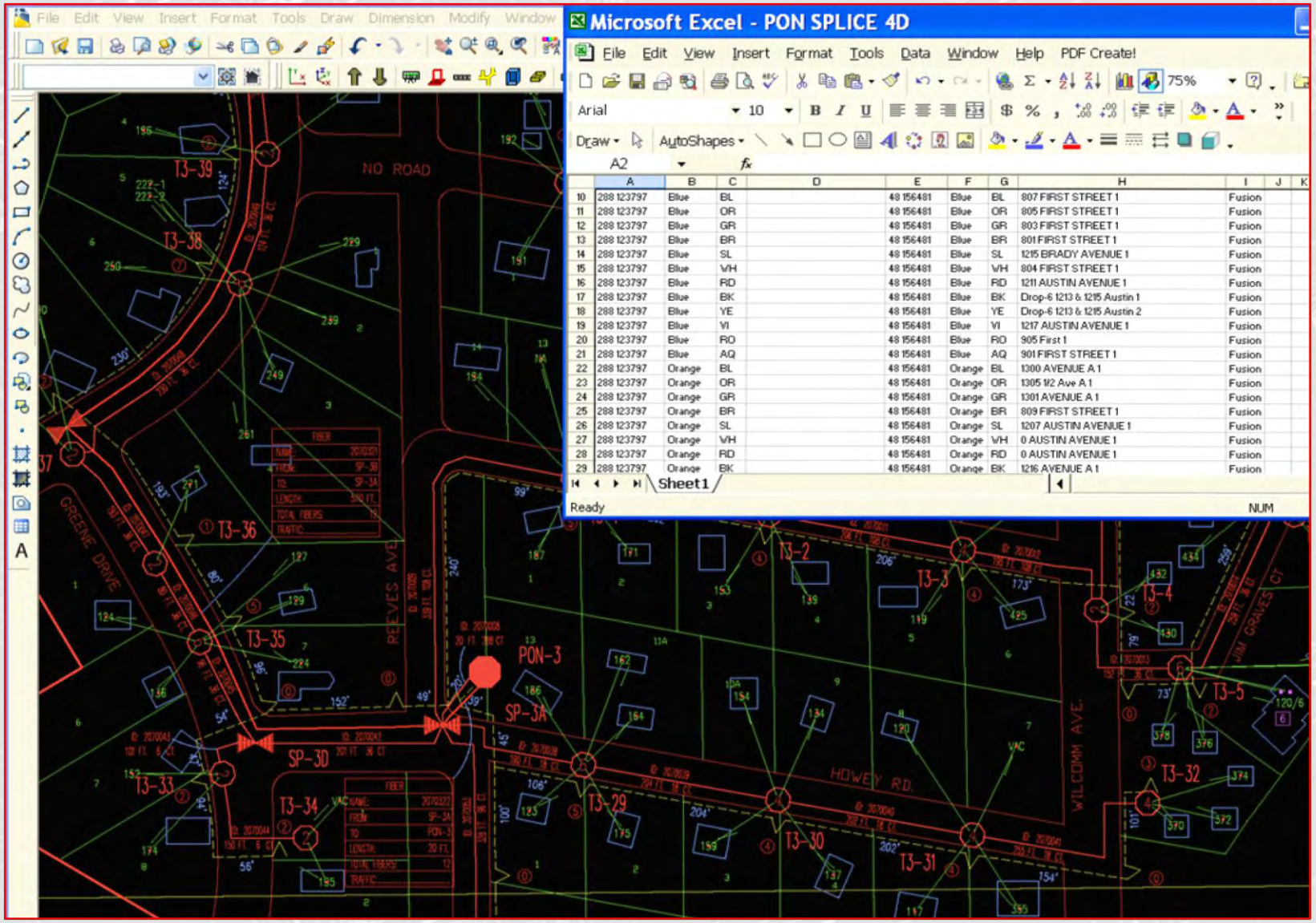
FTTH Sample OSPInSight

No matter how complex the network is, splitters are easy to trace.



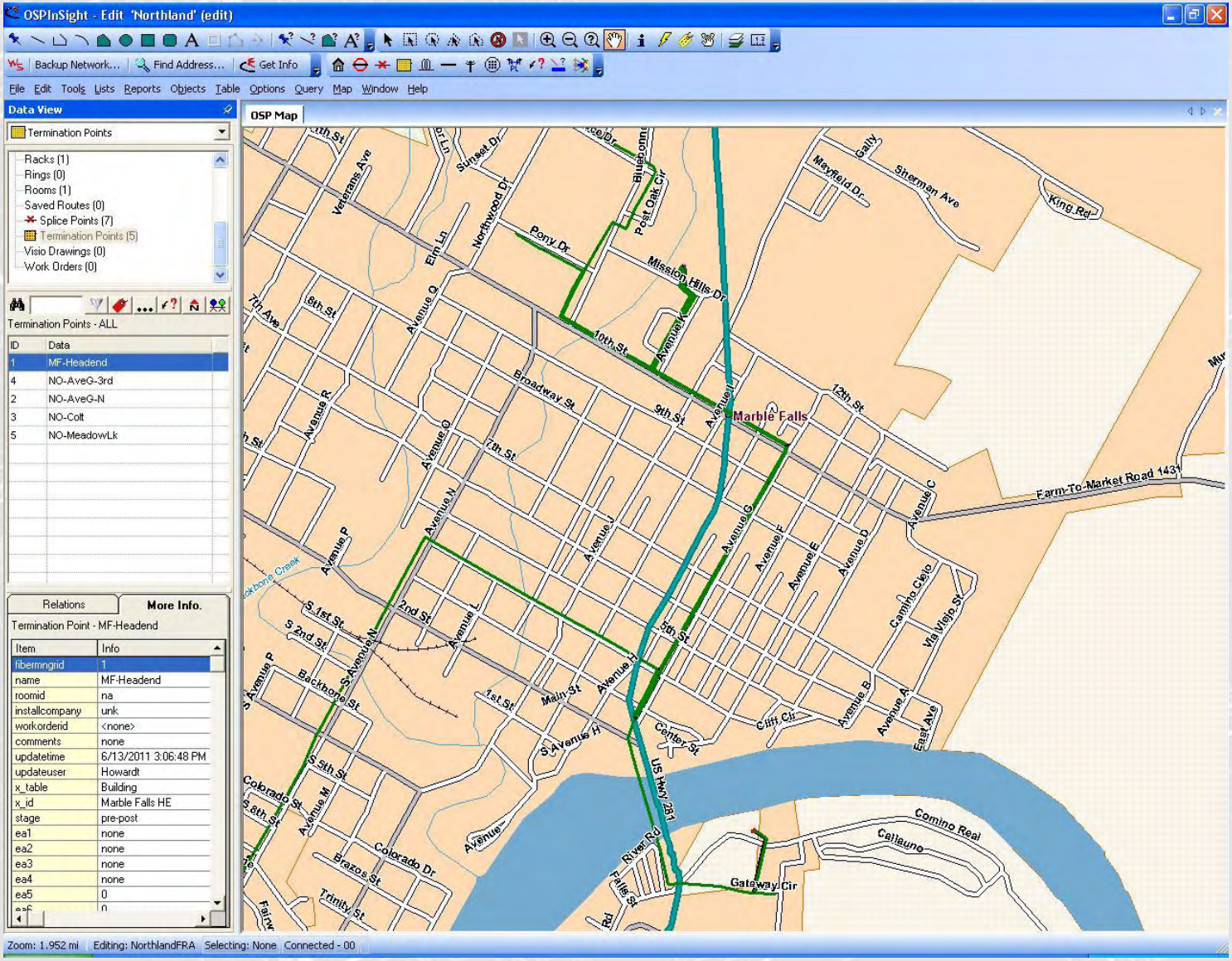
Fiber to Home Design w/Drops

Lode Fiber PON Design

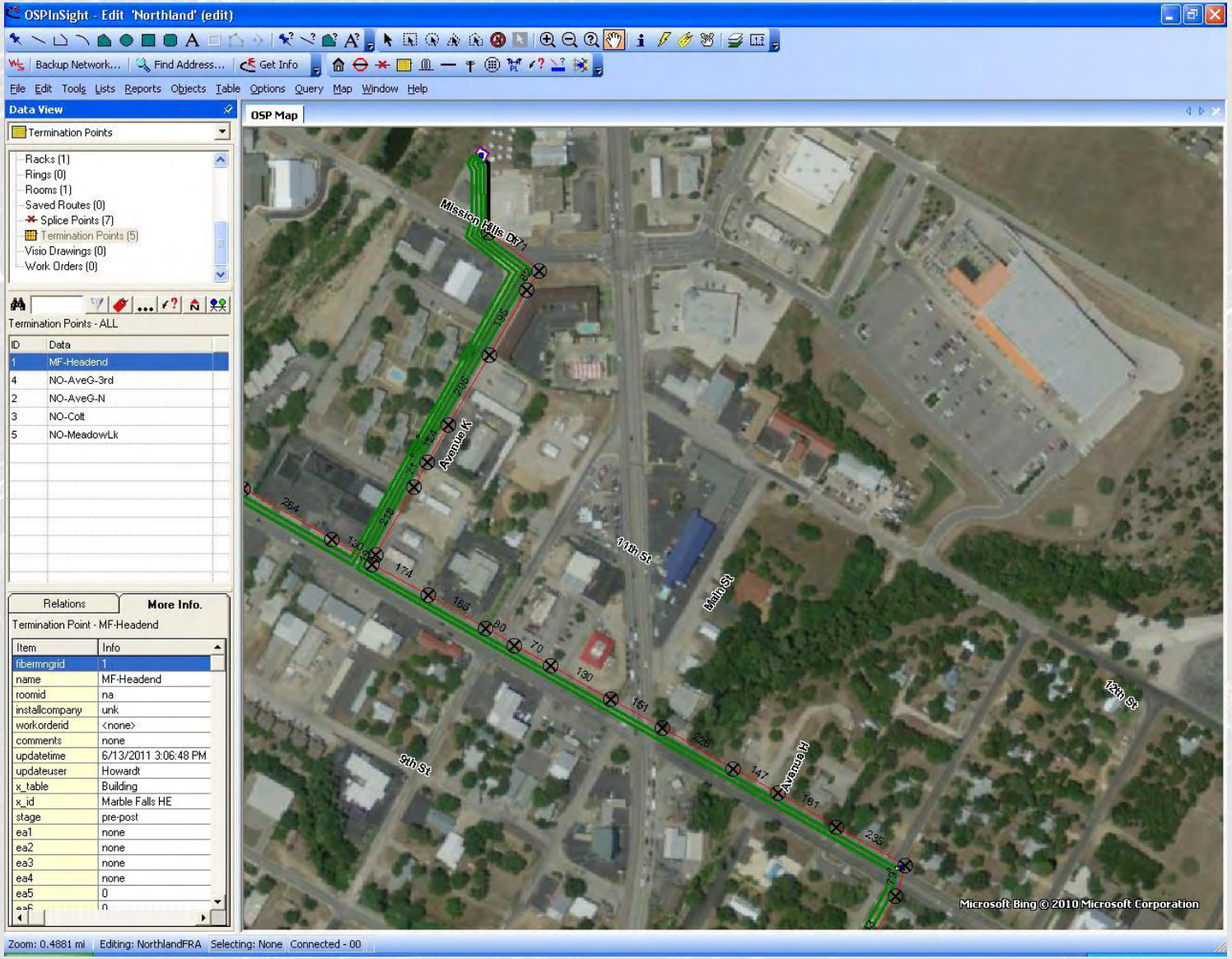


	A	B	C	D	E	F	G	H	I	J	K
10	288 123797	Blue	BL		48 156481	Blue	BL	807 FIRST STREET 1	Fusion		
11	288 123797	Blue	OR		48 156481	Blue	OR	805 FIRST STREET 1	Fusion		
12	288 123797	Blue	GR		48 156481	Blue	GR	803 FIRST STREET 1	Fusion		
13	288 123797	Blue	BR		48 156481	Blue	BR	801 FIRST STREET 1	Fusion		
14	288 123797	Blue	SL		48 156481	Blue	SL	1215 BRADY AVENUE 1	Fusion		
15	288 123797	Blue	WH		48 156481	Blue	WH	804 FIRST STREET 1	Fusion		
16	288 123797	Blue	RD		48 156481	Blue	RD	1211 AUSTIN AVENUE 1	Fusion		
17	288 123797	Blue	BK		48 156481	Blue	BK	Drop-6 1213 & 1215 Austin 1	Fusion		
18	288 123797	Blue	YE		48 156481	Blue	YE	Drop-6 1213 & 1215 Austin 2	Fusion		
19	288 123797	Blue	VI		48 156481	Blue	VI	1217 AUSTIN AVENUE 1	Fusion		
20	288 123797	Blue	RD		48 156481	Blue	RD	905 First 1	Fusion		
21	288 123797	Blue	AQ		48 156481	Blue	AQ	901 FIRST STREET 1	Fusion		
22	288 123797	Orange	BL		48 156481	Orange	BL	1300 AVENUE A 1	Fusion		
23	288 123797	Orange	OR		48 156481	Orange	OR	1305 1/2 Ave A 1	Fusion		
24	288 123797	Orange	GR		48 156481	Orange	GR	1301 AVENUE A 1	Fusion		
25	288 123797	Orange	BR		48 156481	Orange	BR	809 FIRST STREET 1	Fusion		
26	288 123797	Orange	SL		48 156481	Orange	SL	1207 AUSTIN AVENUE 1	Fusion		
27	288 123797	Orange	WH		48 156481	Orange	WH	0 AUSTIN AVENUE 1	Fusion		
28	288 123797	Orange	RD		48 156481	Orange	RD	0 AUSTIN AVENUE 1	Fusion		
29	288 123797	Orange	BK		48 156481	Orange	BK	1216 AVENUE A 1	Fusion		

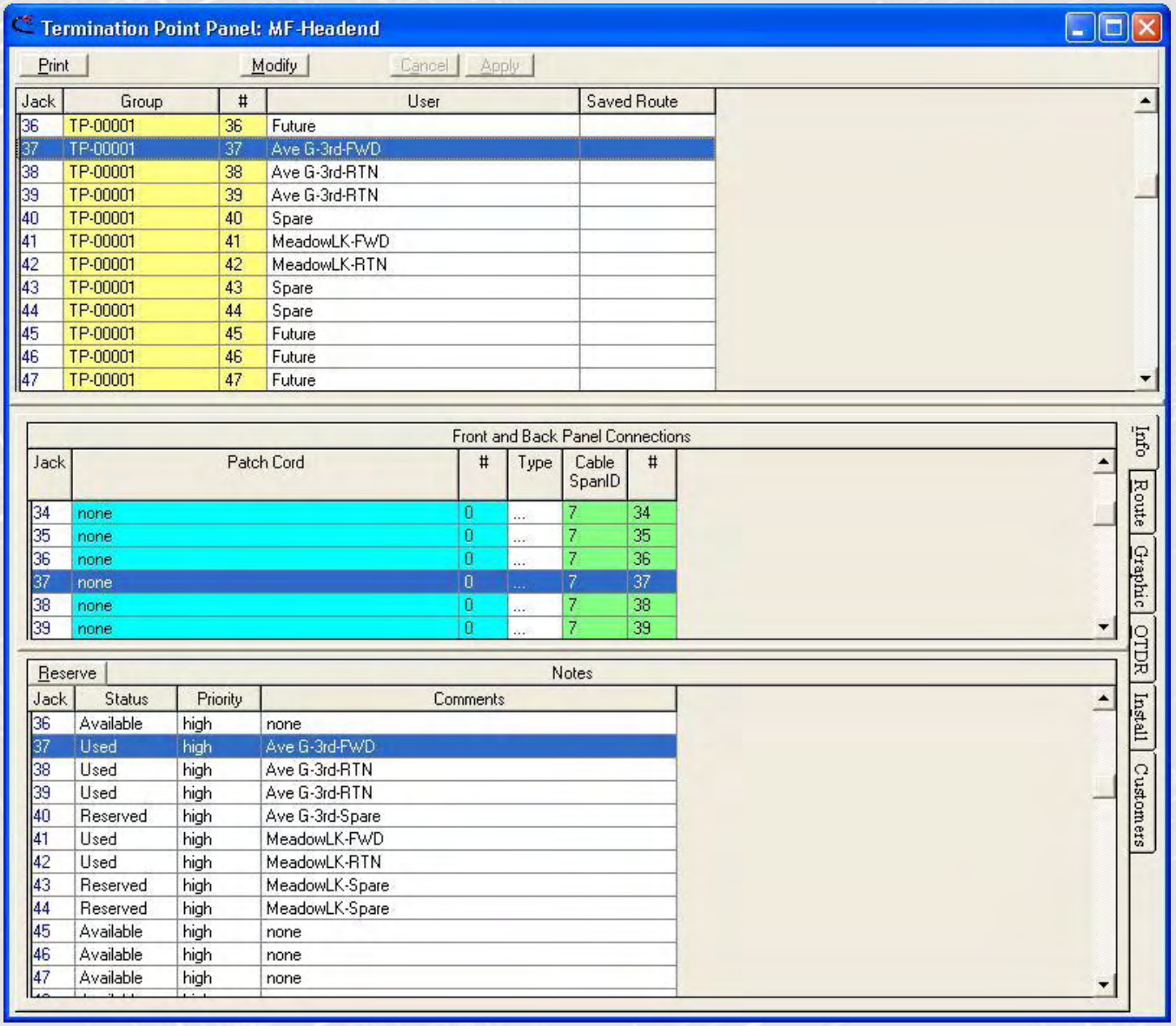
OSPInSight Fiber



OSPInSight with Aerial Background



OSPInSight Patch Panel Layout

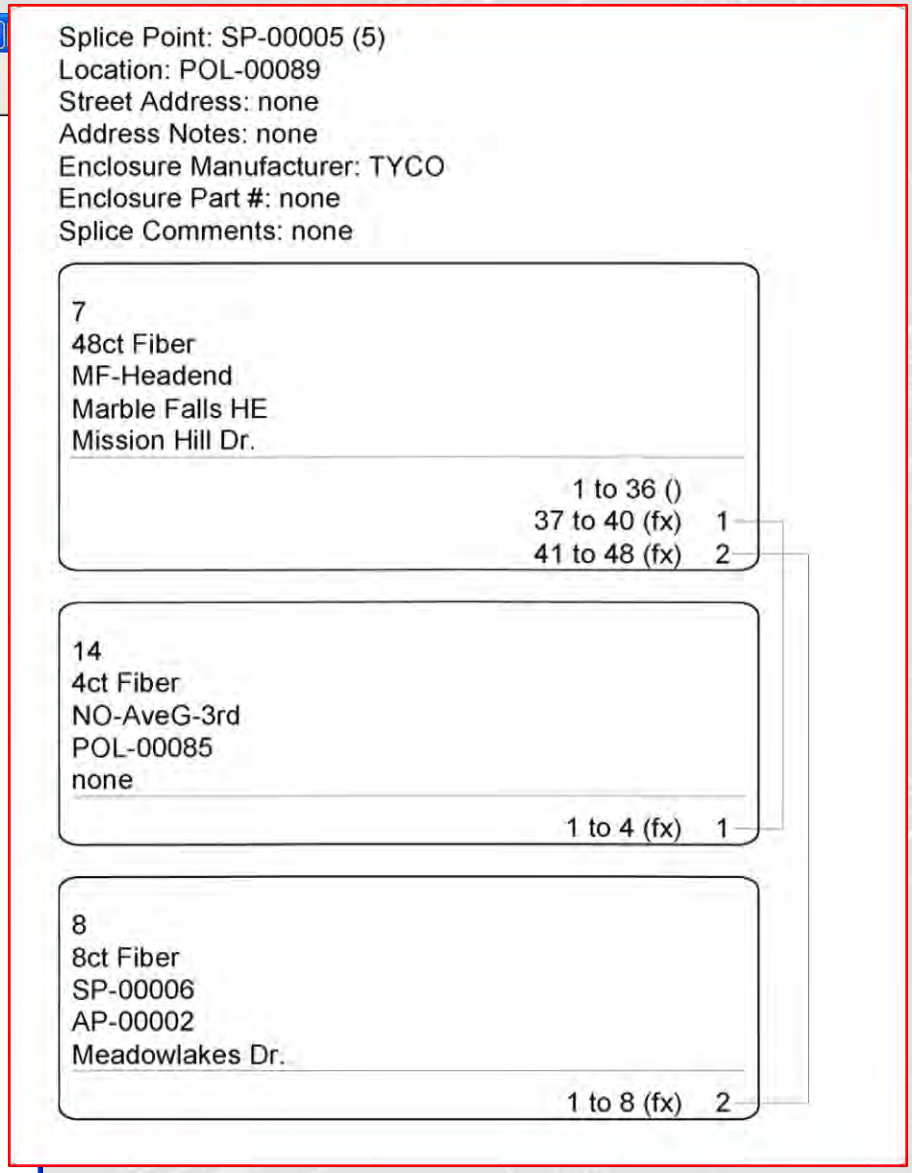


OSPInSight Splice Sheet & Diagram

Splice Spreadsheet

Splice Point: SP-00005 | Include "dead" and "no splice" | Print ... | Reference span: 7 | GO | Order by tray | Display users

type	tray	span: 7	bundle	fiber	span: 8	bundle	fiber	span: 14	bundle	fiber
fusion		37	br	bl				1	bl	bl
fusion		38	br	or				2	bl	or
fusion		39	br	gr				3	bl	gr
fusion		40	br	br				4	bl	br
fusion		41	br	sl	1	bl	bl			
fusion		42	br	wh	2	bl	or			
fusion		43	br	rd	3	bl	gr			
fusion		44	br	bk	4	bl	br			
fusion		45	br	yl	5	bl	sl			
fusion		46	br	vi	6	bl	wh			
fusion		47	br	rs	7	or	bl			
fusion		48	br	aq	8	or	or			
dead		1	bl	bl						
dead		2	bl	or						
dead		3	bl	gr						
dead		4	bl	br						
dead		5	bl	sl						
dead		6	bl	wh						
dead		7	bl	rd						
dead		8	bl	bk						
dead		9	bl	yl						
dead		10	bl	vi						
dead		11	bl	rs						
dead		12	bl	aq						
dead		13	or	bl						
dead		14	or	or						
dead		15	or	gr						
dead		16	or	br						
dead		17	or	sl						
dead		18	or	wh						
dead		19	or	rd						
dead		20	or	bk						
dead		21	or	yl						
dead		22	or	vi						
dead		23	or	rs						
dead		24	or	aq						
dead		25	gr	bl						
dead		26	gr	or						
dead		27	gr	gr						
dead		28	gr	br						
dead		29	gr	sl						
dead		30	gr	wh						
dead		31	gr	rd						
dead		32	gr	bk						
dead		33	gr	yl						
dead		34	gr	vi						
dead		35	gr	rs						
dead		36	gr	aq						



HFC & PON Splice Sheets

Splice Report — Created on Wednesday, February 28, 2007 at 14:33
MODIFIED MARCH 17, 2008
Enclosure: HE-PONB-ShortSt

Splicer:
Company:
Date:

Cable	Buffer	Fiber	Destination	Cable	Buffer	Fiber	Destination	Type	Tray	Pos	Loss
288 114623	Blue	BL		48 102436	Blue	BL	104 N Main 1	Fusion			0.002
288 114623	Blue	OR		48 102436	Blue	OR	DROP 274721 1	Fusion			0.002
288 114623	Blue	GR		48 102436	Blue	GR	100 N Booker 1	Fusion			0.002
288 114623	Blue	BR		48 102436	Blue	BR	300 N Main 1	Fusion			0.002
288 114623	Blue	SL		48 102436	Blue	SL	311 N Center 1	Fusion			0.002
288 114623	Blue	WH		48 102436	Blue	WH	309 N Center 1	Fusion			0.002
288 114623	Blue	RD		48 102436	Blue	RD	307 N Center 1	Fusion			0.002
288 114623	Blue	BK		48 102436	Blue	BK	120 S Broadway 1				
288 114623	Blue	YE		48 102436	Blue	YE	209 N Broadway 1				
288 114623	Blue	VI		48 102436	Blue	VI	110 S Broadway 1				
288 114623	Blue	RO		48 102436	Blue	RO	108 S Broadway 1				
288 114623	Blue	AQ		48 102436	Blue	AQ	106 S Broadway 1				
288 114623	Orange	BL		48 102436	Orange	BL	104 S Broadway 1				
288 114623	Orange	OR		48 102436	Orange	OR	207 N Main 1				
288 114623	Orange	GR		48 102436	Orange	GR	212 N Broadway 1				
288 114623	Orange	BR		48 102436	Orange	BR	200 S Broadway 1				
288 114623	Orange	SL		48 102436	Orange	SL	205 N Center 1				
288 114623	Orange	WH		48 102436	Orange	WH	203 N Center 1				
288 114623	Orange	RD		48 102436	Orange	RD	201 N Center 1				
288 114623	Orange	BK		48 102436	Orange	BK	107 S Broadway 1				
288 114623	Orange	YE		48 102436	Orange	YE	305 N Center 1				
288 114623	Orange	VI		48 102436	Orange	VI	303 N Center 1				
288 114623	Orange	RO		48 102436	Orange	RO	301 N Center 1				
288 114623	Orange	AQ		48 102436	Orange	AQ	115 S Broadway 1				
288 114623	Green	BL		48 102436	Green	BL	309 N Fisk 1				
288 114623	Green	OR		48 102436	Green	OR	305 N Fisk 1				
288 114623	Green	GR		48 102436	Green	GR	303 N Fisk 1				
288 114623	Green	BR		48 102436	Green	BR	100 N Center 1				
288 114623	Green	SL		48 102436	Green	SL	201 S Broadway 1				
288 114623	Green	WH		48 102436	Green	WH	209 S Broadway 1				
288 114623	Green	RD		48 102436	Green	RD	211 S Broadway 1				
288 114623	Green	BK		48 102436	Green	BK	401 N Fisk 1				
288 114623	Green	YE		48 102436	Green	YE	409 N Fisk 1				
288 114623	Green	VI		48 102436	Green	VI	213 S Broadway 1				
288 114623	Green	RO		48 102436	Green	RO	301 N Fisk 1				

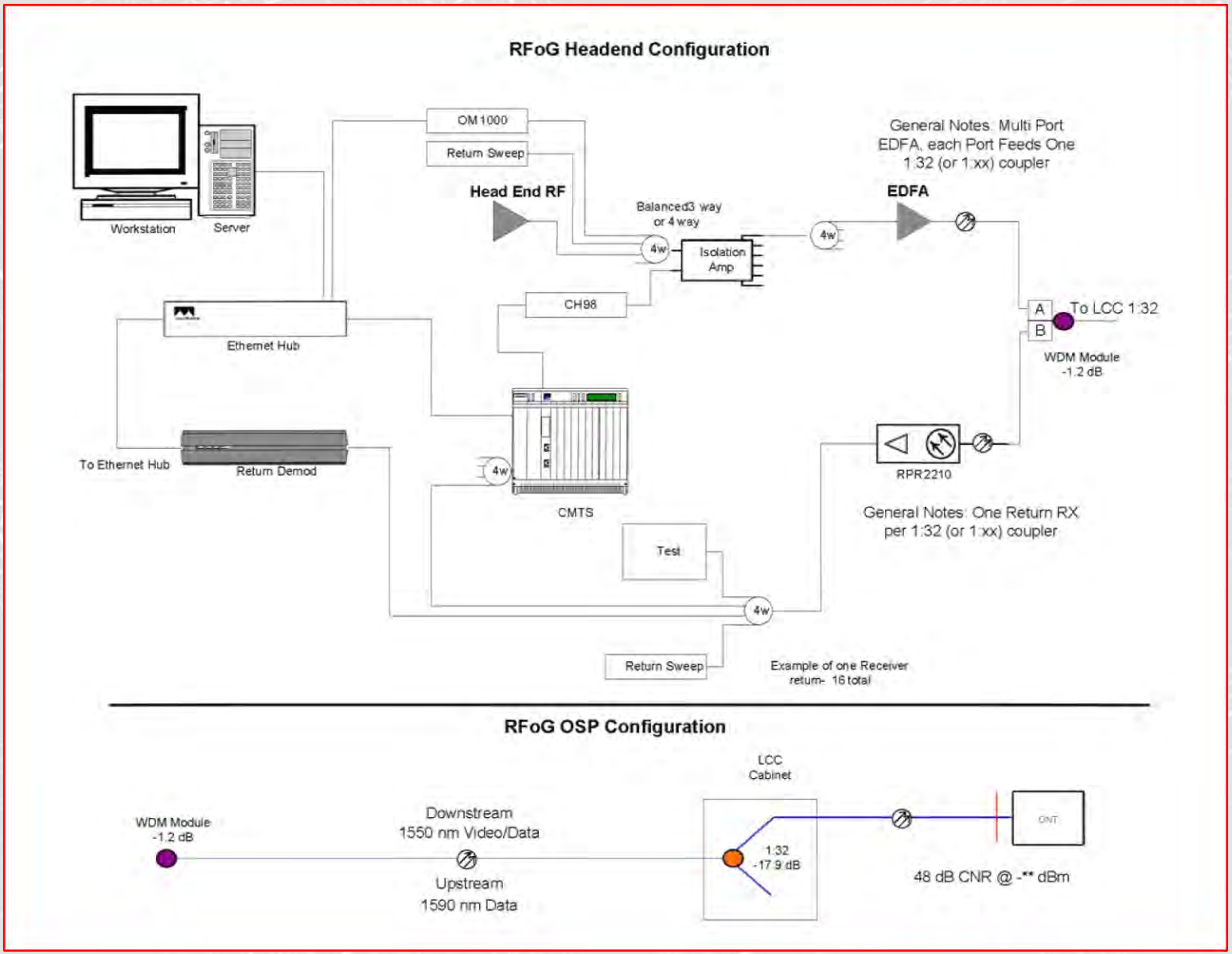
SYSTEM B037

NUM	SOURCE ID	CABLE ID	FIBER COUNT	FIBER COLOR	BUFFER COLOR	LOCATION NUMBER	TRAFFIC ID	BUFFER COLOR	FIBER COLOR	FIBER COUNT	CABLE ID	NEXT STATION ID
1	SPL-5637		78F-1	BLUE	BLUE	B037	**B047-F**	BLUE	BLUE	72F-1		SPL-5734
2	SPL-5637		78F-2	ORANGE	BLUE	B037	**B047-R**	BLUE	ORANGE	72F-2		SPL-5734
3	SPL-5637		78F-3	GREEN	BLUE	B037	SPARE	BLUE	GREEN	72F-3		SPL-5734
4	SPL-5637		78F-4	BROWN	BLUE	B037	SPARE	BLUE	BROWN	72F-4		SPL-5734
5	SPL-5637		78F-5	SLATE	BLUE	B037	FUTURE	BLUE	SLATE	72F-5		SPL-5734
6	SPL-5637		78F-6	WHITE	BLUE	B037	FUTURE	BLUE	WHITE	72F-6		SPL-5734
7	SPL-5637		78F-7	RED	BLUE	B037	**B046-F**	BLUE	RED	72F-7		SPL-5734
8	SPL-5637		78F-8	BLACK	BLUE	B037	**B046-R**	BLUE	BLACK	72F-8		SPL-5734
9	SPL-5637		78F-9	YELLOW	BLUE	B037	SPARE	BLUE	YELLOW	72F-9		SPL-5734
10	SPL-5637		78F10	VIOLET	BLUE	B037	SPARE	BLUE	VIOLET	72F10		SPL-5734
11	SPL-5637		78F-11	ROSE	BLUE	B037	FUTURE	BLUE	ROSE	72F-11		SPL-5734
12	SPL-5637		78F-12	AQUA	BLUE	B037	FUTURE	BLUE	AQUA	72F-12		SPL-5734
13	SPL-5637		78F-13	BLUE	ORANGE	B037	**B045-F**	ORANGE	BLUE	72F-13		SPL-5734
14	SPL-5637		78F-14	ORANGE	ORANGE	B037	**B045-R**	ORANGE	ORANGE	72F-14		SPL-5734
15	SPL-5637		78F-15	GREEN	ORANGE	B037	SPARE	ORANGE	GREEN	72F-15		SPL-5734
16	SPL-5637		78F-16	BROWN	ORANGE	B037	SPARE	ORANGE	BROWN	72F-16		SPL-5734
17	SPL-5637		78F-17	SLATE	ORANGE	B037	FUTURE	ORANGE	SLATE	72F-17		SPL-5734
18	SPL-5637		78F-18	WHITE	ORANGE	B037	FUTURE	ORANGE	WHITE	72F-18		SPL-5734
19	SPL-5637		78F-19	RED	ORANGE	B037	**B042-F**	ORANGE	RED	72F-19		SPL-5734
20	SPL-5637		78F-20	BLACK	ORANGE	B037	**B042-R**	ORANGE	BLACK	72F-20		SPL-5734
21	SPL-5637		78F-21	YELLOW	ORANGE	B037	SPARE	ORANGE	YELLOW	72F-21		SPL-5734
22	SPL-5637		78F-22	VIOLET	ORANGE	B037	SPARE	ORANGE	VIOLET	72F-22		SPL-5734
23	SPL-5637		78F-23	ROSE	ORANGE	B037	FUTURE	ORANGE	ROSE	72F-23		SPL-5734
24	SPL-5637		78F-24	AQUA	ORANGE	B037	FUTURE	ORANGE	AQUA	72F-24		SPL-5734
25	SPL-5637		78F-25	BLUE	GREEN	B037	**B044-F**	GREEN	BLUE	72F-25		SPL-5734
26	SPL-5637		78F-26	ORANGE	GREEN	B037	**B044-R**	GREEN	ORANGE	72F-26		SPL-5734
27	SPL-5637		78F-27	GREEN	GREEN	B037	SPARE	GREEN	GREEN	72F-27		SPL-5734
28	SPL-5637		78F-28	BROWN	GREEN	B037	SPARE	GREEN	BROWN	72F-28		SPL-5734
29	SPL-5637		78F-29	SLATE	GREEN	B037	FUTURE	GREEN	SLATE	72F-29		SPL-5734
30	SPL-5637		78F-30	WHITE	GREEN	B037	FUTURE	GREEN	WHITE	72F-30		SPL-5734
31	SPL-5637		78F-31	RED	GREEN	B037	**B043-F**	GREEN	RED	72F-31		SPL-5734
32	SPL-5637		78F-32	BLACK	GREEN	B037	**B043-R**	GREEN	BLACK	72F-32		SPL-5734
33	SPL-5637		78F-33	YELLOW	GREEN	B037	SPARE	GREEN	YELLOW	72F-33		SPL-5734
34	SPL-5637		78F-34	VIOLET	GREEN	B037	SPARE	GREEN	VIOLET	72F-34		SPL-5734
35	SPL-5637		78F-35	ROSE	GREEN	B037	FUTURE	GREEN	ROSE	72F-35		SPL-5734
36	SPL-5637		78F-36	AQUA	GREEN	B037	FUTURE	GREEN	AQUA	72F-36		SPL-5734
37	SPL-5637		78F-37	BLUE	BROWN	B037	COLLEGE	BROWN	BLUE	72F-37		SPL-5734
38	SPL-5637		78F-38	ORANGE	BROWN	B037	COLLEGE	BROWN	ORANGE	72F-38		SPL-5734
39	SPL-5637		78F-39	GREEN	BROWN	B037	COLLEGE	BROWN	GREEN	72F-39		SPL-5734
40	SPL-5637		78F-40	BROWN	BROWN	B037	COLLEGE	BROWN	BROWN	72F-40		SPL-5734

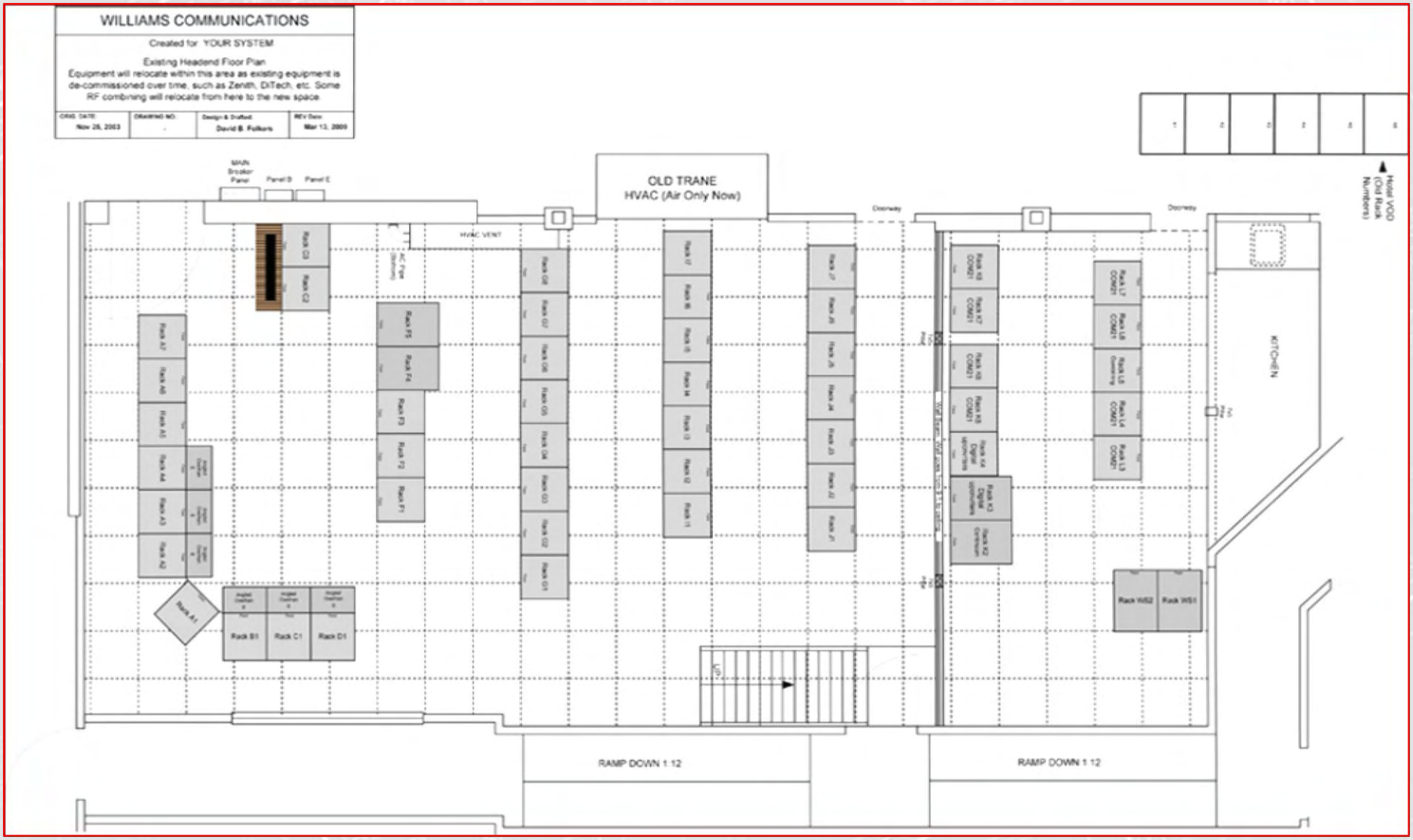
Headend/CO As-Built and Design

- As-Built Headend and Rack Equipment
- Network Diagrams
- Floor Plans
- Audit Existing Equipment and Configuration

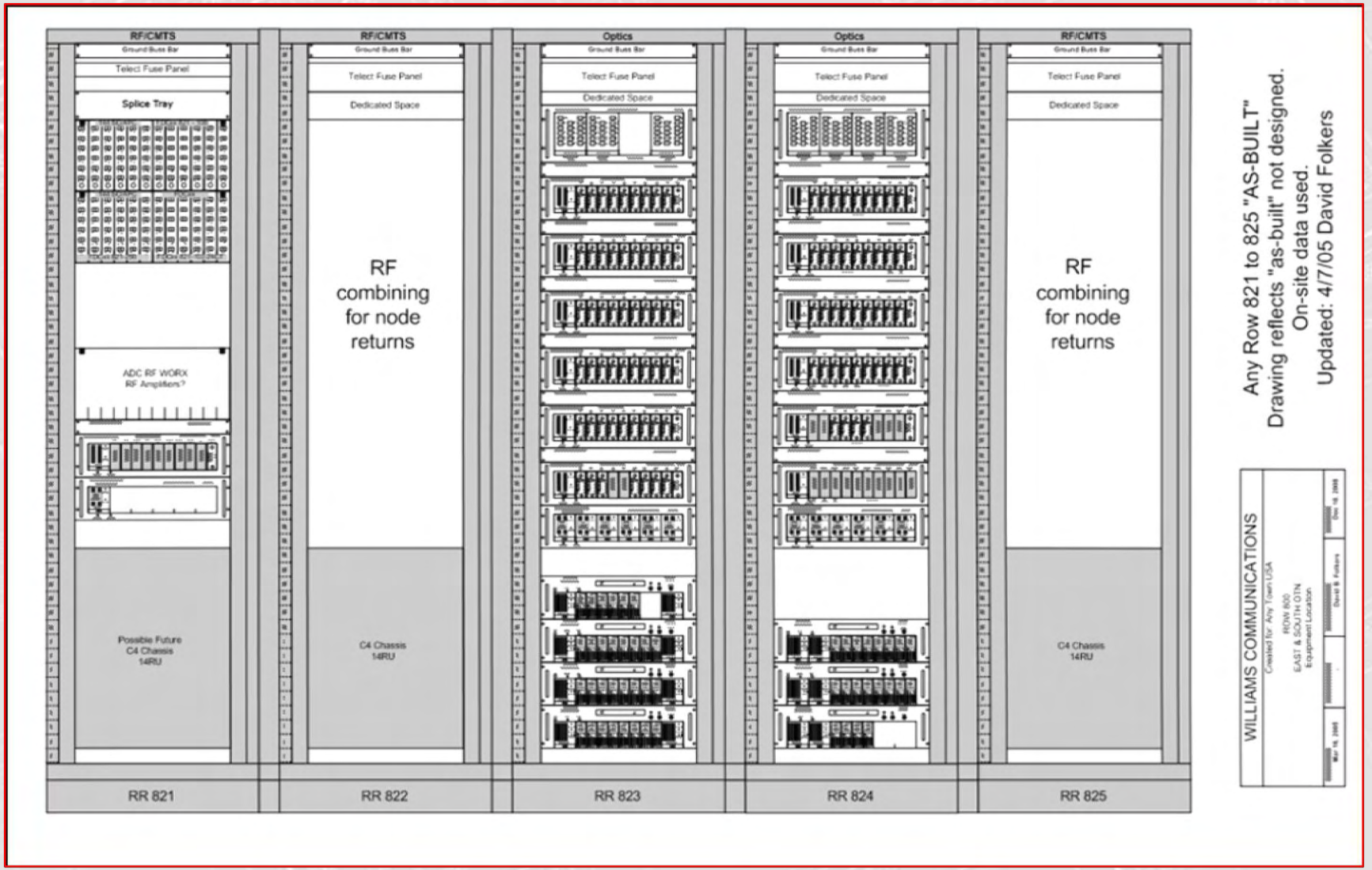
RFoG Headend Configuration



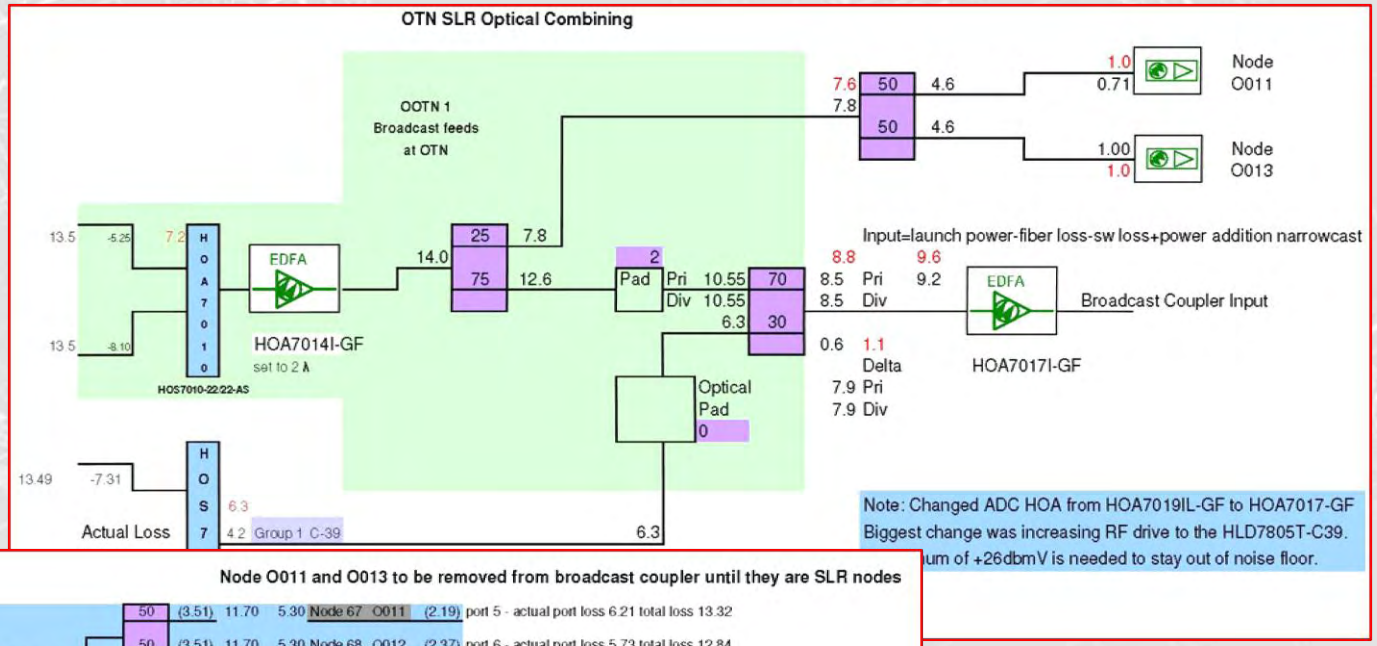
Headend Floor Plan

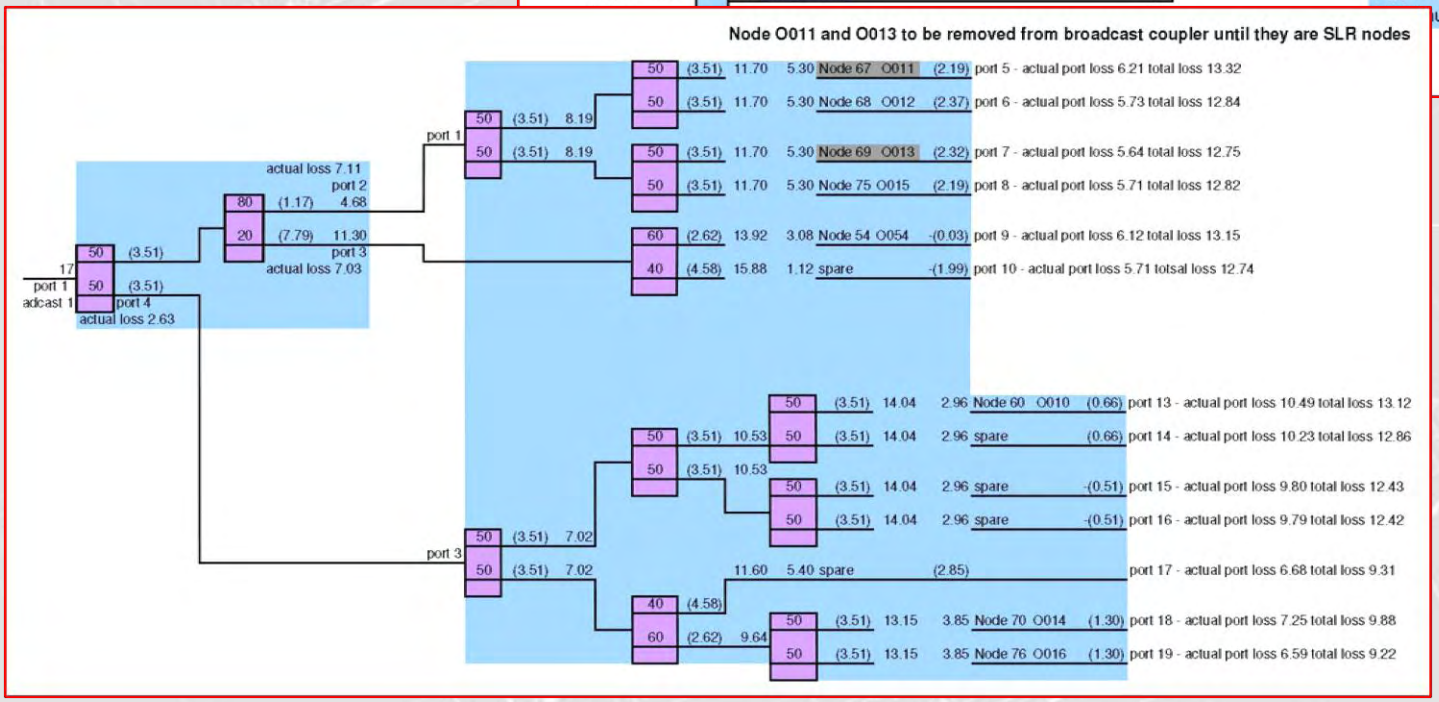


OTN Equipment Rack

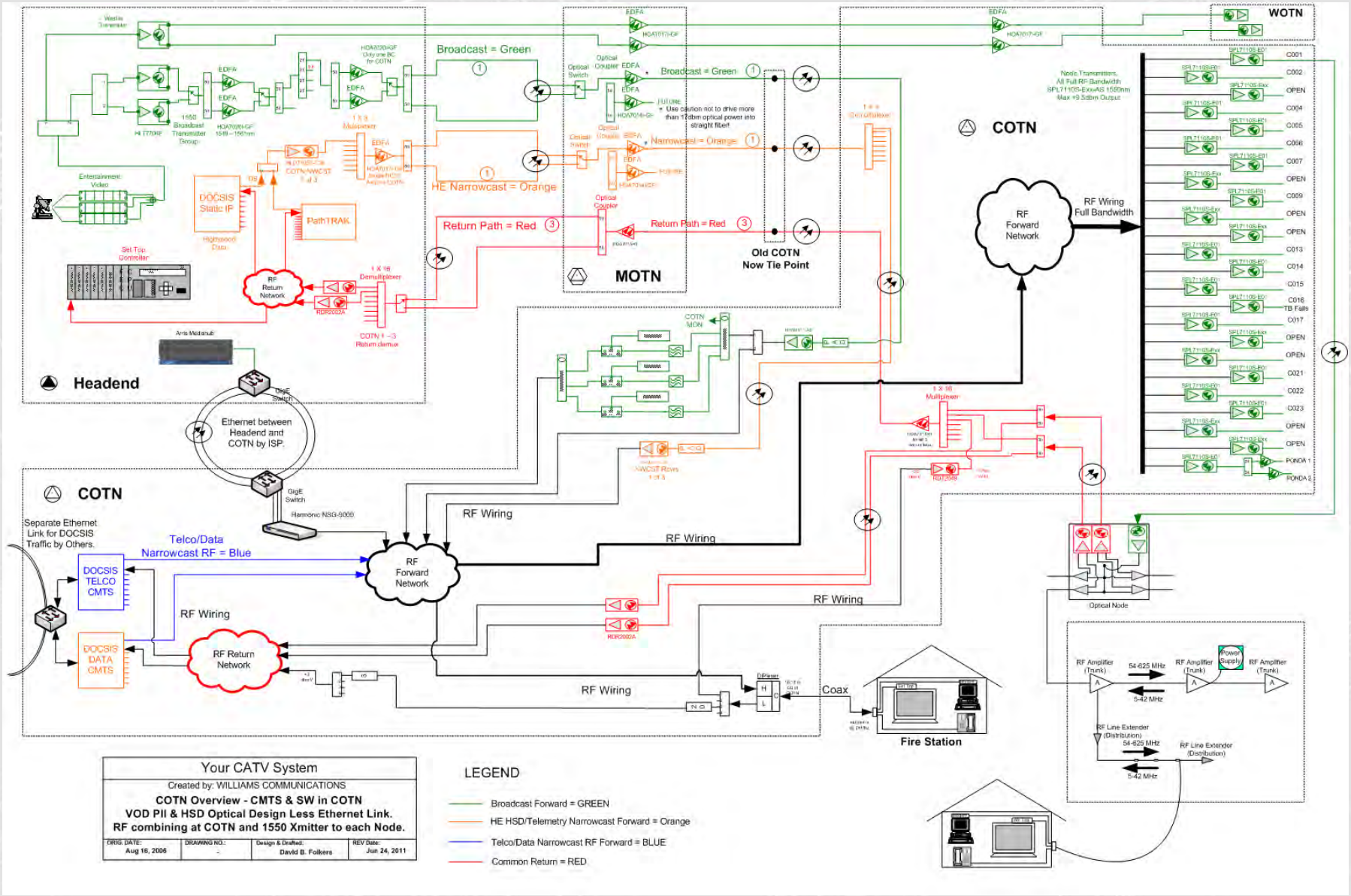


Optical Splitter Networks

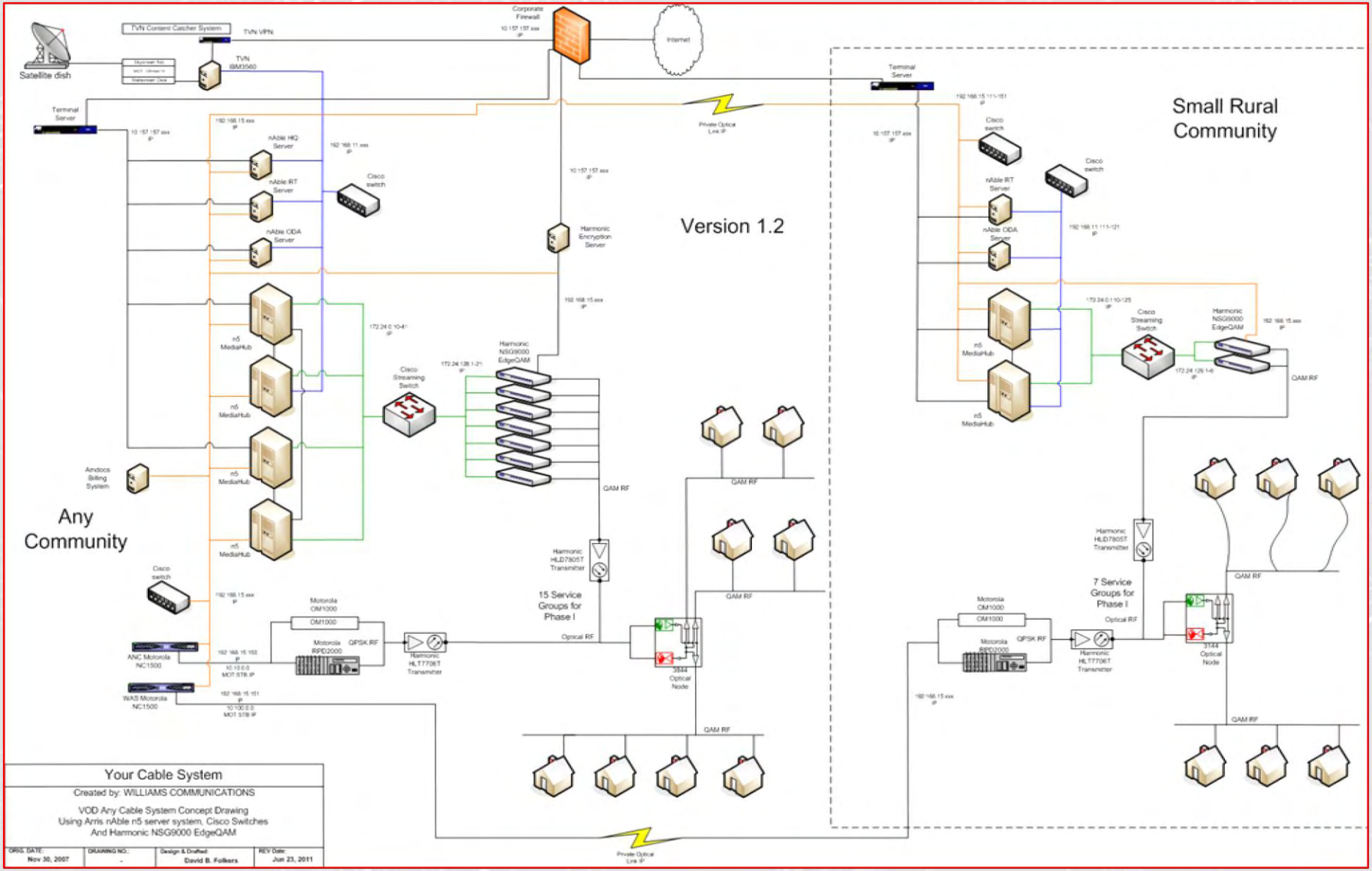




Remote CO Overview



VOD System Concept Drawing



Building a New Headend

Empty Racks

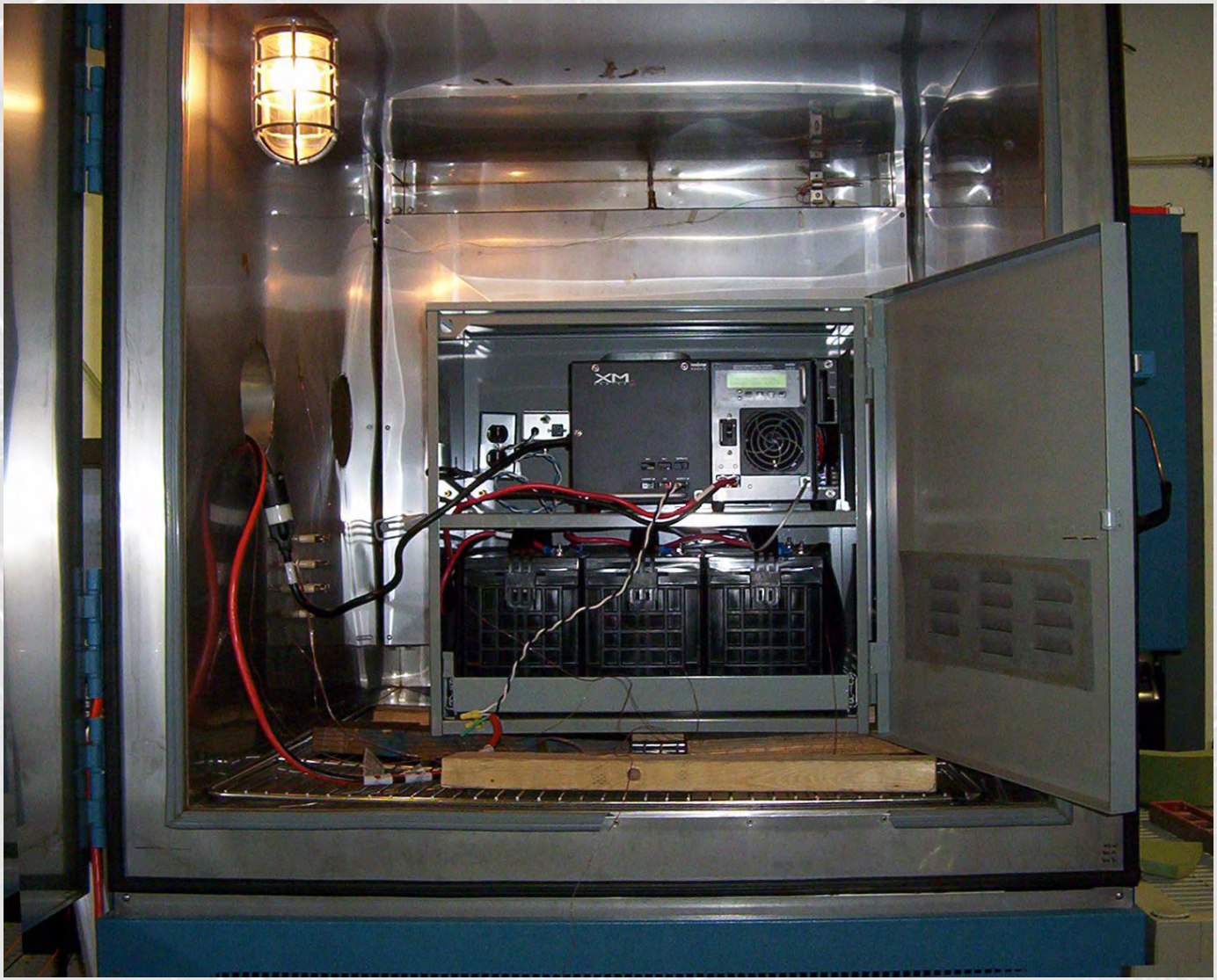
Filled Racks

Environmental Testing

- Testing Batteries for Thermal Conditions
- Thermal Chamber from 30C to -30C for Current Drain and Time for Standby Under Load
- Test Results showed Timeline for Failure

Environmental Test Monitoring

Setup For Testing Battery Standby Time Under Load @ -30C



Battery Standby Test Results

From Test Data on Thermal Battery Testing

Heater Pad Temperature Comparison

Temperature	Test 1 @ 100V/100W C	F	Notes	Test 2 @ 110V/120W C	F	Notes	Test 3 @ 120V/140W C	F	Notes	Alpha Pad 120V/200W F
Battery A (Mid-Outside)	4.6	40.3	2	12.8	55.0	2	17.7	63.9	2	
Battery B (Heater)	28.5	83.3		44.2	111.6		51.3	124.3		160
Battery B (Low-Inside)	12.3	54.1		25.8	78.4		28.2	82.8		
Battery B (Mid-Inside)	10.2	50.4		20.9	69.6		26.0	78.8		
Battery B (High-Inside)	6.1	43.0		14.3	57.7		19.9	67.8		
Battery B (Post)	3.1	37.6	4	11.9	53.4	4	15.4	59.7	4	
Battery C (Mid-Outside)	6.8	44.2	2	16.6	61.9	2	20.9	69.6	2	
Chamber Temp.	-30.2	-22.4		-29.8	-21.6		-29.8	-21.6		
Power Supply Temp.										
Heater Voltage	99.9			113.9 V			120.0 V			
Soak Time	45			24 hrs.			24 hrs.			
Thermostat Cycled	No			No			No	5		
Temperature Range	4 to 15	40 to 60		4 to 15	40 to 60		4 to 15	40 to 60		
Recommended Fuse	49	120		54	130		60	140		180
Recommended Range	-1 to 4	30 to 40		-1 to 4	30 to 40		-1 to 4	40 to 50		40 to 50
Loading at -5C (36v String)	4.0 A			4.2 A			4.2 A			

Notes:

1 Thermistor not insulated.
2 Thermistors insu[illegible]
3 Thermistor locat[illegible]
4 Thermistor reloc[illegible]
5 Battery A top su[illegible]

Battery Comparison

Test	Chamber	Time	Power Removed Temp. A	Temp. B	Temp. C	Time	Standby Termination Temp. A	Temp. B	Temp. C	Soak Time	Standby Duration	Load	Battery	Test	CPU
Bare Metal	-31C	10:51pm	-25.8	-24.4C	-25.7C	2:57am	-21.8C	-21.4C	-21.8C	12 hrs.	04:06 hrs.	4.95a	Excite	1st	XM
Bare Metal	-30C	08:43am	-24.8C	-23.7C	-24.1C	11:47am	-19.1C	-16.9C	-19.4C	12 hrs.	03:04 hrs.	4.95a	Alpha	6th	XM
Bare Metal	-30C	12:57pm	-24.0C	-23.4C	-22.7C	06:20pm	-17.5C	-16.0C	-14.8C	12 hrs.	05:23 hrs.	4.95a	Power	8th/1st	XM
Bare Metal	-30C	12:49pm	-24.8C	-23.8C	-24.1C	03:01pm	-20.5C	-18.1C	19.3C	12 hrs.	02:12 hrs.	4.95a	MK	9th	XM

Comments:

The Excite batteries performed well versus the MK and Aplha batteries. The case density differencial between the Excite and Power battery creates about a twenty-two percent reduction in standby time in the Excite battery versus the Power battery. This percentage should remain constant even in an insulated environment. The only unknown is the long term recharge/discharge impact versus the other batteries.

Battery Standby Time

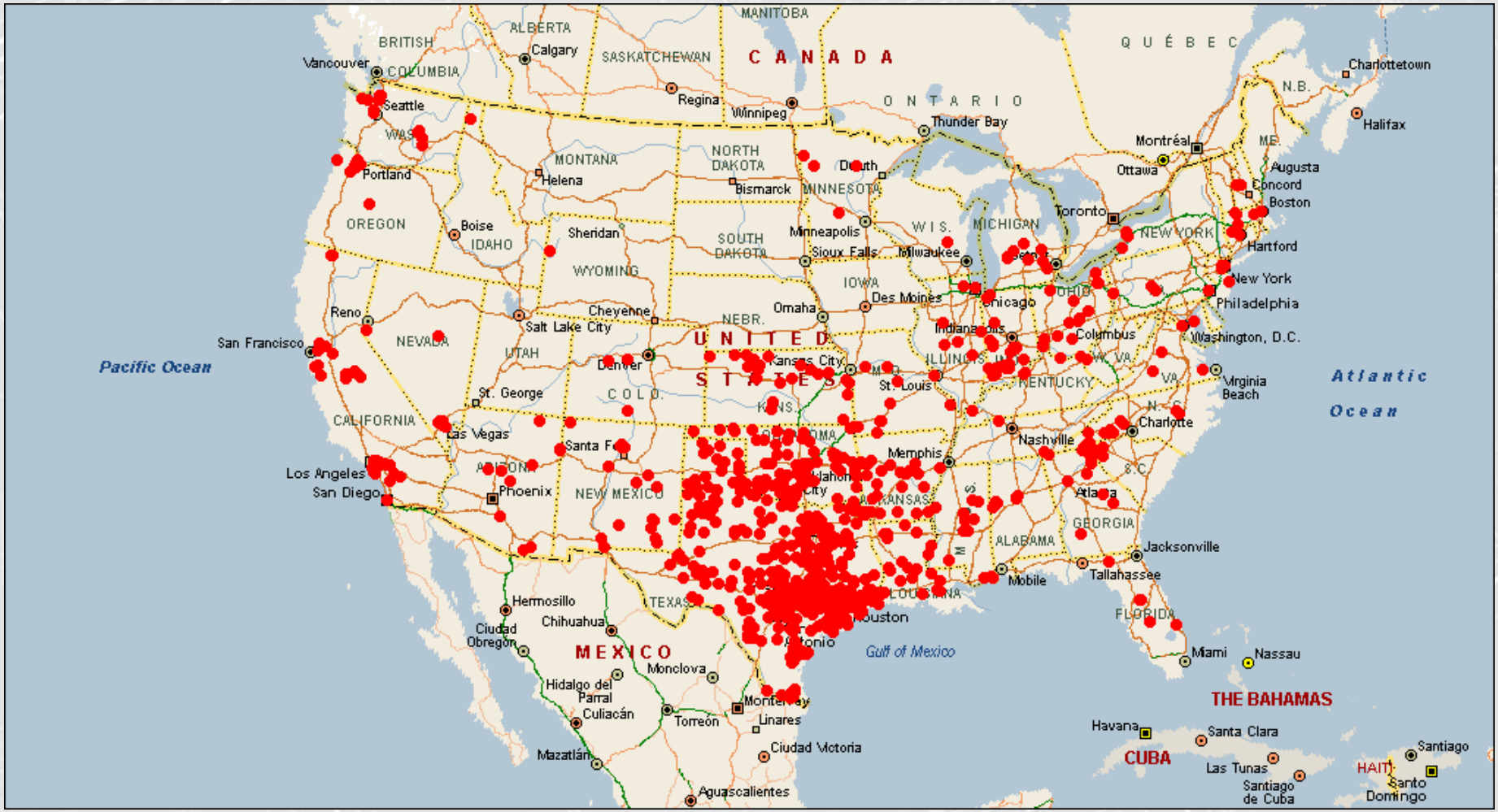
Hours	Batteries	Trays	CURRENT AT 90VAC WITH 180/GXL										
8	3	1	1.03	1.47	1.85	2.23	2.55	2.84	3.09	3.32	3.51	3.67	3.81
8	6	2	2.06	2.94	3.70	4.46	5.11	5.68	6.18	6.63	7.01	7.33	7.62
8	9	3	3.09	4.40	5.55	6.69	7.66	8.52	9.26	9.95	10.52	11.00	11.44
8	4	1	1.37	1.96	2.47	2.97	3.41	3.79	4.12	4.42	4.68	4.89	5.08
8	8	2	2.74	3.91	4.93	5.95	6.81	7.57	8.23	8.84	9.35	9.78	10.17
8	12	4	4.12	5.87	7.40	8.92	10.22	11.36	12.35	13.27	14.03	14.67	15.25
TEMPERATURE			-25C	-20C	-15C	-10C	-5C	0C	5C	10C	15C	20C	25C

Hours	Batteries	Trays	CURRENT AT 90VAC WITH 210/GXL										
8	3	1	1.17	1.67	2.11	2.54	2.91	3.23	3.52	3.78	3.99	4.18	4.34
8	6	2	2.34	3.34	4.21	5.08	5.82	6.47	7.03	7.55	7.99	8.35	8.68
8	9	3	3.52	5.01	6.32	7.62	8.73	9.70	10.55	11.33	11.98	12.53	13.02
8	4	1	1.56	2.23	2.81	3.39	3.88	4.31	4.69	5.04	5.33	5.57	5.79
8	8	2	3.13	4.46	5.61	6.77	7.76	8.62	9.38	10.07	10.65	11.14	11.58
8	12	4	4.69	6.69	8.42	10.16	11.63	12.94	14.07	15.11	15.98	16.71	17.37
TEMPERATURE			-25C	-20C	-15C	-10C	-5C	0C	5C	10C	15C	20C	25C

Note: Temperature De-Ratings taken from Memo of 12/2/05 from Alpha

The use of Alpha BHM (Battery Heater Mats) are designed so that they keep the batteries at a temperature between +5C to +10C (+40F to +50F) The BHM run off 120VAC and are not part of the Run Time Calculations.

Locations We have Worked
North America



Company and Staff Memberships include:

- FTTH Council
- Texas Telephone Association
- Caribbean Cable & Telecommunications Association
- SCTE Standards Committee Member
- SCTE
- BICSI
- IEEE