DESINING PROJECT SCHEDULE FOR MIGRATION PROJECT STO DAGO IN PT. XYZ TO ACCELERATE PROJECT DURATION USING SCHEDULE COMPRESSION – A LESSON LEARN CASE STUDY FOR ANOTHER SIMILAR PROJECT

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ABSTRACT

A project requires a mature planning, execution, and control. All requirements aforementioned for the project implementation are strongly supported by the availability of materials and labor. Inaccuracies in Project Schedule Management will lead to problems such as delays, soaring costs, etc. Projects that have delay indications should be addressed immediately by accelerating the schedule using the Schedule Compression. The delay indication could be seen during the Monitor and Control Project Work through the Earned Value Analysis (EVM). The aim of using schedule compression in this study is to accelerate the duration of Migration Project in STO DAGO which is one of the long-term projects of PT. XYZ. Migration project is the process of transitioning the telecommunication infrastructure from copper transmission media to fiber optic cable. The contract of Migration Project in STO Dago has been running since January 2014 but it has been terminated on February 2018 when the project has not accomplished yet. The result of schedule compression will suggest a Project Manager to specify some options that can be done to finish the STO DAGO migration project on time, where these options could be used as a preventive action so that other migration project will not experience the same thing as delay and terminated project.

Key Words: *Project Schedule Management, Schedule Compression, migration project, Monitor and Control Project Work, Earned Value Analysis*

1. INTRODUCTION

PT. ABC is intensively building fiber optic cable network system for internet service, home phone, and UseeTV. This company is targeting by 2020, all copper cables centered at STO (Sentral Telepon Otomat) are replaced with fiber optic cables. The project of replacing the copper cable to optical fiber is called the migration project. All migration projects are subcontracted to PT. XYZ. Activities on all migration projects are identical to each other. On the previous migration projects, the duration that set by PT. ABC for PT. XYZ is always inappropriate or late. As a result, PT. XYZ was late in accomplishing the project and must pay a penalty. And finally, the project is given extra time to complete. The extra time of PT ABC's project is in the form of contract extention.

Table 1 Late Migration Project in 2016

(Source: PT. XYZ)

Project	Plan 1 (Time and Unit)	Actual 1 (Time and Unit)	Status	Plan 2 (Time and Unit)
Migrasi TITO Jakarta Outer-1 2016	March, 9885 units	March, 1066 units	10.7%	April, 12500 units
Migrasi TITO Jabar 2016	March, 3999 units	March, 2359 units	58.9%	April, 18200 units
Migrasi TITO Jatim 2016	March, 4900 units	March, 654 units	13.3%	April, 5900 units
Migrasi TITO Bali 2016	March, 6001 units	March, 1556 units	25.9%	April, 8400 units

STO Dago Migration Project is one of the example of late project. This project subcontracted from PT. ABC to PT. XYZ, and subcontracted again to CV. In this project, CV is the company that became the project executor and provide materials. According to the interview conducted with the PT XYZ's Project Manager, resource/labor provided from CV for this project is 20 worker, where a team of consists of 2 technician. It means that there are 10 teams provided.

The contract of project started running since 30 January 2014, but this migration project has not completed until the project is terminated (in the 23rd Reconciliation or final stage) in February 2018 because the project has been running too long and never achieved the Scope of Work (SOW) that has been set. This research only focuses on using SOW on 23rd Reconciliation Stage as the target achievement (objective project), where the 23rd Reconciliation Stage start running from 28 December 2017 and ends on 19 February 2018.

Migration project only focuses on the Installation Work Package which is included in Provisioning Type 1 (PT1).

Table 2 STO Dago Reconciliation Data

(Source: PT. XYZ)

Reconciliation Stage	Scope of Work (Plan)	Actual Performance
20th	16111	6096
21st	7091	2715
22nd	4175	607
23rd	4735	903

Due to limited data, PT. XYZ can only show the Reconciliation Stage from 20th to 23rd. According to Table 1, it can be seen that the actual performance never reached the number of Scope of Work. Then, this project requires a corrective which can be the basis for preventive action to prevent delays in migration project.

2. LITERATURE REVIEW

Study that concerned in Earned Value Management that has been conducted by (Pratami, Puspita, & Afrizal, 2017) mentioned that EVM can be used in the project monitoring and controlling and may result in 2 important categories such as cost and schedule. Thus, the EVM in this study is used in the monitoring and controlling phase to determine whether the SPI project is ahead or behind schedule.

One of the pioneering studies on scheduling project management was conducted by (Vya, 2013). She designed the project schedule of Columbia Pkoana Precast Block Production using Critical Path Method in to obtain the optimal time and minimum total cost in project completion. After she designed the project schedule based on the activity list, she crashed the critical activities by using Crashing Method.

Other past study that focuses on Project Schedule Management was conducted by Garg, 2016). His paper tells that crashing is a part of the schedule compression that used to compress the project schedule by decrement the total project schedule length. His study concerned on a case of civil engineering in project network with 8 different activies. The normal duration of project completion is 46 days. The final result shows that the optimum duration and cost is 18 days and 56,200.

3. METHODOLOGY

3.1 PARTICIPANTS

According to the brief explanation in introduction, the research question is to design the project schedule of STO Dago Migration Project in PT. XYZ to accelerate project duration using Schedule Compression to become a lesson learned case study for another similar project.

3.2 MEASUREMENTS

In this paper, we use the Project Schedule Management discusses about the completion time of project. According to PMBOK (2017), there are several process in Plan Schedule Management such as:

1. Plan Schedule Management, this process is undertaken to establish procedures, documentation, and for project planning, development, management, execution, and controlling of project schedule.
2. Define Activities, this process is done by identifying and documenting the specific actions to complete the project deliverables.
3. Sequence Activities, this processes is done by identifying and documenting the relationships of the project activities.
4. Estimate Activity Duration, this process is conducted to estimate the required working periods for the completion of individual activities cwith estimated resources.
5. Develop Schedule, this process is undertaken to analyze the sequence of activities, the duration, the requirement of resource, and the schedule constraints to generate a project schedule model for project execution & monitoring and control.
6. Control Schedule, this process is carried out to monitor the project status process to generate the project schedule update and manage the changes to schedule baseline.

According to PMBOK (2017), Schedule Compression is a technique that used to shorten or to accelerate the project duration without reducing the scope of the project to meet schedule constraints, specified dates, or other schedule objectives. There are 2 types of schedule compression, such as:

1. Crashing is a method for project duration shortening for the least incremental cost by reducing one or more critical activities duration. Crashing actions can includes to bringing additional resources, approving the project overtime, or paying expedite delivery to activities on the critical path.
2. Fast Tracking is a technique where activities that should be done sequentially using the original schedule are done in parallel way for some or all of their duration. In other words, fast tracking of a project means that activities are done simultaneously rather than waiting for each section to be completed separately. However, fast tracking can only be applied if the activity can actually be overlapped. In addition, fast tracking can save time but also add risks and may result in rework.

4. RESULTS AND DISCUSSION

4.1 SPI CHART

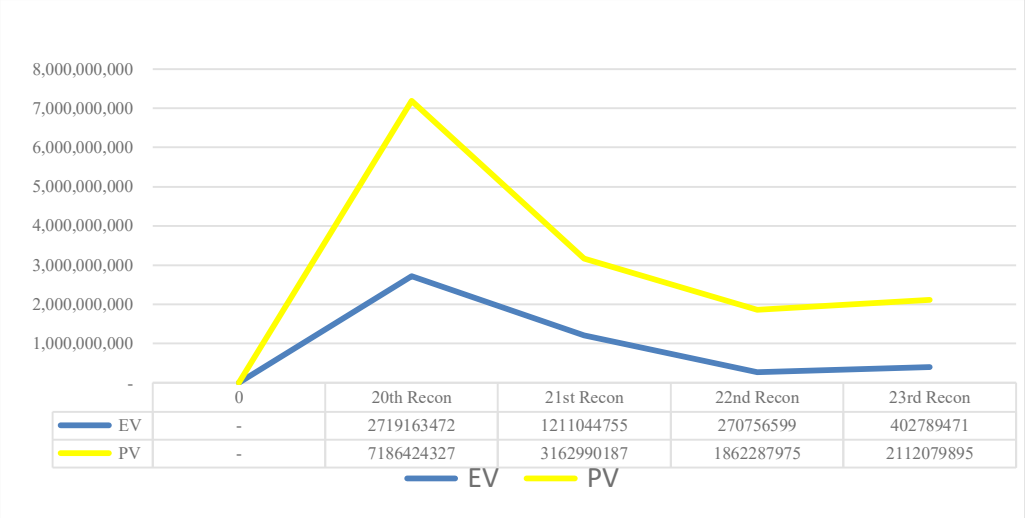


Figure 1 SPI Chart

According to Figure 1, it can be seen that the value of PV is greater that the EV. It means that the result of the division between EV and PV will be less than one. Since the SPI is less than one, it means that this schedule of migration project of STO DAGO are behind the schedule. Based on these result, STO Dago migration project should be addressed immediately by accelerating the schedule using Schedule Compression. This project requires a both corrective and preventive action to prevent repetition of delays in migration project.

4.2 Schedule Development

Table 3 Activity List and Dependencies

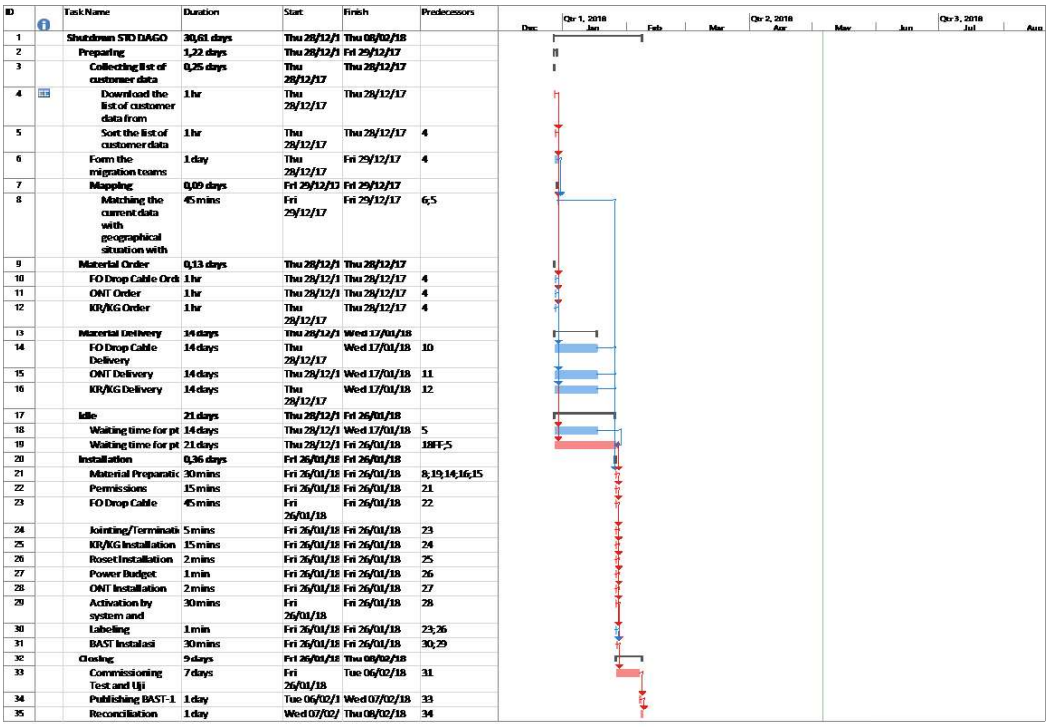
Activity Code	Activity	Predecessor	Resource	Duration
A	Download the list of customer data from PT.ABC	-	1	1 hour
B	Sort the list of customer	A		1 hour
C	Forming the migration team	A	1	1 day
D	Mapping to match the current data with the geographical circumstances (field survey)	B, C	24	45 minutes
E	FO Drop Cable Order	A	1	1 hour
F	ONT Order	A		1 hour
G	KR/KG Order	A		1 hour
H	FO Drop Cable Delivery	E	-	14 days
I	ONT Delivery	F	-	14 days
J	KR/KG Delivery	G	-	14 days
K	Waiting time for pt2	B	-	14 days
L	Waiting time for pt3	K	-	21 days

Table 3 Activity List and Dependencies (cont.)

M	Material Preparation	D, H, I, J, K, L	12	30 minutes
N	Permissions	M	24	15 minutes
O	FO Drop Cable	N		45 minutes
P	Jointing/Termination	O		5 minutes
Q	KR/KG Installation	P		15 minutes
R	Roset Installation	Q		2 minutes
S	Power Budget	R		1 minute
T	ONT Installation	S		2 minutes
U	System Activation and Migration	T		30 minutes
V	Labeling	R		1 mintue
W	BAST Installation	U, V		30 minutes
X	Commissioning Test	W	1	7 days
Y	Publishing BAST-1	X	1	1 day
Z	Reconciliation	Y	1	1 day

The schedule development done by using Microsoft Project based on activity list in Table 3 is as follows:

Table 4 Schedule Development



ID	Task Name	Duration	Start	Finish	Predecessors
1	Shutdown STO DAGO	30,61 days	Thu 28/12/1	Thu 08/02/18	
2	Preparing	1,22 days	Thu 28/12/1	Fri 29/12/17	
3	Collecting list of customer data	0,25 days	Thu 28/12/17	Thu 28/12/17	
4	Download the list of customer data from	1 hr	Thu 28/12/17	Thu 28/12/17	
5	Sort the list of customer data	1 hr	Thu 28/12/17	Thu 28/12/17	4
6	Form the migration teams	1 day	Thu 28/12/17	Fri 29/12/17	4
7	Mapping	0,09 days	Fri 29/12/17	Fri 29/12/17	
8	Matching the current data with geographical situation with	45 mins	Fri 29/12/17	Fri 29/12/17	6;5
9	Material Order	0,13 days	Thu 28/12/1	Thu 28/12/17	
10	FO Drop Cable Ordi	1 hr	Thu 28/12/1	Thu 28/12/17	4
11	ONT Order	1 hr	Thu 28/12/1	Thu 28/12/17	4
12	KR/KG Order	1 hr	Thu 28/12/17	Thu 28/12/17	4
13	Material Delivery	14 days	Thu 28/12/1	Wed 17/01/18	
14	FO Drop Cable Delivery	14 days	Thu 28/12/17	Wed 17/01/18	10
15	ONT Delivery	14 days	Thu 28/12/1	Wed 17/01/18	11
16	KR/KG Delivery	14 days	Thu 28/12/17	Wed 17/01/18	12
17	Idle	21 days	Thu 28/12/1	Fri 26/01/18	
18	Waiting time for pt	14 days	Thu 28/12/1	Wed 17/01/18	5
19	Waiting time for pt	21 days	Thu 28/12/1	Fri 26/01/18	18FF;5
20	Installation	0,36 days	Fri 26/01/18	Fri 26/01/18	
21	Material Preparatic	30 mins	Fri 26/01/18	Fri 26/01/18	8;19;14;16;15
22	Permissions	15 mins	Fri 26/01/18	Fri 26/01/18	21
23	FO Drop Cable	45 mins	Fri 26/01/18	Fri 26/01/18	22
24	Jointing/Terminati	5 mins	Fri 26/01/18	Fri 26/01/18	23
25	KR/KG Installation	15 mins	Fri 26/01/18	Fri 26/01/18	24
26	Roset Installation	2 mins	Fri 26/01/18	Fri 26/01/18	25
27	Power Budget	1 min	Fri 26/01/18	Fri 26/01/18	26
28	ONT Installation	2 mins	Fri 26/01/18	Fri 26/01/18	27
29	Activation by system and	30 mins	Fri 26/01/18	Fri 26/01/18	28
30	Labeling	1 min	Fri 26/01/18	Fri 26/01/18	23;26
31	BAST Instalasi	30 mins	Fri 26/01/18	Fri 26/01/18	30;29
32	Closing	9 days	Fri 26/01/18	Thu 08/02/18	
33	Commissioning Test and Uji	7 days	Fri 26/01/18	Tue 06/02/18	31
34	Publishing BAST-1	1 day	Tue 06/02/1	Wed 07/02/18	33
35	Reconciliation	1 day	Wed 07/02/	Thu 08/02/18	34

According to Tale 3, it can be seen that the critical path is on Activity 4 – 5 – 19 – 21 – 22 – 23 – 24 – 25 – 26 – 27 – 28 – 29 – 31 – 33 – 34 – 35. The completion day of STO Dago migration project takes 30,6 days from preparing tasks until closing tasks for one house. Schedule Compression will be done only on critical activities. (J.M. Nicholas & H. Steyn, 2011) stated that shortening the critical activities will impact the same to the project duration. It is because the critical path have 0 total float, where any delays occur in any critical path may result delay in project duration.

4.3 Schedule Compression

1. **Schedule Compression Scenario I (Crashing Scenario)**

   According to Table 4, the installation for migration for a house takes 0,3 day. It means that 1 team can reached 3 houses for installation a day.

   Available Team = 10 teams

   SOW = 4735 houses

   According to Table 2, the SOW of 23rd Reconciliation Stage is 4735 houses, with this SOW number, then this migration project of STO Dago will finish on:

   The expected duration should be $= \frac{4735 \text{ houses}}{3 \text{ x } 10\text{teams}}$

   = 159 days

   While, the actual project duration in only from 28 December 2017 - 19 February which is only 38 days (working days from Monday – Friday at 8am-5pm). To pursue the delay to be resolved on 23rd Reconciliation, then the workers that should be added are as follows,

   Duration = 38 days

   Houses/day = 4735/38

   = 125houses/day

   1team/day = 3 house/day

   Additional Team = (125/3) – 10

   = 32 teams

   = 64 workers

   Crashing Scenario will be accomplished if the project team is added with 32 more teams. With this scenario, the project will reach the closing stage without being terminated where the scope of work (4735 houses) can be done in 38 days. In addition, this scenario assume that the project duration of 38 days already included with material availability (no longer need to order and delivery the material), the development of PT2 and PT3 has finished (in service) and the number of customer is fixed.

Table 5 Service Price

(Source: PT. XYZ)

Description	Service Price per installation unit
Migrasi FO 3P (Phone + Internet + IPTV)	Rp 446.057,-

Table 6 Material Price

(Source: PT. XYZ)

Description	Material Price per installation unit
Material	Rp 501.460,-

Table 7 Salary Expenses

(Source: PT. XYZ)

Position	Salary
Technician	Rp 3.400.000,-

If the 32 teams are provided by CV, then the SOW are accomplished. So, the crash cost that PT. XYZ should pay for,

PT. XYZ should pay the service cost = 4735 x Rp 446.057,-

= Rp 2.112.079.895,-

PT. XYZ should pay the material cost = 4735 x Rp 501.460,-

= Rp 2.374.413.100,-

Crash Cost = Rp 4.486.492.995,-

While if the 42 teams are provided by PT.XYZ, then the SOW are also accomplished. So the crash cost that PT. XYZ should pay for,

PT. XYZ employee salaries = 84 x Rp 3.400.000,- x 2month

= Rp 5.712.000.000,-

PT. XYZ should pay the material cost = 4735 x Rp 501.460,-

= Rp 2.374.413.100,-

Crash Cost = Rp 8.086.413.100,-

2. Schedule Compression Scenario II (Crashing and Fast Tracking)

According to Table 4, the installation activity is a part of critical path. In this scenario, the crashing is implementing the additional 32 teams which comes from the previous calculation. The fast tracking done by release the installation activity from its dependency against Idle Time (Waiting Time for Provisioning Type 2 and Waiting Time for Provisioning Type 3). It means that Waiting Time for Provisioning Type 2 and 3 release from critical path. The development of PT2 and PT3 could be completed from afar the day before the installation (leading supply) or it can be completed at the beginning of the migration project since the target of PT. ABC in 2020, all copper cables centered at STO (Sentral Telepon Otomat) are replaced with fiber optic cables. Soon or later, the PT2 and PT3 will loaded by the customers through the available ODP.

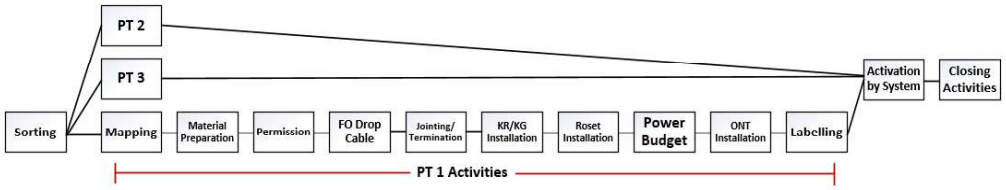


Figure 2 AoN of Existing Schedule

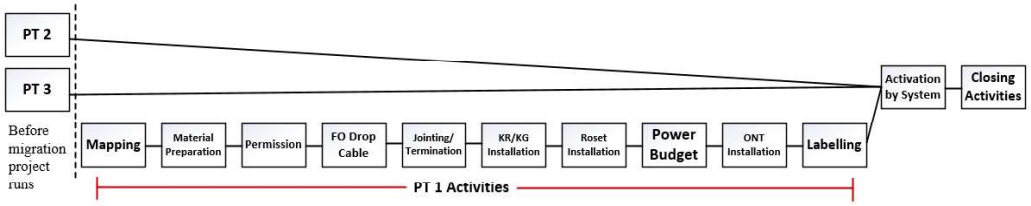
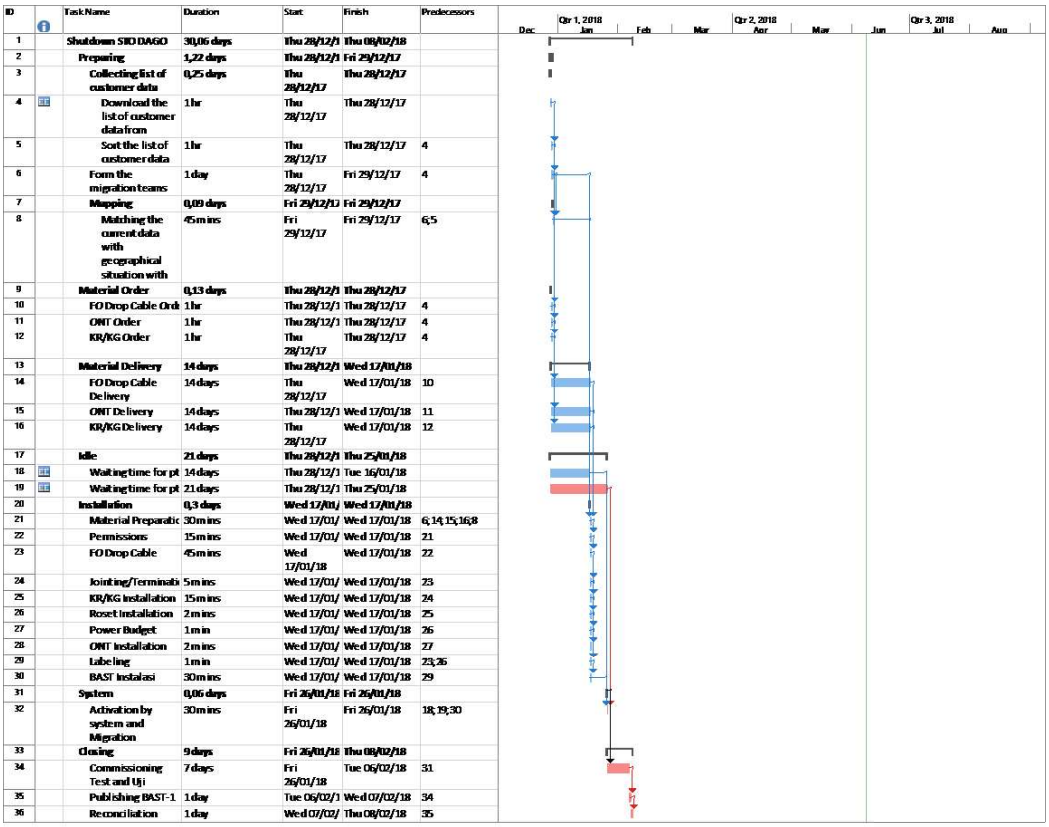


Figure 3 AoN of Scenario II

According to Figure 3, Activation by System done in the central office without back to the customer houses and and can be done simultaneously.

Table 8 Scenario 2



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3	Collecting list of customer data	0,25 days	Thu 28/12/17	Thu 28/12/17	
4	Download the list of customer data from	1 hr	Thu 28/12/17	Thu 28/12/17	
5	Sort the list of customer data	1 hr	Thu 28/12/17	Thu 28/12/17	4
6	Form the migration teams	1 day	Thu 28/12/17	Fri 29/12/17	4
7	Mapping	0,09 days	Fri 29/12/17	Fri 29/12/17	
8	Matching the current data with geographical situation with	45 mins	Fri 29/12/17	Fri 29/12/17	6;5
9	Material Order	0,13 days	Thu 28/12/1	Thu 28/12/17	
10	FO Drop Cable Ord	1 hr	Thu 28/12/1	Thu 28/12/17	4
11	ONT Order	1 hr	Thu 28/12/1	Thu 28/12/17	4
12	KR/KG Order	1 hr	Thu 28/12/17	Thu 28/12/17	4
13	Material Delivery	14 days	Thu 28/12/1	Wed 17/01/18	
14	FO Drop Cable Delivery	14 days	Thu 28/12/17	Wed 17/01/18	10
15	ONT Delivery	14 days	Thu 28/12/1	Wed 17/01/18	11
16	KR/KG Delivery	14 days	Thu 28/12/17	Wed 17/01/18	12
17	Idle	21 days	Thu 28/12/1	Thu 25/01/18	
18	Waiting time for pt	14 days	Thu 28/12/1	Tue 16/01/18	
19	Waiting time for pt	21 days	Thu 28/12/1	Thu 25/01/18	
20	Installation	0,3 days	Wed 17/01/	Wed 17/01/18	
21	Material Preparatic	30 mins	Wed 17/01/	Wed 17/01/18	6;14;15;16;8
22	Permissions	15 mins	Wed 17/01/	Wed 17/01/18	21
23	FO Drop Cable	45 mins	Wed 17/01/18	Wed 17/01/18	22
24	Jointing/Terminati	5 mins	Wed 17/01/	Wed 17/01/18	23
25	KR/KG Installation	15 mins	Wed 17/01/	Wed 17/01/18	24
26	Roset Installation	2 mins	Wed 17/01/	Wed 17/01/18	25
27	Power Budget	1 min	Wed 17/01/	Wed 17/01/18	26
28	ONT Installation	2 mins	Wed 17/01/	Wed 17/01/18	27
29	Labeling	1 min	Wed 17/01/	Wed 17/01/18	23;26
30	BAST Instalasi	30 mins	Wed 17/01/	Wed 17/01/18	29
31	System	0,06 days	Fri 26/01/18	Fri 26/01/18	
32	Activation by system and Migration	30 mins	Fri 26/01/18	Fri 26/01/18	18;19;30
33	Closing	9 days	Fri 26/01/18	Thu 08/02/18	
34	Commissioning Test and Uji	7 days	Fri 26/01/18	Tue 06/02/18	31
35	Publishing BAST-1	1 day	Tue 06/02/1	Wed 07/02/18	34
36	Reconciliation	1 day	Wed 07/02/	Thu 08/02/18	35

According to Table 8, the Scenario 2 release the Activation by System activity from installation. In this scenario, it means the time saved is 30 minutes x 4735 houses = 142050 minutes.

5. CONCLUSIONS AND RECOMMENDATIONS

The report of Reconciliation Stage from 20th – 23rd shows that the SPI of STO Dago migration project are behind schedule. This project requires the corrective and preventive action to prevent the repetion of delays such as:

a. Scenario 1, provided more 32 teams so the total team should be 42 teams (84 workers) to complete the installation of migration (PT1) in 38 days. There are 2 options to provided the required additional resources, which are provided by CV or PT. XYZ.
b. Scenario 2, using the 42 teams, release the installation activity from its dependency against Idle Time (Waiting Time for Provisioning Type 2 and Waiting Time for Provisioning Type 3), and conducting the Activation by System in Central simultaneously. When the Activation by System done in Central, time will be saved as much as 142050 minutes.

The recommendations which the project manager can consider are:

a. Perform the Plan Schedule Management properly in all phase.
b. Perform a leading supply system for PT1, PT2, and PT3 so the customers do not turn to other competitors.
c. Use the previous project as lesson learned so that the same error will not happen again

   Please follow Harvard Referencing Style.

d. Documenting the project data completely.

References

Garg, A. (2016). *Project Crashing Algorithm.* Allahabad: ResearchGate.

John. M Nicholas, Herman Steyn. (2011). *Project Management for Engineering, Business, and Technology.* Abingdon: Routledge.

Pratami, Puspita, & Afrizal. (2017). *Designing Internal Audit Process on Infrastructure Project in Indonesia Based on PMBOK 5th Edition.* Bandung: ResearchGate.

Project Management Institute. (2017). *A Guide to the Project Management Body of nowledge (PMBOK® Guide) 6th Edition.* Pennsylvania: Project Management Institute.

Vyas, M. R. (2013). *Scheduling Project Management Using Crashing CPM Network to get Project completed on Time.* Udaipur: International Journal of Engineering Research & Technology (IJERT).