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KM TRANS LOGISTICS: WORKSHOP OPERATIONS

Debjit Roy and Arindam Bandyopadhyay wrote this case solely to provide material for class discussion. The authors do not intend to illustrate either effective or ineffective handling of a managerial situation. The authors may have disguised certain names and other identifying information to protect confidentiality.

In October 2013, Arihant Jain, co-executive director of Kundanmal Mukanmal Trans Logistics Pvt. Ltd., India (KM), arrived at his office to begin his day's work. KM was a road transportation company functioning as a logistics provider for flatbed steel and finished automobiles (primarily four-wheeler passenger cars and light to medium cargo vehicles).

Jain was in a pensive mood. The KM workshop in Jaipur was facing regular logistics issues and delays in repair and maintenance of trucks and carriers due to resource idiosyncrasies. Worker unavailability was a cause of concern on certain days, while excess capacity plagued the day-to-day operations at other times. With the Jaipur workshop dedicated to repair and maintenance of a large fleet of 175 trucks, management of labour manpower was a frequent cause of concern for the two executive directors, Jain and his cousin, Anuj Jain. There were difficulties with mechanics resorting to fraudulent means (showing false records of repair work done, stealing or selling off fuel, engine oil, lubricants and parts, etc.), loitering, arguing and teaming up with truck drivers to create a ruckus when unoccupied. All of these problems disrupted workshop operations, especially during festive seasons when labourers often did not even turn up for work.

Both directors were serious this time about rightsizing manpower at the KM workshop. Maximum labour issues happened around festive occasions, when time-consuming repair activities such as accidents, denting, cabin, wheel and axle repair issues continued to pile up and manpower idiosyncrasies exacerbated the situation. A schematic system to estimate or predict the number of labourers required in each department — and the workshop as a whole — was a solution the executive directors looked forward to. They hoped to estimate the right number of manpower resources (including seasonal variations), figure out a mechanism to allocate trucks to mechanics and bays,[1] and reduce the waiting time of trucks requiring repair, making workshop operations more efficient overall.

WARNING SIGNS BEFORE FESTIVAL TIME

Jain was interrupted from his work by a telephone call from Anuj. There had been three accidents within the previous 18 hours and the mechanical labourers had not shown up to work. Anuj reminded Jain that

[1] *A bay is a marked area in the workshop where a truck is positioned for repair (see Exhibit 3).*

with the festive season of Diwali[2] approaching, the workers had requested leave from October 30 to November 7. Although he had asked the works manager to discuss the gravity of the situation with the mechanics and ask them to work a bit longer than the stipulated seven hours each day, Anuj was apprehensive since bays were expected to be occupied for stretches of four to 20 days when any accident cases arrived. Workers were threatening to leave, regardless of wages, and Anuj estimated that KM would incur opportunity costs of approximately INR 2,500[3] per truck for each day of delay.

Jain asked Anuj to do a rough analysis on the number of mechanics needed during the course of the month. He asserted that in the long term, KM should hire an operations consultant to address the company's problems in detail. If a solution could be developed which could predict or estimate the number of workers needed in each of KM's six departments, the company would hire that number of mechanics accordingly. Similarly, Jain wanted Anuj to examine bay utilization and do a comparison between the time each truck spent at the workshop and the maximum time KM could allow each truck to spend there.

ABOUT KM TRANS LOGISTICS

KM was founded as a family-owned business in Jaipur by brothers Kamal Kumar Chandwar and Prabhachand Chandwar on August 23, 1988. KM maintained a fleet of 625 carriers in three vehicle categories: flatbed carriers, car carriers and chassis carriers (see Exhibit 1). Nearly 600 (97 per cent) of the vehicle fleet were manufactured by TATA Motors. The car carriers segment transported nearly 17,000 cars per month, the chassis/truck carrier segment transported approximately 225 trucks per month and the flatbed steel segment carried nearly 11,000 tons of steel per month.

The company owned two workshops — one in Gurgaon, Haryana, which was spread over a 0.5 acre open piece of land, and one in Gidani, Rajasthan, nearly 50 kilometres (km) from Jaipur, the capital city of Rajasthan. Out of the 625 carriers, 175 were repaired and maintained in the Jaipur workshop, whereas the remaining 450 were maintained by the Gurgaon workshop, which enjoyed locational advantage. However, since the Jaipur workshop was equipped with better technology and machinery, some carriers came for repairs to the Jaipur workshop en-route to delivery to the client. In addition, the Chandwar family was based in Jaipur and hence, the workshop there enjoyed direct care and attention from a number of the company family members. The Gurgaon operations faced minimum labour problems as the labourers there were paid on salaried terms and conditions (unlike Jaipur where payment was on a per job basis). The salaried payment structure worked well there because of a professionally managed team, which was well trained and more educated and hence, demanded a fixed minimum salary.

MANPOWER AND WORKFORCE STRUCTURE AT THE KM WORKSHOP

The Manager Tier

Anuj Jain, in his capacity as executive director, headed the operations of the workshop, with two works managers (engineers by profession) reporting to him.

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[2] *Diwali — a five day long Hindu festival — is known as the 'festival of lights' because houses, shops and public places are decorated with small earthenware oil lamps. Many Indians (particularly Northern Indians) prefer to take time off from work during the festival in order to be with their families. /www.bbc.co.uk/schools/religion/hinduism/diwali.shtml, accessed August 1, 2014.*

[3] *60 INR (Indian Rupee)=1 USD (US Dollar)*

The Supervisor Tier

There were a few supervisors reporting to the works manager, on an ad hoc basis. Workers could assume the role of supervisor after reaching a certain level of seniority.

There were certain supervisors engaged in recording the in and out times of trucks to the workshop, as well as drivers, job cards and worker assignment duties. These supervisors also took note of tracking data for trucks, in the form of truck number, client information, loading point, destination and driver information, among other details. At the end of the day, the final status of each truck in-service was transferred to a spreadsheet for records and future reference. The workshop was planning global positioning system (GPS) integration with a new Enterprise Resource Planning (ERP) system to track carrier movements automatically. All desk operations were carried out by these supervisors. A few call supervisors were also present at the support desks; these individuals engaged in negotiations with clients and performed financial and other book-keeping activities. There were nearly 10 such supervisors present at the workshop as of October 2013.

The Mechanic/Technician/Assistant Tier

There were 36 workers spread across six functional groups: mechanical, electrical, denting, balancing, tire and welding. The workers had no formal training and were largely unskilled when they joined. However, with experience, they acquired varied skills and at varying levels. They could be classified as high-, medium- or low-skilled workers (see Exhibit 2).

WORKSHOP LAYOUT AND BAYS

The Jaipur workshop was fairly self-sufficient as far as repair and maintenance of trucks was concerned. The family decided not to engage authorized service centres for repair and maintenance of trucks, not only because they cost more per repair, but also because they caused excessive delays, taking up to five days to repair small problems that could be fixed in a matter of a few hours if done in-house — provided mechanics and all spare parts were made available. In March 2014, the workshop acquired a TATA-authorized service centre status. However, it continued to hold repair operations for its own carriers and the management did not plan to engage in repair work for carriers owned by other parties.

The workshop procured all its spare parts inventory from authorized dealers and stocked them in its own stores in the workshop after batch inspections were completed at Jaipur. It took an average of two days for parts to arrive at the sales and marketing office in Jaipur and then another day from the Jaipur office to the workshop. The mean lead time for procurement was therefore approximately three days.

Spare parts were issued to mechanics for repair and maintenance. Shortage of spare parts was generally not a major problem for the workshop. When a truck arrived at the workshop, the driver would be expected to first inform the security personnel at the gate about the problems in the truck that require repair. If it was a very minor issue requiring less than 30 minutes of repair time (e.g., broken headlight, minor lubrication, small wiring changes, etc.), it was not allowed to enter the premises. Repair was done outside the gate directly on the service lane outside the workshop.

Once a truck was allowed to enter, it spent at least 45 minutes getting in, finding a space, parking the carrier, being inspected, being repaired and then exiting the workshop premises. Job cards, if necessary, also had to be prepared. There were avoidable and unnecessary delays due to human factors (such as driver

unavailability for driving out of the workshop, etc.). Hence, it was always better to minimize the waiting time of trucks.

The workshop had eight numbered service bays (see Exhibits 1 and 3). A ninth inspection bay was intended for inspection of the truck from beneath. However, drivers were reluctant to drive over the inspection bay, worrying that some of the carrier wheels might fall into the pit (as there was not enough room to manipulate a large-sized vehicle comfortably) and the carrier would either get stuck or parts would break; in either case it would be very difficult to extricate/repair the fallen part of the vehicle. Bay nine was therefore largely unused, as of October 2013.

Management had decided to convert a large unused space into four extra bays. These bays were to be used exclusively for accident, denting, welding, cabin setting and tire repair cases, in addition to making new horse[4] cabins out of irrecoverably damaged trucks. All jobs taking four days or more were to be serviced in these four side bays (accident jobs could take up to 20 days to repair). These new bays would improve workshop operations tremendously as time-consuming jobs would be separated from the speedier jobs.

Other important structures in the workshop included the spares store, the driver and mechanic training room, lubricants storage room, tire storage, supervisors room, works manager room, lathe room, engine repair room and a few other amenities for workers and drivers (pantry, rest room with nearly 20 beds and canteen).

WORKSHOP OPERATIONS

A detailed list of carrier arrivals for servicing showing the count of jobs from April 1, 2013 to June 12, 2013, is given in Exhibit 4. The service time for each of these types of jobs is detailed in Exhibit 5. These service times varied according to the skill level of the worker employed to do the job. The given times are for skill level 10 (expert) mechanics. Hence, for four- (low) rated mechanics, the service time increased by a ratio of 10 to four or 2.5 times of the time taken by an expert mechanic.

Mechanics worked in day-long shifts from 10:00 a.m. until 7:00 p.m. at the latest, with one hour designated for lunch break and an additional hour allowed for in-work breaks. Each mechanic therefore worked approximately seven hours each day. This figure did not change much on a seasonal basis.

Accidents were a critical and special type of workshop operation, which required maximum amount of bay time and labour effort (see Exhibit 6). The accident case of a truck generally occupied the bay and a huge percentage of labour effort for any duration between 12 to 15 days — even up to 20 days in some severe cases. For that duration of time, the whole bay was occupied and no other work could be performed there. Sometimes, the carrier was damaged beyond repair and only the mangled horse was brought back to the workshop. If the horse was not repairable, it was broken down and any salvageable engine and mechanical parts were extricated to construct another horse.

The criticality of accident cases was so high that in Exhibit 5 (Mechanic Requirements), the numbers have been scaled to reflect the actual utility of each department in fixing accident cases. For example, a value of 0.1 for Balancer showed that a worker was needed for wheel balancing for only 10 per cent of the job service time. Sometimes, carrier accidents involving axle damage or tire damage were so severe that the whole axle needed to be changed. There were 16 cases of accidents from April to June 2013, and these cases occupied the maximum portion of work time available to the labour workforce and management

[4] *Front portion of the truck*

alike, aside from all the legal hassles and police interrogations the concerned parties also had to undergo in case of an accident. Seeing this problem, the brothers decided to construct the four extra bays on the unused side of the workshop. Jobs were taken up in “shortest job first” order and the priority of car carriers was always higher than flatbed steel carriers.

While a majority of incoming trucks were driver-reported problems, there were certain routine checks and repairs carried out on trucks as well. The ERP system used at the workshop carefully tracked the routes on which every truck was plying, repair required on each truck by its registration number, last job card and repair report, total distance travelled by the truck since last repair and a few other technical or truck-specific parameters (see Exhibit 7). The process of truck position tracking was manual as of October 2013; however, GPS integration was being planned. The ERP system even notified supervisors as to any routine repairs required on each truck as soon as it entered the workshop and supervisors queried its repair history and last job sheet. Hence, no truck left the workshop without completing a preventive maintenance checklist (see Exhibit 8).

MAINTENANCE MODEL

All repairs were carried out in-house using spare parts procured from authorized dealers. Some parts were occasionally procured from local dealers at lower cost (quality notwithstanding) but the advice of expert technicians and the works manager was generally taken in cases of deviation from original component purchases.

The bays and mechanics (resources) were reserved for the KM fleet only. With regards to outsourced repair, a few cases of accident, engine overhaul, repairs related to fuel injection pumps, steering, radiators, turbochargers, boring engines and wheel alignment were subcontracted to third parties, who sometimes brought mobile vans to the workshop for conducting repairs. On occasion, employing these mobile repair vans worked well to avoid delays. Some tasks such as wheel balancing had to be necessarily outsourced since it was not feasible for the company to incur high fixed costs of purchasing and maintaining computerized high technology machinery, which was to be used sparingly. In case of outsourced engine overhaul, the truck occupied the bay for the entire duration of time when the engine was under repair (separated from the horse). These carriers weighed several tons and it was expensive to invest in a machine that could tow away the carrier while the engine was disassembled for repair. This was another factor contributing to lowered efficiency of operations.

Some spare engines, engine components, gears, radiators and a few critical components were repaired and kept spare on a rotational basis to save time and money during emergency delivery situations. Delays were greatly minimized using these spare components.

Seasonality of jobs also played a role in worker selection — on both skill level and number of mechanics to be kept. For example, in the rainy season, tire problems and accidents were more frequent. During summers, engine overheating and head repairs were more common; while during winters, lamp repairs were frequently reported by drivers.

WORKSHOP COMPETITION

There were several small to medium-sized workshops owned by similar transporters in the vicinity. Consequently, KM faced considerable competitive threat with respect to availability of labour in times of need. The notable competing workshops were: Rajesh Motors (30 km away from the KM workshop), Anand Motors (12 km away) and Fast-Speed Motors (50 km away). These workshops were very attractive

job-hopping destinations for the labourers, who gained tremendous bargaining power due to the locational advantage they had on offer — i.e., with the workshops being within such close distances of one another. The compensation terms were also very competitive. Labourers often formed cartels and bargained with workshop managers to get their terms accepted. This was a significant concern for a majority of transportation providers in North India.

HUMAN RESOURCE ISSUES OR SEVERE CHALLENGES?

The same morning after his telephone call to Jain, Anuj arrived at the workshop, pondering over the long list of trucks awaiting repairs. His main concern was the labourers, who were adamant about taking long leaves — 10 to 15 days in duration — that KM could not afford to allow. If they took such long leaves, all pending transportation orders for car transportation to showrooms in North India would need to be cancelled during the festive season. Each day of delay meant incurring heavy opportunity costs and causing dissatisfaction to the showroom owners.

The workers threatened to leave the job, knowing that there were several competing workshops in and around Jaipur, even though they were much smaller in size and scale of operations than KM. This made labour problems very delicate to handle, with respect to both truck drivers and mechanics.

Anuj noted:

> [For many workers], the time that they spend idling in the workshop is not only wasteful but also dangerous for regular streamlined operations. They cause mischief, loiter around, gossip and misbehave with co-workers to distract even those mechanics who are at work! The drivers leave for rest breaks and come back at their own will. Sometimes, they even come up with faulty excuses and false alarms as if there is a functional problem with the truck requiring repair, just to idle in the waiting room. That is why we fix small issues outside the gate itself. The security guards have been instructed not to allow any truck into the workshop that does not need repair. On certain occasions, a mechanic goes out and checks if repairs are needed at all on a waiting truck. Only if the truck is cleared for inspection, it is allowed to enter the premises.

In spite of all these measures, many fraudulent cases entered the workshop.

A bigger challenge for large transport companies in India was the problem of corrupt drivers. They quoted a lower amount to the client company for carrying the load than the quoted figure in the KM contract terms and then took the work as a private job. Though most of KM's clients were professionally run organizations, some of the lesser known companies such as small town car showrooms and dealers did agree to pay the driver for transportation services. Some drivers even started casual businesses out of these practices, utilizing the client contacts acquired during their work for KM. Though the driver indulged in such malpractices for small gains, the end loser was the transporter company.

Both fuel and parts were occasionally stolen. Even worse than other malpractices, sometimes, the loaded material in the truck was stolen. Brand new cars were stolen from car carriers. Steel slabs and sheets were stolen from flatbed carriers. Corrupt drivers often had the audacity to demand higher salaries and threaten to leave when confronted with their malicious actions. Due to driver problems, 10 per cent of the fleet was always off road, parked at arbitrary places, even in loaded condition.

Jain and Anuj knew that the critical success factors in the transport business were extreme patience, courage and resilience. Gaurav Benera, another senior workshop executive, said:

> Clients such as car retailers, showrooms and even steel manufacturers demand on-time, perfect delivery in mint condition. If any premium customer's ordered car gets delayed, they threaten the dealers with severe consequences such as barging into the dealer's showroom with armed goons. If such an incident happens, the first blame for delay always comes to the transporter and you have to be patient enough to listen to the complaints they hurl at you.
>
> For the steel and cement industry, there are measurable parameters. Say, an hour of delay will get you one black star in transporter evaluation criteria. Repeat that delay three times, and you may not be able to renew the contract. Raw material procurement is one of the most critically tracked activities in the steel and cement industries. You simply cannot delay it. This is why such human [resource] factors are affecting daily operations in our workshop. There is just too much at stake for a single hour of delay.

RECRUITMENT

While the senior executives (works managers and above) were recruited through professionally conducted interviews, the mechanics were hired on an ad-hoc basis. They typically learned from their seniors who had been in the business of truck repairs for a long period of time. Some mechanics trained at local workshops or vocational training schools were hired occasionally, but they usually did not stay for a long time. The works manager said:

> These mechanics generally are able to do quality work, even without any formal education. We do not worry about how long they are going to stay with us. There is no shortage of manpower available from nearby localities close to the highway. Also, we cannot afford to hire trained mechanics. Their demands are just too much. A better strategy is to hire an experienced and trained mechanic for short periods of time — say seven to 10 days — for the purpose of training our mechanics.

LIMITED ENTRY BARRIERS TO TRANSPORT BUSINESS IN INDIA

Entry barriers to the logistics business in India were quite low. Small loans of only INR 400,000 to 500,000 were sufficient to purchase a truck. Alternatively, one could rent a truck to drive for a few years, earn some requisite amount to purchase trucks and other assets and then gradually expand the business. There was no minimum qualification in terms of formal education required to start up on one's own business, which is why any truck driver could start a casual transportation business on the side. However, to scale the business to large proportions (INR 10 to 20 million in turnover annually), a professional scheme of management had to be adopted.

CORE ISSUES

The brothers believed that poor manpower planning was hurting the timely repair of the trucks. It was possible that a shortage of repair personnel and the staff's low skill levels introduced long waiting delays for the trucks to be repaired; however, too many repair personnel also disrupted the maintenance operations. Nevertheless, there were other factors that could be responsible for the long repair delays, which could not be ruled out. They pondered upon several other reasons for long delays: Was the number of repair bays sufficient to meet the truck repair demand? Were the repair processes designed efficiently? Were other organizational problems marring the operational performance? How could they optimize workshop performance?

EXHIBIT 1: THE WORKSHOP IN GIDANI (DISTRICT DUDU, RAJASTHAN)

Numbered Bays (Side Views)

Inspection Bay – Largely unused – Drivers are reluctant to drive over it.

Chassis Carriers

Car Carriers

Flatbed Steel

Source: Company files.

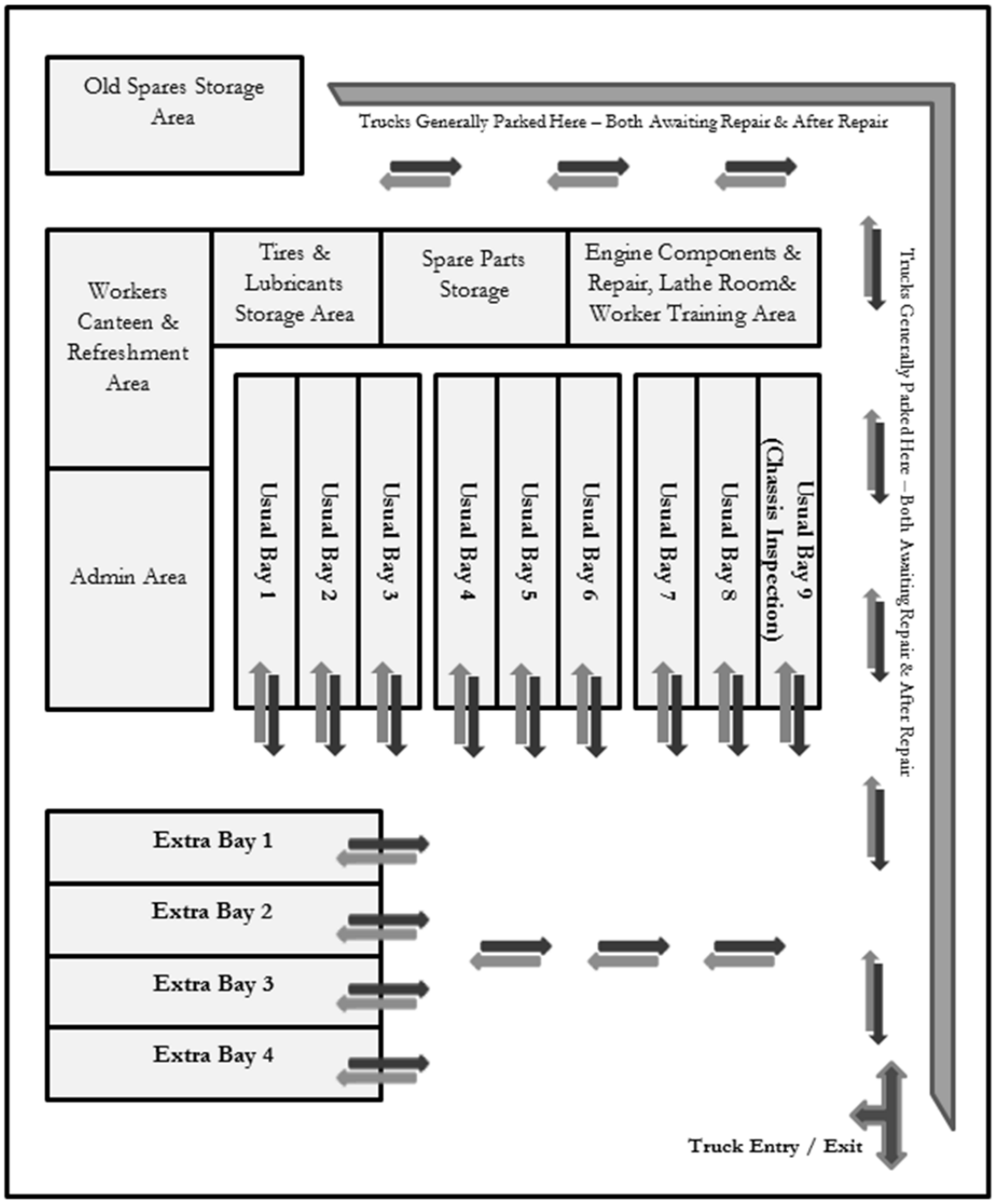
EXHIBIT 2: WORKER SKILL MAP

Number of workers in each department is tabulated below, segregated on skill level.

Department	High Skilled	Medium Skilled	Low Skilled	All
Mechanical	3	8	3	**14**
Denting	3	1	1	**5**
Balance Rod	3	0	0	**3**
Electrician	3	0	0	**3**
Welder	1	4	1	**6**
Tire	5	0	0	**5**
Total	**18**	**13**	**5**	**36**

Source: Company documents and interviews of personnel.

EXHIBIT 3: WORKSHOP LAYOUT



Source: Company records.

EXHIBIT 4: NUMBER OF ARRIVALS OF TRUCKS FOR REPAIRS [73 DAYS – APRIL TO JUNE'13]

Job Type	Usual OR Extra Bay	Flatbed	Car Carrier	Std. Deviation (Arrivals / Day)	Labour Cost (INR)
Accident	Extra	7	9	0.31	15,000
Air Filter Change	Usual	39	10	0.64	30
Balance Rod Alignment (Leaf Spring)	Usual	89	9	1.39	100
Battery Check Or Change	Usual	45	6	0.75	100
Brake Lining Change	Usual	13	8	0.35	15
Brake Oil	Usual	9	8	0.36	30
Brake Setting	Usual	58	30	0.82	10
Cabin Setting	Extra	9	8	0.36	250
Clutch Overhaul	Usual	15	20	0.49	700
Clutch Setting	Usual	53	33	0.90	50
Compressor Overhaul	Usual	13	5	0.39	300
Coolant Tank Repair	Usual	6	1	0.21	70
Coolant Change	Usual	29	11	0.56	50
Cross Change	Usual	1	6	0.21	50
Crown Oil Change	Usual	15	6	0.44	75
Denting	Extra	23	6	0.49	4,000
Diesel Filter Change	Usual	49	38	0.94	40
Diesel Tank Repair	Usual	4	1	0.18	350
Engine Oil Change	Usual	31	16	0.72	75
Engine Oil Top-up	Usual	92	27	1.24	75
Engine Overhaul	Usual	9	6	0.27	5,000
Fan Belt Change	Usual	7	4	0.29	50
Fifth Wheel Check	Usual	15	4	0.44	50
Fuel Injection Pump Repair	Usual	22	26	0.62	500
Gear Lever Setting	Usual	36	18	0.68	50
Gear Oil Change	Usual	16	7	0.42	75
Gear Overhaul	Usual	15	7	0.36	600
Horse Hub Grease	Usual	31	16	0.55	65
Hosepipe Change	Usual	13	3	0.35	40
Pressure Leakage	Usual	114	89	1.28	40
Radiator Service New	Usual	39	7	0.68	325
Relay Valve	Usual	13	8	0.41	200
Self-Alternator Service	Usual	14	7	0.41	200
Steering Box Oil Filter	Usual	42	12	0.83	35
Tappet Setting Change	Usual	26	11	0.48	100
Thermostat Valve Repair	Usual	1	1	0.12	70
Trolley Grease	Usual	63	23	0.99	65
Turbo Check Change	Usual	11	1	0.30	50
Tire	Extra	90	64	1.24	40
Water Body Change	Usual	3	0	0.14	100
Window Glass Or Machining	Usual	8	11	0.39	50
Wiring	Usual	317	134	2.89	1,000

Source: Company documents and interviews of personnel. 1) Includes frequently bundled jobs. 2) Costs mentioned above are only indicative, for calculation purposes, actual costs may vary greatly especially for accident, denting and few other unpredictable cases.

EXHIBIT 5: SERVICE TIMES AND MECHANIC REQUIREMENTS

Job Type	Expected Time Taken (Minutes)	Mean Time (Minutes) *
Accident	Uncertain (Generally > 15 Days)	6,300
Air Filter Change	5	5
Balance Rod Alignment (Leaf Spring)	90	90
Battery Check Or Change	30	30
Brake Lining Change	90 (per wheel)	540
Brake Oil	30	30
Brake Setting	30	30
Cabin Setting	Uncertain	180
Clutch Overhaul	180Mins	240
Clutch Setting	30	30
Compressor Overhaul	90	90
Coolant Tank Repair	60-90 (Metal)	75
Coolant Change	30	30
Cross Change	60-75	67
Crown Oil Change	30	30
Denting	Uncertain	240
Diesel Filter Change	30	30
Diesel Tank Repair	Leyland - 240/TATA - 90	100
Engine Oil Change	30	30
Engine Oil Top-up	10	10
Engine Overhaul	2400	900
Fan Belt Change	30	30
Fifth Wheel Check	60	60
Fuel Injection Pump Repair	180	180
Gear Lever Setting	30	30
Gear Oil Change	30	30
Gear Overhaul	180	210
Horse Hub Grease	30 (per wheel)	180
Hosepipe Change	60	60
Pressure Leakage	30	30
Radiator Service New	60	60
Relay Valve	90	90
Self-Alternator Service	60	60
Steering Box Oil Filter	30-45	36
Tappet Setting Change	30-60	45
Thermostat Valve Repair	30-45	36
Trolley Grease	30 (per wheel)	195
Turbo Check Change	90	90
Tire	10-20Mins	30
Water Body Change	60-90	75
Window Glass Or Machining	50-60	55
Wiring	20-60	45

Source: Company documents and interviews of personnel. 1) Includes frequently bundled jobs. 2) Service Times indicated here are those expected for expert mechanics (Skill level 10). For low skilled workers, service times are expected to increase as per skill level. 3) Service Times have low standard deviation (maximum 0.3) except for accident, denting and outsourced engine overhaul cases. Suitable assumptions may be made regarding the mathematical distribution of service times.

EXHIBIT 5 (CONTINUED)

Mechanic Requirements

Job Type	Mechanical	Denting	Balancer	Electrician	Welder	Tire
Accident #	0.3	0.7	0.1	0.3	0.6	0.1
Air Filter Change	1	0	0	0	0	0
Balance Rod Align (Leaf Spring)	0	0	1	0	0	1
Battery Check Or Change	0	0	0	1	0	0
Brake Lining Change	1	0	0	0	0	1
Brake Oil	1	0	0	0	0	0
Brake Setting	1	0	0	0	0	0
Cabin Setting	0	1	0	0	0	0
Clutch Overhaul	2	0	0	0	0	0
Clutch Setting	1	0	0	0	0	0
Compressor Overhaul	1	0	0	0	0	0
Coolant Tank Repair	1	0	0	0	0	0
Coolant Change	1	0	0	0	0	0
Cross Change	1	0	1	0	0	0
Crown Oil Change	1	0	0	0	0	0
Denting	0	2	0	0	0	0
Diesel Filter Change	1	0	0	0	0	0
Diesel Tank Repair	0	1	0	0	1	0
Engine Oil Change	1	0	0	0	0	0
Engine Oil Top-up	1	0	0	0	0	0
Engine Overhaul	1	0	0	0	0	0
Fan Belt Change	1	0	0	0	0	0
Fifth Wheel Check	0	0	2	0	0	0
Fuel Injection Pump Repair	1	0	0	0	0	0
Gear Lever Setting	1	0	0	0	0	0
Gear Oil Change	1	0	0	0	0	0
Gear Overhaul	2	0	0	0	0	0
Horse Hub Grease	2	0	0	0	0	1
Hosepipe Change	1	0	0	0	0	0
Pressure Leakage	1	0	0	0	0	0
Radiator Service New	1	0	0	0	0	0
Relay Valve	1	0	0	0	0	0
Self-Alternator Service	0	0	0	1	0	0
Steering Box Oil Filter	2	0	0	0	0	0

EXHIBIT 5 (CONTINUED)

Tappet Setting Change	1	0	0	0	0	0
Thermostat Valve Repair	1	0	0	0	0	0
Trolley Grease	2	0	0	0	0	1
Turbo Check Change	1	0	0	0	0	0
Tire	0	0	0	0	0	2
Water Body Change	1	0	0	0	0	0
Window Glass Or Machining	0	1	0	0	0	0
Wiring	0	0	0	1	0	0

Note: Figures in decimals indicate the pro-rated quantum of labour time needed in that particular department with respect to other departments using whole number of labourers for that job type. In other words, a mechanic is needed on 3 accidents out of 10 (0.3), while a balancer is needed in 1 accident of 10 (0.1), assuming all accidents take equal time to repair.
Source: Company documents and interviews of personnel. 1) Includes frequently bundled jobs. 2) Service times indicated here are those expected for expert mechanics (skill level 10). For low-skilled workers, service times are expected to increase as per skill level.

EXHIBIT 6: ACCIDENT CASES IN APRIL, MAY AND JUNE 2013

Vehicle No	Date	Vehicle Type
GC-3420	01-04-2013	Flatbed Carrier
GC-6533	06-04-2013	Flatbed Carrier
GC-7223	02-05-2013	Flatbed Carrier
GC-3421	14-05-2013	Flatbed Carrier
GC-6779	24-05-2013	Flatbed Carrier
GC-6953	04-06-2013	Flatbed Carrier
GD-2622	19-06-2013	Flatbed Carrier
GC-9117	09-04-2013	Car Carrier
GC-6947	15-04-2013	Car Carrier
GC-9115	24-04-2013	Car Carrier
GD-1913	16-05-2013	Car Carrier
GD-2839	19-05-2013	Car Carrier
GD-8714	13-06-2013	Car Carrier
GC-5829	12-06-2013	Car Carrier
GC-5432	08-06-2013	Car Carrier
GC-9513	17-06-2013	Car Carrier

Source: Company records.

EXHIBIT 7: ROUTINE CHECKS & REPAIRS

Job Type	Conducted Every Regular Interval
Engine Oil Change	21,000 kms
Set of 3 (Oil Filter, Diesel Filter, Water separator)	21,000 kms
Horse Hub Grease	45,000 kms
Trolley Grease	40,000-80,000 kms
Gear Oil	72,000 kms
Crown Oil	72,000 kms

Source: Company records.

EXHIBIT 8: TRUCK IN & OUT TIMES

Sample Data (Showing 7 out of 340 Cases)

Vehicle #	In Date	In Time	Out Date	Out Time
GA-5988	01-09-2013	10:00:00	01-09-2013	18:30:00
GA-9388	01-09-2013	10:10:00	01-09-2013	16:50:00
GE-1706	01-09-2013	10:25:00	01-09-2013	16:00:00
GD-4542	01-09-2013	10:30:00	01-09-2013	11:00:00
GB-6778	01-09-2013	10:35:00	06-09-2013	19:30:00
GD-8714	01-09-2013	15:00:00	01-09-2013	18:45:00
GA-7292	02-09-2013	09:45:00	02-09-2013	12:15:00

Vehicle Statistics on Time Spent in Workshop
[Data Available for 340 cases from April 2013 to June 2013]*

Trucks Spent Less Than 1 Day	310
Trucks Spent More Than 1 Day	30
Trucks Spent More Than 2 Days	8
Trucks Spent More Than 5 Days	5
Trucks Spent More Than 20 Days	1

(These time duration statistics below are inclusive of value added (VA), non-value added (NVA) and waiting times. Driving in and out times are a portion of NVA time.)*

Max # Days *	1	2	3	4	5	6	8	21	>=22
Mean Times (Minutes) #	259.5	358.3	366.7	366.7	401.2	446.8	505.8	592.4	592.4
Std. Dev. Times (Minutes) @	259.8	455.1	479.9	479.9	653.1	879.5	1163.9	1974.0	1974.0

** = It is a Data Table. If data for trucks spending more number of days (than Max # Days) are ignored, these would be the mean and standard deviation of time spent in the workshop.*
 # = Mean of time spent by trucks in the workshop in Minutes (those spending maximum N or more days).
@ = Standard Deviation of time spent by trucks in the workshop in Minutes (those spending maximum N or more days).
Source: Company documents and analytics performed on the data by the case writer.