VALIANT TMS®
Powered by People

Customer:	**Volvo**
Program:	**P6700**
Commodity:	**Bodysides (17JPH)**
Plant:	**Dublin Virginia**
Job #	**16150**
Date:	**2/9/2022**
Cycle Time:	**212.0**

Operator obtain small parts	How many	1	1.8
Operator load small parts	How many	1	1.8
Operator place small part (no precision)	How many	1	0.5
Operator obtain medium parts	How many	1	2.4
Operator load medium parts	How many	1	3.0
Operator place medium part (no precision)	How many	1	1.0
Operator obtain large parts	How many	1	4.2
Operator load large parts	How many	1	4.2
Operator place large part (no precision)	How many	1	1.8
Operator total walk	Total in feet	7	2.1
Operator hit P.B.			0.0
Operator Load Assist- load/unload part to fixt or rack(includes lwr, open/close clp and raise)	# of loads /unloads	1	12.5
Operator walk with load assist	Total in feet	4	2.0
Fixture - Clamp/Gripper close	# of close		0.0
Fixture - Clamp /Gripper open	# of open		0.0
Fixture - Suction Cup vacuum on	# of vacuum on		0.0
Fixture - Suction Cup vacuum off	# of vacuum off		0.0
Fixture - Manual Clamp close	# of close		0.0
Fixture - Manual Clamp open	# of open		0.0
Fixture - Shot pin extend	# of extends		0.0
Fixture - Shot pin retract	# of retracts		0.0
Fixture - Slide extend	# of extends		0.0
Fixture - Slide retract	# of retracts		0.0
Fixture - Pivot close	# of close		0.0
Fixture - Pivot open	# of open		0.0
Fixture - Trunnion rotates 180	# of rotates		0.0
Fixture - Turn Table rotates 180	# of rotates		0.0
Robot pick part	# of picks	0	0.00
Robot rotate 45	# of rotates		0.0
Robot rotate 90	# of rotates		0.0
Robot rotate 180	# of rotates	1	3.0
Robot rotate 270	# of rotates		0.0
Robot place part	# of places	0	0.0
Robot moves on 7th axis	Distance (# foot)		0.0
Robot rotate to home	# of rotates		0.0
Robot delay	# of delays		0.0
Robot date scribe	# of date scribe	1	6.0
Robot check tree (nuts & studs)	# of check positions		0.0
Robot changes EOAT (drop 1 and pick 1)	# of changes		0.0
Weld robot in			0.0
Weld robot welds (GEO)	# of welds -GEO-	1	4.0
Weld robot welds (Respot)	# of welds -Respot-	1	3.5
Weld robot out			0.0
Mig robot in			0.0
Mig robot weld	# of welds		0.0
Mig robot weld	Weld Length (mm)		0.0
Mig robot out			0.0
Laser brazing robot in			0.0
Seam detection at start of process	Weld Length (mm)		0.0
Laser brazing robot welds	Weld Length (mm)		0.0
Laser brazing robot out			0.0
Adh/Seal robot in		1	1.5
Adh/Seal robot	# of Beads	2	2.5
Adh/Seal robot	Adh/Seal Length (mm)	650	2.2
Adh/Seal robot out		1	1.5
Proj/clinch nut/stud Weld robot in		1	1.5

Proj/clinch nut/stud Weld robot welds	# of welds	1	5.5
Proj/clinch nut/stud Weld robot out			0.0
DA studs Weld robot in		1	1.5
DA studs Weld robot welds	# of DA welds	1	3.5
DA studs Weld robot out		1	1.5
FDS robot in			0.0
FDS robot Screws	# of screws		0.0
FDS robot out			0.0
SPR robot in			0.0
SPR robot Rivets	# of Rivets		0.0
SPR robot out			0.0
Manual Weld - Operator obtains weld gun (medium)			0.0
Manual Weld - Operator obtains weld gun (large)			0.0
Manual Weld - Operator repositions weld gun (<6")			0.0
Manual Weld - Operator repositions weld gun (>6",<24")			0.0
Manual Weld - Operator repositions weld gun (>24")			0.0
Manual Weld - Operator repositions weld gun through access hole			0.0
Manual Weld - Operator rotates weld gun			0.0
Manual Weld - Operator returns weld gun to hook			0.0
Manual Weld - Operator releases weld gun			0.0
Manual Weld - Operator welds - 1st in a group or only (simple)			0.0
Manual Weld - Operator welds - each additional weld (simple)			0.0
Manual Weld - Operator welds - 1st in a group or only (complex)			0.0
Manual Weld - Operator welds - each additional weld (complex)			0.0
Manual Weld - Operator welds - 1st in a group or only (heavy gauge)			0.0
Manual Weld - Operator welds - each additional weld (heavy gauge)			0.0
		TOTAL ESTIMATED TIME	**74.97**
		TOTAL AVAILABLE TIME	212.00
		DIFFERENCE	**137.03**

Geo welds =	4.00	secs. Per weld
Respot welds =	3.50	secs. Per weld

MIG welds =	25	inches per min.

Laser brazing =	130	inches per min.
Note: Range of **95 inches/min** to max speed of **173 inches/min.** To achieve higher speeds 6 KW power unit needs to be used. **130 inches/min is an average.**		

Adhesive/Seal =	300	mm per sec.

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

115.20

TOOL DESCRIPTION:

STA 010 OPER LOAD (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME		
							WORK	WAIT	% UTIL.
	7.4	16.98	212.00	96.80	2.43	N/A	113.40	98.60	53.49

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154 165 176 187 198
1	V01GL1UQ52-A Fixture moves into station			13.5	13.5	
2	**OPER 1**					
3	Oper 1 walks into fixture		4	1.20	14.70	
4	**Oper 1 loads (9601)**			3.00	17.70	
5	**Oper 1 loads (9597)**			3.00	20.70	
6	Oper 1 walks to dunnage		7	2.10	22.80	
7	Oper 1 gets (9605)			2.40	25.20	
8	Oper 1 walks to fixture		7	2.10	27.30	
9	**Oper 1 loads (9605)**			3.00	30.30	
10	Oper 1 walks to staging table		6	1.80	32.10	
11	Oper 1 gets (9596 ASM)			2.00	34.10	
12	Oper 1 gets (9607 ASM)			2.00	36.10	
13	Oper 1 walks to fixture		7	2.10	38.20	
14	**Oper 1 loads (9596 ASM)**			3.00	41.20	
15	**Oper 1 loads (9607 ASM)**			3.00	44.20	
16	Oper 1 walks to load assist		7	2.10	46.30	
17	Oper 1 obtains assist			1.20	47.50	
18	Oper 1 gets (2136)			12.50	60.00	
19	Oper 1 walks to fixture		7	3.50	63.50	
20	**Oper 1 loads (2136)**			12.50	76.00	
1	Oper walks to palm buttons		4	2.00	78.00	
2	Oper presses palm buttons			1.00	79.00	
3	Oper dispose of assist			1.80	80.80	
4	Oper presses palm button			1.00	81.80	
5	010-GEO Pin Retracts	UQ2.1		1.00	80.00	
1	**OPER 2**					
2	Oper 2 walks into fixture		4	1.20	14.70	
3	**Oper 2 loads (1088)**			3.00	17.70	
4	**Oper 2 loads (2138)**			3.00	20.70	
5	Oper 2 walks to dunnage		7	2.10	22.80	
6	Oper 2 gets C-PILLAR			4.20	27.00	
7	Oper 2 walks to fixture		7	2.10	29.10	
8	**Oper 2 loads C-PILLAR**			4.20	33.30	

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

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115.20

Operator
Machine
Robot
Operator Wait

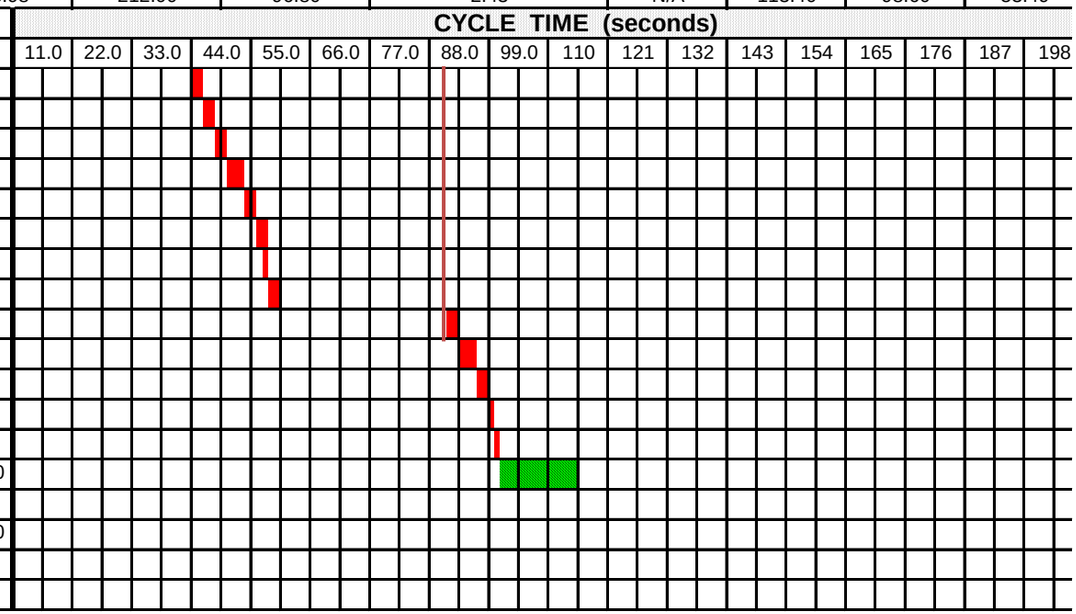
Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

TOOL DESCRIPTION:

STA 010 OPER LOAD (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.
7.4	16.98	212.00	96.80	2.43	N/A	113.40	98.60	53.49

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
9	Oper 1 walks to dunnage		7	2.10	35.40
10	Oper 1 gets (HEADER)			2.40	37.80
11	Oper 1 walks to fixture		7	2.10	39.90
12	**Oper 1 loads (HEADER)**			3.00	42.90
13	Oper 2 walks to dunnage		7	2.10	45.00
14	Oper 2 gets (7213)			1.80	46.80
15	Oper 2 walks to next dunnage		3	0.90	47.70
16	Oper 2 gets (9606)			1.80	49.50
17	Oper 2 walks to fixture		7	2.10	82.90
18	**Oper 2 loads (9606)**			2.40	85.30
19	**Oper 2 loads (7213)**			2.40	87.70
20	Oper walks to palm button		4	1.20	88.90
21	Oper presses palm button			1.00	89.90
22	V01GL1UQ52-A Fixture moves out of station			15.00	104.90
	Total Cycle Time				104.90
	Estimated Walk Total				
	Jobs Per Hour				34.32



MACHINE TIME
1.00

209	220

MACHINE TIME
1.00

209	220

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Vo
P6
Bodyside
Dublin

0.00

TOOL DESCRIPTION:

STA 010 GEO LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPE WORK
	7.4	16.98	212.00	212.00	N/A	472.14	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154
1	Logic Delay			1.25	1.25	
2	**L320 SPECIFIC GEO FIXTURE TRANFER**					
3	V01GL1UQ52-A Loaded Fixture moves up to transfer			3.00	4.25	
4	V01GL1UQ52-A Loaded Fixture transfer to weld pos			9.00	13.25	
5	V01GL1UQ52-A Loaded Fixture moves down at weld station			3.00	16.25	
6	V01GL1UQ52-B Fixture moves up to transfer			3.00	16.25	
7	V01GL1UQ52-B Fixture moves from stand-by pos to load pos			7.50	23.75	
8	V01GL1UQ52-B Fixture moves down at loading station			3.00	26.75	
9	DELAY FROM STA 010 OPER FIXTURE B LOAD (L320)			76.40	103.15	
10	010-GEO Clamps Close	UQ11.2,		1.50	104.65	
11	**ROBOT GEO WELD**					
12	Robot V01AR21 moves in and welds (18) spots C-Gun			64.97	81.22	
13	Robot V01AR21 clears to drop C-Gun			2.37	83.59	
14	C-Gun Drop Delay			2.00	85.59	
15	Robot V01AR21 clears Gun Stand 1			1.40	86.99	
16	Robot V01AR21 moves to Gun Stand 2			2.13	89.12	
17	Robot V01AR21 moves in to pick X-Gun			2.64	91.76	
18	X-Gun Pick Delay			2.00	93.76	
19	Robot V01AR21 clears gun change to weld			1.99	95.75	
20	Robot V01AR21 welds (2) spots X-Gun			12.65	108.40	
21	010-GEO Respot Clamps Open	UQ13.2,		1.15	109.55	
22	010-GEO Pin Retracts	UQ7.1		1.15	109.55	
23	Robot V01AR21 welds (1) spot X-Gun			7.05	116.60	
24	Robot V01AR21 clears to Tip Dress X-Gun			2.50	119.10	
25	Average Tip Dress X-Gun every 17th body			0.50	119.60	
26	Robot V01AR21 clears to drop X-Gun			2.15	121.75	
27	X-Gun Drop Delay			2.00	123.75	
28	Robot V01AR21 clears Gun Stand 2			1.73	125.48	
29	Robot V01AR21 moves to Gun Stand 1			2.13	127.61	
30	Robot V01AR21 moves to pick C-Gun			2.01	129.62	
31	C-Gun Pick Delay			2.00	131.62	
32	Robot V01AR21 clears Gun Stand 1			1.80	133.42	
33	Robot V01AR21 moves to In Air Weld			8.27	141.69	
1	Robot V01AR22 moves in and welds (6) spots C-Gun			25.99	42.24	

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
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Operator
Machine
Robot
Operator Wait

Vo
P6
Bodyside
Dublin

0.00

TOOL DESCRIPTION:

STA 010 GEO LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPE WORK
	7.4	16.98	212.00	212.00	N/A	472.14	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110	121	132	143	154
2	Robot V01AR22 clears to drop C-Gun			6.91	49.15														
3	Robot V01AR22 moves to Gun Stand 1			2.08	51.23														
4	C-Gun Drop Delay			2.00	53.23														
5	Robot V01AR22 clears Gun Stand 1			1.68	54.91														
6	Robot V01AR22 moves to Gun Stand 2			2.18	57.09														
7	X-Gun Pick Delay			2.00	59.09														
8	Robot V01AR22 clears Gun Stand 2			2.11	61.20														
9	Robot V01AR22 moves to weld X-Gun			8.35	69.55														
10	Robot V01AR22 welds (4) spots X-Gun			25.02	94.57														
11	Robot V01AR22 clears to Tip Dress X-Gun			2.50	97.07														
12	Average Tip Dress X-Gun every 13th body			0.70	97.77														
13	Robot V01AR22 clears to gun stand 2			7.77	105.54														
14	Robot V01AR22 moves to drop X-Gun			2.78	108.32														
15	X-Gun Drop Delay			2.00	110.32														
16	Robot V01AR22 clears gun stand 2			1.61	111.93														
17	Robot V01AR22 moves to gun stand 1			2.61	114.54														
18	C-Gun Pick Delay			2.00	116.54														
19	Robot V01AR22 clears gun stand 1			1.85	118.39														
20	Robot V01AR22 moves to In Air Weld			7.54	125.93														
21																			
22	Robot V01AR23 welds (14) spots C-Gun			54.13	70.38														
23	Robot V01AR23 clears to Tip Dresser			1.43	71.81														
24	Average Tip Dress every 4th body			2.14	73.95														
25	Robot V01AR23 clears to gun stand 1			1.02	74.97														
26	Robot V01AR23 moves to drop C-Gun			2.40	77.37														
27	C-Gun Drop Delay			2.00	79.37														
28	Robot V01AR23 moves to gun stand 2			1.70	81.07														
29	Robot V01AR23 moves to pick X-Gun			2.23	83.30														
30	X-Gun Pick Delay			2.00	85.30														
31	Robot V01AR23 moves to weld			3.42	88.72														
32	Robot V01AR23 welds (12) spots X-Gun			42.94	131.66														
33	010-GEO Respot Clamp Open			1.15	132.81														
34	Robot V01AR23 welds (2) spots X-Gun			10.06	142.87														
35	010-GEO Clamps Open	UQ11.2,		2.50	145.37														
36	010-GEO Pins Retract	UQ1.2,		2.50	145.37														

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

0.00

Vo
P6
Bodyside
Dublin

TOOL DESCRIPTION:

STA 010 GEO LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPE WORK
	7.4	16.98	212.00	212.00	N/A	472.14	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN	CYCLE TIME (seconds)
				SEC	SEC	11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154
37	010-GEO Pins Extend	UQ2.1		2.50	145.37	
38	Robot V01AR11 (020-R05) moves to pick asm from 010-GEO			4.84	150.21	
39	Robot V01AR11 (020-R05) EOAT Clamps Close			1.50	151.71	
40	Robot V01AR11 (020-R05) moves to In Air Weld			4.21	155.92	
41	010-GEO Clamps Open	UQ13.2		1.50	155.92	
42	010-GEO Pins Extend	UQ1.2,		1.50	155.92	
43	Robot V01AR11 (020-R05) return to home			4.72	204.98	
44						
45	**FIXTURE RETURN**					
46	V01GL1UQ52-A Unloaded Fixture moves up to transfer			3.00	158.92	
47	V01GL1UQ52-A Fixture transfer to stand-by pos (RB3)			4.50	163.42	
48	V01GL1UQ52-A Loaded Fixture moves down stand-by pos (RB3)			3.00	166.42	
49						
50	**ROBOT IN AIR WELD**					
51	Robot V01AR21 moves in and welds (16) spots C-Gun			37.51	193.43	
52	Robot V01AR21 moves to Tip Dress C-Gun			1.00	194.43	
53	Average Tip Dress C-Gun every 2nd body			4.39	198.82	
54						
55	Robot V01AR22 moves in and welds (1) spot C-Gun			8.14	164.06	
56	Robot V01AR22 welds (6) spots C-Gun			17.42	194.66	
57	Robot V01AR22 moves to Tip Dresser			0.90	195.56	
58	Average Tip Dress every 4th body			0.92	196.48	
59						
60	Robot V01AR23 moves in and welds (7) spots X-Gun			21.32	177.24	
61	Robot V01AR23 welds (8) spots X-Gun			23.02	200.26	
62	Robot V01AR23 clears to Tip Dress X-Gun			1.00	201.26	
63	Average Tip Dress X-Gun every 2nd body			4.35	205.61	
64	Robot V01AR23 moves to gun stand 1			3.99	209.60	
65	X-Gun Drop Delay			2.00	211.60	
66	Robot V01AR23 moves to gun stand 2			0.40	212.00	
67	**Wrapped Timing**			1.11	1.11	
68	Robot V01AR23 moves to pick C-Gun			2.73	3.84	
69	C-Gun Pick Delay			2.00	5.84	
70	Robot V01AR23 clears gun stand 2			2.28	8.12	
71	Robot V01AR23 rth			1.45	9.57	

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
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Operator
Machine
Robot
Operator Wait

Vo
P6
Bodyside
Dublin

0.00

TOOL DESCRIPTION:	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPE WORK
STA 010 GEO LH (L320)	7.4	16.98	212.00	212.00	N/A	472.14	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110	121	132	143	154
	RCS Timing																		
	Total Cycle Time				212.00														
	Estimated Walk Total																		
	Jobs Per Hour				16.98														

olvo

700

es (17JPH)

Virginia

RATOR TIME		MACHINE
WAIT	% UTIL.	TIME
N/A	N/A	92.95

165	176	187	198	209	220

olvo

700

es (17JPH)

Virginia

RATOR TIME		MACHINE
WAIT	% UTIL.	TIME
N/A	N/A	92.95

165	176	187	198	209	220

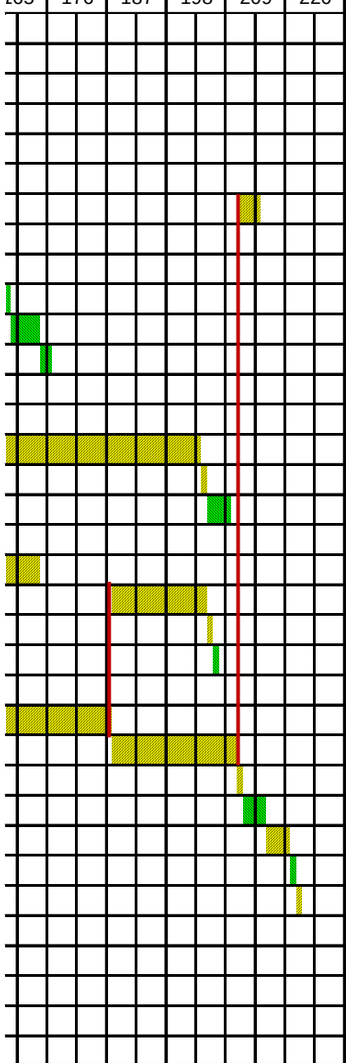
olvo

700

es (17JPH)

Virginia

RATOR TIME		MACHINE
WAIT	% UTIL.	TIME
N/A	N/A	92.95



olvo

700

es (17JPH)

Virginia

RATOR TIME		MACHINE
WAIT	% UTIL.	TIME
N/A	N/A	92.95

165	176	187	198	209	220

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
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190.30

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

TOOL DESCRIPTION:

STA 020 OPER LOAD (L320)

Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.
7.4	16.98	212.00	21.70	0.90	N/A	38.20	173.80	18.02

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154 165 176 187 19
1	020-GEO Tooling Open in load pos					
2	**OPER 1 LOAD**					
3	Op 1 walks into fixture w/part		4	1.20	1.20	
4	**Op1 loads B-Pillar (78525346)**			4.20	5.40	
5	Op1 walks to staging table		5	1.50	6.90	
6	Op1 obtains Window Blind Mnt (78549599)			1.80	8.70	
7	Op1 walks to fixture		5	1.50	10.20	
8	**Op1 loads Window Blind Mnt (78549599)**			1.80	12.00	
9	Op1 walks out of fixure		4	1.20	13.20	
10	Op1 obtains B-Pillar (78525346)			1.80	15.00	
11	Op1 walks to staging table		5	1.50	16.50	
12	**OPER 2 LOAD**					
13	Op2 walks into fixture w/parts		4	1.20	1.20	
14	**Op2 loads A-Pillar Inner (78522132)**			3.00	4.20	
15	**Op2 loads Header Inner (78577511)**			3.00	7.20	
16	Op2 walks to dunnage		7	2.10	9.30	
17	Op2 obtains Header Inner Mid (78565102)			4.20	13.50	
18	Op2 walks to fixture			1.80	15.30	
19	**Op2 loads Header Inner Mid (78565102)**			4.20	19.50	
20	Op2 walks tp palm button		4	1.20	20.70	
21	Op1&2 presse palm button			1.00	21.70	
22	020-GEO Tooling Close index out of station (REF)			11.00	32.70	
	Total Cycle Time				32.70	
	Estimated Walk Total					
	Jobs Per Hour				110.09	

	MACHINE TIME	
	N/A	
8	209	220

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

0.00

TOOL DESCRIPTION:

STA 020 MH & GEO (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME		
							WORK	WAIT	% UTIL.
	7.4	16.98	212.00	212.00	N/A	261.60	21.70	190.30	10.24

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154 165 176 187 19
1	Logic Delay			1.25	1.25	
2	**FIXTURE TRANSFER**					
3	Delay from STA 020 OPER LOAD			21.70	22.95	
4	020-GEO Clamps Close	UQ10.2,		3.00	25.95	
5	020-GEO Pins Extend	UQ4.3,		3.00	25.95	
6	020-GEO Dump Close	UQ31.1		2.00	25.95	
7	V01GL2UQ51 GEO Slide indexs into STA 020			11.00	36.95	
8	020-GEO Dump Open	UQ31.1		2.00	38.95	
9	**ROBOT WELD**					
10	Robot V01AR24 moves to weld 020-GEO			0.20	26.15	
11	Robot V01AR24 welds 3 spots			9.56	46.51	
12	Robot V01AR24 welds 8 spots			23.65	70.16	
13	Robot V01AR24 welds 22 spots			52.47	122.63	
14	Robot V01AR24 welds 4 spots and clears			10.44	133.07	
15	020-GEO Respot Clamps Open (REF)	UQ15.1,		2.00	135.35	
16	Robot V01AR24 moves in and welds 2 spots			5.37	140.72	
17	Robot V01AR24 clears to Tip Dresser			2.50	143.22	
18	Average Tip Dress every 2nd Body			5.00	148.22	
19	Robot V01AR24 return to home			2.37	150.59	
1	Robot V01AR25 moves from home			1.52	27.47	
2	Robot V01AR25 moves to weld 020-GEO			0.02	36.97	
3	Robot V01AR25 welds 9 spots			25.60	72.11	
4	Robot V01AR25 welds 14 spots			35.61	107.72	
5	Robot V01AR25 welds 3 spots			10.72	133.35	
6	020-GEO Respot Clamps Open (REF)	UQ15.1,		2.00	135.35	
7	Robot V01AR25 welds 1 spot (RCS)			5.79	141.14	
8	Robot V01AR25 clears to Tip Dresser			2.50	143.64	
9	Average Tip Dress every 2nd body			5.00	148.64	
10	Robot V01AR25 return to home			1.74	150.38	
11	V01GL2UQ51 GEO Slide index out of STA 020			11.00	154.64	
12	**ROBOT UNLOAD TO STA 040**					
13	Robot V01AR11 moves to pick from 020-GEO			4.60	148.24	
14	Robot V01AR11UQ41 Clamps Close			2.00	150.24	
15	020-GEO Clamps Open	UQ10.2,		2.00	152.24	

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

0.00

TOOL DESCRIPTION:

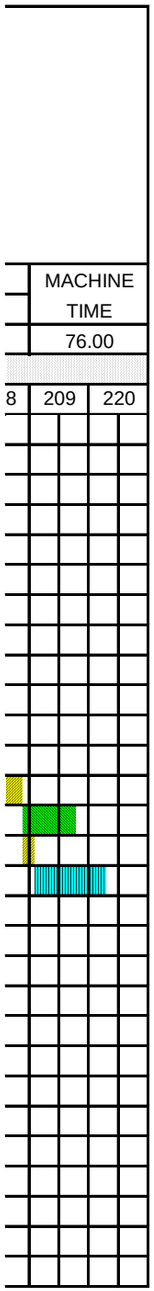
STA 020 MH & GEO (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME		
							WORK	WAIT	% UTIL.
	7.4	16.98	212.00	212.00	N/A	261.60	21.70	190.30	10.24

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110	121	132	143	154	165	176	187	19
16	020-GEO Pins Retract	UQ4.3,		2.00	152.24																		
17	Robot V01AR11 clears to unload to STA 040			5.10	157.34																		
18	Robot V01AR11 moves to drop asm (Bodyside Inner)			0.05	157.39																		
19	Robot V01AR11 moves in and drops asm to STA 040			6.41	163.80																		
20	040-GEO Clamps Close			3.00	166.80																		
21	Robot V01AR11UQ41 Clamps Open			2.00	168.80																		
22	Robot V01AR11 clears from drop			5.76	174.56																		
23	**ROBOT MH (STA 010 IN AIR WELD)**																						
24	Robot V01AR11 moves to STA 010 In-Air Weld			7.48	182.04																		
25	Robot V01AR11 moves to pick from STA 010-GEO			4.72	186.76																		
26	Robot V01AR11UQ41 Clamps Close			2.00	188.76																		
27	010-GEO Clamps Open			3.00	191.76																		
28	Robot V01AR11 clears from pick			4.60	196.36																		
29	(V01GL1UQ52-A indexes out of STA 010 weld pos)			10.50	206.86																		
30	Robot V01AR11 moves to In-Air weld pos			2.59	198.95																		
31	Delay In-Air Weld Process from STA 010 GEO LH			13.05	212.00																		
32	**Wrapped Timing**			31.82	31.82																		
33	Robot V01AR11 clears from In-Air weld			5.39	37.21																		
34	**ROBOT UNLOAD TO STA 030**																						
35	Robot V01AR11 moves to to STA 030			2.66	39.87																		
36	Robot V01AR11 moves to drop asm (Bodyside Outer)			4.67	44.54																		
37	030-GEO Clamps Close			1.50	46.04																		
38	Robot V01AR11UQ41 Clamps Open			2.00	48.04																		
39	Robot V01AR11 clears from drop			7.74	55.78																		
40	Robot V01AR11 return to home			9.77	65.55																		
	Total Cycle Time				212.00																		
	Estimated Walk Total																						
	Jobs Per Hour				16.98																		

	MACHINE TIME
	76.00

8	209	220	


MACHINE
TIME
76.00
8
209
220

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

42.77

TOOL DESCRIPTION:

STA 030 RESPOT LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME		
							WORK	WAIT	%
	7.4	16.98	212.00	169.23	N/A	162.98	N/A	N/A	

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0	22.0	33.0	44.0	55.0	66.0	77.0	88.0	99.0	110	121	132	143	154	165	176	18
1	**030 RESPOT**																					
2	Logic Delay			1.25	1.25																	
3	Robot V01AR11 drop delay			11.00	12.25																	
4	030-RS Clamps Close	UQ5.2,		1.50	13.75																	
5	Robot V01AR26 moves in, welds 50 spots, and clears			142.97	156.72																	
	Robot V01AR26 moves to Tip Dresser			2.50	159.22																	
	Average Tip Dress every body			10.00	169.22																	
	Robot V01AR26 return to home			2.50	171.72																	
	RCS Timing																					
	Total Cycle Time				171.72																	
	Estimated Walk Total																					
	Jobs Per Hour				20.96																	

		MACHINE
% UTIL.		TIME
N/A		10.25
7	198	209	220

Man and Machine Motions
PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

0.00

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

TOOL DESCRIPTION:

STA 40 MARRIAGE LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTI
	7.4	16.98	212.00	212.00	N/A	304.71	19.10	192.90	9.01

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC
1	Logic Delay			1.25	1.25
2	**ROBOT SEALER**				
3	Robot V01AR31 moves to pounce STA 030			1.67	2.92
4	Robot V01AR31 moves to pick			3.27	6.19
5	Robot V01AR31UQ41 Clamps Close			1.50	7.69
6	030-RS Clamps Open			1.00	8.69
7	Robot V01AR31 clears from STA 030 pick			3.27	11.96
8	Robot V01AR31 moves to PED 040-PA1			2.90	14.86
9	Robot V01AR31XQ41 Adh Apply 650mm			15.69	30.55
10	Robot V01AR31 clears to Pass Table			4.19	34.74
11	Robot V01AR31 drops to Pass Table			4.11	38.85
12	Robot V01AR31UQ41 Clamps Open			1.00	39.85
13	Robot V01AR31 clears from Pass Table			3.44	43.29
14	**ROBOT UNLOAD STA 040**				
15	Robot V01AR31 moves to STA 040-GEO			5.95	49.24
16	Robot V01AR31 moves to pick BS Asm			3.68	52.92
17	Robot V01AR31UQ41 Clamps Close			1.50	54.42
18	040-GEO Clamps Open			1.00	55.42
19	Robot V01AR31 clears from pick			3.77	59.19
20	**ROBOT LOAD STA 050**				
21	Robot V01AR31 moves to pounce 050-RS			3.94	63.13
22	Robot V01AR31 moves to drop			3.99	67.12
23	050-RS Clamps Close			1.50	68.62
24	Robot V01AR31UQ41 Clamps Open			1.00	69.62
25	Robot V01AR31 clears from drop			4.02	73.64
26	**ROBOT LOAD STA 040**				
27	Robot V01AR31 moves to Pass Table			5.52	79.16
28	Robot V01AR31 moves to pick			4.11	83.27
29	Robot V01AR31UQ41 Clamps Close			1.50	84.77
30	Robot V01AR31 clears from pick			3.44	88.21
31	Robot V01AR31 moves to 040-GEO			5.95	94.16
32	Robot V01AR31 moves to drop			3.68	97.84
33	040-GEO Clamps Close			1.50	99.34
34	Robot V01AR31UQ41 Clamps Open			1.00	100.34
35	Robot V01AR31 clears from drop			3.77	104.11
36	Robot V01AR31 return to home			7.67	111.78
37	**ROBOT WELD**				
38	Robot V01AR29 moves in and welds (13) spots			41.21	140.55
39	Robot V01AR29 welds (3) spots			12.19	152.74

Man and Machine Motions
PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

0.00

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

TOOL DESCRIPTION:

STA 40 MARRIAGE LH (L320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME		
							WORK	WAIT	% UTI
	7.4	16.98	212.00	212.00	N/A	304.71	19.10	192.90	9.01

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN	CYCLE TIME (seconds)
				SEC	SEC	12.5 25.0 37.5 50.0 62.5 75.0 87.5 100 113 125 138 150 163 175 188 200 213
40	Robot V01AR29 welds (9) spots			32.37	185.11	
41	040-GEO Respot Clamps Open	UQ43.1		1.50	186.61	
42	Robot V01AR29 moves to Tip Dresser			2.00	188.61	
43	Average Tip Dress every 2nd body			5.00	193.61	
44	Robot V01AR29 return to home			2.00	195.61	
1	(Robot V01AR28 with C-Gun)					
2	Robot V01AR28 moves in and welds (13) spots			42.10	141.44	
3	Robot V01AR28 welds (5) spots			13.61	155.05	
4	Robot V01AR28 welds (7) spots			20.69	175.74	
5	040-GEO Respot Clamps Open (REF)			1.50	186.61	
	Robot V01AR28 welds (2) respots			8.02	194.63	
	Robot V01AR28 moves to Tip Dresser			2.00	196.63	
	Average Tip Dress every 2nd body			5.00	201.63	
	Robot V01AR28 moves to drop C-Gun			3.07	204.70	
	C-Gun Drop Delay			1.50	206.20	
	Robot V01AR28 clears gun changer			1.67	207.87	
	Robot V01AR28 moves to pick X-Gun			2.08	209.95	
	X-Gun Pick Delay			1.50	211.45	
	Robot V01AR28 clears gun changer			0.55	212.00	
	Wrapped Timing			0.81	0.81	
	Robot V01AR28 moves and welds (5) spots			22.31	23.12	
	Robot V01AR28 clears to gun Tip Dresser			2.00	25.12	
	Average Tip Dress every 11th body			1.00	26.12	
	Robot V01AR28 clears to gun changer			2.18	28.30	
	Robot V01AR28 moves to drop X-Gun			1.84	30.14	
	X-Gun Drop Delay			1.50	31.64	
	Robot V01AR28 clears gun changer			1.77	33.41	
	Robot V01AR28 moves to pick C-Gun			1.72	35.13	
	C-Gun Pick Delay			1.50	36.63	
	Robot V01AR28 clears gun changer			1.46	38.09	
	Robot V01Ar28 moves to weld			4.13	42.22	
	RCS Timing					
	Total Cycle Time				212.00	
	Estimated Walk Total		0			
	Jobs Per Hour		72		16.98	

	MACHINE TIME
L.	
	29.75

225	238	250

	MACHINE TIME
L.	
	29.75

225	238	250

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

22.68

TOOL DESCRIPTION:

STA 50 RESPOT LH (320)

	Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME WORK	OPERATOR TIME WAIT	OPERATOR TIME % UTIL.
	7.4	16.98	212.00	189.32	N/A	342.90	N/A	N/A	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.		RUN SEC	CYCLE TIME (seconds) 11.0 22.0 33.0 44.0 55.0 66.0 77.0 88.0 99.0 110 121 132 143 154 165 176 187 198
1	Logic Delay			1.25	1.25	
2	Robot V01AR31 loads bodyside to respot fixture			12.00	13.25	
	Pin Extend	UQ16.1		1.50	14.75	
3	Clamps Close	UQ3.2,		1.50	14.75	
1	Robot V01AR211 moves to weld position			1.50	16.25	
2	Robot V01AR211 welds in respot fixture @ 2.6			154.33	170.58	
3	Robot V01AR211 clears			1.50	172.08	
1	Robot V01AR212 moves to weld position			1.50	16.25	
2	Robot V01AR212 welds in respot fixture @ 2.6			158.57	174.82	
3	Robot V01AR212 clears			1.50	176.32	
1	Pin Retracts	UQ16.1		1.00	177.32	
2	Clamps Open	UQ3.2,		1.00	177.32	
1	Robot 050-R05 unloads bodyside complete from			12.00	189.32	
1	*RCS Timing*					
	Total Cycle Time				189.32	
	Estimated Walk Total		0			
	Jobs Per Hour				19.02	

MACHINE TIME
4.75

209	220

Man and Machine Motions

PRELIMINARY TIMING ESTIMATES

VALIANT TMS
Powered by People

Operator
Machine
Robot
Operator Wait

Volvo
P6700
Bodysides (17JPH)
Dublin Virginia

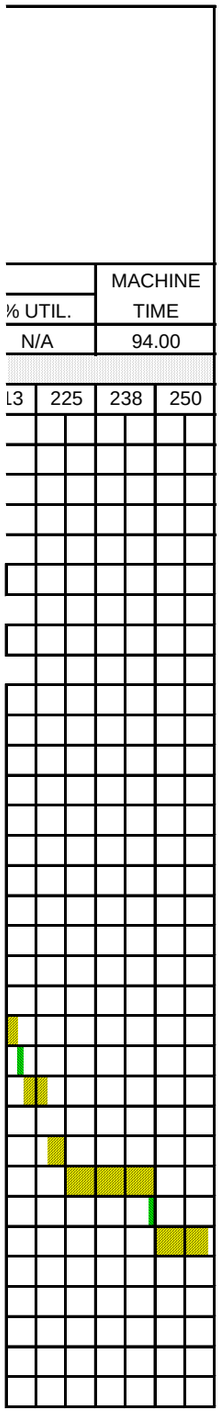
6.00

TOOL DESCRIPTION:

STA 50 STUD AND VISION (L320)

				Hours /Shift	REQUIRED JPH	TOTAL TIME AVAILABLE	TOTAL TIME UTILIZED	TOTAL MILES WALKED APPROX. 8 HR SHIFT	ROBOT TIME	OPERATOR TIME	
										WORK	WAIT
				7.4	16.98	212.00	206.00	N/A	112.00	N/A	N/A

step #	STATION DESCRIPTION	Cyl. Num.	WALK DIST.	SEC	RUN SEC	CYCLE TIME (seconds) 12.5	25.0	37.5	50.0	62.5	75.0	87.5	100.0	112.5	125	138	150	163	175	188	200	21
	Logic Delay			1.25	1.25																	
	DATE SCRIBE																					
1	Robot V01AR212 moves to pick BS LH Asm			4.31	5.56																	
2	Robot V01AR212XQ11 Clamps Close			1.50	7.06																	
3	V01UQ53 050-RS Clamp Open			1.00	8.06																	
4	Robot V01AR212 clears from pick			4.16	12.22																	
5	Robot V01AR212 rotates to Date Scribe			6.70	18.92																	
6	V01PF1 Date Scribe Clamp Close			1.50	20.42																	
7	Date Scribe Delay			5.00	25.42																	
8	V01PF1 Date Scribe Clamp Open			1.00	26.42																	
9	Robot V01AR212 clears from Date Scribe			3.41	29.83																	
	ROBOT STUD WELD																					
10	Robot V01AR212 moves and welds (5) studs			40.87	70.70																	
11	Robot V01AR212 moves and welds (1) studs			10.24	80.94																	
12	Robot V01AR212 clears to V01UQ54 Vision Check			9.60	90.54																	
	VISION CHECK																					
13	Robot V01AR212 drops BS LH Asm to Vision Check			8.23	98.77																	
	V01UQ54 060-VC Clamps Close			1.50	100.27																	
	Robot V01AR212 clears Vision Check			5.93	106.20																	
	060-VC Vision Check Delay			94.00	200.20																	
	Robot V01AR212 moves in to pick			8.23	208.43																	
	V01UQ54 060-VC Clamps Open			1.00	209.43																	
	Robot V01AR212 clears to V01UQ54 Vision Check			6.05	215.48																	
	ROBOT UNLOIAD																					
	Robot V01AR212 moves to drop to Conveyor			2.69	218.17																	
	Robot V01AR212 drops to Conveyor V01GL11			19.93	238.10																	
	Robot V01AR212XQ11 Clamps Open			1.00	238.10																	
	Robot V01AR212 return to home			10.38	248.48																	
	Total Cycle Time				100.27																	
	Estimated Walk Total		0																			
	Jobs Per Hour				35.90																	


MACHINE
% UTIL.
TIME
N/A
94.00
13
225
238
250

VALIANT TMS
Powered by People

Robot / Operator Utilization Matrix

Customer: Volvo

Program: P6700

Commodity: Bodyside (17 JPH)

Over Cycle

Station #	Robot / Operator #	System Cycle Time	Proposed Cycle Time	Utilization
10	Oper 1,2,3 & 4	211.76	74.20	35.04%
10	10R1	211.76	206.50	97.52%
10	10R2	211.76	206.50	97.52%
10	10R3	211.76	206.50	97.52%
10	10R5	211.76	112.50	53.13%
20	Oper 5	211.76	78.90	37.26%
20	20R1	211.76	208.00	98.22%
20	20R5	211.76	153.50	72.49%
30	30R1	211.76	162.00	76.50%
30	30R2	211.76	162.00	76.50%
30	30R3	211.76	47.53	22.45%
40	40R1	211.76	210.00	99.17%
40	40R2	211.76	210.00	99.17%
40	40R4	211.76	93.50	44.15%
50	50R1	211.76	190.00	89.72%
50	50R2	211.76	190.00	89.72%
50	50R3	211.76	61.00	28.81%
60	60R1	211.76	179.00	84.53%
70	70R1	211.76	54.00	25.50%
		211.76	0.00	0.00%

	Robot Material Handling	Secs
1	Logic delay	1.0
2	Rotates approx. 45 degrees to	3.0
3	Rotates approx. 90 degrees to	4.0
4	Rotates approx. 180 degrees to	6.0
5	Clamps on end effector extend, securir	1.0
6	Clamps on end effector retract, releasir	1.0
7	Articulates part through welds at PED \	3.0
8	Rotates clear of fixture	3.0
9	Rotate to home	3.0
10	Rotates to Pounce	2.0
11	Articulate and pick second part	5.0
12	Articulate and set second part	5.0

	Welding Robots Only	Secs
1	Rotates approx. 45 degrees to	3.0
2	Rotates approx. 90 degrees to	4.0
3	Rotates pounce to first weld	2.0
4	Articulate weld gun through welds on part in fixtur	3.0
5	Repositions to weld in additional plane	3.0
6	Moves clear of fixture clamps	1.5
7	Rotates clear of fixture	2.5
8	Rotate home to pounce	2.0
9	Logic delay	1.0

Handling parts	Obtain		Select		Load		Place	
Very Small Part (No Walk)	0.7	0.2	0.7	0.2	1.1		0.5	
Small Part	3.5	0.9	3.5	0.9	1.1		0.5	
Medium Part	4.4		5.3		1.1		1.0	
Large Part	5.4		6.3		2.7		1.8	
Large Special	6.7		7.6		2.7		1.8	
Very Large Part * V0	17.5	V0	18.4	V0	1.7	V0	0.5	V0
Very Large Part * F0	12.0	F0	12.9	F0	1.7	F0	0.5	F0
Very Large Part * N0	15.5	N0	16.4	N0	2.0	N0	0.5	N0
Very Large Part * H0	11.6	H0	12.5	H0	2.0	H0	0.5	H0
Very Large Part * V1	18.8	V1	19.7	V1	1.7	V1	0.5	V1
Very Large Part * F1	13.3	F1	14.2	F1	1.7	F1	0.5	F1
Very Large Part * N1	14.7	N1	15.6	N1	2.0	N1	0.5	N1
Very Large Part * H1	10.9	H1	11.8	H1	2.0	H1	0.5	H1

	Other Robot Operations	Secs
1	Rotates pounce to start position	2.0
2	Apply mastic daubs at PED stand	3.0
3	Apply mastic bead at PED stand	275.0
4	Apply adhesive at PED stand	275.0
5	Apply sealer at PED stand	275.0
6	Repostions to another area on part	2.0
7	Apply mastic bead at fixture	275.0
8	Apply adhesive at fixture	275.0
9	Apply sealer at fixture	275.0
10	Apply CLINCH nuts	4.5
11	Apply WELD nuts	5.5
12	Applies date stamp	2.0

	Palm Buttons	Secs
	Step to pedestal, press and release 2 palm buttor	2.9
	Press palm button located on fixture requiring one	0.6
	Press and hold palm button (hold dependent on n	0.6
	Depress foot pedal	0.4
	Turn selector knob	1.2
	Press toggle switch	0.6
	Press keypad button (when extra force not require	0.5
	Firmly press keypad button (when button requires	1.2

Unload/Transfer/Position		Unload	Transfer	Position
Very Small Part		1.7	3.7	0.8
Small Part		1.7	4.0	0.8
Medium Part		1.7	5.2	1.1
Large Part		2.6	8.3	2.3
Very Large Part *	V	1.7	10.4	1.4
Very Large Part *	F	1.7	7.2	1.4
Very Large Part *	N	1.7	9.2	1.4
Very Large Part *	H	1.7	9.2	1.4

Part Handling

Note that lines between jobs contain "blanks" (not

Walk / Carry Parts

Obtain / Select/ Load / Place Parts

Unload / Transfer / Position Part

Palm Buttons

Handling with Hoists

Typical Part Sizes

Walk	Sec/ft
Standard walk with any other than large part	0.3
Any walk with very large object or 2 operators wal	0.4
Unrestricted walk over a long distance such in a v	0.2
Standard walk without part	0.3

Hoists	Type	0 Hooks	1 Hook	2 Hooks
Obtain and engage part	V	9.7	11	12.8
Obtain and engage part	F	7.4	8.6	10.4
Obtain and engage part	N	9.5	9.3	11.1
Obtain and engage part	H	7.7	9.1	10.9
Disengage from part and put aside	V	4.6	5.8	7.5
Disengage from part and put aside	F	5.2	6.3	8.0
Disengage from part and put aside	N	2.2	3.4	5.0
Disengage from part and put aside	H	6.1	7.2	8.9

Manual Tools
Note that lines between jobs contain "blanks" (not empty) to mak
Tool Handling (nut runners) / fastener securing
Open / Close doors, decklids, or hoods
Fit Closure Panels
Use portable fixtures
Manual clamping

Fasteners	Secs
Obtain power tool (and release after using)	4.5
Obtain power tool (and release after using) if gre	5.3
Insert margin or flushness gauge into gap	1.0
Hand start nut, screw, or bolt	3.0
Load nut, screw, or bolt to power tool	1.2
Secure nut, screw, or bolt using power tool	

Tool Motor Type / per fastener times	Torque	Secs
N01-N05	0.70-2.50	2.5
N1-N8	2.51-20.00	2.5
N9-N11	20.1-40.0	4.0
N12-N14	40.1-90.0	5.9
N15	90.1-115.0	6.6
N16	115.1-150.	7.9
N17-N22	150.1-700.	8.5

Very Small	Small	Medium	Large	Very Large
Bolt	Anchor	A-pillar	Bodyside	Cab Back
J-clip	Applicator	B-pillar	Dash Panel	Floor-pan
J-nut	Bar	Cowl side	Deck-lid	Rear Floor Pan
Locator	Brace	Cowl top	Door	Underbody
Nut	Bracket	C-pillar	Door-opening-Panel	
Nut and bolt assembly	Daub	D-pillar	Fender	
Nut and Washer Asser	Door-hinge	Front floor pan crossm	Floor	
Palm button	Fastener	Grille Opening Reinfor	Frame rail	
Pot-rivet	Header	Liftgate	Front Fender Body	
Push pin	Nut and Plate assembl	Package Tray	Hood	
Rivet	Reinforcement	Pillar	Lower back panel s/a	
Rivnut	Teleauto ticket	Plenum	Quarter panel	
Screw		Roof Bow	Roof	
Solder		Roof Rail	Tailgate	
Stud			Underbody Reinforcement	
Stud bolt			Wheelhouse inner	
Tab			Wheelhouse outer	
U-nut			Wheelhouse panel	
Weld				
Weld bolt				
Weld nut				

Portable Fixtures	
Obtain SMALL fixture and postion to body pane	4.4
Obtain MEDIUM fixture and postion to body par	5.5
Obtain LARGE fixture and postion to body pane	7.7
Pull detail locking in	1.9
Turn detail pin	1.2
Press control button on fixture	0.5
Rotate fixture on bench	3.4
Remove SMALL fixture after being unclamped f	1.4
Remove MEDIUM fixture after being unclampec	3.1
Remove LARGE fixture after being unclamped f	4.4

Fit Door / Hood / Decklids	
Fit Door	17.8
Fit Decklid	21.9
Fit Hood (assume same as decklid)	21.9

Open Close Doors, Decklids, Hoods	
Open Door	2.3
Open Hood	3.2
Open Decklid	2.1
Close Door	2.1
Close Hood	2.7
Close Decklid	2.1
Prop Open Hood	7.7
Remove prop rod (slave) from hood	1.4
Prop Open Decklid	7.7
Remove prop rod (slave) from decklid	1.4

Clamping	
Close manually operated fixure clamp	11.4
Open manually operated fixture clamp	2.3
Apply hand clamp	3.8
Remove hand clamp	3.1
Enter vehicle	6.1
Exit vehicle	2.2
Sit in chair or on stool	3.9

GEO Fixtures	
fixture clamps close	1.0
fixture clamps open	1.0
Shot Pins Extend	1.0
Shot Pins retract	1.0
Slides extend	2.0
Slides retract	2.0
Cylinders extend	1.0
Cylinders retract	1.0
Trunnion Rotate	4.0
Table Rotate	4.0