OM 380.17 Bagchi & Gutierrez
Group Report – 1 (worth 2.5% of your course grade)

Case: Toyota Motor Manufacturing

Names of Group Members and Index Numbers

Name (First, Last)	Index Number	Signature
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***** By signing my name, I am affirming that:**

- **I have read the course syllabus.**
- **I have contributed as expected toward the fulfillment of this assignment.**
- **The work our group is turning in is the work product of our group.**
- **Our group did not get outside help in fulfilling this assignment.**

This report is based on the *Toyota Motor Manufacturing* case. Please read the case carefully and answer the questions that follow on the next page. **Your submission must have this page as the cover page. Please submit by the beginning of class on the day the assignment is due.**

(1) Assembly comprises 769 team members. Given that TMM operates two shifts a day, what is the proportion of team members engaged in 'non-essential' work?

Answer:
In TMM assembly operations, it is given that there are 353 stations on the conveyer line. Also, the TMM operates two shifts a day. On an average there is one person (team member) on a working station and since they are working 2 shifts, there are 2*353 = 706 essential workers.
Thus, non-essentials workers are 769-706 = 63.
Hence, the proportion of team members engaged in "non-essential" work is 63/769 = 0.08192 ~ 0.082 or ~**8.2%.**

(2) The length of a station is 5.7 meters (Exhibit 6). What is the speed of the assembly line (in miles per hour)?

Answer:
In the case study, it is mentioned that the assembly line operates on a cycle time of 57 seconds. Now, it is given that each station is 5.7m long. Calculation:

Speed = Distance/Time -> 5.7/57 = 0.1 m/s
To convert this in mph -> 0.1m/s * 2.23694 miles/hour = 0.223694 mph

Thus, the speed of the assembly line is approximately **0.2237 miles per hour**.

(3) What is the capacity of the assembly line (cars per day; cars per week; and cars per year) assuming 100% line utilization?

Answer:
In the case study, following is given:

1) Line Cycle Time: The assembly line is operating on a line cycle time of 57 seconds i.e., a car is produced every 57 seconds when the line is running at 100% utilization.
2) Shift Duration: Regular shifts lasts 525 minutes. If we remove the 45 minutes of lunch time and two 15-minute breaks we are left with 525-45-(2*15) = 450 minutes of productive time.
3) Number of shifts: TMM operates two shifts a day.

So, we get cars per Shift as: (450 x 60) s/ (57) s/car = 473.68 ~ 473 cars/shift
Thus, we can calculate the capacity as follows, given 100% line utilization:

- Cars per Day (2 shifts):

- o 473 * 2 = **946 cars/day**
- Cars per Week (assuming 5 working days):
    - o 946 * 5 = **4730 cars/week**
- Cars per Year (assuming 50 working weeks):
    - o 4730 * 50 = **236,500 cars/year**

b) How many fewer cars are produced per shift if the run ratio is 95%?

Answer:
Cars produced = cars per shift x run ratio = 473 * 0.95 = 449.35 ~ 449 cars per shift
Fewer cars produced = 473-449 = 24
Hence at 95% run ratio, **~24 fewer cars** are produced per shift.

c) How many fewer cars are produced per shift if the run ratio is 85%?

Answer:
Cars produced = cars per shift x run ratio = 473 * 0.85 = 401.55 ~ 401 cars per shift
Fewer cars produced = 473-401 = 72
Hence at 85% run ratio, **~72 fewer cars** are produced per shift

(4) This question is designed to help estimate how much time KFS has to assemble a seat. Of the 353 stations, at least 314 (353 minus 39 in Groups 2 and 3 in Exhibit 6) are between the end of the paint line and the first seat installation station. What is the corresponding throughput time? In other words, how much time is there between when a car enters assembly and when the seat is needed?

Answer:
Since a seat arrives the final seat installation station exactly at the same time when the car enters the final seat installation station, we can say that the time of arrival of seat at the final seat installation station is equivalent to the time of arrival of the car at the final seat installation station.
Since the cycle time is 57 seconds and there are 314 stations, the throughput will be simply 314 stations * 57 seconds/station = 17,898 seconds = **298.3 minutes ~ 4.97 hours**.
Hence, there is approximately a time of 5 hours between a car enters assembly and when the seat is needed.

b) How long might a finished seat have to wait at KFS before traveling to TMM? How long might a seat have to wait at TMM before traveling on the overhead conveyor belt?

Answer:
Since KFS has to provide the seat JIT hence it has to mimic the TMM cycles (as explained above), so a seat will be loaded at a rate of 57 seconds/ seat. Also, it is given that the truck can carry 58 seats hence, the first loaded seat will have to wait 57 seconds/seat * (58-1) seats i.e., 57 * 57 seconds = 3249 seconds ~ **54.15 minutes**.
Following the similar logic at TMM, we need to find the time of the last seat that gets unloaded from truck. The last seat will have to wait for the same time at TMM before travelling on the overhead conveyor belt which is ~**54.15 minutes**

(5) "Of all TPS components perhaps the one receiving most notoriety has been workers' "ability" to stop the line." On a line segment with 40 stations, how many andon pulls might you expect per shift?

Answer:
We know that a team member, on average, pulled the andon cord nearly one dozen times per shift, and typically, one of these andon pulls resulted in an actual line stoppage. Hence, on a line segment with 40 stations, total no of pulls = 40*12 = **480 pulls**

How many line stoppages might you expect per shift?

Answer:
Out of every dozen pulls, estimated 1 pull results in actual line stoppage, hence expected line stoppages = 480/12 = **40**

What might be the cost of stopping the line for one cycle?

Answer:

To calculate the cost of stopping the line for one cycle we are assuming that production capacity lost will be recovered in overtime.
There are 204 leaders in total for all the shifts. When considering a cycle, we can say that there are 102 leaders that are working overtime. Also, it is given that on an average each leader has 4 team members, hence we will have 102*4 = 408 members.

Overtime cost for 408 members is: $17 * 1.5 *(57/3600) * 408 ~ $0.403 * 408 [$17 is the team worker's hourly wage who gets 50% increment on overtime. Since we are considering one cycle thus it amounts 57/3600 hours] = $164.424
It is given that a team leader earns 5%-8% more in overtime as compared to the worker. So the lower bound is $0.403*1.05 ~ $0.423 and upper bound of $0.403*1.08 ~ $0.435 per team leader. Hence, the lower and upper bound of 102 leaders will be 102*0.423 = $43.146 and $44.37.
Hence the total cost of stopping the line for one cycle will between **$207.57 and $208.79**. So we can say approximately **$208** is the cost of stopping the line for one cycle.

(6) At the Georgetown, Kentucky facility, when the line has to be stopped, it is always stopped at the end of a cycle. Why doesn't Toyota stop the line in the middle of a cycle? Note that the question is not about whether the line is stopped; it is about when.

Answer:

These are the following reasons to not stop the cycle in the middle:
1) Visual Control and Jidoka: The andon system implemented in the TMM's supply chain ensures immediate quality issue resolution at cycle's end.
2) Efficiency: It helps in minimizing the downtime and as a result maximizes the work done.
3) Standardized Work: Mid-cycle stops disrupt the consistency and quality.