

# **Vehicle Scheduling System**

by

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the requirements for the

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Universiti Teknologi PETRONAS

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CERTIFICATION OF APPROVAL

**Vehicle Scheduling System**

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A project dissertation submitted to the  
Mechanical Engineering Programme  
University Teknologi PETRONAS  
in partial fulfilment of the requirement for the  
BACHELOR OF ENGINEERING (Hons)  
(MECHANICAL ENGINEERING)

Approved by,

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(Dr. Ainul Akmar Binti Mokhtar)

UNIVERSITI TEKNOLOGI PETRONAS  
TRONOH, PERAK  
September 2013

## CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

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KAMARUL AZRIN BIN KHAMIS

## **ABSTRACT**

The final year project is an implement for all final year students of Universiti Teknologi PETRONAS to turn out well-formed graduated who are not only technically competent but also acquire other personality such as making research, critical thinking and solution or problem synthesis ability.

The final year project will grant prospect to UTP's students to apply the understanding of the engineering subjects to solve problem. With this problem solving, students develop their ability to make research regarding the problem, make hypothesis, making the solver for the problem and explore the consequences of the solution.

This report briefly explains the research, techniques and methods applied by the student on solving the problem. Each decision and research is been made by the student with the help of the supervisor. The topic or problem is given to the student. The student might also propose their own topic.

Each topic have their own supervisor who will monitor the student's progress. For the final year project I, the student need to make research regarding the topic and find the method to solve the problem. Final year project will end with proposal defense which the student need to defend their topic and research.

During the final year project II, to student need to solve the problem relating the topic given. The student need to make the poster for the presentation (pre-SEDEX). Then they need to complete the final report and technical paper. Lastly the will have viva with the examiner to present their final results.

In this report, I will explain all the method and result that I got to solve the problem I have. In the first chapter I will explain the background of the project and the problem that I receive. Then in the second chapter I will show the research I have make. In

this part, we can see the solution that have been applied by other to solve the problem.

Chapter three will cover on the methodology to solve the problem given. In this chapter we can see the flow of the project and the gantt chart of the project. Next chapter is chapter four which will cover on results and discussion. The result given should solve the problem and achieve the objective(s) of the project. Finally, chapter five will cover on conclusion and recommendation. The recommendation are for future improvement of the project.

## **ACKNOWLEDGEMENT**

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Background of Study**

Nowadays we can see all around the world, the vehicles either public or personal have been installed with gps tracking system. There are lots of benefit that we can gain by having this system in our vehicles. One of the interesting part is the cost of the insurance will be low as this system are applied to our personal vehicles. Furthermore we also can see this system been applied to the public transport, for example in Light Rail Transit (LRT). When LRT arrive certain station the system will automatically alert the passenger regarding the station.

By applying this system to our belongings we can prevent our vehicles been stolen or we can monitored our company's asset. In this final year project I apply this system to company asset. The companies that have faith for me are Bakticon Engineering Sdn Bhd and InnoChems Technologies Sdn Bhd. Both of this companies make business that need to transport their product to a long journey. Therefore they ask me to apply this system in their asset. Their whole aim are to make sure their asset arrive at the destination in time and within the given schedule.

In this final year project, I will apply this system to both of the companies and at the same time use linear programming system to set and monitor the delivering schedule. For FYP 1, it will more focus on the research and learning on using the system and applying the linear programming in the system. While for FYP 2, I will get the data from the system, analyze and applying programing.

## **1.2 Problem Statement**

The situation now the company got lots of journey demand as they need to carry the asset from one destination to another locations. However the company have limited number of driver compare to the number of journeys. Furthermore there is a rule set by the government which the driver cannot work more than specific time given. They also should have enough rest time. For example if the driver have working 8 hours a day for four days, he/she need a day off for a rest. Lastly, as the company receive lots of journey demands, they didn't know how many time they should accept the journey to cover the cost and give maximum profit.

## **1.3 Objectives**

The objectives of my project are as follow:-

- Installing the GPS system to collect the journey information
- Applying linear programing to know the breakeven value of the journey
- Make the schedule system to get maximum profit available

## **1.4 Scope of Study**

As to make sure this final year project could be finish in two semester which is 8 months, I have make some limitation for the project. For the programming I will not use C++ as it will take long time to enter the coding and make the simulation. Therefore I will just use Microsoft Excel to compute the linear programing.

## **CHAPTER 2**

### **LITERATURE REVIEW**

Vehicle tracking systems are commonly used by fleet operators for fleet management functions such as “fleet tracking, routing, dispatch, on-board information and security” (Al-Shaery, 2013). Along with commercial fleet operators, urban transit agencies use the technology for a number of purposes, including monitoring schedule adherence of buses in service, triggering changes of buses’ destination sign displays at the end of the line (or other set location along a bus route), and triggering pre-recorded announcements for passengers. The American Public Transportation Association estimated that, at the beginning of 2009, “around half of all transit buses in the United States were already using GPS-based vehicle tracking system to trigger automated stop announcements” (Dimitri Panagiotakopoulos, 2013).

This can refer to external announcements (triggered by the opening of the bus’s door) at a bus stop, announcing the vehicle’s route number and destination, primarily for the benefit of visually impaired customers, or to internal announcements (to passengers already on board) identifying the next stop, as the bus (or tram) approaches a stop, or both. Data collected as a transit vehicle follows its route is often continuously fed into a computer program which compares the vehicle’s actual location and time with its schedule, and in turn produces a frequently updating display for the driver, telling him/her how early or late he/she is at any given time, potentially making it easier to adhere more closely to the published schedule.

Such programs are also used to provide customers with “real-time information as to the waiting time” (Phan, 2013) until arrival of the next bus or tram/streetcar at a given stop, based on the nearest vehicles’ actual progress at the time, rather than merely giving information as to the scheduled time of the next arrival. Transit systems providing this kind of information assign a unique number to each stop, and waiting passengers can obtain information by entering the stop number into an automated telephone system or an application on the transit system’s website. Some transit agencies “provide a virtual map on their website, with icons depicting the current locations of buses in service on each route, for customers’

information, while others provide such information only to dispatchers or other employees” (Xingxing Li, 2013). Other scenarios in which this technology is employed include:

- Fleet management – When managing a fleet of vehicles, knowing the real-time location of all drivers allows management to meet customer need more efficiently. Whether it is delivery, service or other multi-vehicle enterprises, drivers now only need a mobile phone with telephone or Internet connection to be inexpensively tracked by and dispatched efficiently.
- Asset tracking – Companies needing to track valuable assets for insurance or other monitoring purposes can now plot the real-time asset location and closely monitor movement and operating status.
- Field service management – Companies with a field service workforce for services such as repair or maintenance, must be able to plan field worker’s time, schedule subsequent customer visits and be able to operate these departments efficiently. Vehicle tracking allows companies to quickly locate a field engineer and dispatch the closest one to meet a new customer request or provide site arrival information.
- Field sales – Mobile sales professionals can access real-time locations. For example, in unfamiliar areas, they can locate themselves as well as customers and prospects, get driving directions and add nearby last-minute appointments to itineraries. Benefits include increased productivity, reduced driving time and increased time spent with customers and prospects.

## METHODOLOGY

First of all, I will make a research regarding the system that already been used from others company. From this research I can know the advantage and disadvantage of this system, and I can improve the weakness of the system. To apply this system to vehicle management, I will install the device in the company's vehicle and set up the system in computer to synchronize with the device I already installed. When all of this have been set up, I will receive notification by email or via the software.

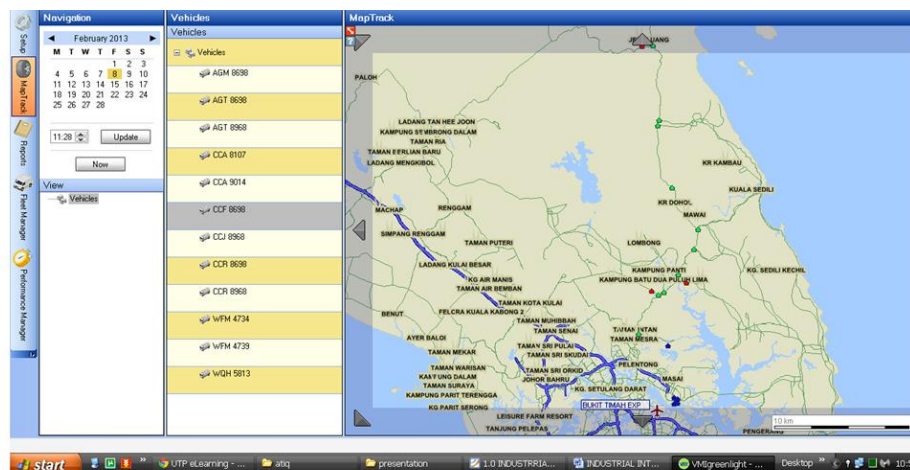


Figure 1: GPS Tracking Software

Every day I will receive email from the system that give report of the daily journey of the company's vehicle. The nine report that I will receive are Daily Summary Report, Condensed Time at Locations Report, Daily Activity Report, Detailed Journey Report, Distance Traveled Report, Idling Report, Journey Report, Operating Cost Summary and Speeding Exceptions Report. There are lots of information that I can receive from this report. However I will just focus to certain part as to ensure the project can be finish in the given time (2 semester).

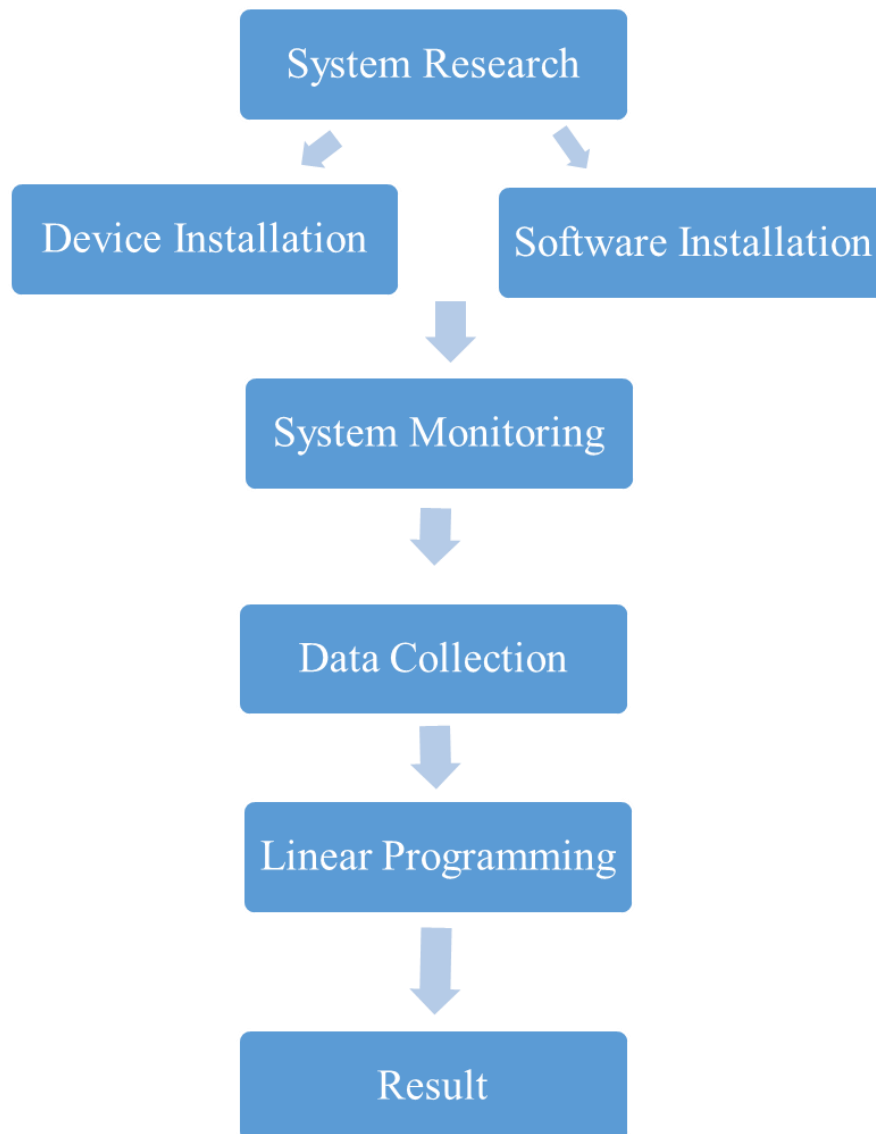
To make linear scheduling based on the report I receive daily, I will focus on 8 important point which are:-

- Cost per kilometer and idle cost
- Speed limit and maximum speed location
- Stopping time
- Working hour

- Driving time
- Maximum distance covered
- Idling, maximum standing and operating time
- Start and ending location on that day

From this 8 point we will analyze and apply linear programming to find the suitable value. Variations of linear programming problems can arise when one want to get certain value of maximization or minimization.

The figure below shows the main procedure in completing this project in order to achieve its objectives.



*Figure 2: Methodology of Project*

To make sure I can complete my final year project in this two semester, I have set milestone to achieve and producing gantt chart. This gantt chart is used to know the aim of the project every weeks.

Table 1: Gantt chart for FYP 1

No	Action/Plan	Week													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Consolidation of FYP topics														
2	Topic proposal														
3	Research / Literature review														
4	Meeting with company engineer														
5	Submission of extended proposal														
6	Proposal defense														
7	Device installation														
8	Data Collection														
9	Submission of interim report														

Table 2: Gantt chart for FYP2

No	Action/Plan	Week														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Continue Project															
2	Submit Progress Report															
4	Pre-SEDEX															
5	Submit Draft Dissertation															
6	Submit Dissertation & Technical Paper															
7	Oral Present															
8	Submit Hard Bound															

LEGEND	
	Project Schedule
	FYP Schedule

## CHAPTER 4

### RESULTS & DISCUSSION

After I synchronize the device in the vehicles and make the software programming in my computer, I will receive daily journal information in my computer either via email or live notifications. From this information/report I will create the scheduling for the company. The scheduling is for the optimum working hour for the drivers. Below are the report that I will receive every day that consist all the information of the journey.

#### DAILY SUMMARY REPORT

Bakticon Engineering

##### **Daily Summary Report**

For 01/03/2013 00:00 to 01/03/2013 23:59  
All Data

01/03/2013 Vehicle	Departure Time	Depart Location	Arrival Location	Arrival Time	Driving Time	Total Time	Distance	Sensor Activity	Drop Count
AGM 8698	06:20	Jalan Jabor - Al Muktafi Billah Shah (70kph), N of , Kemaman,	Jalan Jabor - Al Muktafi Billah Shah (70kph), N of , Kemaman,	11:01	03:28	04:41	73.86	00:00	0
AGT 8698	08:31	Office	Office	14:58	01:47	06:27	0.03	00:00	0
CCA 8107	-	Moving	Office	16:57	13:19	13:57	412.35	00:00	0
CCA 9014	14:45	Office	Office	16:40	00:25	01:55	0.10	00:00	0
CCF 8698	07:44	Jalan Jabor - Al Muktafi Billah Shah (70kph), N of Perasing, Kemaman,	Office	11:58	03:31	04:14	28.64	00:00	0
CCR 8698	14:22	(50kph), N of Kampung Balok Baru, Kuantan,	(50kph), N of Kampung Balok Baru, Kuantan,	15:12	00:50	00:50	0.00	00:00	0
WFM 4734	07:52	Office	Office	10:12	01:14	02:20	8.67	00:00	0
WFM 4739	07:44	Jalan Jabor - Al Muktafi Billah Shah (70kph), N of Perasing, Kemaman,	Office	17:23	04:54	09:40	20.51	00:00	0
WQH 5813	09:29	Office	Office	17:49	03:04	08:20	0.09	00:00	0
Totals On 01/03/13					32:32	52:25	544.26	00:00	0

*Figure 3: Daily Summary Report*

In this report we can see the overall summarize of the vehicle's journey on that specific day. We can know the departure and the arrival time of each of the vehicles. Furthermore it show the location of the departure and final location. On the right side of the report we can see there is total distance cover by the vehicles on that day. Here there is two time reported which are driving time and total time while the value are not same. Driving time is the time taken while the vehicle is moving only (not include idle and rest). While total time is the working hour of the driver on that day (also known as the difference between arrival and departure time).



## CONDENSED TIME AT LOCATIONS REPORT

Bakticon Engineering

### Condensed Time At Locations Report

For 01/03/2013 00:00 To 01/03/2013 23:59

Show Passing Thru : No

Sort Order : Location, Date, Vehicle/Driver, Arrival Time

All Data

Visited Location : Cargill				
Date	Vehicle	From	To	Visit Length
01/03/2013				
	AGM 8698	07:13	09:50	02:36
	CCF 8698	08:41	10:32	01:51
	CCF 8698	11:15	11:51	00:36
	WFM 4734	08:08	10:00	01:52
	WFM 4739	08:43	10:16	01:34
Total visit length for day: 08:29		Total Visits For Day: 5		Average visit length for day: 01:42

Total visit length for location:	08:29
Total visits counted for location:	5
Average visit length for location:	01:42

Figure 4: Condensed Time at Locations Report

Condensed time at locations report are different compare to daily summary report. In this report it show for how long the vehicles stop at every location. It's also show the number of company's vehicles visit the location on that particular day.

## DAILY ACTIVITY REPORT

Bakticon Engineering

### Daily Activity Report

For 01/03/2013 00:00 to 01/03/2013 23:59

All Data

AGM 8698							
Date	Ign On	Departed From	Arrived At	Ign Off	Driving Time	Standing Time	Distance Travelled (km)
01/03/2013							
	Standing For (06:20)						
	06:20	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	Cargill	08:30	02:10	00:59	33.86
	09:30	Cargill	Office	10:05	00:35	00:13	4.28
	10:18	Office	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	11:01	00:43	12:58	35.72
Totals On 01/03/2013		Total Driving Time	03:28	Total Distance	73.86		
		Total Standing Time	20:31				
Totals For AGM 8698		Total Driving Time	03:28	Daily Average Driving Time	03:28		
		Total Standing Time	20:31	Daily Average Standing Time	20:31		
		Total Distance	73.86	Daily Average Distance	73.86		

Figure 5: Daily Activity Report

In this report, it show the detailed journey information of each of the company vehicles. The company can know when the drivers start working on that day and until what time he/she drives. The company also can know the location if the driver stop for having a rest. By using this report we can calculate the fuel consumption by

the vehicle. In this report, it have a new term which is standing time. Standing time is a time taken when the engine is off.

## DETAILED JOURNEY REPORT

Bakticon Engineering

### Detailed Journey Report

For 01/03/2013 00:00 to 01/03/2013 23:59

All Data

AGM 8698									
Date	Start Time	Driver	Driving Time	Idling Time	Stop Time	Standing Duration	Arrived At	Max Speed (kph)	Distance (km)
01/03/2013									
	06:20	Janas	02:10	01:17	08:30	00:59	Cargill	65	33.86
	09:30	Janas	00:35	00:16	10:05	00:13	Office	63	4.28
	10:18	Janas	00:43	00:05	11:01	-	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	77	35.72
Totals On 01/03/2013			03:28	01:38		01:13			73.86
									03:28 @ 10.00 per hour: \$34.71 73.86 km @ 0.86 per km: \$63.52 Total Cost: \$98.23
Totals For AGM 8698			03:28	01:38		01:13		Total Cost: \$98.23	73.86

Figure 6: Detailed Journey Report

In this report, I will more focus on the time taken. This report show the start, stop, idling and standing time. Idling time is the time taken whenever the engine is running but the vehicles is not moving. We also can get the maximum speed the driver drives during journey. The company want me to set the idling time because they want to monitor the diesel consuming. As we get the total time taken and total distance cover, we can calculate the diesel price. After a meeting been conduct, the company have set that the diesel price been divided into two types. Diesel price based on distance covered (RM 0.86 per km) and diesel price based on time taken (RM 10.00 per hour). At the right bottom of the report we can see the total diesel cost.

## DISTANCE TRAVELLED REPORT

Bakticon Engineering

### Distance Travelled

For 01/03/2013 00:00 to 01/03/2013 23:59

All Data

AGM 8698							
Start Time	Departed From	End Time	Arrived At	Driving Time	Distance Travelled (km)	Driver	
01/03/2013							
06:20	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	08:30	Cargill	02:10	33.86	Janas	
09:30	Cargill	10:05	Office	00:35	4.28	Janas	
10:18	Office	11:01	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	00:43	35.72	Janas	
Totals On 01/03/2013							
Total Driving Time:		03:28	Total Hours Worked: 04:41		Total Distance:		73.86
Totals For AGM 8698							
Total Distance:		73.86	Total Number Of Days: 1		Daily Average Distance:		73.86
Total Driving Time:		03:28			Daily Average Driving Time:		03:28
Total Hours Worked:		04:41			Daily Average Hours Worked:		04:41

Figure 7: Distance Travelled Report

As the name, this report focus more on the total distance covered by the vehicle on that particular day. Furthermore, the driving time and working hours also shown at the left bottom of the report. From this report we can calculate the average time taken for a certain journey.

## IDLING REPORT

Bakticon Engineering

### **Idling Report**

For 01/03/2013 00:00 to 01/03/2013 23:59  
All Data

AGM 8698				
Date	Started Idling	Finished Idling	Idling For	Location
01/03/2013				
	06:21	06:29	00:08	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,
	07:15	08:08	00:53	Cargill
	08:10	08:19	00:09	Cargill
	08:21	08:27	00:06	Cargill
	08:29	08:30	00:01	Cargill
	09:31	09:37	00:06	Cargill
	09:40	09:43	00:03	Cargill
	09:47	09:49	00:02	Cargill
	09:59	10:04	00:05	Office
	10:19	10:24	00:05	Office
Totals On 01/03/2013		Total Idling Time For Day	01:38	
Totals For AGM 8698				
Total Idling Time: 01:38			Total Idling Cost: \$16.33	
Average Time Spent Idling per day: 01:38			Average Idling Cost per day: \$16.33	
Total Days Worked: 1				

Figure 8: Idling Report

In this report I focus more on the idling time. We want to reduce the idling time during the vehicle journey, as it consume diesel. The company want to optimize the profit they gain. By using the diesel rate that have been set by the company, I can calculate the idling cost of every vehicles.

## JOURNEY REPORT

Bakticon Engineering

### Journey Report

For 01/03/2013 00:00 to 01/03/2013 23:59  
All Data

AGM 8698											
Date	Ign On	Driver	Started Moving	Departed From	Arrived At	Stopped Moving	Ign Off	Time Taken	Standing Time	Distance Travelled (km)	
01/03/2013											
Standing For (06:20)											
06:20	Janas		06:20	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	06:21	-	00:01	-	-	
-	Janas		06:29	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	Cargill	07:15	-	00:46	-	-	
-	Janas		08:08	Cargill	Cargill	08:10	-	00:02	-	-	
-	Janas		08:19	Cargill	Cargill	08:21	-	00:02	-	-	
-	Janas		08:27	Cargill	Cargill	08:29	-	00:02	-	-	
-	Janas		08:30	Cargill	Cargill	08:30	08:30	00:00	00:59	33.86	
09:30	Janas		09:30	Cargill	Cargill	09:31	-	00:01	-	-	
-	Janas		09:37	Cargill	Cargill	09:40	-	00:03	-	-	
-	Janas		09:43	Cargill	Cargill	09:47	-	00:04	-	-	
-	Janas		09:49	Cargill	Office	09:59	-	00:10	-	-	
-	Janas		10:04	Office	Office	10:05	10:05	00:01	00:13	4.28	
10:18	Janas		10:18	Office	Office	10:19	-	00:01	-	-	
-	Janas		10:24	Office	Jalan Jabor - Al Muktafi Billah Shah (70kph), -1.10km N of , Kemaman,	11:01	11:01	00:37	12:58	35.72	
Totals On 01/03/2013											
Total Idling At Start of Journey					00:00	Total Moving Time			01:50		
Total Idling During Journey					01:38	Total Driving Time			03:28		
Total Idling At End of Journey					00:00	Total Standing Time			20:31		
Total Idling					01:38	Total Distance			73.86		
Collated on 03/03/2013 at 00:38 GMT											
MPL1200R1.0											
Page 1 of 13											

Collated on 03/03/2013 at 00:38 GMT

MPL1200IR1.0

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### Journey Report

Continued.....

Totals For AGM 8698											
Total Idling At Start of Journey					00:00	Total Moving Time			01:50		
Total Idling During Journey					01:38	Total Driving Time			03:28		
Total Idling At End of Journey					00:00	Total Standing Time			20:31		
Total Idling					01:38	Total Distance			73.86		
Daily Average Idling At Start of Journey					00:00	Daily Average Moving Time			01:50		
Daily Average Idling During Journey					01:38	Daily Average Driving Time			03:28		
Daily Average Idling At End of Journey					00:00	Daily Average Standing Time			20:31		
Daily Average Idling					01:38	Daily Average Distance			73.86		

Figure 9: Journey Report

This report is quite lengthy as I set it to show all the detailed off the vehicle's journey. It shows all the important time taken during the journey and time taken at certain locations. Furthermore, we can get the standing time and the location of the standing. Therefore, we can know where the driver takes a rest and how long they take rest.

## OPERATING COST SUMMARY REPORT

Bakticon Engineering

### Operating Cost Summary Report

For 01/03/2013 00:00 to 01/03/2013 23:59  
All Data

Vehicle	Days Worked	Driving Time	Idling Time	Operating Time	Standing Time	Operating Cost	Distance Travelled (km)	Distance Cost
AGM 8698	1	01:50	01:38	03:28	20:31	\$34.67	73.86	\$63.52
AGT 8698	1	00:08	01:39	01:47	22:12	\$17.83	0.03	\$0.03
CCA 8107	1	09:02	07:17	16:19	07:40	\$163.17	492.22	\$388.86
CCA 9014	1	00:10	00:15	00:25	23:34	\$4.17	0.10	\$0.08
CCF 8698	1	01:09	02:22	03:31	20:28	\$35.17	28.64	\$24.63
CCR 8698	1	00:03	00:47	00:50	23:09	\$8.33	0.00	\$0.00
WFM 4734	1	00:44	00:30	01:14	22:45	\$12.33	8.67	\$6.85
WFM 4739	1	01:18	03:36	04:54	19:05	\$49.00	20.51	\$16.20
WQH 5813	1	00:11	02:53	03:04	20:55	\$30.67	0.09	\$0.07
<b>Total for vehicles shown</b>	<b>9</b>	<b>14:35</b>	<b>20:57</b>	<b>35:32</b>	<b>180:19</b>	<b>\$355.33</b>	<b>624.14</b>	<b>\$500.24</b>
<b>Average across all vehicles shown for period</b>								
<b>(9 vehicles)</b>	<b>1.00</b>	<b>01:37</b>	<b>02:20</b>	<b>03:57</b>	<b>20:02</b>	<b>\$39.48</b>	<b>69.35</b>	<b>\$55.58</b>
<b>Daily average per vehicle for days worked</b>								
<b>(9 days)</b>		<b>01:37</b>	<b>02:20</b>	<b>03:57</b>	<b>20:02</b>	<b>\$39.48</b>	<b>69.35</b>	<b>\$55.58</b>

Figure 10: Operating Cost Summary Report

In this report I summarize all the cost of the vehicles on one day. The cost are been divided based on the distance and operating cost. By using this report I can calculate the total diesel cost that the company need on that one day.

## SPEEDING EXCEPTIONS REPORT

Bakticon Engineering

### Speeding Exceptions Report

For 01/03/2013 00:00 to 01/03/2013 23:59  
All Data  
Shows exceptions when speeding over 80 kph

<b>CCA 8107</b>		
Date Time	Exception	Location
<b>01/03/2013</b>		
04:57	Started speeding, reached speed of 85 kph	Jalan Semarak 39 (50kph), 0.16km NE of Bandar Baru Pancur, Seremban,
04:59	Started speeding, reached speed of 83 kph	(50kph), 0.13km N of Taman Perwira, Seremban,
06:07	Started speeding, reached speed of 91 kph	(50kph), 0.15km NW of Kampung Batu 8, Seremban,
06:08	Started speeding, reached speed of 92 kph	Interchange (90kph), 0.18km S of Taman Asoka, Seremban,
10:33	Started speeding, reached speed of 82 kph	Jalan Pajam Batu 13 (70kph), 0.15km SE of Taman Anggerik, Seremban,
11:04	Started speeding, reached speed of 103 kph	Kajang - Seremban Highway (90kph), 1.12km S of Taman Anggerik, Seremban,
11:05	Started speeding, reached speed of 92 kph	Kajang - Seremban Highway (90kph), 1.12km S of Kampung Gebok, Seremban,
11:06	Started speeding, reached speed of 96 kph	Kajang - Seremban Highway (90kph), 1.12km SW of Kampung Che Lah, Seremban,
11:07	Started speeding, reached speed of 94 kph	Kajang - Seremban Highway (90kph), 0.15km S of Taman Andalas, Seremban,

Figure 11: Speeding Exceptions Report

After discussion with the manager of the company, we have agreed to set the speeding limit to be 80 km/h for the vehicles. This to prevent damage on the

company assets and the company's vehicles. In this report we can see when the driver drives exceed the speeding limit and it locations.

Bakticon Engineering have 9 drivers with their own vehicles. Below are the list of the drivers:-

*Table 3: Vehicles List*

<b>Vehicle</b>	<b>Vehicle Registration No</b>	<b>Driver</b>
A	AGM 8698	Janas
B	CCF 8698	Maseri
C	WFM 4734	Zuraimi
D	WFM 4739	Adnan
E	CCA 8107	Napi
F	AGT 8698	Razali
G	CCA 9014	Fazil
H	WQH 5813	Hazaha
I	CCR 8698	Romainor

This company have 4 working journey every day and they have set the standard for every journey they have:-

*Table 4: Journey Estimations*

<b>No</b>	<b>Journey</b>	<b>Distance (km)</b>	<b>Time Taken (Hours)</b>	<b>Total Days Work</b>	<b>Diesel Cost by Distance (RM)</b>	<b>Diesel Cost by Time Taken (RM)</b>	<b>Total Cost (RM)</b>
1	Office - Kemaman	35.72	0.72	1	30.7192	7.2	37.9192
2	Office - Kampung Balok Baru	2.5	0.05	1	2.15	0.5	2.65
3	Office - Cargill	4.28	0.09	1	3.6808	0.9	4.5808
4	Office - Ngo Chew Hong	326.27	6.53	1	280.5922	65.3	345.8922

From the data that I receive daily, I will analyze and produce estimation for cumulative total cost (TC) and revenue (R). The total cost id the addition of fixed cost (FC) and Variable Cost (VC). Fixed cost in this journey is the cost of diesel, labor, toll, mobile credit, insurance and food. While variable cost is the cost of

maintenance of the vehicles. After I calculate the value, I will plot a graph where the total cost and revenue against the number of journey. From this graph I can get the value breakeven ( $Q_{BE}$ ). Breakeven value is a value whenever the line of total cost intercept the line of revenue. The value to the left of this breakeven means that the company still loss while the value to the right means the company start to gain profits. In the next page, I will show the calculation that I have made for every journey the company have taken.

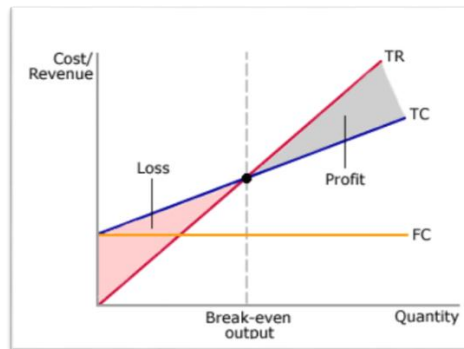


Figure 12: Breakeven Point

## Office - Ngo Chew Hong

Table 5: Calculated Value of Office - Ngo Chew Hong Journey

Journey/Month (Q)	Fixed Cost (FC)	Variable Cost (VC)	Total Cost (TC)	Revenue, R
1	1101.78	0	1101.78	550.89
2	2203.56	0	2203.56	1189.92
3	3305.34	375	3680.34	2134.6
4	4407.12	0	4407.12	2732.41
5	5508.9	0	5508.9	3635.87
6	6610.68	350	6960.68	4872.48
7	7712.46	0	7712.46	5707.22
8	8814.24	0	8814.24	6875.11
9	9916.02	375	10291.02	8438.64
10	11017.8	0	11017.8	9475.31
11	12119.58	0	12119.58	10907.62
12	13221.36	375	13596.36	12780.58
13	14323.14	0	14323.14	14036.68
14	15424.92	0	15424.92	15733.42
15	16526.7	375	16901.7	17915.8
16	17628.48	0	17628.48	19391.33
17	18730.26	0	18730.26	21352.5
18	19832.04	375	20207.04	23844.31
19	20933.82	0	20933.82	25539.26
20	22035.6	0	22035.6	27764.86
21	23137.38	375	23512.38	30566.09
22	24239.16	0	24239.16	32480.47
23	25340.94	0	25340.94	34970.5
24	26442.72	375	26817.72	38081.16
25	27544.5	0	27544.5	40214.97
26	28646.28	0	28646.28	42969.42
27	29748.06	375	30123.06	46389.51
28	30849.84	0	30849.84	48742.75
29	31951.62	0	31951.62	51761.62
30	33053.4	375	33428.4	55491.14
31	34155.18	0	34155.18	58063.81

From this value that we have calculate we will plot the graph to know the value of breakeven.



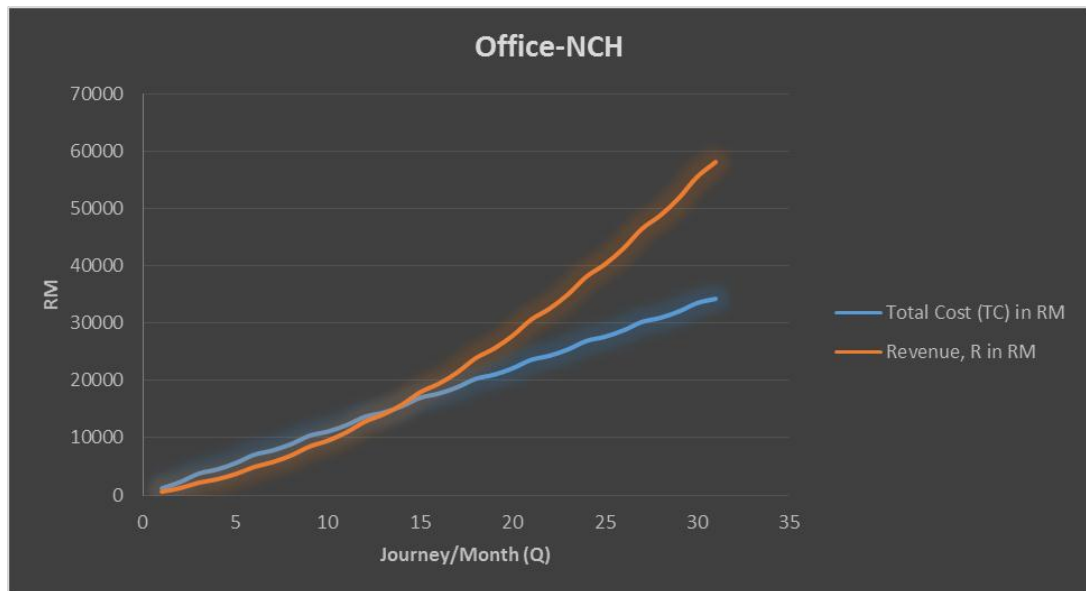


Figure 13: Graph for Office - Ngo Chew Hong Journey

From this graph we can see that the two line intercept at  $Q=13.5$  which it means for this journey, the company should exceed 14 journeys per month to start gain profit.

## Office – Kemaman

Table 6: Calculated Value of Office - Kemaman Journey

Journey/Month (Q)	Fixed Cost (FC)	Variable Cost (VC)	Total Cost (TC)	Revenue, R
1	297.92	0	297.92	148.96
2	595.84	0	595.84	345.5872
3	893.76	375	1268.76	837.3816
4	1191.68	0	1191.68	881.8432
5	1489.6	0	1489.6	1221.472
6	1787.52	350	2137.52	1923.768
7	2085.44	0	2085.44	2043.7312
8	2383.36	0	2383.36	2526.3616
9	2681.28	375	3056.28	3484.1592
10	2979.2	0	2979.2	3634.624
11	3277.12	0	3277.12	4260.256
12	3575.04	375	3950.04	5451.0552
13	3872.96	0	3872.96	5654.5216
14	4170.88	0	4170.88	6423.1552
15	4468.8	375	4843.8	7846.956
16	4766.72	0	4766.72	8103.424
17	5064.64	0	5064.64	9015.0592
18	5362.56	375	5737.56	10671.8616
19	5660.48	0	5660.48	10981.3312
20	5958.4	0	5958.4	12035.968
21	6256.32	375	6631.32	13925.772
22	6554.24	0	6554.24	14288.2432
23	6852.16	0	6852.16	15485.8816
24	7150.08	375	7525.08	17608.6872
25	7448	0	7448	18024.16
26	7745.92	0	7745.92	19364.8
27	8043.84	375	8418.84	21720.6072
28	8341.76	0	8341.76	22189.0816
29	8639.68	0	8639.68	23672.7232
30	8937.6	375	9312.6	26261.532
31	9235.52	0	9235.52	26783.008

From this value that we have calculate we will plot the graph to know the value of breakeven.

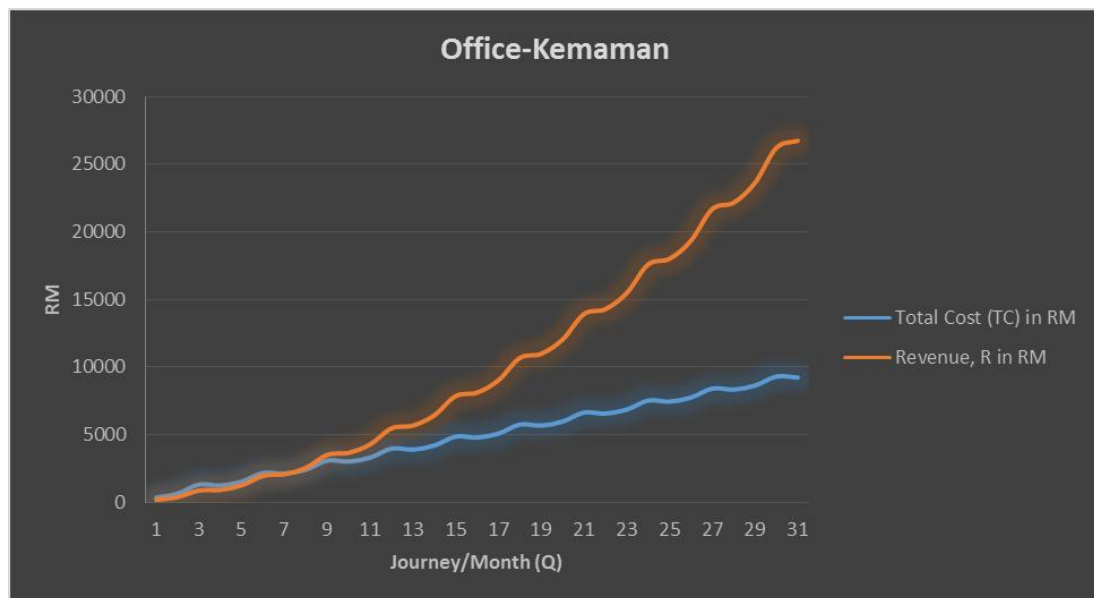


Figure 14: Graph for Office - Kemaman Journey

From this graph we can see that the two line intercept at  $Q=7.5$  which it means for this journey, the company should exceed 8 journeys per month to start gain profit.

## Office - Kampung Balok Baru

Table 7: Calculated Value of Office - Kampung Balok Baru Journey

Journey/Month (Q)	Fixed Cost (FC)	Variable Cost (VC)	Total Cost (TC)	Revenue, R
1	132.65	0	132.65	66.325
2	265.3	0	265.3	175.098
3	397.95	375	772.95	633.819
4	530.6	0	530.6	519.988
5	663.25	0	663.25	756.105
6	795.9	350	1145.9	1489.67
7	928.55	0	928.55	1355.683
8	1061.2	0	1061.2	1719.144
9	1193.85	375	1568.85	2792.553
10	1326.5	0	1326.5	2573.41
11	1459.15	0	1459.15	3064.215
12	1591.8	375	1966.8	4444.968
13	1724.45	0	1724.45	4173.169
14	1857.1	0	1857.1	4791.318
15	1989.75	375	2364.75	6479.415
16	2122.4	0	2122.4	6154.96
17	2255.05	0	2255.05	6900.453
18	2387.7	375	2762.7	8895.894
19	2520.35	0	2520.35	8518.783
20	2653	0	2653	9391.62
21	2785.65	375	3160.65	11694.405
22	2918.3	0	2918.3	11264.638
23	3050.95	0	3050.95	12264.819
24	3183.6	375	3558.6	14874.948
25	3316.25	0	3316.25	14392.525
26	3448.9	0	3448.9	15520.05
27	3581.55	375	3956.55	18437.523
28	3714.2	0	3714.2	17902.444
29	3846.85	0	3846.85	19157.313
30	3979.5	375	4354.5	22382.13
31	4112.15	0	4112.15	21794.395

From this value that we have calculate we will plot the graph to know the value of breakeven.

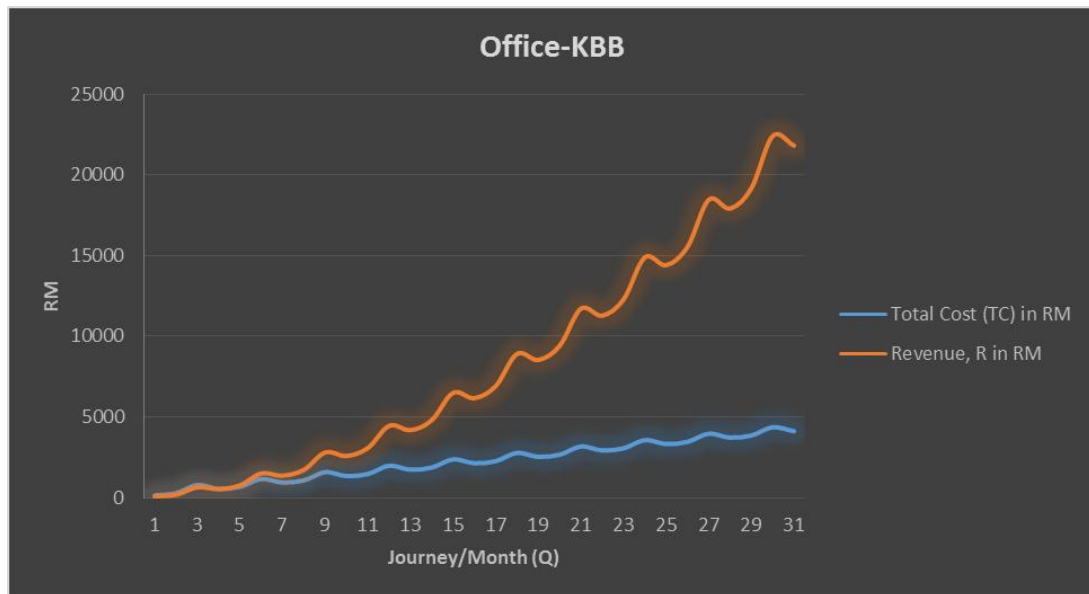


Figure 15: Graph for Office - Kampung Balok Baru Journey

From this graph we can see that the two line intercept at  $Q=4.5$  which it means for this journey, the company should exceed 5 journeys per month to start gain profit.

## Office – Cargill

Table 8: Calculated Value of Office - Cargill Journey

Journey/Month (Q)	Fixed Cost (FC)	Variable Cost (VC)	Total Cost (TC)	Revenue, R
1	164.58	0	164.58	82.29
2	329.16	0	329.16	204.0792
3	493.74	375	868.74	642.8676
4	658.32	0	658.32	566.1552
5	822.9	0	822.9	806.442
6	987.48	350	1337.48	1471.228
7	1152.06	0	1152.06	1405.5132
8	1316.64	0	1316.64	1764.2976
9	1481.22	375	1856.22	2710.0812
10	1645.8	0	1645.8	2600.364
11	1810.38	0	1810.38	3077.646
12	1974.96	375	2349.96	4276.9272
13	2139.54	0	2139.54	4150.7076
14	2304.12	0	2304.12	4746.4872
15	2468.7	375	2843.7	6199.266
16	2633.28	0	2633.28	6056.544
17	2797.86	0	2797.86	6770.8212
18	2962.44	375	3337.44	8477.0976
19	3127.02	0	3127.02	8317.8732
20	3291.6	0	3291.6	9150.648
21	3456.18	375	3831.18	11110.422
22	3620.76	0	3620.76	10934.6952
23	3785.34	0	3785.34	11885.9676
24	3949.92	375	4324.92	14099.2392
25	4114.5	0	4114.5	13907.01
26	4279.08	0	4279.08	14976.78
27	4443.66	375	4818.66	17443.5492
28	4608.24	0	4608.24	17234.8176
29	4772.82	0	4772.82	18423.0852
30	4937.4	375	5312.4	21143.352
31	5101.98	0	5101.98	20918.118

From this value that we have calculate we will plot the graph to know the value of breakeven.

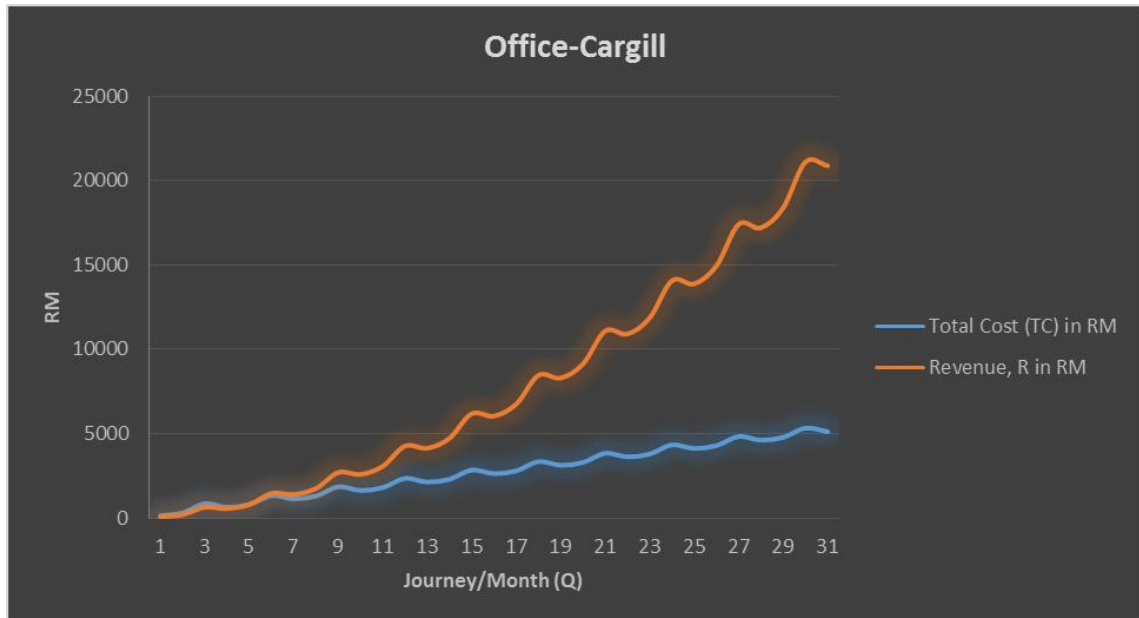


Figure 16: Graph for Office - Cargill Journey

From this graph we can see that the two line intercept at  $Q=5.7$  which it means for this journey, the company should exceed 6 journeys per month to start gain profit.

After all the analysis above we can get all the breakeven value for each journey as follow:-

Table 9: No of Journey Breakeven

No	Journey	Q(BE)
A	Office - Kemaman	8 days
B	Office - Kampung Balok Baru	5 days
C	Office - Cargill	6 days
D	Office - Ngo Chew Hong	14 days

From all this value that we receive we can set the scheduling of all the driver following the available journey. Here we can maximize the profit as we will make the journey which give more revenue the highest priority compare to the journey give less revenue. Between all the journeys the highest revenue the company gain is the journey from office to Ngo Chew Hong. Therefore we will make more this journey compare to others. In the next page we can see the example of the scheduling with some rules that need to be follow.

Table 10: Vehicle Scheduling

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Janas	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B
Maseri	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C
Zuraimi	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X
Adnan	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D
Napi	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B
Razali	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C
Fazil	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X
Hazaha	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A
Romainor	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C	A	X	C	B	D	X	C	B	C

	JOURNEY
A	Office - Kemaman
B	Office - Kampung Balok Baru
C	Office - Cargill
D	Office - Ngo Chew Hong
X	Off Day

Rules that need to be follow:-

- After 8 hours work for 4 days, a day off will be given
- Maximum working hour for a day is 16 hours
- Minimum working hour for a day is 8 hours



## **CHAPTER 5**

### **CONCLUSION**

From this final year report, I can schedule the journey of each of the driver and at the same time I can monitor the company's asset. Nowadays there are lots of companies that use this similar kind of device in their business. Although the name are different, but it still use the same concept and satellite. By using this software our company can optimize the usage of driver and maximize the profit that they will gain.

This project have achieved the objectives and solve the company problem. By applying this system the company can know the number of journey they required to get the maximum profit. It's also can prevent the company to loss as they know the breakeven point. Furthermore, the company can manage all the journey with the number of driver they have now. Lastly, they can detect which journey can give more revenues compare to others by using this journey.

### **RECOMMENDATION**

As this project been made for 8 months only, it have lots of limitations. The value that we receive from the daily report might be different for every month. To make sure the calculation the calculation and scheduling work easy and faster, we might use C++ software for the programing. This software also have some weakness as the people that manage the software cannot give any warning or notifications to the driver as the system is one way system. We should make the gps system in the vehicle have some alert sound or communication thing that can give warning to the driver.

## REFERENCES

- A. Al-Shaery, S. Z. (2013). An enhanced calibration method of GLONASS inter-channel bias for GNSS RTK. GPS Solutions, 165.
- Dimitri Panagiotakopoulos, A. M. (2013). Extreme value theory-based integrity monitoring of global navigation satellite systems. GPS Solutions, 72.
- gps tracking system. (2000). Retrieved from [http://www.minorplanet.com.my/corp\\_profile.php?main=com\\_frontpage&sub=cp](http://www.minorplanet.com.my/corp_profile.php?main=com_frontpage&sub=cp)
- Guan Wen Huang, Q. Z. (2013). Real-time clock offset prediction with an improved model. GPS Solutions, 16.
- Phan, Q.-H. (2013). GPS multipath mitigation: a nonlinear regression approach. GPS Solutions, 371.
- The function of gps tracking unit. (n.d.). Retrieved from [https://en.wikipedia.org/wiki/GPS\\_tracking\\_unit](https://en.wikipedia.org/wiki/GPS_tracking_unit)
- Tian Jin, J. R. (2013). Stability analysis of GPS carrier tracking loops by phase margin approach. GPS Solutions, 423.
- Xingxing Li, M. G. (2013). Real-time precise point. GPS Solutions, 170.