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Summary

In the upcoming project, the production process of front bumper bracket of Pride (car) has been examined from the point of view of work and time study. The producer organization of this product is Teklan Machinery Firm, located in Arak city.

The project includes the following Topics:

1) The location of the project

Teklan Machinery Firm has 400 employees, which cooperates with car manufacturing companies, including Saipa, and its products include bumpers, fuel tanks, lowe engine trays, and similar car-related products. The raw materials of the company include steel sheets, bolts and nuts, glue, labels, etc., which steel sheet can be considered as the main raw material.

2) The product:

The product is the front bumper bracket of Pride, which consists of four main parts:

- Forehead: including forehead plate and four oblique numbers
- back page
- Right headlight: including right lamp bowl, right inner reinforcement, side reinforcement, right connection plate and welding screw (Bolt).
- Left headlight: including left lamp bowl, left inner reinforcement, side reinforcement, left connection plate and welding screw.

The production process includes 13 workstations and 4 main sections that perform the assembly process mainly by welding.

In the last part, the production process is studied using the tools of method and time measurement. Method study tools include photo, assembly Chart, OPC, FPC, from-to table, production line balance, work cycle and bill of materials (BOM).

To study time, allowance table has been drawn including standard time calculation.

Production Processes

There are 4 groups of working Stations:

1) stations A, B, C and D

2) Station E

3) Stations F, G and H

4) Stations I, J, K, L and M

Work Study

Picture

Fig. 1- Left lamp bowl

Fig. 2- Bracket before Painting

Assembly Chart

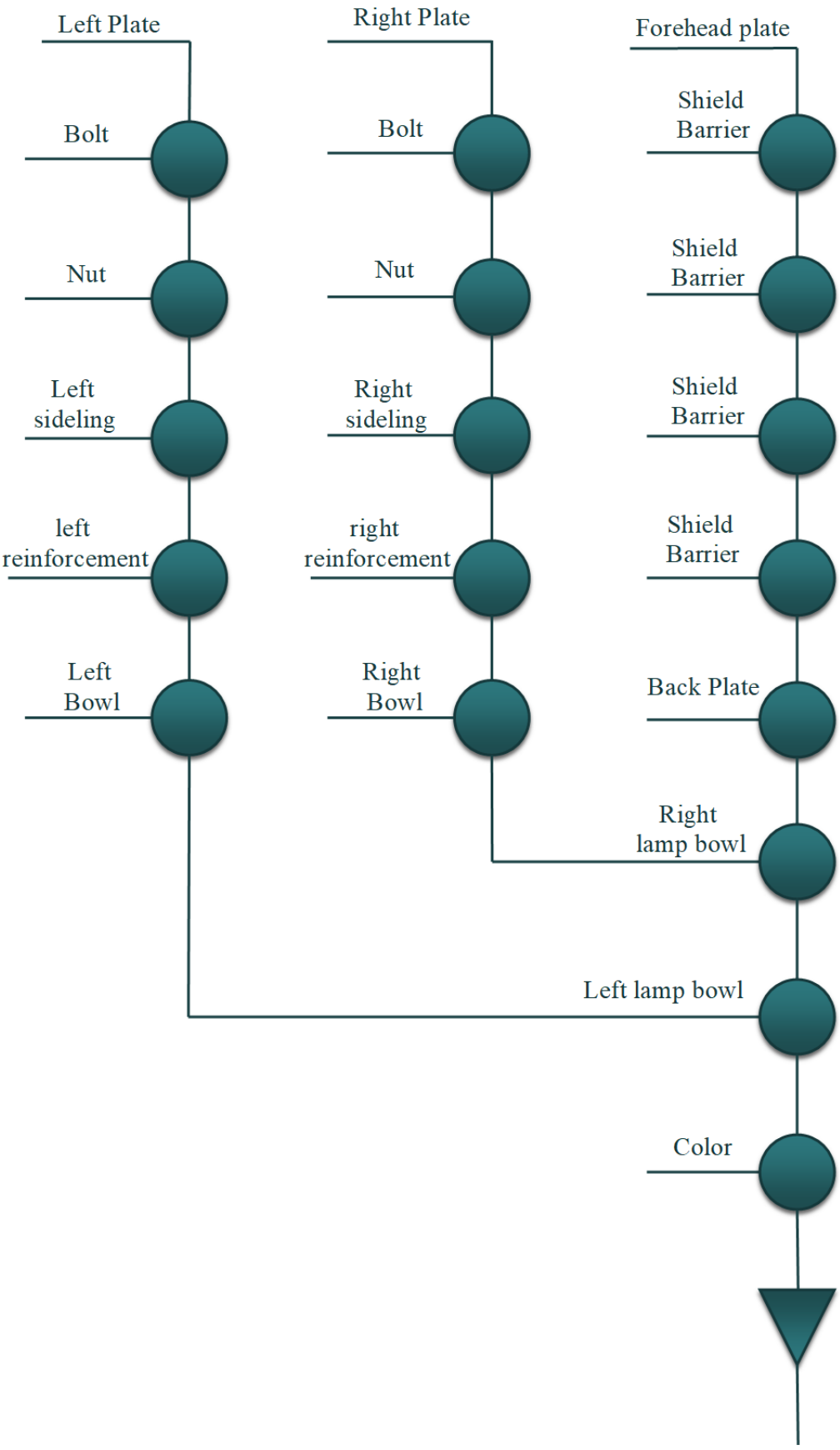

Fig. 3- Assembly Chart of the front bumper bracket

Operation Process Chart (OPC)

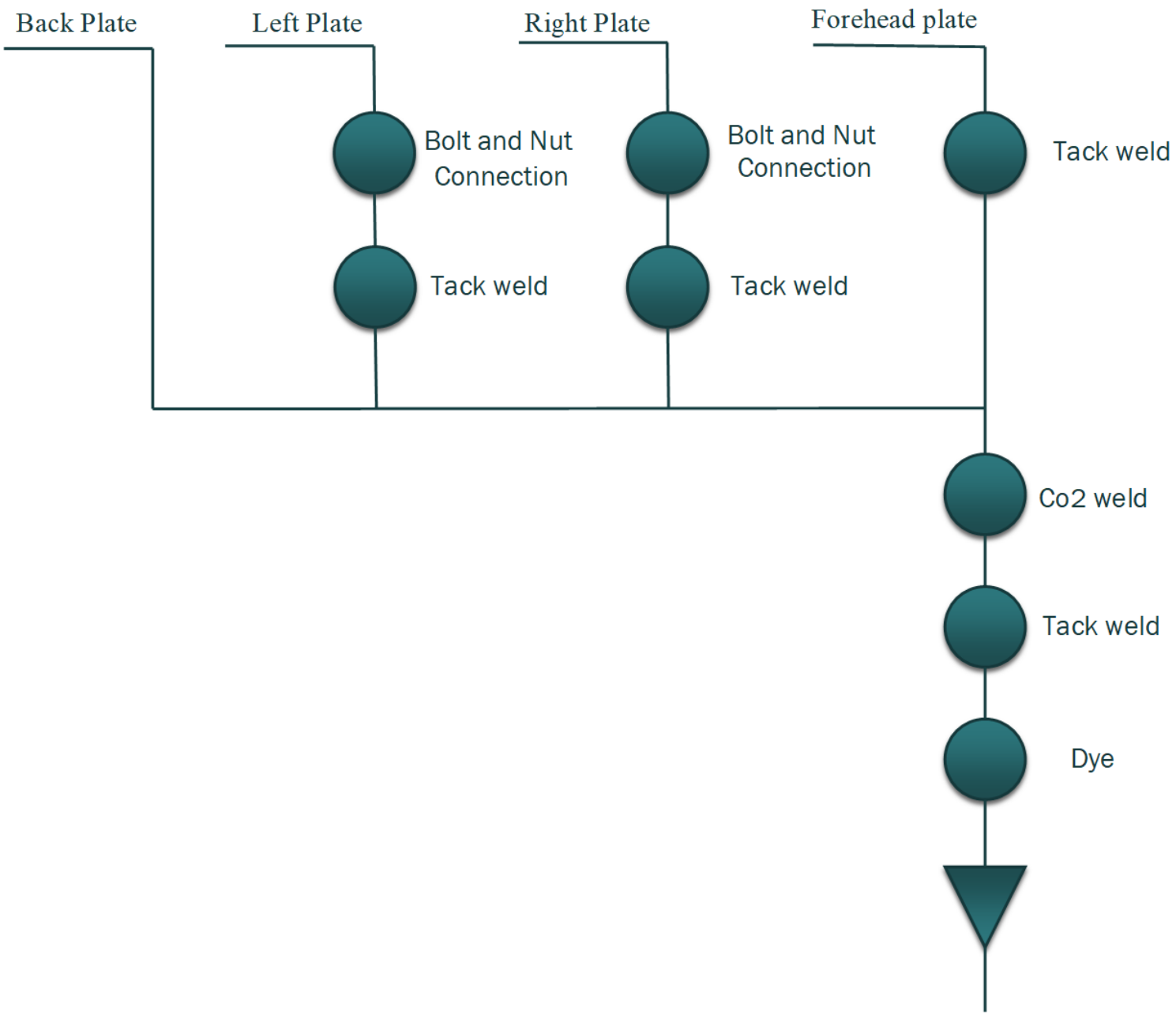

Fig. 4- Operation Process Chart of the front bumper bracket

Production line balancing

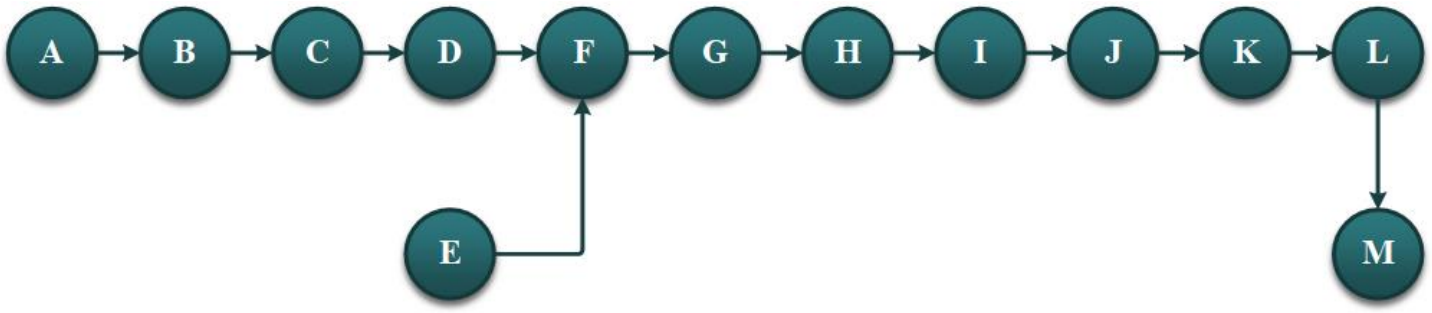

Fig. 5- Production Line Schematic

Table 12- Production Line Balancing

Remaining time of the station	Cumulative time of the station	Selection	Candidate	Station
16.93 7.22	16.67 26.38	E(16.67) A(9.71)	A(9.71) E(16.67)	1
9.8 2.16	23.8 31.44	C(23.8) B (7.64)	B(7.64) C (23.8)	2
16.7	17.53	D (17.53)	D (17.53)	3
- 40.87	74.47	F (74.47)	F (74.47)	4
8.22	25.38	G (25.38)	G (25.38)	5
19.77 6.44	13.83 27.16	H (13.83) I (13.33)	H (13.83) I (13.33)	6
21.6 10.29	12 23.31	J (12) K (11.31)	J (12) K (11.31)	7
4.07	29.53	L (29.53)	L (29.53)	8
1.6	32	M (32)	M (32)	9

Bottleneck :Station F

Approach: Technology change

Total production line time

C= (7*60*60)/750 = 33.6

$$N_t = \frac{287.2}{C} = \frac{287.2}{33.6} = 8.54 \approx 9$$

Time study

Table 17- Determining allowances and calculating standard time

standard time	normal time (Performance Factor =1)	observed time	Sum of allowances + 1	Variable										Constant			Production: Bumper Bracket
				Physical uniformity	Intellectual uniformity	mental tension	Hearing tension	Visual tension	Air conditions	Light conditions	Carrying loads and using power	Abnormal body position	Standing	other	tiredness	Personal needs	
4.72	4.07	4.07	1.16	0.02	0.04	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال تقویتی داخل راست به کاسه چراغ راست
4.99	4.31	4.31	1.16	0.02	0.04	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال تقویتی داخل چپ به کاسه چراغ چپ
4.03	3.48	3.48	1.16	0.02	0.04	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال تقویتی کناری به کاسه چراغ راست
3.61	3.12	3.12	1.16	0.02	0.04	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال تقویتی کناری به کاسه چراغ چپ
7.89	7.11	7.11	1.11	0	0.01	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال پیچ جوشی به کاسه چراغ راست
7.11	6.95	6.95	1.11	0	0.01	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال پیچ جوشی به کاسه چراغ چپ
3.89	3.51	3.51	1.11	0	0.01	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال پیچ جوشی به صفحه اتصال راست

4.31	3.91	3.91	1.11	0	0.01	0.01	0	0	0	0	0	0	0	0	0.04	0.05	اتصال پیچ جوشی به صفحه اتصال چپ
8.28	1.08	7.08	1.17	0.02	0.04	0.01	0	0	0	0	0.01	0	0	0	0.04	0.05	اتصال صفحه اتصال راست به کاسه چراغ راست
9.25	7.91	7.91	1.17	0.02	0.04	0.01	0	0	0	0	0.01	0	0	0	0.04	0.05	اتصال صفحه اتصال چپ به کاسه چراغ چپ
16.97	14.89	14.89	1.14	0	0.01	0.01	۰	۰	۰	۰	0.01	۰	0.02	۰	0.04	0.05	اتصال ٤ مایل به ورق پیشانی
74.47	61.55	61.55	1.21	0	0	0.04	0	0.02	0	0	0.02	0.02	0.02	0	0.04	0.05	جوشکاری Co2
25.38	21.15	21.15	1.20	0.02	0.04	0.01	0	0	0	0	0.02	0	0.02	0	0.04	0.05	تکمیل جوش
13.83	12.14	12.14	1.14	0	0	0.01	0	0	0	0	0.02	0	0.02	0	0.04	0.05	پلیسه گیری و تاب گیری
13.33	13.33	13.33	1	0	0	0	0	0	0	0	0	0	0	0	0	0	شست و شو
12	12	12	1	0	0	0	0	0	0	0	0	0	0	0	0	0	خشک کردن
11.31	10.01	10.01	1.13	0.02	0.01	0.01	0	0	0	0	0	0	0	0	0.04	0.05	پاشش رنگ
29.53	29.53	29.53	1	0	0	0	0	0	0	0	0	0	0	0	0	0	پخت رنگ
32	32	32	1	0	0	0	0	0	0	0	0	0	0	0	0	0	سرد شدن(تاخیر)

Station A: 4.72+4.99

Station B: 3.61+4.03

Station C: 7.89+7.71+3.89+4.31

Station D: 8.28+9.25

Station E: 146.97

Station F: 74.47

Station G: 25.38

Station H: 13.83

Station I: 13.33

Station J: 12

Station K: 11.31

Station L: 29.53

Station M: 32

Conclusion

1) Station F was identified as a bottleneck. The work operation in this station includes about 60 seconds of welding, which is more than the production cycle. So, increasing the number of workers in this station causes no change, and it is also not possible to work more than 1 person beacuase of the delicacy of the work and the small dimensions of the piece.

The suggested solution is to change the welding technology and reduce the working time so that the welding time is less than the cycle time.

2) In station L (painting furnacen), there is enough place to place more products in the furnace, but the pieces are placed far apart. By reducing the distance between the holding hooks, more products could be painted, which results in cost reduction (due to higher scale production) and increased production rate.