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VEHICLE FLEET SIZE OPTIMIZATION

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Abstract – *Fleet Optimization speaks to an important action at strategic and operational levels to be looked by privately owned businesses and open offices committed to travelers and cargo transportation administrations. Numerical models and calculation systems have been created for upgrading and reenacting the task of transport armadas so as to serve the clients request with the goal of cost proficiency. Many fleet optimization problems refers to the combinatorial streamlining issues, for example, vehicle steering and planning, that are famously hard to explain, even in a static setting. Besides dynamic fleet administration concern constant necessities of the given benefit and the control of unexpected occasions that could influence the exhibitions of the vehicle activities.*

Key Words: Fleet Optimization, Fleet management, Armadas, Dynamic Fleet optimization

1. INTRODUCTION

Dealing with a fleet effectively to addresses request inside cost imperatives is a test. A fleet administration program adjusts numerous goals including driver administration, speed administration, fuel administration, course administration, fleet size and organization administration. On the off chance that those destinations are not adjusted, clients might be troubled and add up to fleet expenses could be problematic. Fleet administration is a managerial approach that enables organizations to sort out and arrange work vehicles with a hope to enhance proficiency, lessen costs, and furnish consistence with government controls. The Fleet Management System gathers, store and give finish complete data about the ebb and flow condition of the vehicles and payload, the course history, the normal occasions, and additionally the driver exercises for the vehicle support and administrator organizations. At the end of the day, fleet administration is the advancement of costs, dangers and effectiveness in fleet activities. Numerous associations depend on fleet supervisors to control costs, expand gainfulness, and alleviate dangers of their fleet vehicles.

The expression "optimization" has been utilized such a great amount, for such huge numbers of things, that at this point it has no significance. Optimization is the way toward limiting or amplifying some amount, given an arrangement of connections amongst factors and an arrangement of requirements that must be fulfilled. The arrangement of connections and the arrangement of imperatives together are called a streamlining issue. Fleets constitute the most vital creation implies in transportation. Their suitable administration is significant for all organizations having transportation obligations. The choice of what number of vehicles stay with in a fleet to satisfy changing with time transportation necessities is known as fleet estimating issue. While, if there should be an occurrence of an armada piece issue sorts of vehicles ought to be characterized too. The request of different business vehicles can likewise be of various sorts as indicated by particular highlights of burdens, separations, courses or areas of goal focuses/clients, their requests and numerous others.

1.1 Genesis of the problem

The problem at different plants was that they were unable to manage their own fleet of vehicles in carrying out the assigned job. Additional requirement of commercial vehicles was initiated to carry out the extra work. Moreover, demands were also raised for purchase of new commercial vehicles. The contractors were also asked to arrange for extra commercial vehicles to carry out the left over work.

The task was to analyze the current “as-is” scenario and understand the work of various commercial vehicle, employed at various different plants and based on the analysis, the utilization of different commercial vehicles was calculated. The study helped us to analyze the current usage of various employed commercial vehicles and also recommend possible feasible suggestion to improve the ongoing process.

For the task of selecting possible alternatives regarding purchasing and hiring of commercial vehicles, data was collected regarding the purchasing cost and hiring cost of different commercial vehicles. Further this data is supplemented with additional data regarding the maintenance cost of vehicles, salary given to drivers and helpers, cost of diesel consumed per annum, tyre cost of different vehicles, insurance cost, road tax and other cost. This total cost of different vehicles is compared with the total tonnage of material shifted by them in a year. This process is carried out for all different alternatives i.e., purchasing a vehicle, hiring a vehicle or having a mixed system which comprises of purchased as well as hired vehicles. The data are analyzed and appropriate decisions are taken.

1.2 Objective to be addressed

The objectives of this report are listed as:

- To optimize the no. of commercial vehicles employed at various plants

- To analyze the impact of managing own fleet of vehicle i.e., purchasing own vehicle, outsourcing the transportation facility i.e., hiring from contractor or having a mixed system i.e., hiring few vehicles and purchasing few vehicles.

2. DATA SOURCE

The various input factors for this analysis are obtained from the various concerned departments of the company.

The Input Parameters are included in this calculation are listed below. The Sources of Data collected are maintained below. The purchase details of various employed commercial vehicles including their road tax, maintenance cost, salary of drivers and helpers, cost of tyre, insurance cost and various other parameters, are listed below.

Table -1: Input parameters and sources of data regarding the purchase of different vehicles

S. No.	Description	Hyva (20 T)	Hyva (30 T)	Poclain	Pay Loader	Trailer
1	Total tonnage of work done	2500 – 3000 MT	3000 – 3200 MT	2000 – 2500 MT	2000 – 2200 MT	2500 – 3000 MT
2	Capacity	17 MT	24 MT	20 MT	8 MT	60 MT
3	Distance (Total Trips per day)	454 km	347 km	25 km	40 km	50 km
4	Average speed	26 Km/h	23 km/h	15 km/h	20 km/h	22 km/hr
5	Mileage	1.5 km/lt	1 km/lt	16 lt/hr	7.5 lt/hr	1.5 lt/hr
6	No. of days/yr	365	365	365	365	365
7	Loading time	23 min	26 min	2 min	5 min	4 min
8	Vehicle availability	1260 min/day	1260 min/day	1260 min/day	1260 min/day	1260 min/day
9	Max. availability/month	29 days	29 days	29 days	29 days	29 days
10	Price (Ex-Showroom)	27.4 lakhs	30 lakhs	45 lakhs	24.85 lakhs	23.73 lakhs
11	Diesel price/lt	60 Rs.	60 Rs.	60 Rs.	60 Rs.	60 Rs.
13	Maintenance (p.a)	1.15 crore	1.17 crore	1.25 crore	90 lakhs	85 lakhs
14	Road Tax (p.a.)	8,84,000	9,10,000	9,75,000	8,50,000	7,75,450
15	Tyre Cost (p.a.)	1.18 crore	1.20 crore	1.75 crore	1.10 crore	11.19 crore
16	Salary (8 hrs) of 2 driver+2 helpers (p.a.)	3,62,080	3,50,460	3,35,750	3,70,060	3,65,600
17	Insurance Cost (p.a)	22.5 lakhs	23.6 lakhs	25.8 lakhs	19.3 lakhs	19.1 lakhs
18	Maintenance Manpower (1 supervisor + 5 skilled Technician)	9.76 lakhs	10.1 lakhs	12.85 lakhs	8.87 lakhs	8.50 lakhs

Table -2: Input parameters and sources of data regarding the description of hired vehicles

Dept.	Work Details	Vehicle Descrip.	Vehicle Capacity (per trip)	Nos. of vehicles Required	Vehicle Deployment
Dept. 1	Coke, Coal, Dolo, Lime, Iron PCI feeding to BF-2	Pay loader	2.5 - 3 M^3	1	24 Hrs
	Stacking to raw material in 07 yards and feeding at ground hopper	Pay loader	2.5 - 3 M^3	1	24 Hrs
	Feeding of Raw materials at GH-4, GH-5 & Coke ground hopper for sinter plant & BF and spreading of wet materials, separation of foreign particles	Poclain	3D Excavator	1	24 Hrs
Dept. 2	Wagon cleaning material has to be shifted to the concerned user yard, shifting of bolder which comes in rakes	Tractor trolley		2	12 Hrs
Dept. 3	DRI raw material-1/Ore Pallets, Coal, Dolomite Charging, shifting from Yard to Ground Hopper, DSC material Charging & Shifting, Coal Shifting Yard to coal shed and coal shed to Charging	Pay loader	2.5 - 3 M^3	1	24 Hrs
Dept. 4	Raw material Charging, Lifting and Shifting	Pay loader	2.5 - 3 M^3	1	24 Hrs
Dept. 5	Structure, Equipment's Maintenance and Misc.	Hydra	14 MT	1	12 Hrs
	Dust Shifting, Scrap Shifting, Spares parts movement	Tractor trolley		1	12 Hrs
	Cast House cleaning, waste material shifting, Hot metal cleaning etc	Poclain	3D Excavator	1	24 Hrs
Dept. 6	Skull Pit cleaning, PCM Jam cleaning, Material Handling, Sand, Earth Shifting, etc.	Poclain	3D Excavator	1	24 Hrs
Dept. 7	Coal loading, charging	Pay loader	2.5 - 3 M^3	1	24 Hrs
	Shifting of spillage coal from AFBC Boiler over the year, shifting of coal spillage from CHP	Tractor trolley		1	12 Hrs
Dept. 8	Reject Coal Loading, Wash Coal Loading from washery, etc.	Pay loader	2.5 - 3 M^3	1	24 Hrs
Dept. 9	internal shifting from miscellaneous work	Tractor trolley		1	12 Hrs

Vehicle	Desc.	UOM	Scope of Diesel	Existing rate in Rs/Unit for the FY 2015-16		Proposed Rates in Rs/Unit for the FY 2016-17		Diesel Consumption	
				With Helper	Without Helper	With Helper	Without Helper	Existing 2015-16	Proposed 2016-17
Hyva	24 hr	MON	COMPANY	2255000	2259000	2255000	2259000	1 L/1.5 KM	1 L/1.5 KM
	12 hr	MON	COMPANY	2250000		2250000		1 L/1.5 KM	1 L/1.5 KM
Poclain	12 hr	MON	COMPANY	2550000		2550000		16 L/HR	16 L/hrs
	24 hr	MON	COMPANY	2790000		2290000	2670000	16 L/HR	16 L/hrs
	24 hr	MON	COMPANY	3000000		2950000		17 L/HR	17 L/hrs
Pay loader	12 hr	MON	COMPANY	2255000	2250000	2255000	2260000	7.5 L/hrs	7.5 L/hrs
	24 hr	MON	COMPANY	2255000	2255000	2255000	2255000	7.5 L/hrs	7.5 L/hrs
Trailer	24 hr	MON	VENDOR	2425000		2425000			
	12 hr	MON	VENDOR						
	Day	DAY	VENDOR						

Fig -1: Input parameters and sources of data regarding the hiring of different vehicles

3. DATA ANALYSIS

3.1 Requirement assessment of fleet size

To optimize the no. of currently employed commercial vehicles at different plants, Industrial engineering tools such as work study, equipment utilization, interviewing for information etc. have been put to use in order to achieve the desired objective.

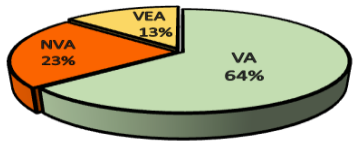

Chart -1: Pie Chart showing utilization of Poclain

The above study and analysis showed that the currently employed poclain at Raw Material Handling Plant was not fully utilized and the additional work can be done by the existing poclain, and therefore there was no need to provide additional poclain for the extra task.

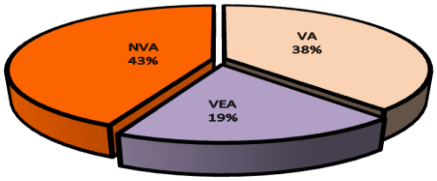

Chart -2: Pie Chart showing utilization of Payloader

The above study and analysis showed that the currently employed pay loader at Direct Reduced Iron Plant was not fully utilized and the additional work can be done by the existing pay loader, and therefore there was no need to provide additional pay loader for the extra task.

Table -3: Number of trailers required

S. No.	Description	Measures
1	Total time taken by 1 trailer for internal shifting	200 mins
2	Total availability of trailer per day	1260 mins
3	Min requirement of trailer per day	860 mins
4	No. of trailers required per day	6
5	% utilization of trailer	68%

Cycle Time = (Positioning time+ loading time in trailer + Total travelling time (Both way) +
Positioning time+ unloading time + Forced delays (Due to Railway Crossing
and Bridge) + Allowances @ 15 %) = 100 mins + 100 mins (including forced delays, waiting time & allowances) = 200 mins
Trailer requirement:

No. of trips of trailer per day = (vehicle availability per day) / (Cycle time) = 1260 mins (21 X 60 mins) / 200 = 6 trailers

3.2 Analysis of available alternatives

3.2.1 Managing own Fleet of vehicle i.e. Purchasing own vehicle

The Excel Sheet for Calculations in this method is shown below. This system includes Cost of purchase of vehicles and cost of managing the fleet of vehicles. The cost of each Hyva, Pay Loader, Poclain and Trailer is given in table below: (from input sheet)

Table -4: The purchase cost (Ex-Showroom price) of different commercial vehicles

S. No.	Description	Measures
1	Hyva – 20 T	27,40,000
2	Hyva – 30 T	30,00,000
3	Poclain	45,00,000
4	Pay Loader	24,85,000
5	Trailer	23,73,000

If this alternative is adopted i.e. purchasing of equipment's or vehicles then several parameters, like maintenance cost, salary of drivers and helpers (incl. of PF, ESIC and mobile bill) per annum, diesel cost per annum, average tyre cost and insurance cost, road tax and manpower maintenance (1 supervisor and 5 skilled technician), are considered for calculating the total cost. Calculation of other cost in

purchasing of equipment's which includes all the above parameters is shown below

Table -5: Summary of Calculation for purchasing alternative

Description	Hyva 20 T + 30 T	Poclain	Pay Loader	Trailer	Total
Average Maintenance Cost	2,32,80,750	1,25,50,000	90,85,750	85,46,950	5,34,63,450
Salary of 2 Driver & 2 Helper/ annum	7,12,540	3,35,750	3,70,750	3,65,600	17,84,640
Diesel Cost/Annum	1,74,41,900	12,47,500	8,76,000	10,95,000	2,06,60,400
Average Tyre cost	2,32,80,750	1,75,40,000	1,10,30,000	1,19,76,000	63,826,750
Avg. Insurance Cost	46,20,886	25,89,480	19,36,560	19,10,475	1,10,57,401
Road Tax	17,94,000	9,75,000	8,50,000	7,75,000	43,94,000
Maintenance manpower (1supervisor +5 skilled technician)	19,86,535	12,85,740	8,87,060	8,50,790	50,10,125
Other Cost/ Annum	7,31,17,361	3,65,23,470	2,50,36,120	2,55,19,815	16,01,96,766
Total Cost			Rs. 17,52,94,766		
Total Cost per total work done			Rs. 240.12		

3.2.2 Outsourcing (Hiring) the facility

In this alternative the Hyva, Poclain, Pay Loader and other Machinery were hired from the contractor. The calculation in this system is given below

Table -6: Summary for Calculation for Hiring

Description	Hyva 20 T + 30 T	Poclain	Pay Loader	Trailer	Total
Hiring Charge	5,50,20,000	3,60,00,000	2,70,60,000	2,91,00,000	14,71,80,000
Diesel cost	1,74,41,900	12,47,500	8,76,000	10,95,000	2,06,60,400
Salary of supervisors (4 in nos.)	26,99,075	16,21,490	12,57,810	12,16,390	67,94,765
Total Cost / annum	7,51,60,975	3,88,68,990	2,91,93,810	3,14,11,390	17,46,35,165
Total cost / annum			Rs. 17,46,35,165		
Total cost per total work done			Rs. 239.22		

3.2.3 Mixed system i.e. Hiring Hyva (20T + 30T) & Poclain and purchasing Pay Loader & Trailer

In this alternative Hiring charges of Hyva (20T + 30T) and Poclain are taken and the Purchasing of Pay Loader and Trailer are considered.

The calculation is taken from the other above alternatives. The Summary of calculations is given below.

Table -7: Purchasing of Hyva (20T + 30T) and Poclain

Description	Hyva (20T + 30T)	Poclain	Total
Average Maintenance Cost	2,32,80,750	1,25,50,000	3,58,30,750
Salary of 2 Driver & 2 Helper/ annum	7,12,540	3,35,750	10,48,290
Diesel Cost/Annum	1,74,41,900	12,47,500	1,86,89,400
Average Tyre cost	2,32,80,750	1,75,40,000	4,08,20,750
Avg. Insurance Cost	46,20,886	25,89,480	72,10,366
Road Tax	17,94,000	9,75,000	27,69,000
Maintenance manpower (1 supervisor+5 skilled technician)	19,86,535	12,85,740	32,72,275
Other Cost/ Annum	7,31,17,361	3,65,23,470	10,96,40,831
Total Cost (1)		Rs. 11,98,80,831	

Table -7: Hiring of Pay Loader and Trailer

Description	Pay Loader	Trailer	Total
Hiring Charge	2,70,60,000	2,91,00,000	5,61,60,000
Diesel cost	8,76,000	10,95,000	19,71,000
Salary of supervisors (4 in nos.)	12,57,810	12,16,390	24,74,200
Total Cost / annum	2,91,93,810	3,14,11,390	6,06,05,200
Total Cost / annum (2)		Rs. 6,06,05,200	
Total Cost (1 + 2)		Rs. 17,89,26,031	
Total Cost per total work done		Rs. 245.10	

3. CONCLUSIONS

Comparing per tonnes cost involves in various alternative available, the summary table for all the parameters are prepared as given below.

Table -7: Summary of various alternatives

Option 1: Purchase All: Hyva, Poclain, Pay Loader & Trailer	Total Cost / Annum (in Rs. Crore)	Rs. 17,52,94,766
	Total Cost per total work done	Rs. 240.12
Option 2: Purchase: Hyva & Poclain Hire: Pay Loader & Trailer	Total Cost / Annum (in Rs. Crore)	Rs. 17,89,26,031
	Total Cost per total work done	Rs. 245.10
Option 3: Hire all: Hyva, Poclain, Pay Loader & Trailer	Total Cost / Annum (in Rs. Crore)	Rs. 17,46,35,165
	Total Cost per total work done	Rs. 239.22

Our suggestion for going with the 3rd option i.e. hiring the entire vehicle in which the total cost per total work done is Rs 239.22

On carrying out the study of different commercial vehicles employed at various plants, it was found out that there was a need of proper utilization of existing commercial vehicles. By minimizing certain delays and improving certain process, the utilization of existing commercial vehicles can be enhanced and a lot of funds can also be saved in total diesel cost, maintenance cost and various other parameters. Moreover, during the analysis of the study, it was also found that extra additional task arising in different plants can also be handled by the existing machinery employed in different plants, and that there was no need to deploy additional equipment's and extra machinery for the additional task.

During the study the objective of deciding whether to purchase a new machinery or to hire the machinery from the contractor or having a mixed system of purchased as well as hired machinery for various tasks at different plants. On the analysis of various different alternatives, it was found that the alternative of hiring different commercial vehicles from the contractor in which the total cost per total work done was minimum. This comparison was carried out between all the three alternatives where the total cost per total work done was compared and the minimum cost per total work done was selected in the alternative in which all the commercial vehicles were hired from the contractor.

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