**K. J. Somaiya College of Engineering, Mumbai-77**
**(Autonomous College Affiliated to University of Mumbai)**

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|---|---|
| **Batch: A2** | **Roll No.: 1911027** |
| **Experiment / assignment / tutorial No. 7** | |
| **Grade: AA / AB / BB / BC / CC / CD /DD** | |
| **Signature of the Staff In-charge with date** | |

**Title:** Calculating Earned Value.

**Objective:** To Demonstrate Earned Value Analysis and prepare baseline budget calculation.

**Expected Outcome of Experiment:**

| Course Outcome | After successful completion of the course students should be able to |
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| CO4 | Monitor the progress of projects and to assess the risk of slippage so that project's requirements can be controlled. |

**Books/ Journals/ Websites referred:**


1. *Bob Hughes, Mike cotterell, Rajib Mall"Software Project Management", fifth Edition, Tata McGraw Hill, Special Indian Edition*
2. *Royce, "Software Project Management", Pearson Education, 1999.*
3. *Project Management Institute: "A Guide to the Project Management Body of Knowledge (PMBOK Guide)" 5th Edition Project Management Institute.*
4. *John Nicholas, Herman Steyn, "Project Management for Business Engineering and Technology" 4th Edition.*


**Pre Lab/ Prior Concepts:**
Work Breakdown Structure of Project, Project Plan

**New Concepts to be learned**

- Planned Value (PV), Actual Cost (AC), Earned Value (EV)
- Cost Efficiency indicator
- Baseline schedule and budget

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**Work-out :**

**Students are needed to calculate Earned Value by assigning 'value' to each task or work package and create Baseline budget**

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**Following are the metrics which are calculated for the project:**

- Budgeted Cost of Work Performed = BCWP
- Budgeted Cost of Work Scheduled= BCWS
- Actual Cost of Work Performed= ACWP
- Schedule Variance (SV) = BCWP - BCWS
- Schedule Performance Index (SPI) = BCWP / BCWS
- Cost Variance (CV) = BCWP - ACWP
- Cost Performance Index (CPI) = BCWP / ACWP
- Estimate At Completion (EAC) = BAC / CPI
- Variance At Completion (VAC)
- Budget At Completion (BAC)
- Schedule At Completion (SAC) = Total duration / SPI

**Assumption:** Out of the allocated time to the project, 4 months have been completed, and the following are the activities that are in progress or completed. Activities A to F are completed, and those from G to J are ongoing.

| Activity Code | Particulars | Predecessor(s) | Duration | BCWP | BCWS | ACWP |
|---|---|---|---|---|---|---|
| A | Server and database procurement | - | 14 | 3500000 | 3000000 | 3700000 |
| B | Data Collection of existing EV infrastructure | A | 28 | 950000 | 1300000 | 875000 |
| C | Geospatial Analysis and | B | 21 | 800000 | 650000 | 750000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | site selection for public and semi public charging stations. | | | | | |
| D | Tie Ups with electricity provider. | C | 14 | 175000 | 100000 | 175000 |
| E | Charging station planning and pricing for private charging infrastructure. | D | 7 | 125000 | 300000 | 150000 |
| F | Pricing calculations for charging EV at public and semi public charging stations. | D | 21 | 450000 | 300000 | 375000 |
| G | Land Acquisition and permissions for installing charging stations. | F | 56 | 4000000 | 2500000 | 4300000 |
| H | Charging stations logistics, delivery and tracking. | C | 28 | 750000 | 750000 | 640000 |
| I | Connecting EV charging stations to | H, D | 28 | 200000 | 350000 | 250000 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | electricity grids. | | | | | |
| J | Installation of EV charging stations. | I | 28 | 12000000 | 12500000 | 13500000 |

| SV | SPI | CV | CPI | EAC | VAC | SAC |
|---|---|---|---|---|---|---|
| 500000 | 1.166666667 | -200000 | 0.9459459459 | 3171428.571 | -171428.5714 | 12 |
| -350000 | 0.7307692308 | 75000 | 1.085714286 | 1197368.421 | 102631.5789 | 38.31578947 |
| 150000 | 1.230769231 | 50000 | 1.066666667 | 609375 | 40625 | 17.0625 |
| 75000 | 1.75 | 0 | 1 | 100000 | 0 | 8 |
| -175000 | 0.4166666667 | -25000 | 0.8333333333 | 360000 | -60000 | 16.8 |
| 150000 | 1.5 | 75000 | 1.2 | 250000 | 50000 | 14 |
| 1500000 | 1.6 | -300000 | 0.9302325581 | 4622500 | -2122500 | 35 |
| 0 | 1 | 110000 | 1.171875 | 546133.3333 | 203866.6667 | 28 |
| -150000 | 0.5714285714 | -50000 | 0.8 | 312500 | 37500 | 49 |
| -500000 | 0.96 | -1500000 | 0.8888888889 | 15187500 | -2687500 | 29.16666667 |

**Conclusions:**

1) **Activities that are behind schedule:**
   a) Data Collection of existing EV infrastructure: Considering the size of India, it is very evident that a good amount of time will be required to get different aspects of a particular land.
   b) Charging station planning and pricing for private charging infrastructure: Due to the negotiations made by the private charging infrastructure provider, it will take additional time to get the best deal after all the negotiations, which will benefit both the parties, i.e., the provider and the consumer.
   c) Connecting EV charging stations to electricity grids: There are many cases where the connections made to the EV charging stations from the electricity provider's place include areas that are not authorized, so the connections have

to be diverted, and it will take time to map the exact places for efficient connections.

d) Installation of EV charging stations: It is the actual physical work, and many factors may affect it such as climate, labour attendance, raw materials, etc.

**2) Activities that are on schedule:**

a) Server and database procurement: Because there are so many service providers, it will not take much time to find the exact service provider to procure the server and the database's, configuration also takes less time.

b) Geospatial Analysis and site selection for public and semi public charging stations: It is very evident that analysing the data of the entire land area of India is very time-consuming, but due to the computing infrastructure rise this activity will not take any additional time to find the correct places for building charging stations.

c) Tie Ups with electricity provider: Considering the requirement of electricity for the project, it is very important to find the best deal with the electricity provider that is providing service near the place where the station will be installed and electricity provider will also get business due to tie up there wont be any delays from both the sides.

d) Pricing calculations for charging EV at public and semi public charging stations: The project that has been developed is already implemented in other nations, so calculations of prices can be easily made by considering the prices of other nations at the base.

e) Land Acquisition and permissions for installing charging stations: Installation of EV charging stations on a particular land area makes that area a self-financed area, as the owner will get a good amount for the same, and as benefits are provided, it won't take much time to acquire the land.

f) Charging stations logistics, delivery and tracking: Due to the developed infrastructure and the good export policy of India, this activity can be easily accelerated with the help of special permissions.

**3) Activities that are over budget:**

a) Server and database procurement: Considering the amount of data that will be required to be stored and the requests that are served with the help of the server, it is evident that additional spare money will be required for the efficient operation of the server and database.

b) Charging station planning and pricing for private charging infrastructure: Negotiations by the private infrastructure provider may require additional meetings and benefits, so they may require additional cost.

c) Land Acquisition and permissions for installing charging stations: The permissions process goes through a series of parties, from the actual land owner

to the middle man and then to the government, and satisfying the needs of all may incur some additional cost.

d) Connecting EV charging stations to electricity grids: The reason given for the schedule delay also applies to the cost.
e) Installation of EV charging stations: The reason given for the schedule delay also applies to the cost.

**4) Activities that are not overbudget:**

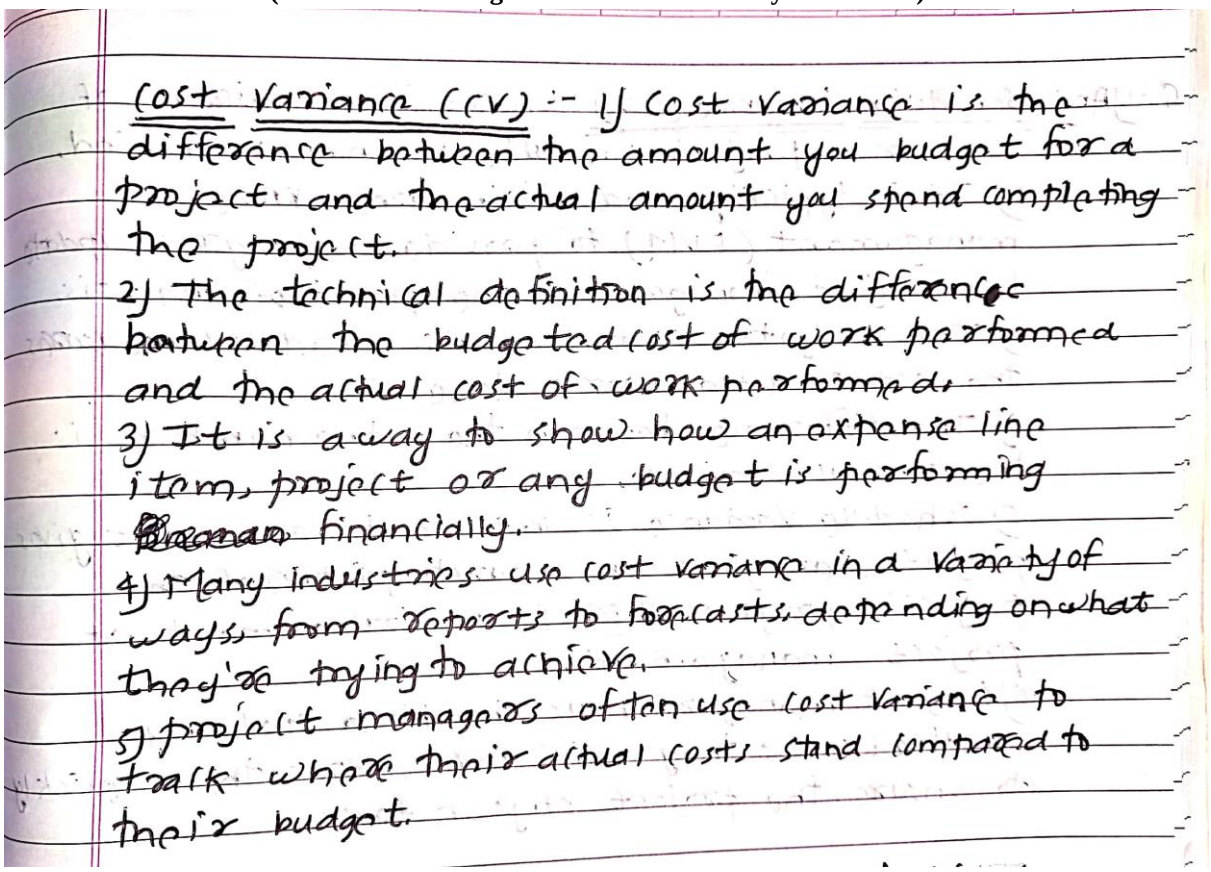
a) Data Collection of existing EV infrastructure: Multiple data providers may help in getting the data at the best price, so there won't be any problem with additional spending on this activity.
b) Geospatial Analysis and site selection for public and semi public charging stations: Due to the computing power available nowadays, it won't take any additional devices to speed up the process of analysis, so this activity won't add any additional cost other than that of the budget allocated.
c) Tie Ups with electricity provider: Electricity providers will also get business by making tie-ups, so they will also provide the best deal, which will benefit both parties.
d) Pricing calculations for charging EV at public and semi public charging stations: The reason given for the schedule delay also applies to the cost.
e) Charging stations logistics, delivery and tracking: This activity's costs will be specified in the contract, so there will be very few chances of going over budget.

**Post Lab Questions:**

1) Explain what is Schedule Variance (SV), Time Variance (TV) and Cost Variance (CV).

Q-1) Ans) Schedule variance (SV) :- 1) It is an indicator of whether a project schedule is ahead or behind.
2) It is typically used within earned value management (EVM) to provide a progress update for project managers at the point of analysis.
3) The budgeted cost of work scheduled measures the cost of actual work done.
4) The difference between these two numbers is the schedule variance.
5) Schedule Variance is important because it gives project managers an accurate picture of the project's progress, which is a vital element of project management.
6) Project managers must be able to spot any roadblocks as they arise and address them quickly to ensure the project stays on track.

Time variance (TV) :- 1) A time variance is the difference between the standard hours and actual hours assigned to a job.
2) The concept is used in standard costing to identify inefficiences in a production process.
3) The variance is then multiplied by the standard cost per hour to quantify the monetary value of the variance.
4) The main problem with the time variance concept is that it is calculated from a baseline that may have been poorly derived.
5) Thus, if the baseline time goal was overly optimistic, there will always be an unfavourable time variance, no matter how efficiently the work may be conducted.



Cost Variance (CV) :- 1) Cost variance is the difference between the amount you budget for a project and the actual amount you spend completing the project.
2) The technical definition is the difference between the budgeted cost of work performed and the actual cost of work performed.
3) It is a way to show how an expense line item, project or any budget is performing financially.
4) Many industries use cost variance in a variety of ways from reports to forecasts, depending on what they're trying to achieve.
5) project managers often use cost variance to track where their actual costs stand compared to their budget.

2) A project having following 150 modules is to be developed in 30 weeks. On an average 5 modules are expected to be developed in a week. Cost of development of each module is 7500 INR.

- A review is taken after 12 th week and it was observed that 54 modules are developed and the amount spent is 5, 00,000 INR.
  Comment on progress of the project. Also state when the project is expected to complete if continued with the same pace and what will be expected cost when the project gets completed.
- Similar activity is carried out after 24 th week and the status was 124 modules completed and amount spent is 9,00,000.
  Comment on progress of the project. Also state when the project is expected to complete if continued with the same pace and what will be expected cost when the project gets completed.

Q-2 Ans) Case A :- BCWS = Weeks x Modules x Cost.
BCWS = 12 x 5 x 75000 = ₹4,50,000

BCWP = modules developed x cost.
till 12th week
= 54 x 7500
= ₹4,05,000.

ACWP = ₹5,00,000.

∴ SV = BCWP - BCWS = ₹-45,000.
∴ SPI = BCWP / BCWS = 0.9.

∴ As SV < 0 and SPI < 1, the project is behind schedule.

CV = BCWP - ACWP = ₹ -95,000

CPI = BCWP / ACWP = 0.81

∴ As CV < 0 and CPI < 0, the project is overbudget.

∴ Estimate at completion = Budget at completion / CPI.
EAC

$$= \frac{150 \times 7500}{0.81}$$

= ₹ 13,88,888.89

∴ Schedule at completion = Total number of weeks / SPI
SAC

$$= \frac{30}{0.9}$$

= 33.3 weeks

Case B :-

BCWS = 24 × 5 × 7500 = ₹ 9,00,000.

BCWP = 124 × 7500 = ₹ 9,30,000

ACWP = ₹ 9,00,000.

∴ SV = BCWP - BCWS = ₹ 30,000.

∴ SPI = BCWP / BCWS = 1.03.

∴ The project is operating on time.

DATE

PAGE NO.

CV = BCWP − ACWP = ₹30,000

CPI = BCWP / ACWP = 1.03.

∴ The project is not over budget.

∴ EAC = BAC / CPI.

= $\frac{150 \times 7500}{1.03}$

= ₹ 10,92,233.

∴ SAC = $\frac{\text{Total number of weeks}}{\text{CPI}}$

= $\frac{30}{1.03}$

= 29.1 weeks.