

# Henderson Panelboard Panelboard Extraction

Detecting the panelboard is going through three steps:

1. Panelboard detection
2. Template Matching
3. Information Extraction

Model can also detect some drawings or images similar to tables by detecting them as tables. Therefore, before trying to extract the information we should be sure that we are dealing with an image that contains a panelboard. For this reason we do an extra step where we check once again if the image contains a table while we are doing template matching. If the image contains a table and we have found the right template, then we can extract the information. This three step model has an accuracy of 90%.

## Panelboard Checking

- There are three rules used for detecting if there is a table in image
  - The template matching score should be above 0.4
  - The header template should be positioned above end template

The threshold for the first rule was decided based on some experiments with a corpus that has images of drawings, unknown tables (tables that are not defined with template) and known tables (tables for which we have template to use for template matching). Based on this corpus, drawings have a score under 0.4 and unknown tables have a score under 0.5, while known tables have a score above it, with average 0.66. The above two rules give us an accuracy of 80% on checking if the image contains a table.

Average score for drawings for header 0.4  
Average score for drawings for footer 0.37  
Average score for unknown tables for header 0.49  
Average score for unknown tables for footer 0.48  
Average score for tables for header 0.68  
Average score for tables for footer 0.63

	Header Score	Footer Score	Image Name	Image Layout	Template Layout	Is Table	Header Distance	Header Position	Footer Distance	Footer Position
8	0.336998	0.539122	layout5_23-cropped.png	5	5	False	15	0	30	1
40	0.295547	0.473847	layout5_20-cropped.png	5	5	False	120	0	15	1
70	0.553338	0.538887	layout3_15-cropped.png	3	4	False	72	0	97	1
83	0.336543	0.486283	layout5_21-cropped.png	5	5	False	15	0	30	0
94	0.552811	0.533906	layout3_13-cropped.png	3	4	False	67	0	67	1

Table1. Information about images that are detected wrong.

PANELBOARD: R3LEA (EXISTING)										EQUIPMENT GROUND BUS													
BUS AMPS: 100A MAIN SIZE/TYPE: MLO VOLTS/PHASE: 208Y/120 V 3P/4W SUPPLIED BY: R3LEA										FAULT CURRENT: EXISTING AIC RATED: FULLY RATED AIC RATING: 35,000 SERVES: 3RD LEVEL MOUNTING: SURFACE LOCATION: ELECT RM P6-33													
										LINE-SIDE LUGS: MECHANICAL													
CKT NO.	DESCRIPTION	LOAD TYPE	NOTES	WIRE SIZE	BKR AMP	P	PHASE A	PHASE B	PHASE C	P	BKR AMP	WIRE SIZE	NOTES	LOAD TYPE	DESCRIPTION	CKT NO.							
1							192				1	20		E	EXISTING LOAD	2							
3	SPARE				20	1		0	0		1	20			SPARE	4							
5	SPARE				20	1			0	0	1	20			SPARE	6							
7	SPARE				20	1	0	0			1	20			SPARE	8							
9	SPARE				20	1		0	0		1	20			SPARE	10							
11	SPARE				20	1			0	0	1	20			SPARE	12							
13	SPARE				20	1	0	0			1	20			SPARE	14							
15	SPARE				20	1		0	0		1	20			SPARE	16							
17	SPARE				20	1			0	0	1	20			SPARE	18							
19	SPARE				20	1	0	0			1	20			SPARE	20							
21	SPARE				20	1		0	0		1	20			SPARE	22							
23	SPARE				20	1			0	0	1	20			SPARE	24							
25	SPARE				20	1	0	0			1	20			SPARE	26							
27	SPARE				20	1		0	0		1	20			SPARE	28							
29	SPARE				20	1			0	0	1	20			SPARE	30							
31	SPARE				20	1	0	0			1	20			SPARE	32							
33	SPARE				20	1		0	0		1	20			SPARE	34							
35	SPARE				20	1			0	0	1	20			SPARE	36							
37	SPARE				20	1	0	0			1	20			SPARE	38							
39	SPARE				20	1		0	0		3	50	EX	E	EXISTING LOAD	40							
41	SPARE				20	1			0	0						42							
							TOTAL LOAD (VA):		192 VA		0 VA		0 VA										
							TOTAL AMPS:		2 A		0 A		0 A										
LOAD TYPE										PANELBOARD TOTALS													
EXISTING LOAD (E)										192 VA	100%	192 VA	EX - EXISTING				NL - REUSE EXISTING CIRCUIT BREAKER FOR NEW LOAD ADDED				TOTAL CONNECTED LOAD		192 VA
COOLING (C)										0 VA	0%	0 VA									TOTAL NEC LOAD		192 VA
HEATING (H)										0 VA	100%	0 VA											
LIGHTING (L)										0 VA	125%	0 VA											
RECEPTACLES (R)										0 VA	0%	0 VA											
MOTORS (M)										0 VA	100%	0 VA											
SUPPLEMENTAL HEAT (U)										0 VA	100%	0 VA											
MISC EQUIP (Z)										0 VA	100%	0 VA											
REFRIGERATION (F)										0 VA	100%	0 VA											
SIGN/DISPLAY (D)										0 VA	125%	0 VA											
KITCHEN (K)										0 VA	100%	0 VA											
LARGEST MOTOR										0 VA	125%	0 VA											
SHOW WINDOW (W)										0 VA	125%	0 VA											
TRACK LIGHTING										0 VA	100%	0 VA											

PANELBOARD: P6PE (EXISTING)										EQUIPMENT GROUND BUS									
BUS AMPS: 225A MAIN SIZE/TYPE: MLO VOLTS/PHASE: 208Y/120 V 3P/4W SUPPLIED BY: P6LE VIA 30KVA XFMR										FAULT CURRENT: EXISTING AIC RATED: FULLY RATED AIC RATING: FCA +10% MINIMUM SERVES: LEVELS P6, P6 MOUNTING: SURFACE LOCATION: ELECTRICAL ROOM P6-33									
										LINE-SIDE LUGS: MECHANICAL									
CKT NO.	DESCRIPTION	LOAD TYPE	NOTES	WIRE SIZE	BKR AMP	P	PHASE A	PHASE B	PHASE C	P	BKR AMP	WIRE SIZE	NOTES	LOAD TYPE	DESCRIPTION	CKT NO.			
1	EXISTING LOAD	E		EX 20 1			200	300			1 20	EX		E	EXISTING LOAD	2			
3	EXISTING LOAD	E		EX 20 1				200	1341		1 20	12	NL	L	LTG - LVL P6 LOBBY	4			
5	EXISTING LOAD	E		EX 20 1			572	750			1 20	12	NL	LZ	LTG - LVL P6 LOBBY	6			
7	SPARE			EX 20 1				0	720		1 20	EX		E	EXISTING LOAD	10			
11	EXISTING LOAD	E		EX 20 1					460	720	1 20	EX		E	EXISTING LOAD	12			
13	EXISTING LOAD	E		EX 20 1			460	690			1 20	EX		E	EXISTING LOAD	14			
15	EXISTING LOAD	E		EX 20 1				460	460		1 20	EX		E	EXISTING LOAD	16			
17	EXISTING LOAD	E		EX 20 1					460	720	1 20	EX		E	EXISTING LOAD	18			
19	EXISTING LOAD	E		EX 20 1			690	480			1 20	EX		E	EXISTING LOAD	20			
21	EXISTING LOAD	E		EX 20 1				690	690		1 20	EX		E	EXISTING LOAD	22			
23	EXISTING LOAD	E		EX 20 1					540	460	1 20	EX		E	EXISTING LOAD	24			
25	EXISTING LOAD	E		EX 20 1			150	690			1 20	EX		E	EXISTING LOAD	26			
27	EXISTING LOAD	E		EX 20 1				460	460		1 20	EX		E	EXISTING LOAD	28			
29	EXISTING LOAD	E		EX 20 1					690	270	1 20	EX		E	EXISTING LOAD	30			
31	EXISTING LOAD	E		EX 20 1			480	0			1 20				SPARE	32			
33	EXISTING LOAD	E		EX 20 1				720	0		1 20				SPARE	34			
35	EXISTING LOAD	E		EX 20 1					0	0	1 20				SPARE	36			
37	EXISTING LOAD	E		EX 20 1			720	0			1 20				SPARE	38			
39	EXISTING LOAD	E		EX 20 1				690	200		1 20	EX		E	EXISTING LOAD	40			
41	EXISTING LOAD	E		EX 20 1					200	200	1 20	EX		E	EXISTING LOAD	42			
TOTAL LOAD (VA):							6182 VA	7091 VA	6396 VA										
TOTAL AMPS:							52 A	58 A	54 A										
LOAD TYPE										PANELBOARD NOTES									
EXISTING LOAD (E)		16280 VA	100%	16280 VA	EM - EMERG LTG HANDLE-ON CLAMP										OL - REFER TO ONE-LINE DIAGRAM		TOTAL CONNECTED LOAD		19669 VA
COOLING (C)		0 VA	0%	0 VA	NL - REUSE EXISTING CIRCUIT BREAKER												TOTAL NEC LOAD		20391 VA
HEATING (H)		0 VA	100%	0 VA	FOR NEW LOAD ADDED												TOTAL CONNECTED CURRENT		55 A
LIGHTING (L)		2889 VA	125%	3611 VA													TOTAL NEC DEMAND CURRENT		57 A
RECEPTACLES (R)		0 VA	0%	0 VA															
MOTORS (M)		0 VA	100%	0 VA															
SUPPLEMENTAL HEAT (U)		0 VA	100%	0 VA															
MISC EQUIP (Z)		500 VA	100%	500 VA															
REFRIGERATION (F)		0 VA	100%	0 VA															
SIGN/DISPLAY (D)		0 VA	125%	0 VA															
KITCHEN (K)		0 VA	100%	0 VA															
LARGEST MOTOR		0 VA	125%	0 VA															
SHOW WINDOW (W)		0 VA	125%	0 VA															
TRACK LIGHTING		0 VA	100%	0 VA															

Fig.1 Example images detected as drawing.

PANELBOARD: FS1N-2NW7										FED FROM: DP1N-2NW3										EQUIPMENT GROUND BUS									
BUS AMPS: 100A										AIC RATING: FCA +10% MINIMUM FULLY RATED																			
MAIN SIZE/TYPE: MLO										SERVES: CONCESSION/PANTRY																			
VOLTS/PHASE: 208Y/120V, 3PH, 4W										MOUNTING: RECESSED																			
SECTION: 1										LOCATION: PANTRY 02.27E.02																			
CKT NO.	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO.	BKR AMP	P	P	BKR AMP	WIRE NO.	VOLTAMPS/PHASE			DESCRIPTION	CKT NO.														
		A	B	C							A	B	C																
1	PWR-5012	1,269			8	40	2	1	20	12	360			RCPT-5027 (2) A	2														
3	SPARE													RCPT-5025 A	4														
5	SPARE													RCPT-5027 (3) B	6														
7	SPARE													RCPT-5025 B	8														
9	SPARE													RCPT-5042 (2) A	10														
11	RCPT-5006			1,092	12	20	1	1	20	12			1,800	RCPT-5042 (2) B	12														
13	RCPT-5003 (2)	1,920			12	20	1	1	20	12	360			RCPT - 02.27E.02 GEN	14														
15	RCPT-5004		180		12	20	1	1	20					SPARE	16														
17	RCPT-5046 A			1,400	12	20	1	1	20					SPARE	18														
19	RCPT-5046 C	1,400			12	20	1	1	20					SPARE	20														
21	RCPT-5046 A		1,400		12	20	1	1	20					SPARE	22														
23	EQUIPPED SPACE								1	1	20			SPARE	24														
25	EQUIPPED SPACE								1	1				EQUIPPED SPACE	26														
27	EQUIPPED SPACE								1	1				EQUIPPED SPACE	28														
29	EQUIPPED SPACE								1	1				EQUIPPED SPACE	30														
SUBTOTAL		4,589	2,849	2,492							1,500	2,580	2,340	SUBTOTAL															
TOTAL PHASE A - VA		6,089	LOAD		CONN VA		DF		LOAD		CONN VA		DF																
AMPS		51	COOLING				1.00		REFRIG				1.00																
TOTAL PHASE B - VA		5,429	HEATING				0		SIGN/DISP				1.25																
AMPS		45	LIGHTING				1.25		KITCHEN		5,190		0.80																
TOTAL PHASE C - VA		4,832	RECEPTACLES		9,060		1.0/5		EXISTING				1.00																
AMPS		40	MOTORS				1.00		LRG MOTOR				1.25		TOTAL DEMAND														
TOTAL PNLBD - VA		16,350	SUPP HEAT				1.00		SHOW WNDW				1.25		15,312 VA														
AMPS		45	MISC EQUIP		2,100		1.00		LTG TRACK				1.00		43 A														
PANELBOARD NOTES																													

PANELBOARD: FS1N-6NW1										FED FROM: USS-1NW1 VIA TX-FSN-6NW2										EQUIPMENT GROUND BUS									
BUS AMPS: 1000A										AIC RATING: FCA +10% MINIMUM FULLY RATED																			
MAIN SIZE/TYPE: 1000A MCB										SERVES: NW FOOD PORTABLES																			
VOLTS/PHASE: 208Y/120V, 3PH, 4W										MOUNTING: SURFACE																			
SECTION: 1										LOCATION: ELEC 06.27H.02																			
CKT NO	DESCRIPTION	VOLTAMPS/PHASE			WIRE NO	BKR AMP	P	P	BKR AMP	WIRE NO	VOLTAMPS/PHASE			DESCRIPTION	CKT NO														
		A	B	C							A	B	C																
1	6NW F&B CART SPONSORED CONCONOURSE A	5,764			6	60	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE H	2														
3			5,764									2,882			4														
5				5,764									2,882		6														
7	6NW F&B CART SPONSORED CONCONOURSE B	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE I	8														
9			2,882									2,882			10														
11				2,882									2,882		12														
13	6NW F&B CART SPONSORED CONCONOURSE C	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE J	14														
15			2,882									2,882			16														
17				2,882									2,882		18														
19	6NW F&B CART SPONSORED CONCONOURSE D	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE K	20														
21			2,882									2,882			22														
23				2,882									2,882		24														
25	6NW F&B CART SPONSORED CONCONOURSE E	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE L	26														
27			2,882									2,882			28														
29				2,882									2,882		30														
31	6NW F&B CART SPONSORED CONCONOURSE F	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE M	32														
33			2,882									2,882			34														
35				2,882									2,882		36														
37	6NW F&B CART SPONSORED CONCONOURSE G	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE N	38														
39			2,882									2,882			40														
41				2,882									2,882		42														
SECTION: 2																													
43	6NW F&B CART SPONSORED CONCONOURSE O	2,882			10	30	3	3	30	10	2,882			6NW F&B CART SPONSORED CONCONOURSE P	44														
45			2,882									2,882			46														
47				2,882									2,882		48														
49															50														
51	SPARE				-	100	3	3	30	-				SPARE	52														
53															54														
55															56														
57	SPARE				-	60	3	3	30	-				SPARE	58														
59															60														
61	SPARE				-	20	1	1	20	-				SPARE	62														
63	SPARE				-	20	1	1	20	-				SPARE	64														
65	SPARE				-	20	1	1	20	-				SPARE	66														
67	EQUIPPED SPACE								1	1				EQUIPPED SPACE	68														
69	EQUIPPED SPACE								1	1				EQUIPPED SPACE	70														
71	EQUIPPED SPACE								1	1				EQUIPPED SPACE	72														
73	EQUIPPED SPACE								1	1				EQUIPPED SPACE	74														
75	EQUIPPED SPACE								1	1				EQUIPPED SPACE	76														
77	EQUIPPED SPACE								1	1				EQUIPPED SPACE	78														
79	EQUIPPED SPACE								1	1				EQUIPPED SPACE	80														
81	EQUIPPED SPACE								1	1				EQUIPPED SPACE	82														
83	EQUIPPED SPACE								1	1				EQUIPPED SPACE	84														
SUBTOTAL		25,938	25,938	25,938							23,056	23,056	23,056	SUBTOTAL															
TOTAL PHASE A - VA		48,994	LOAD		CONN VA		DF		LOAD		CONN VA		DF																
AMPS		408	COOLING				1.00		REFRIG				1.00																
TOTAL PHASE B - VA		48,994	HEATING				0		SIGN/DISP				1.25																
AMPS		408	LIGHTING				1.25		KITCHEN		146,982		0.65																
TOTAL PHASE C - VA		48,994	RECEPTACLES				1.0, 3		EXISTING				1.00																
AMPS		408	MOTORS				1.00		LRC MOTOR				1.25		TOTAL DEMAND														
TOTAL PNLBD - VA		146,982	SUPP HEAT				1.00		SHOW WNDW				1.25		95,538 VA														
AMPS		408	MISC EQUIP				1.00		LTG TRACK				1.00		265 A														
PANELBOARD NOTES																													
FEED THRU CONNECTION: (3) Sets of 400kcmil																													