

# Line Balancing At Assembly Frame - Chassis Line

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**Abstract** - The project was to carry out the time study of unique parts of CITY, compare station wise process time between CITY and AMAZE, and balance the parts accordingly on Chassis Line. The aim of the project was to improve line balancing and find manpower required for HONDA CITY. Time taken for each process was recorded and multiple readings were taken for the same during DT (dynamic trial). Similar procedure was repeated for all variants. In order to compare the recorded values with those in the process sheet, the time in both was maximized and then compared.

## I.INTRODUCTION

*All Amaze Process Distribution Compared With CITY*

*Total HONDA CITY variant – 19*

Table-1 Variant Details

PETROL(MT)	PETROL(CVT)	DIESEL(MT)	EXPORT (MT)	EXPORT(CVT)
EA0(E-5MT)	EA5(E-CVT)	EA0(E-6MT)	NA0 (TREND-5MT)	NA5 (TREND-CVT)
EB0(S-5MT)	EB5(S-CVT)	EB0(S-6MT)	NB0 (ELEG-5MT)	NB5 (ELEG-CVT)
EC0(SV-5MT)	EC5(SV-CVT)	EC0(SV-6MT)		
ED0(V-5MT)	ED5(V-CVT)	ED0(V-6MT)		
EE0(VX-5MT)	EE5(VX-CVT)	EE0(VX-6MT)		

*Process Distribution for Amaze*

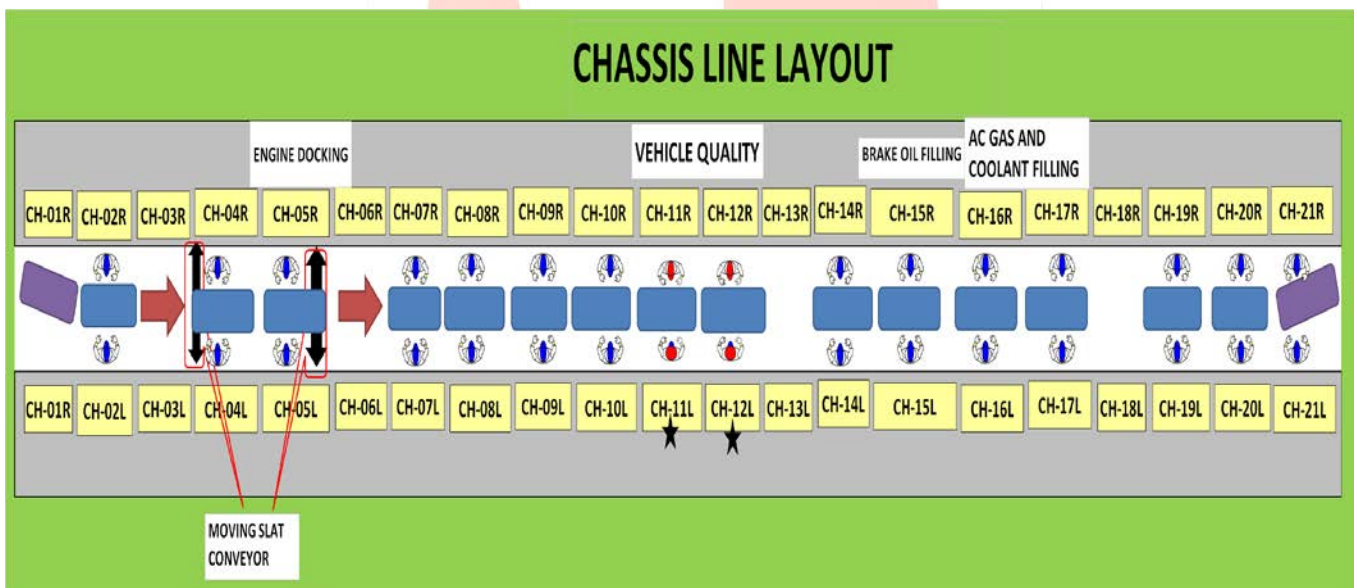


Figure 1- Layout

- WORKING STATIONS ( ) - 14
- FAST MOVING STATION ( ) - 2
- ANGULAR WORKING STATIONS ( ) - 2
- LINE QUALITY STATION ( ) - 2

No. of unique parts for CITY - 16 parts

Table 2 – Unique parts for CITY

S.NO.	UNIQUE PART NAME
1	TUBE ASSY, FUEL PURGE (PETROL)
2	TUBE ASSY C, FUEL VENT (PETROL)

3	TUBE ASSY , FUEL VENT (PETROL)
4	CANISTER BRKT (PETROL)
5	VALVE, TWO WAY (PETROL)
6	CANISTER ASSY (PETROL)
7	TUBE ASSY, FUEL OUTLET (DIESEL)
8	TUBE ASSY, FUEL INLET (DIESEL)
9	TUBE ASSY B , FUEL VENT (DIESEL)
10	BRKT, HAND PRIMER (DIESEL)
11	CLAMP, HAND PRIMER (DIESEL)
12	HAND PRIMER (DIESEL)
13	VALVE, TWO WAY (DIESEL)
14	FRAME COMP
15	HAND BRAKE BOLTS
16	PROTECTOR F/TANK

**Process time for AMAZE**

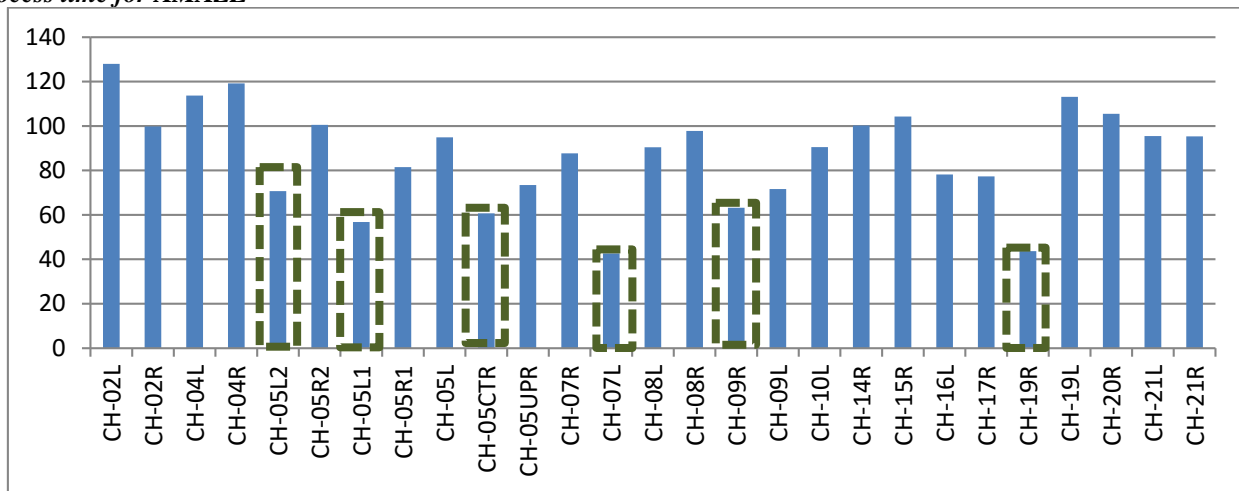


Figure 2- Process time for Amaze

NOTE - Cycle time less at station no - 5L-2, 5L-1, 5CTR, 7L, 9R, 19R City process distribution done as per amaze stations having less cycle time.

Table 3 – Process Distribution

SL. NO.	UNIQUE PART NAME	STATION NO.	STATUS	REASON
1	TUBE ASSY, FUEL PURGE (PETROL)	7L	NG	1. FITMENT CAN BE DONE BUT WITH SUB-ASSY IT WILL CONSUME MORE TIME.
2	TUBE ASSY C, FUEL VENT (PETROL)	7L	NG	
3	TUBE ASSY , FUEL VENT (PETROL)	7L	NG	
4	CANISTER BRKT (PETROL)	7L	NG	
5	VALVE, TWO WAY (PETROL)	7L	NG	
6	CANISTER ASSY (PETROL)	7L	NG	
7	TUBE ASSY, FUEL OUTLET (DIESEL)	5L-1	NG	1. NO SPACE FOR SUB-ASSY. 2. MOVEMENT FOR ITS INSTALLATION WILL BE MORE.
8	TUBE ASSY, FUEL INLET (DIESEL)	5L-1	NG	
9	TUBE ASSY B , FUEL VENT (DIESEL)	5L-1	NG	
10	BRKT, HAND PRIMER (DIESEL)	5L-1	NG	
11	CLAMP, HAND PRIMER (DIESEL)	5L-1	NG	
12	HAND PRIMER (DIESEL)	5L-2	NG	
13	VALVE, TWO WAY (DIESEL)	5L-2	NG	
14	FRAME COMP	9R	NG	1.INSTALLED SHOULD BE BEFORE EXHAUST PIPE INSTALLATION.
15	HAND BRAKE BOLTS	5CTR	OK	1.CHANCES OF HAND BRAKE WIRE FOULING & DAMAGE AS ITS HAGING WITH THE AXLE. 2.THERE ARE TOTAL 7 BOLTS TIME REQUIRED IS MORE.
16	PROTECTOR F/TANK	19R	NG	1. NO SPACE TO GET UNDER BODY AS IT MOVES WITH LOW BASE.

## Extra time taken in process – 3 processes

PROCESS NAME
ABS WIRE ROUTING LH
ABS WIRE ROUTING RH
LEVER ASSY, CHANGE

Time recorded for unique parts of various variants of Honda City.

Table 4 – Takt time for CITY (Petrol)

PART NAME	STATION NO.	TAKT TIME			AVG
		1	2	3	
TUBE ASSY, FUEL PURGE	CH-02	8.8	8.9	9.6	9.2
TUBE ASSY C, FUEL VENT	CH-02	3.6	4.2	4.1	4
TUBE ASSY B, FUEL VENT	CH-02	8.7	9.3	8.8	9
CANISTER BRKT	CH-02	29	31	31	31
VALVE, TWO WAY	CH-02	15	18	19	17.3
CANISTER ASSY FITMENT	CH-02	49	48	51	49
FRAME COMP	CH-02	91	95	92	93
HAND BRAKE BOLTS	CH-05R	77	76	76	77
PROTECTOR F/TANK	CH-05R	47	48	47	48
ABS WIRE ROUTING	CH-05R2	83	79	78	80
ABS WIRE ROUTING	CH-05L2	61	55	59	58
LEVER ASSY, CHANGE	CH-20R	132	126	131	128

Station-wise process time comparison of CITY and Amaze (PETROL).

Table 5 – Comparison of takt time of CITY and AMAZE (Petrol)

S.NO.	STATION NO.	AMAZE	CITY
1	CH-02L	128	353.6
2	CH-02R	99.8	116.8
3	CH-04L	113.7	116.7

4	CH-04R	119.2	120.3
5	CH-05L2	70.7	93.4
6	CH-05R2	100.5	124.6
7	CH-05L1	56.8	75.8
8	CH-05R1	81.5	129.3
9	CH-05L	94.9	113.2
10	CH-05CTR	60.7	153
11	CH-05UPR	73.4	97.1
12	CH-07R	87.7	88.6
13	CH-07L	42.7	46.1
14	CH-08L	90.4	94
15	CH-08R	97.8	99.1
16	CH-09R	63.2	68.3
17	CH-09L	71.6	74.6
18	CH-10L	90.5	93.2
19	CH-14R	100.2	100.7
20	CH-15R	104.3	106.2
21	CH-16L	78.2	81.1
22	CH-17R	77.3	81.1
23	CH-19R	43.7	44.9
24	CH-19L	113.1	117.1
25	CH-20R	105.5	128
26	CH-21L	95.5	98.7
27	CH-21R	95.3	102

Station wise takt time comparative graph of AMAZE and CITY (Petrol).

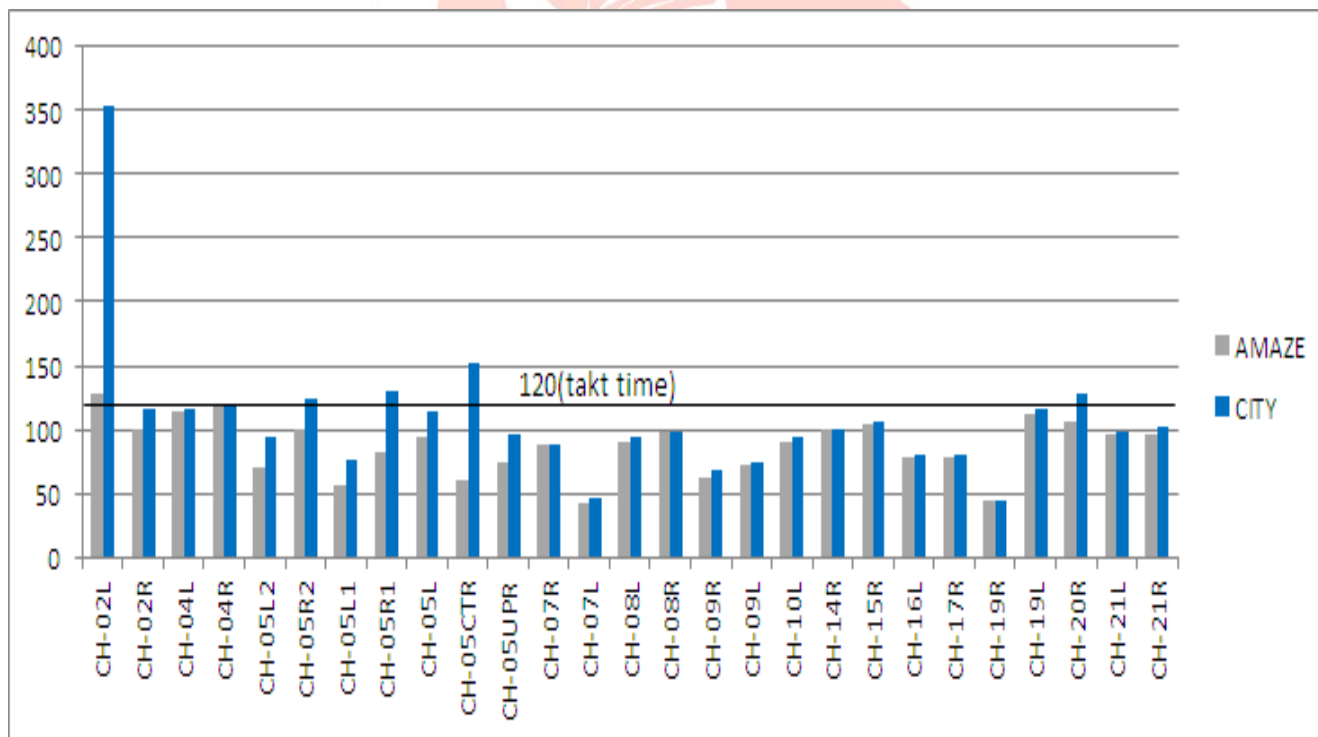


Figure 3 – Graph comparison of takt time of CITY and AMAZE (Petrol)

Time recorded for unique parts of various variants of Honda City.

Table 6 – Time recorded for Unique parts of Honda CITY(Diesel)

PART NAME	STATION NO.	TAKT TIME		AVG
		1	2	
HAND PRIMER CLAMP	CH-02	16	15	15.5
HAND PRIMER CLAMPING	CH-02	6	5	5.5

<b>TUBE ASSY, FUEL OUTLET</b>	CH-02	7	6	6.5
<b>TUBE ASSY, FUEL INLET</b>	CH-02	5	6	5.5
<b>TUBE ASSY B, FUEL VENT</b>	CH-02	4	5	4.5
<b>HAND PRIMER FITMENT</b>	CH-02	37	36	36.5
<b>VALVE, TWO WAY</b>	CH-02	19.7	21.3	20.5
<b>FRAME COMP.</b>	CH-02	96	93	94.5
<b>HAND BRAKE BOLTS</b>	CH-05R	69	71	70
<b>PROTECTOR F/ TANK</b>	CH-05R	42	44	43
<b>ABS WIRE ROUTING</b>	CH-05R2	82	77.3	80
<b>ABS WIRE ROUTING</b>	CH-05L2	52	54	53
<b>LEVER ASSY, CHANGE</b>	CH-20R	126	134	130

Station-wise process time comparison of CITY and AMAZE (Diesel).

Table 7 – Comparison of takt time of CITY and AMAZE (Diesel)

S.NO.	STATION NO.	AMAZE	CITY
1	CH-02L	158.9	348.9
2	CH-02R	99.8	114.1
3	CH-04L	114.9	116.7
4	CH-04R	112.6	114.3
5	CH-05L2	70.7	94.4
6	CH-05R2	100.5	123.3
7	CH-05L1	73.7	78.1
8	CH-05R1	96.1	129.9
9	CH-05L	85.8	119.5
10	CH-05CTR	62.4	155.3
11	CH-05UPR	95.6	97.1
12	CH-07R	74.2	88.6
13	CH-07L	99.8	99.1
14	CH-08L	90.4	93.2
15	CH-08R	76	78.1
16	CH-09R	59.3	61.2
17	CH-09L	48.4	49.1
18	CH-10L	81.5	83
19	CH-14R	111.1	108
20	CH-15R	111	106
21	CH-16L	114.1	110.5
22	CH-17R	85.6	88.3
23	CH-19R	43.7	46.1
24	CH-19L	95.9	98.2
25	CH-20R	105.5	130
26	CH-21L	86.9	88.5
27	CH-21R	104.8	100.2

Station wise takt time comparative graph of amaze and city (DIESEL).

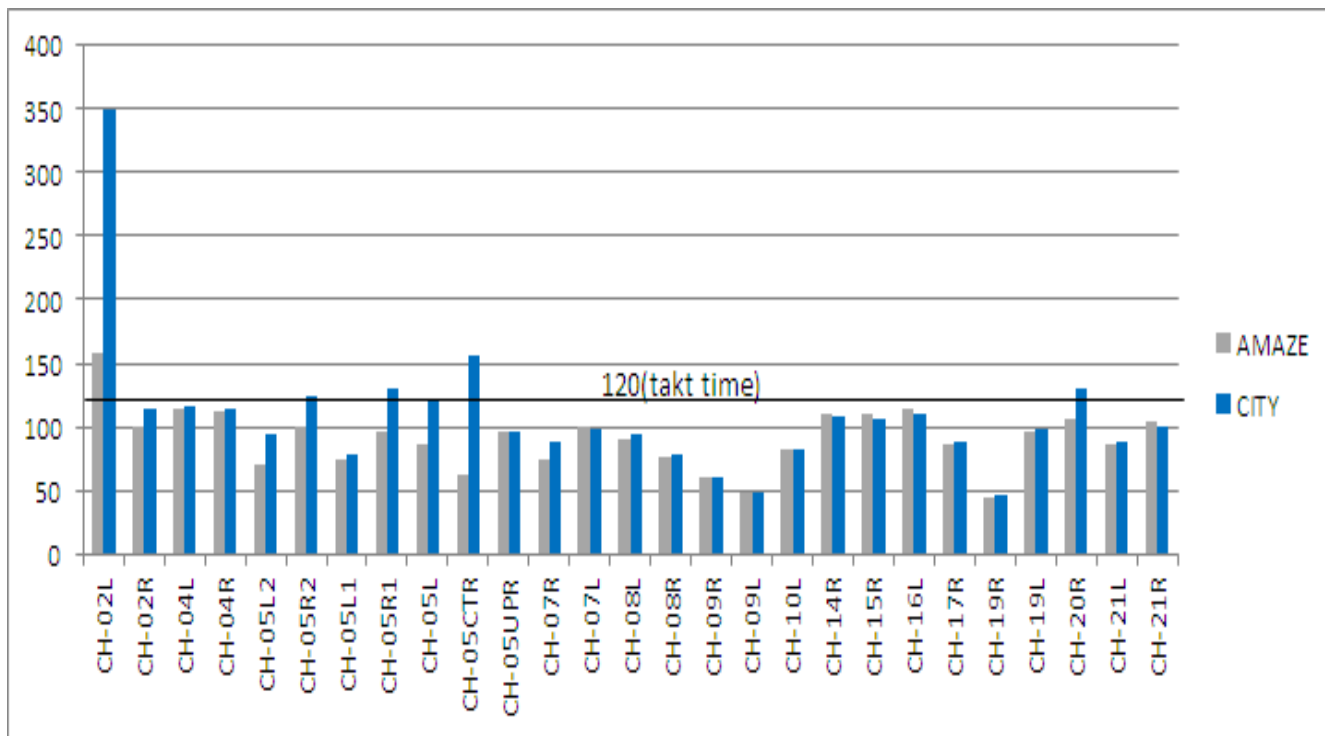


Figure 4 - Takt time comparative graph of AMAZE and CITY (Diesel)

Station-wise takt time of 2CT (PETROL).

Table 8 - Takt time of CITY (Petrol)

S.NO.	STATION NO.	CITY(PETROL)
1	CH-02L	353.6
2	CH-02R	116.8
3	CH-04L	116.7
4	CH-04R	120.3
5	CH-05L2	93.4
6	CH-05R2	124.6
7	CH-05L1	75.8
8	CH-05R1	129.3
9	CH-05L	113.2
10	CH-05CTR	153
11	CH-05UPR	97.1
12	CH-07R	88.6
13	CH-07L	46.1
14	CH-08L	94
15	CH-08R	99.1
16	CH-09R	68.3
17	CH-09L	74.6
18	CH-10L	93.2
19	CH-14R	100.7
20	CH-15R	106.2
21	CH-16L	81.1
22	CH-17R	81.1
23	CH-19R	44.9
24	CH-19L	117.1
25	CH-20R	128
26	CH-21L	98.7
27	CH-21R	102

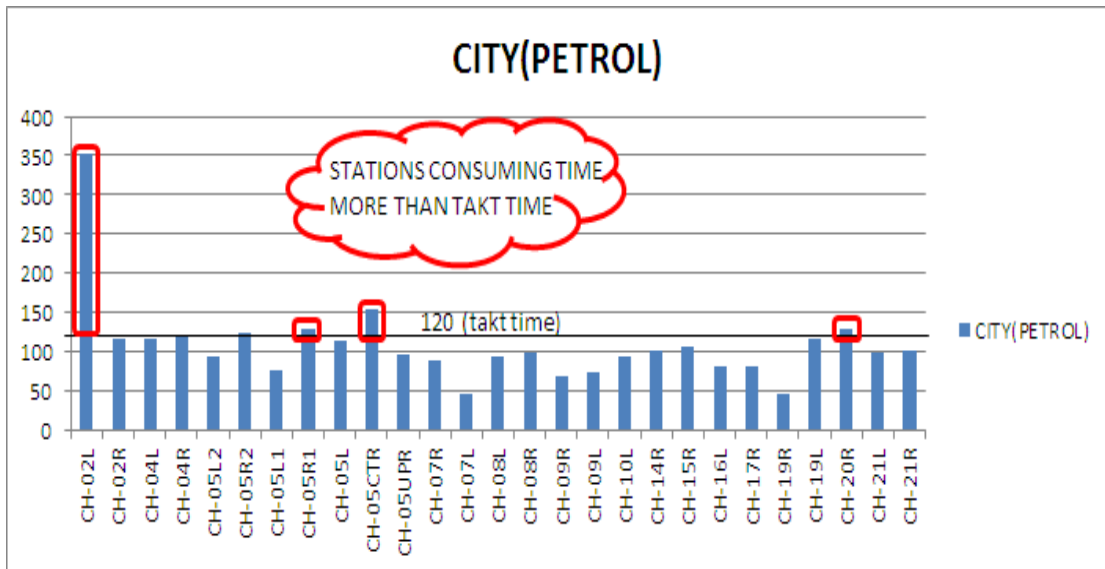


Figure 5 – Higher time consuming stations (Petrol)

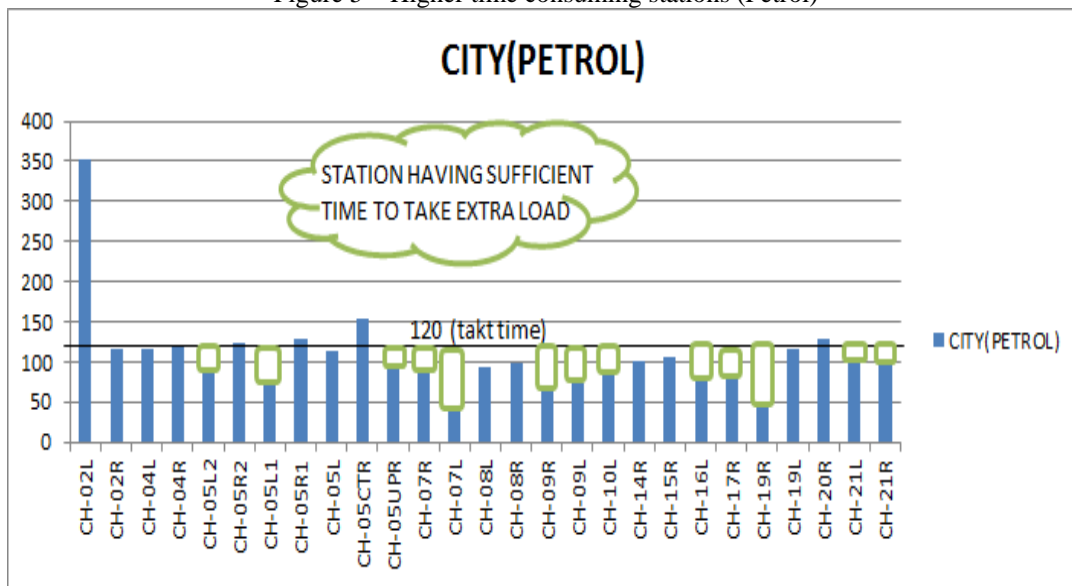


Figure 6 – Lower time consuming stations (Petrol)

Station-wise takt time of CITY (Diesel).

Table 9 - Takt time of CITY (Diesel)

S.NO.	STATION NO.	CITY(DIESEL)
1	CH-02L	348.9
2	CH-02R	114.1
3	CH-04L	116.7
4	CH-04R	114.3
5	CH-05L2	94.4
6	CH-05R2	123.3
7	CH-05L1	78.1
8	CH-05R1	129.9
9	CH-05L	119.5
10	CH-05CTR	155.3
11	CH-05UPR	97.1
12	CH-07R	88.6
13	CH-07L	99.1
14	CH-08L	93.2
15	CH-08R	78.1
16	CH-09R	61.2
17	CH-09L	49.1
18	CH-10L	83
19	CH-14R	108

20	CH-15R	106
21	CH-16L	110.5
22	CH-17R	88.3
23	CH-19R	46.1
24	CH-19L	98.2
25	CH-20R	130
26	CH-21L	88.5
27	CH-21R	100.2

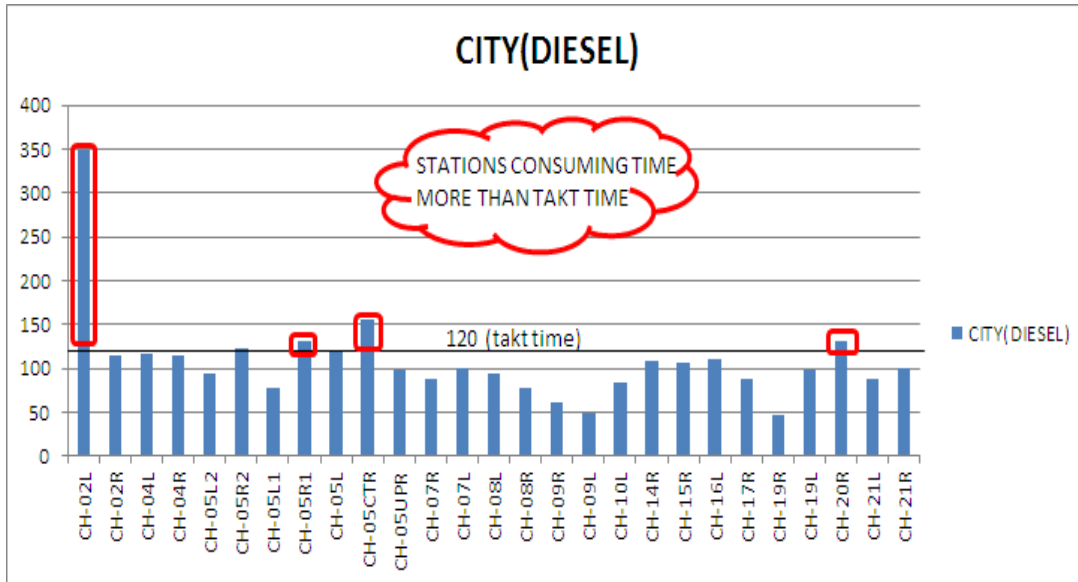


Figure 7 – Higher time consuming stations (Diesel)

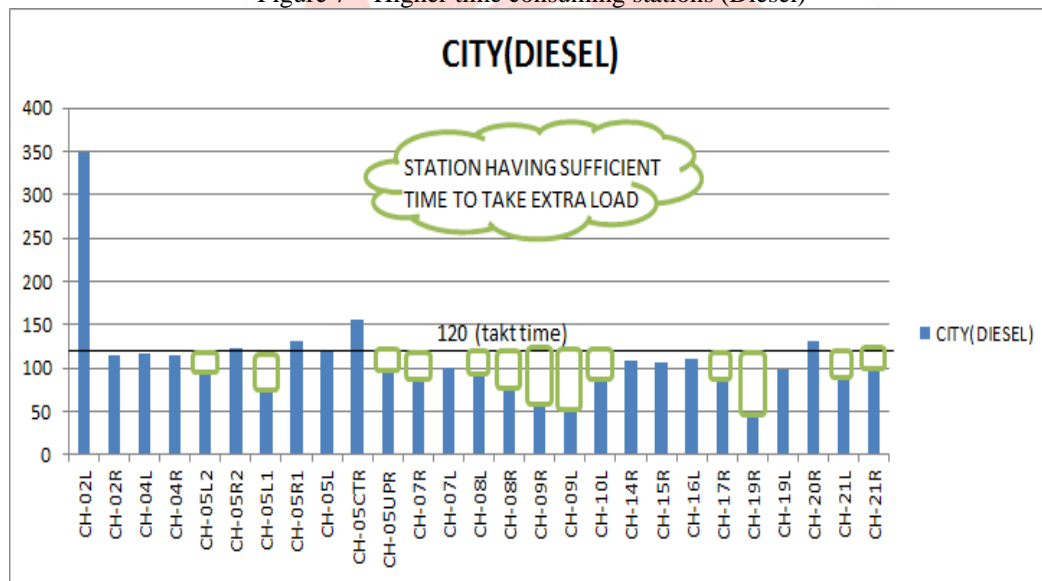


Figure 8 – Lower time consuming stations (Diesel)

**II. OBSERVATIONS:**

From the comparative graph we see that mainly time difference occur on stations CH-02, CH-05 and CH-20. Tact Time of the line = 110 sec.

❖ **CH-02**

- Total process time recorded on CH-02 = 470.4 sec.
- Number of manpower required =  $470.4/110 = 4.4$  i.e. **5**.
- The requirement of extra manpower is due to the installation of new parts (Frame comp., Canister in city petrol and hand primer in city diesel and their sub assembling). Installation of fuel tank in city also consume more time than amaze.

❖ **CH-05**

- Total process time recorded = 797.79 sec.
- Number of manpower =  $797.79/110 = 7.32$  i.e. **8**.



- The requirement of extra manpower is due to the torquing of extra bolts in Hand Brake Wire i.e. 7 bolts in city instead of 5 bolts in amaze and installation of extra part (Protector plate). ABS wire routing also require more time in city than amaze.

#### ❖ **CH-20R**

- Total process time recorded = 130 sec.
- Number of manpower required =  $130/110 = 1.2$  i.e. **2**.
- The time required for the fitment of Lever Assy Change is more in city than that of amaze.

### **III. CONCLUSION**

#### **CH-02**

- Extra manpower (2 numbers) will be required for installation of extra parts.
- The already working manpower (3 numbers) cannot perform this extra work because the time consumption in fuel tank installation is also increased.
- For canister sub-assembly and hand primer sub-assembly, a sub-station will be required. The empty station i.e. CH-01 can be used for the sub-assembly and fitment of these parts, one manpower will be required for this work.
- For the frame comp. fitment (aligning frame and torquing 10 bolts), 1 extra manpower will be required and this work can also be done at CH-01.

#### **CH-05**

- This station has 7 manpower for processes on amaze but in city 1 extra manpower will be required at the center position for the tightening of 7 bolts in hand brake wire and fitment of extra part (Protector Plate).
- In amaze the torquing of hand brake bolts (5 numbers) has 2 manpower at rear but the load of torquing 7 bolts cannot be put on them because the time required for ABS wire routing is also increased.

#### **CH-21R**

- The time taken by Lever Assy Change fitment is higher than the tact time.
- By considering this we have to increase the manpower but it cannot be done because this work can be performed by one manpower. He can use the next station to complete the work.

### **IV. UTILIZATION OF EXTRA MANPOWER FOR AMAZE**

- Multiskilling of new MA for minimum 2 stations on line for CITY model.
- Chassis line internal Kaizen target taken i.e. 1.5 per manpower.
- Training & Formation of NHC (NEW HONDA CIRCLE) team.

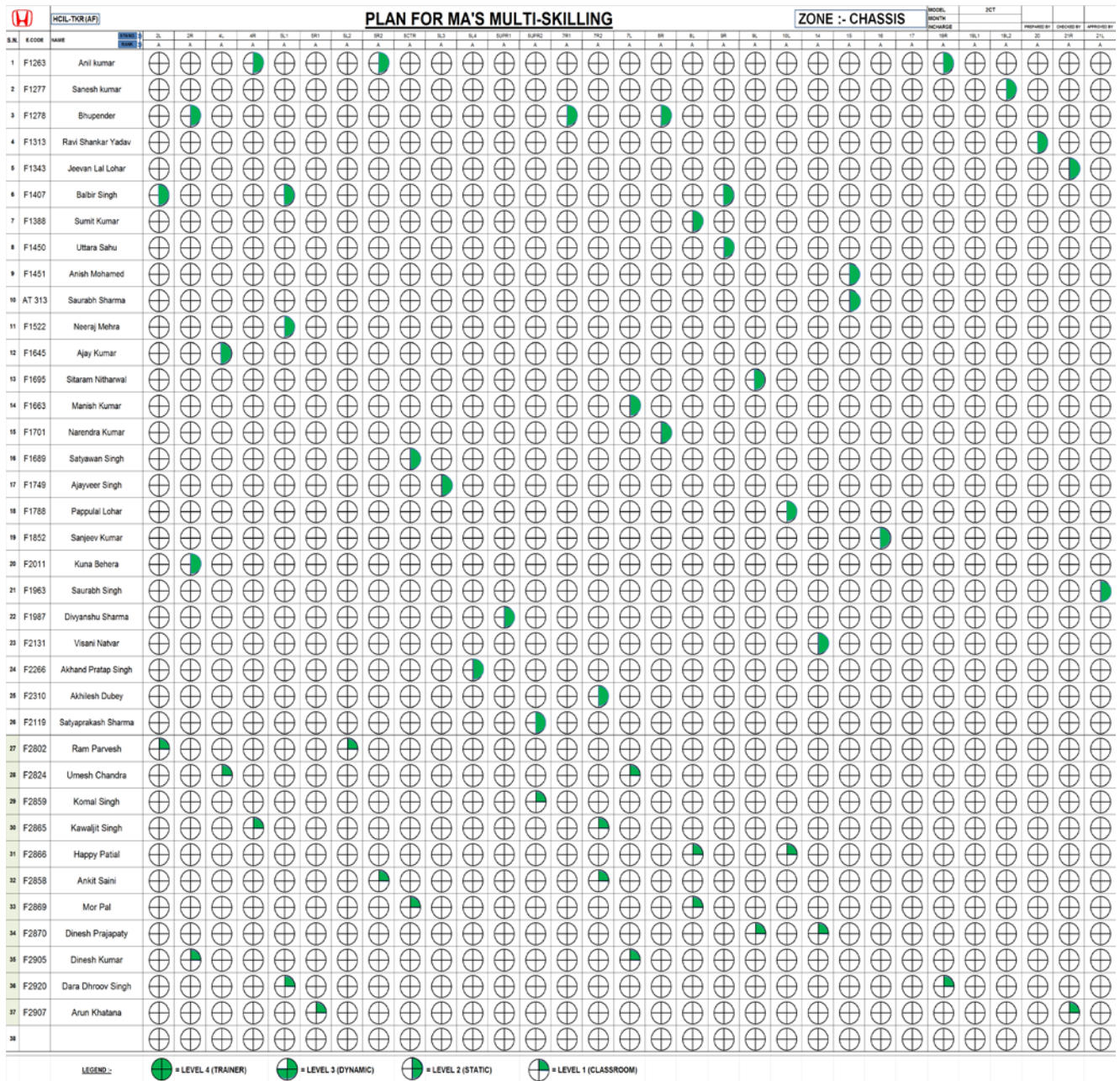


Figure 9 – Multiskilling Plan

V. **RESULT:** The extra manpower will be required at CH-02 (2 numbers) and CH-05 (1 number).

VI. **ACKNOWLEDGMENT**

To pursue any project or research, it needs a lot of cooperation, interaction and guidance.

The task of completing the project report on industrial training will be incomplete, without expressing thanks to the persons who have lend their helping hands and made this training a success

I am thankful to HONDA CAR INDIA LTD. for giving me an opportunity to get knowledge of manufacturing during the course of industrial training during which we were able to gain knowledge of various parts of automobile.

With deep reverence I would like to thank Mr Rahul Jha my mentor, who helped me continuously in building my knowledge relating to various parts assembled in automobile and also extended supportive hand whenever we faced problems during my training.

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