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National coal mining giant

implements **RFID**-based



Efficient automated tracking of thousands of trucks

Weighbridge data management integration

VEHICLE TRACKING SYSTEM

Intelligent order monitoring, trip validation and alerts

Correct payment based on actual trips made and quantity transported



INSIDE: Key Requirements Solution Implementation Working Benefits Links

# TECHNOLOGY

Solution: EPC Gen2 compliant vehicle tracking solution

Tag Type: Parka<sup>™</sup> UHF Passive

Reader/Antenna: Xtenna™ Xtenna Proximity™

Method: Multiple Tracking via Integrated Reader/Antenna modules

Integration Platform: RFID Middleware:

Xtenna™ WebToolkit Xtenna™ Studio

Application: Essen RFID's Vehicle Tracking System Database: SQL Server 2005 Exp. ed. Messaging: Message Queuing Server ERP: SAP

Tag Manufacturer/Supplier: Essen RFID, with US based chip inlay

**Reader/Antenna Manufacturer:** Essen RFID, with US based module

Systems Integrator: Essen RFID

For further details contact:

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## KEY REQUIREMENTS:

Mahanadi Coalfields Limited (MCL) is a subsidiary of Coal India Limited, the country's monopoly coal mining company and one of the largest in the world. MCL mines and transports coal in huge quantities on a daily basis. For transporting coal, it utilizes its own trucks as well as those of contracted vendors and truck operators. Tracking these trucks and the coal being transported over multiple trips is an enormous task, with considerable theft taking place during coal transport. The existing system was found inadequate in coping with this, as well as being tedious, inefficient and time-consuming for weighbridge operators who had to manually enter truck details each time.

The company's logistics department is required to make payments based on trips made and quantity of coal carried. Inefficiency in the existing process resulted in overpayment for goods and services. The company required a solution that could verify each vehicle trip, track theft during trips and automate the payment process for truck drivers, thereby decreasing the processing time in managing trips and improving productivity.

Main challenges in implementation:

- Identify each truck automatically with minimal supervision.
- Validate order completion of each trip within stipulated date.
- Allow loading of ordered quantity only, with alert to the next truck that the order has been completed.
- Tracking each trip with weight details so that correct payment is made as per actual trips made and quantity transported.

# SOLUTION:

Essen RFID proposed a RFID-based system that identifies trucks at the weighbridge and tracks their trip details along with their weighment information, updates transactions and saves this information into the server as well as sends it to SAP, the ERP in use by the company. This system enables automation and data updating in near real-time across remote locations within a large mining area.

# IMPLEMENTATION:

Xtenna<sup>™</sup> RFID Antenna-Readers are installed at each weighbridge and at the IN and OUT gates. PARKA<sup>™</sup> tags are registered and affixed to all trucks. Essen RFID's Vehicle Tracking System (VTS) software is installed at each remote location with SQL Server as their back-end database. When connectivity is available at these remote locations, data is posted on the central server via a Message Queuing Server and completed trip transactions are sent to SAP.



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## CASE STUDY

### WORKING:

Details of each transport contractor/vendor are entered into the Vehicle Tracking System.

Version:1.0.0.54 User:admin						V	/ehicl	e Tra	acking	Sv	stem 🕻	
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Mine Master	WB											
	VENDOR_ID	CODE_NO	PARTY_TYPE	PARTY_NAME	ADDRESS	CITY	MOBILE_NO	PHONE_NO	EMAIL	VAT_NO	WEBSITE	W_CF
	1	P001	Transporter	Sharma Transport	er Jagatpur,Cuttak	Cuttak	7894561253	56895231	sharma@gmail.com	VAT-01	www.sharma.com	1000
	2	P002	Transporter	Mokal Transporte	r Shastri Nagar,Kanch	i Kanchi	8546967545	58/94562	mokal@gmail.com	VA1-02	www.mokal.com	1000
Cancel Trip	<											
- Subser Management	🦂 Data Entry Form.											
- 🔢 Role Master	Code No	P001		Contr	act from Mor	day , Aug	ust 19, 2013 🔲 🗸					
	Party Type	Transporter		Cont	act to Thur	day , Octo	ber 31, 2013 🗐 🗸					
Reports	Party Name	Sharma Trans	porter	Agree	ament no							
	Address	Jagatpur, Cutt	ak	, igit.	inclu-inc web							
Device Status	City	Cuttak		∨at_r	10 VAT-	11						
	Ulty Makila an	7994561253		Web:	site www	sharma.con	n					
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	Phone_no	56895231		Syste	em ID 1			1				
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Status Time: 10:0:15 Tags read: 1	🕝 Qk	🔀 <u>C</u> an	cel	🖌 Qlear	📸 Export To Excel							
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010c51303032343800000000												
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In the Route Master, route details of source and destination as well as the optimum travel duration are entered.

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ctions	📑 Weig	ht from	24000	aje					
Masters	WB		24000						
- A Party Master	ROUTE_ID	ROUTE_CODE	ROUTE_NAME	ROUTE_SOURCE	ROUTE_DESTINATION	ROUTE_TRAVEL_DURATION	IS_DELETED	CREATED_BY	
Route Master	▶ 1	R001	Source 1 - Destination 1	Source 1	Destination 1	5.02	N	admin	
W Vehicle Master	2	R002	Source 2 - Destination 2	Source 2	Destination 2	5.00	N	admin	
Post Good Issue     Viewer User Management     Ser Master	<								
Role Master	🛷 Data Entry Form.								
Bole Mapping	Route Code	R001							
	Route Name	Source 1 - De	tination 1						
	Route Source	Source 1							
	Route Destinat	ion Destination 1							
	Travel Duration	5.02							
	System ID	1							
	2 <u>O</u> k	X Car	cel 🖌 🖌 🖓 🤆 Clea	ar 🔂 Exp	ort To Excel				
ce Status									
>									
viceIP:									
2.168.123.147									
Tag Found	🛃 Route Details								
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Details of each truck are registered in the Vehicle Master. These include the truck license plate number, driver name, contact number and address, the tare weight of the truck, etc. A PARKA™ RFID tag is read using the Xtenna Proximity<sup>™</sup> reader and assigned to the vehicle in the database. The tag is then affixed on the truck's windshield. The truck owner (vendor/contractor) is selected from the previously entered screen and assigned to the vehicle in the database. A route is then assigned to the vehicle.

Vehicle Tracking System1.0.0.54												- = >
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- A Party Master 	Vehicle Code		📓 Search	Code	License Plat	e No	<b>1</b>	earch Licens	- Ba	ear Filter		
# Vehicle Master	Vehicle Details in	VEH NO V	EH CODE DRIVE	R NAME	TARE WT	ΜΑΧ CAPA		R TARE DAT	TAG ID		NUM OF AYLE	VEH STATI
- Derivery_Order	1	OR-01-AR-3481 V	-001 GAUR	AV KLIMAR	9800	30000	NULL	28-08-201	3 01124e31304	4505833323600	7	IS Active
📲 Post Good Issue	> 2	OR-06-BA-8745 V	-002 RAJU	SATANKAR	14000	25000	NULL	24-08-201	3 010e3835323i	8313939000000	4	IS Active
	3	JK-14-GF-3936 V	-003 KART	AR SINGH	10000	20000	NULL	27-08-201	3 01124e31304	45732304c4300	10	IS_Active
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Device Sidius	Vehicle Code	V-002			Vehicle State	JS	IS_Active	~				
	Driver Name	RAJU SATANKA	IR.		Number of A	xle	4	~				
	Tare weight	14000		Get weight	Current Ryut	e	Source 2 · Destination 2	~				
DeviceIP: 192.168.123.147	Party Name	Mokal Transporte	я ~		Device IP		192.168.123.148	~				
Status Time: 16:16:1	Tare Date	Saturday , Ar	ugust 24, 2013 🔲 🔻		Tag ID		010e3835323831393900	0000	Read Tag Cle	ear Tag		
Tags read: 1	System ID	2										
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00000000000	🖳 Vehicle Details	🖳 Inp Details										
≺ Xtenna <sup>™</sup>	Log											

In the Order Form a transport order is placed for the coal with details such as order quantity, order validity date and transporter's name.

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User Management     User Master     If Role Master     To Role Masping	Data Entry Form.     Order_ No     Vendor_Name     Product Name     Location	OD-0001 Shama Transporter Coal Mine	v v	Balance_Qty Order_Date Valid_Date Size	100000 Tuesday , Au Monday , Septe	ust 20, 2013 🗐 v imber 30, 2013 📑 v				
	Order_Qty System ID	100000 1 X <u>C</u> ancel	✓ <u>Cl</u> e	Grade Last_No ar	A ort To Excel					
evice Status	🛒 frmDeliveryOrder									
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When a truck loaded with coal arrives at the weighbridge, the Xtenna<sup>™</sup> reader mounted there reads the vehicle's RFID tag and sends the tag ID to the system. If the vehicle is registered, its details are displayed on the screen.

For each contractor who is given a particular order for transporting coal, the system will allow departure of his trucks only till that particular order has been fully loaded. If the order quantity is exceeded or if he loads up another truck beyond the ordered quantity, the system will not allow that particular truck to proceed from the weighbridge and through the OUT gate.

The Vehicle Tracking System displays alerts on screen to validate each truck and restrict extra trips. These alerts are:

- a. The RFID tag of each truck is read at the weighbridge and validated by the system. If a tag is found to be non-registered, an alert is displayed that the particular vehicle has not been registered in the system and the vehicle is not allowed to proceed.
- b. After registration checking, the next check is whether a valid order has been placed with the particular vendor/transporter, failing which an alert is displayed on the screen.
- c. The third check is if the order is within the valid date. If a truck attempts to undertake a trip after the valid date has lapsed, an alert is displayed on the screen.
- d. The next check is whether the order quantity has been completed. If the order quantity has been already completed by a previous truck, an alert is displayed for the truck currently at the weighbridge.
- e. Once trip has been validated, the next check is if the truck's tare weight is up-to-date. The tare weight of each truck has to be periodically updated to ensure accuracy of trip weighment. If the tare weight of the truck has not been updated after expiry of previous validity duration, it is not allowed to proceed on its trip without updation.
- f. Finally the weighment is checked to ensure that it does not exceed the maximum net weight allowed for the vehicle. If the maximum is exceeded, some of the coal has to be offloaded in order to ensure that the truck is not overloaded on its trip.

After these validations are automatically performed by the system, this data is displayed on the screen along with rest of the order data, such as vendor name, driver name, vehicle license plate number, delivery ID number, order details and balance quantity, gross weight, tare weight, net weight, etc.





Version:1.0.0.54 User:admin			Vehic	le Tracki	ng System
tions	📑 Weight from	2/000	a <u>l</u> a		
Masters Mine Master	WB	24000			
Party Master Route Master Product Master	License Plate No	OR-01-AR-3481	Delivery ID No	L1133	
Illian Waster	🟥 Delivery Order Information.				
Transactions	Delivery Order No	OD-0001 Y	Delivery Order Qty	100000	Current Balance Quantity
Viewer	Delivery Order Date	20-08-2013 00:00:00	Last Balance Qty	100000	85000
User Management	Product Name	Coal 🗸	Grade		
Role Mapping	Relicie Information.				
	Vendor Name	Sharma Transporter	Route Name	Source 1 - Destination 1	Update Tare Weight
	Driver Name	GAURAV KUMAR	Route Source	Source 1	
	Number of Axle	7	Route Destination	Destination 1	
			Tare Date	19-08-2013 00:00:00	
	Gross Weight	24000			
	Tare Weight	9000			
ce Status	Net Weight	15000			
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tus Time: 16:16:0					
s read: 1	💀 Trip Details				
0500024a30313000000000	Log				
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If the tare weight validity has expired, it is updated through the Post Good Issue screen of the system.

Version:1.0.0.54	1				
User:admin	1		Veh	icle Tracl	king System 💭
Actions Masters Mine Master	Weight from WB	2400	0		
Party Master Route Master Product Master	License Plate No	OR-01-AR-3481	Delivery ID No	L1133	
Delivery_Order	Delivery Order Information.				
Transactions R Post Good Issue	Delivery Order No	OD-0001	<ul> <li>Delivery Order Qty</li> </ul>	100000	Current Balance Quantity
Viewer	Delivery Order Date	20-08-2013 00:00:00	Last Balance Qty	100000	85000
User Master	Product Name	Coal	✓ Grade		
	🛷 Vehicle Information.				
	Vendor Name	Sharma Transporter	Route Name	Source 1 - Destination 1	✓ Update Tare Weight
	Driver Name	GAURAV KUMAR	Route Source	Source 1	New Tees Misista Issue
	Number of Axle	7	Route Destination	Destination 1	New Tare VVeight 24000
			Tare Date	19-08-2013 00:00:00	Last Tare Date 19-08-2013 00:00:00
	Gross Weight	24000			✓ Update
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evice Status	Save (F2)	Cancel v	Clear		
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The Viewer module allows the operator to view data without permitting any modification. It can display details of records from the vendor master, vehicle master, route master, delivery orders, trip details, etc.

Vehicle Tracking System1.0.0.54										_ = ×
Version:1.0.0.54 User:admin						Veł	nicle Tra	cking	g Syst	em 🚚
Actions	👳 Weigh WB	nt from	)	4						
	Select VEHIC	LE MASTER	v	O Generate	X Can	icel				
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- Chansactions	VEH_NO	DRIVER_NAME	TARE_WT	MAX_CAPACITY	VENDOR_NAME	TARE_DATE	TAG_ID	NUM_OF_AXLE	VEH_STATUS	ROUTE_NAME
- 📢 Post Good Issue	OR-01-AR-34	81 GAURAV KUMAR	9800	30000	Sharma Transporter	28-08-2013	01124e313044505833323600	7	IS_Active	Source 1 - Destination
Viewer	OR-06-BA-87	45 RAJU SATANKAR	14000	25000	Mokal Transporter	24-08-2013	010e38353238313939000000	4	IS_Active	Source 2 - Destination
Sancer Inp	JK-14-GF-393	6 KARTAR SINGH	10000	20000	Sharma Transporter	27-08-2013	01124e3130445732304c4300	10	IS_Active	Source 1 - Destination
Pre Registration     Pre Registration     Previce Status	¢									>
DeviceIP: 192.168.123.147 Status Time: 16:16:31 Tags read: 1										
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#### **Reports:**

The system automatically logs in details of each trip by each truck and saves them into the database. These trip reports are Windows based, allowing the supervisors to view and print them and also filter data as per search requirement.

The Vehicle Master Report shows details of trucks that are registered into the Vehicle Tracking System (VTS).

Select Report MEHICLE MASTER			~	NOTE: "Select the ap "Click on "Vie	Reporting propriate Report from the w Report" button to gen	a DropDown List grate the Selected report				- 🕫 📕
	Tiew Repo	ort		" Select the re " Select the ci " click on "Ap	quired Filteration field as presponding Checkbox f ply Filteration onselected	shown on the Left side panel of th or the filteration field Report" button to get the desired	ie reporti Report	ng tool		Aten
eport Filteration	E 1	of 1	▶ H I 4		🗐 💷 🖃 - 🗌 75%	•	Find	Next		
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Apply filteration on selected Report	VEH NO:	TARE WT	MAX CAPACITY	VENDOR NAME	TARE DATE	TAG ID	NUM OF AXLE	STATUS	ROUTE NAME	
08.01.48.3491	OR-01-AR-3481	5000	30000	Sharma Transporter	23/11/2013 15.28.23	0a0500044a30303800000000	7	IS_Active	Source 1 - Destination 1	
DRIVER NAME	OR-06-BA-8745	10000	25000	Mokal	18/11/2013 0.00.00	01124e313044573230474800	4	IS_Active	Source 2 - Destination 2	
	JK-14-0F-3936	5001	20000	Sharma Transporter	14/11/2013 19.07.40	01124e313044573557313600	10	IS_Active	Source 1 - Destination 1	
	OR-01-AT-4621	9001	30000	Sharma	14/11/2013 0.00.00	0d090e855231353430433130	10	IS_Active	Source 1 -	
IANE_WI	0R-02-JK-2324	3000	30000	Sharma	23/11/2013 0.00.00	010001000000000000000000000000000000000	7	IS_Active	Source 1 -	
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# CASE STUDY

The Vendor Master Report allows the supervisor to view vendor details such as vendor name, mobile no., email id, along with the contract validity dates.

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Select Report	VENDOR MASTER	Vi	ew Report	v t	ND * C * S * S	TE: elect the app lick on "View elect the req elect the cor lick on "App	ropriate Report f Report" button uired Filteration fi responding Chec ly Filteration onse	rom the Dro to generate ield as show kbox for the elected Rep	pDown List the Selecte on on the Le filteration I ort" button I	d report It side pa ield o get the	nel of the re desired Rej	porting tool				<ul> <li>✓ Xtenna<sup>™</sup></li> </ul>
Report Filteration		E E I N	∢ 1	of 1 🕨 🗎	1 + 0	<b>1</b>	1 in 14 - 1	75%	•		Fi	nd   Next				
Apply filteration	on on selected Report	Party D	)etails:		01/10/2014 18:00	54										
Party_Code_No	^	Party Code	Party Type	Party Name	address	oity	Mobile No	Phone	email	Vat_No	Woharge s	Contract from	contract to	Agreement	1	
P001	v	P001	Transporter	Sharma Transporter	Jagatpur,C uttak	Cuttak	7894561253	66896231	sharma@ gmail.co	VAT-01	1000	19/08/201 3 0.00.00	31/12/201 3 0.00.00	A-001	1	
Party_Type		P002	Transporter	Mokal Transporter	Shastri NagacRan	Ranchi	8546987545	58794562	m mokal@g mail.com	VAT-02	1000	19/08/201 3 0.00.00	31/12/201 3 0.00.00	A-02		2
Party_Name	•		1		un			1				1			1	
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The Total Trip Detail Report shows vendor-wise trip details with total gross weight and net weight information.

8						Reporting						- 8 ×
Select Report TOTAL_TRIP_DETAILS		Vi	ew Report	~	NOTE: * Select the appr * Click on 'View * Select the requ * Select the corre * click on ''Apply	opriate Report fr Report" button t ired Filteration fie sponding Check Filteration onse	om the DropDown Li o generate the Selec Id as shown on the L box for the filteration ected Report" buttor	st ted report .eft side panel o n field n to get the desi	f the reporti red Report.	ng tool		🗸 Xtenna
Report Filteration		E E I N	< 1 of	4 🕨 🎽 🖣		i on Fel-	75% -		Find	Next		
Apply filteration on selected Report		Trip Detail	s: or	/10/2014 18:41.47								^
DELIVERY_ID	^	PARTY NAME: Trip Count:	Sharma Transporter 98	DELIVERY ID	LICENSE NO	VEHICLE	PRODUCT NAME	GROSS WT	TARE WT	NET WT	TRAN DATE	
PARTY_NAME			1	L1345	OR-02-JK-2324	v-004	Char Coal	20000	6000	14000	21/12/2013 13.40.43	
Sharma Transporter			2	L1344	OR-01-AT-4621	V-003	Char Coal	20000	9001	10999	21/12/2013 13.05.19	
LICENSE_PLATE_NO			3	L1343	JK-14-GF-3936	V-003	Char Coal	20000	6001	14999	21/12/2013 12.48.57	
0R-02-JK-2324 v			4	L1341	OR-01-AR-3481	V-001	Char Coal	20000	5000	15000	21/12/2013 12.43.29	3
VEH_CODE			5	L1340	OR-02-JK-2324	v-004	Char Coal	20000	6000	14000	10/12/2013 18.49.02	
v-004 v			6	L1339	OR-01-AT-4521	V-003	Char Coal	20000	9001	10999	10/12/2013 18.48.46	
PRODUCT_NAME			7	L1338	OR-01-AT-4521	V-003	Char Coal	20000	9001	10999	10/12/2013 17.29.14	
Char Coal 🗸			8	L1337	OR-02-JK-2324	₩004	Char Coal	20000	3000	17000	10/12/2013 17.27.08	
PGI_GROSS_WT			9	L1336	OR-02-JK-2324	v-004	Char Coal	20000	3000	17000	23/11/2013 16.16.11	
			10	L1334	OR-01-AT-4621	V-003	Char Coal	20000	9001	10999	23/11/2013 15.55.47	
PGI_TARE_WT			11	L1334	OR-01-AT-4621	V-003	Char Coal	20000	9001	10999	23/11/2013 15.55.47	
			12	L1332	JK-14-GF-3938	V-003	Char Coal	20000	5001	14999	23/11/2013 15.55.17	
PGI_NET_WT			13	L1332	JK-14-GF-3936	V-003	Char Coal	20000	5001	14999	23/11/2013 15.55.17	
			14	L1331	JK-14-0F-3936	V-003	Char Coal	20000	5001	14999	23/11/2013 15.40.21	
FROM PGI_TRAN_DATE	~		15	L1330	JK-14-0F-3936	V-003	Char Coal	15000	5001	9999	23/11/2013 15.33.07	
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All trips are generated automatically using the VTS application. Trips that are cancelled by the operator are then displayed in the Cancelled Trip Details Report.

•					R	eporting						- 8 <mark>-</mark> ×
Select Report TOTA	L CANCELLED TRIP		Tiew Repor	~ t	NOTE: * Select the appropri * Click on "View Rec * Select the required * Select the corresp * click on "Apply Fi	iate Report fro port" button to I Filteration fie onding Check teration onsel	om the DropDown Li o generate the Selec Id as shown on the I dox for the filteration lected Report" button	st .eft side pane n field n to get the de	of the repo sired Repo	rting tool rt.		🗳 Xtenna
Report Filteration			4 1	of 1. ▶ . ▶  .   ∢	• 0 2 3 I	u 🖬 - 1	75% •		Find	I   Next		
Apply filteration on :	selected Report	Cancll Details	ed Trip s:	07/10/201	4 18.42.43							
DELIVERY_ID	^	Sr No.	DELIVERY ID	PARTY NAME	LICENSE PLATE NO	VEH CODE	PRODUCT_NAME	GROSS_W	TARE_W	NET_WT	TRAN_DATE	
L1144 v		1	L1144	Sharma Transporter	OR-01-AR-3481	V-001	Char Coal	51840	12000	39840	28/08/2013	
PARTY_NAME		2	L1142	Sharma Transporter	OR-01-AR-3481	V-001	Char Coal	30000	12000	18000	27/08/2013	
Sharma Transporter 🔍		3	L1141	Sharma	OR-01-AR-3481	V-001	Char Coal	30000	12000	18000	27/08/2013	
LICENSE_PLATE_N0		4	L1140	Sharma Transporter	OR-01-AR-3481	V-001	Char Coal	30000	12000	18000	27/08/2013	
0R-01-AR-3481 v		5	L1134	Mokal Transporter	OR-06-BA-8745	V-002	Char Coal	24000	9500	14500	20/08/2013	3
VEH_CODE		6	L1133	Sharma Transporter	OR-01-AR-3481	V-001	Char Coal	24000	9000	15000	20/08/2013	
V-001 v		7	L1132	Mokal Transporter	OR-06-BA-8745	V-002	Char Coal	15000	9500	6500	19/08/2013	
PRODUCT_NAME				1							10.02.07	1
Char Coal 🗸 🗸												
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The Summary Report shows the vendor-wise total Tare Weight, Gross Weight, Net Weight and Trip Count.

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## BENEFITS:

- Each truck is automatically detected by the RFID system, hence manual entry of truck number is not required. Therefore payment will always be made for the correct truck only.
- Intelligent delivery order monitoring wherein an alert is displayed if an order quantity is transported and the next vehicle comes for the same order.
- Validation of each truck before every trip is undertaken.
- Automated logging of entry and exit at IN and OUT gates.
- Prevents theft in terms of trips made.
- Prevents theft in terms of weighment of coal being transported.
- Prevents overloading of vehicles.
- Saves operator time and brings ease of use.
- Overall efficiency through automated processes.
- Establishes transparency in business operations.
- Enables report generation and analysis in real time.

#### LINKS:

#### Hardware:



Tags:

**PARKA**<sup>™</sup>

Software:





# Reference Example:

http://www.essenrfid.com/Mailer/accessparking-flash-demo.pdf