Bulk LPG TT – Safety in Design & Operation

Sasi Chemmenkottil,  
Vice President (Operations & Logistics)  
Total Oil India Private Limited
TOTAL Group – An Integrated Multi National Oil & Gas Company

Trading
Making the link between our output and our processing sites and providing a supply to our customers
Total Group statistics - 2012

- **Strong international presence**: over 130 countries
- **Sales**: 200 billion euro (+8%)
- **2012 investment budget**: 23 billion dollars
- **Net income**: 12.4 billion euro (+8%)
- **Sale of LPG**: marketed in over 50 countries
- **97,126 employees**
- **Over 700 industrial sites**
- **Ranked 5th publicly traded international oil and gas company in the world**
- **Sale of 1.7 million barrels per day**
- **LPG marketed in over 50 countries**
Components of Safe LPG Transportation

**Tanker**
- Design
- Licensing
- Maintenance
- GPS Tracking
- 3rd party inspection
- Technical up gradation

- Gap in tanker design with Western world
  - Stability studies

**Driver**
- Selection
- Training
- Motivation / Incentive Scheme
- Trip Monitoring
- Counseling
- Disciplinary measures

- Driver Induction requirements
- Additional pre-induction training
- Driver change management
- Changing communication trends
  - Facebook / whatsapp

**Environment**
- Driving safety Policy
- Roads
- Traffic density
- Weather
- Time of the day
- Parking location

- Narrow / hilly / pot holed roads
- Hardly any signages
- Poor implementation of traffic rules
OISD Standards on LPG / Propane Tankers

- OISD standards covers the technical requirements & safety of Tank trucks adequately
  - Standard 151 (Propane Tank Trucks)
  - Standard 159 (LPG Tank Trucks)
- Internal Excess Flow check valve (IEFCV) has been conceived as a safety fitting since long
- Implementation got a boost with PESO circular released in Apr’2013
- Installation of IEFCV’s ensures that LPG is not spilled even if there is rupture of pipelines
- Ensuring no spillage eliminates the chances of BLEVE to a good extent.
- Automating the operations makes the system user friendly
IEFCV AUTOMATION VIDEO

IEFCV VIDEO\VIDEO_TS\VTS_01_1.VOB
AUTOMATION FOR INTERNAL EXCESS FLOW
CHECK VALVE FOR LPG TANKERS

- Scheme suggested complies with PESO Circular no: PV (M)Genl/2009 dtd. 16/04/2013.
- Pneumatic Rotary actuator operating the IEFCV will be activated remotely.
- Hand Lever Operated Valve provided at Driver’s cabin will be used for opening the IEFCV during unloading or loading and closing after the operation
- Push Button provided at the rear end of Tanker used for Emergency shut off
- Air for operation of the pneumatics is stored in 2 dedicated reservoirs housed on the chassis of the vehicle.
- Air tanks are filled using existing compressor, but segregated from braking system

PESO has accorded in-principle approval for the system implemented by TOIPL (shown in video)
SIMPLE PNEUMATIC CIRCUIT USED IN AUTOMATION OF IEFCV
AUTOMATED INTERNAL EXCESS FLOW CHECK VALVE FOR TANKERS
AUTOMATED INTERNAL EXCESS FLOW CHECK VALVE FOR TANKERS

IEFCV

2\textsuperscript{nd} Liquid line plugged (approved by PESO)

Heat / Fire sensor
TANKER EARTH STRIPS & MOUNTING OF AIR TANKS

Interlocking Earthing with flow of LPG at Loading / Unloading locations through Earth Relay is an enhanced safety feature.
EVACUATION THROUGH DRAIN LINE IN CASE OF EMERGENCY
Crash Guard for trailer trucks

- Crash guard to be provided on both sides of the Tanker covering the Rear Wheel till the Tanker Jack
- This will protect the Two Wheelers getting trapped / four wheelers driving into the underbelly of tanker
- Also acts as additional safety feature for protecting the tanker pipelines during accidents

Material of crash Guard - Standard MS Channel
Small changes – Big impact

• Rear view mirrors replaced with BIG mirrors

• Conventional seats replaced with seats in built 3 point inertial seat belts
Third party vetting of LPG Tankers

1. Inspection of tankers through automobile safety experts
   - During induction & thereafter once a year
2. Safe-to-Load” inspection at all sites
   - Tankers are inspected at the loading & unloading locations.
   - Three tier inspections – Safety-In-Charge & Plant-In-Charge

Crack in chassis – detected during vetting

EARLIER – Gardening Plastic Hose

REPLACED with PU Tube as a part of safe to load check
Tire tread checking with tire gauges

What to check?
- Correct pressure
- At least 3 mm minimal depth of tread (check depth gauge)

Use tyres of same tread in one axle
Cardinal Rules of Driving Safety – Total’s Policy

- Ban on night driving (11 PM to 5 AM)
- Maximum Daily driving hours – 10 hrs max in 24 hrs
- Continuous driving – 2 hrs (20 min rest) / 3 hrs (30 min rest) / 4 hrs (40 min rest)
- Speed limit – 50 Km/hr (except in major highways - 60 KM/hr)

GPS system is programmed to generate alerts on violation of all of the above
GPS/GPRS based Vehicle Tracking System – Features

Driving behavior
- Over speeding – 50 Km/hr other than Highways, Highways – 60 Km/hr
- Harsh braking

Fatigue management
- Night driving (11 PM to 5 AM)
- Daily driving – 10 hrs max in 24 hrs
- Continuous driving / Rest period – 2 hrs / 20 min; 3 hrs / 30 min; 4 hrs/40 min

Security /Safety / Fraud
- Unauthorized parking
- Geo-fenced areas - Plants / Customer locations
- Route diversion – Unauthorized routes
- Disconnection due to break down
- Tampering of connections
- Location detection

• GPS unit owned by Total fitted in 100% Bulk LPG tankers & Cylinder trucks

Providing GPS is only the beginning. How do we use the output is most important
### GPS Monitoring, Daily Analysis & Reporting

#### Monitoring of GPS through custom designed front end software
- Alerts through sms / e-mail in case of driving violations
- Automated alerts for driving violations when tanker enters plant geo-fence
- Counseling of Drivers for violations by trained Staff.

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Vehicle Info</th>
<th>Start Location</th>
<th>End Location</th>
<th>Start Date</th>
<th>Start Time</th>
<th>End Date</th>
<th>End Time</th>
<th>Speed</th>
<th>County</th>
<th>Mph</th>
<th>Total Speed</th>
<th>Total Time</th>
<th>Total No Of Days</th>
<th>Total No Of Hours</th>
<th>Total No Of Minutes</th>
<th>Total No Of Seconds</th>
<th>Total No Of Speeds</th>
<th>Total No Of Locations</th>
<th>Total No Of Alerts</th>
<th>Total No Of Drivers</th>
<th>Total No Of Staff</th>
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<tbody>
<tr>
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<td>7505566789</td>
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<td>Noida</td>
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<td>2023-07-05</td>
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<td>Noida</td>
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<td>2023-07-05</td>
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<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Message:** Good Drivers for the day & details of summarized violations below for your information and action.

1. No of trucks on road - 122 Nos.
2. No of trucks with driving hours - (1 to 10 Hours) - 121 Nos.
3. No of trucks with driving hours - (10 to 12 Hours) - 1 Nil.
4. No of trucks with driving hours - Above 12 Hours - 0 Nos.
5. No of Trucks with Night Driving (3:00 am to 6:00 am) - 0 Nos. with avg kms travelled 3285.
6. No of Trucks with Night Driving (6:00 am to 9:00 am) - 0 Nil.
7. No of Trucks with Night Driving (9:00 am to 12:00 am) - 0 Nil.
8. No of Vehicle travelled 400 - 500 kms - 1 No.(R15 GB 0765-406kms)
9. No of Vehicles travelled above 500 kms - Nil.
10. Rest all the trucks are below 400-121 trucks.
11. Speed Violations: above 50 kph - 3 Trucks.
12. Speed Violations: above 60 kph - Nil.
13. Speed Violations: above 70 kph - Nil.
14. Harsh Breaking: Violations: 18 Trucks, (MR38 N 0120 / KA01 AA 86344 / KA01 AA 99357 / KA01 AA 99360 (3 times) / KA01 AA 99361 / KA01 AB 38133 / KA01 AB 58116 / KA09 B 32993 (2 times) / KA01 AB 58117 / KA20 B 5122 / KA21 A 206 (2 times) / KA42 4262 / KA46 682 (2 times) / KL09 AC 4235 / MH43 E 450 (8 times) / NL01 K 4793 / NL01 K 6000 (3 times) / R19 GA 1908) - Need Check their driving experience.
15. No. of Trucks violated Rest Period: Nil.
16. Please find below the list of critical violations - Following drivers to be reprimanded and 12 hrs of rest is required.
Monitoring of Driver’s & follow up

- Driver Risk Profile is generated on monthly basis from GPS reports & Drivers are categorized as follows:
  
  - **High Risk Drivers**
  - **Harsh braking drivers**
  - **High speed drivers**

- **Risky drivers are dealt as follows:**
  - Plants get an automated mail on the violations done by driver’s as soon as the truck enters the plant geo-fence
  - Trained Staff at Plant Counsels drivers
  - Undertakings / Letters obtained from Drivers and transporters
  - Post-counseling, drivers are further monitored by Logistics team
  - In case of no improvement – suspend driver
  - If there is no improvement in behavior after punishment Driver is removed from service
High Risk Driver Management

<table>
<thead>
<tr>
<th>Period</th>
<th>No of Drivers counseled</th>
<th>No of drivers removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct’12</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Nov’12</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>Dec’12</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
<td>Jan’13</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Feb’13</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>Mar’13</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

- Analyze driving habits
- Segregate drivers based on driving habits to High Risk & Risky drivers
- Corrective action through counseling of drivers

After the above action reduction in violations were dramatic
Driving violations - trend

Driving violations are categorized and monitored as percentage of total number of tankers on road on that day.

Graphics show improvements during last 14 months

- **Night Driving**
  - Oct'2012: 4.61%
  - Dec'2013: 0.23%

- **Speed violation**
  - Oct'2012: 2.65%
  - Dec'2013: 0.03%

- **Driving Without rest**
  - Oct'2012: 25.74%
  - Dec'2013: 0.17%

- **Overall violations**
  - Oct'2012: 33.00%
  - Dec'2013: 0.43%

Driving violations are categorized and monitored as percentage of total number of tankers on road on that day.
Defensive Driving Trainings (DDT) & Sensitization Programmes

<table>
<thead>
<tr>
<th>Month</th>
<th>No of DDT sessions conducted</th>
<th>No of Drivers trained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sep’12</td>
<td>13</td>
<td>111</td>
</tr>
<tr>
<td>Oct’12</td>
<td>8</td>
<td>70</td>
</tr>
<tr>
<td>Nov’12</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Dec’12</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Jan’13</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>Feb’13</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Mar’13</td>
<td>5</td>
<td>72</td>
</tr>
<tr>
<td>Apr’13</td>
<td>7</td>
<td>124</td>
</tr>
<tr>
<td>May’13</td>
<td>6</td>
<td>53</td>
</tr>
<tr>
<td>Jun’13</td>
<td>4</td>
<td>36</td>
</tr>
<tr>
<td>Jul’13</td>
<td>4</td>
<td>27</td>
</tr>
<tr>
<td>Aug’13</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>Sep’13</td>
<td>3</td>
<td>45</td>
</tr>
<tr>
<td>Oct’13</td>
<td>8</td>
<td>61</td>
</tr>
<tr>
<td>Nov’13</td>
<td>3</td>
<td>28</td>
</tr>
<tr>
<td>Dec’13</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>TOTAL</td>
<td>82</td>
<td>801</td>
</tr>
</tbody>
</table>

**Driver Sensitization Programmes**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Theme of Programme</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kannur LPG tanker BLEVE</td>
<td>Nov-Dec’12</td>
</tr>
<tr>
<td>2</td>
<td>Training on handling LPG Emergencies</td>
<td>Feb’13</td>
</tr>
<tr>
<td>3</td>
<td>How to use seat belts effectively</td>
<td>Mar - Apr’13</td>
</tr>
<tr>
<td>4</td>
<td>Perne LPG Tanker leakage &amp; fire</td>
<td>Apr’13</td>
</tr>
<tr>
<td>5</td>
<td>Drunken driving</td>
<td>May’13</td>
</tr>
<tr>
<td>6</td>
<td>Reduction in harsh braking (to drivers with harsh braking tendency)</td>
<td>May’13</td>
</tr>
<tr>
<td>7</td>
<td>Safe Driving during Monsoon</td>
<td>June’13</td>
</tr>
</tbody>
</table>

- Regular Driving safety training through Transport safety experts
- Class room & on road training
- Assessment & categorization – High / Low risk
- Refresher courses – once in 6 months
Driver Awareness Campaign
## Drivers Incentive Scheme

<table>
<thead>
<tr>
<th>Incentive</th>
<th>Amount (Rs)</th>
<th>Dist Travelled (KM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan’13</td>
<td>113,289</td>
<td>531,035</td>
</tr>
<tr>
<td>Feb’13</td>
<td>118,217</td>
<td>532,234</td>
</tr>
<tr>
<td>Mar’13</td>
<td>133,227</td>
<td>598,709</td>
</tr>
<tr>
<td>Apr’13</td>
<td>140,241</td>
<td>551,705</td>
</tr>
<tr>
<td>May’13</td>
<td>159,219</td>
<td>627,271</td>
</tr>
<tr>
<td>Jun’13</td>
<td>154,844</td>
<td>558,931</td>
</tr>
<tr>
<td>Jul’13</td>
<td>159,123</td>
<td>553,293</td>
</tr>
<tr>
<td>Aug’13</td>
<td>157,255</td>
<td>548,931</td>
</tr>
<tr>
<td>Sep’13</td>
<td>162,947</td>
<td>529,985</td>
</tr>
<tr>
<td>Oct’13</td>
<td>229,290</td>
<td>800,724</td>
</tr>
<tr>
<td>Nov’13</td>
<td>224,600</td>
<td>664,057</td>
</tr>
<tr>
<td>Dec’13</td>
<td>233,352</td>
<td>598,431</td>
</tr>
</tbody>
</table>

2 paise per RTKM per MT paid by TOIPL for driving without violations
Good Driver Award scheme

Driver Incentive & punishment scheme – 2 paise per KM per MT for Nil driving violation

- Launched on 28th Feb’13.
- Awards till date - 2 Platinum, 11 Gold & 118 Silver Badges till date

- Ten “Good Drivers” to be selected every month with “Nil” driving safety violations
- These Drivers are given ONE Silver Badge each per month which they wear in their uniform
- Driver earning 3 Silver Badges can exchange the same for ONE Golden Badge + Gift worth Rs.10,000/-
- TWO Golden Badges fetches them a Platinum Badge and a gift worth Rs.20,000/-
- Two Driver’s securing max no of Badges shall be called “Guru”
- Guru in Indian tradition means Teacher
- These Drivers will be used to impart Practical Driving Safety Training to other Drivers on-road
Disciplinary Action – Carrot & Stick go together

Punishment for critical violations:
- 1st time – counseling / warning
- 2nd time – counseling / warning + delay in loading / unloading by 6 hours
- 3rd time – counseling / warning + delay in loading / unloading by 12 hours
- 4th time – counseling / warning + delay in loading / unloading by 24 hours
- More than 4 time – suspension of driver from TOIPL operation

Communication to transporters:
- Critical violation
- Undertaking letter from transporter / driver
- Suspension / dismissal of driver for violation
- Tampering of GPS units

<table>
<thead>
<tr>
<th>Description</th>
<th>Jan’13</th>
<th>Feb’13</th>
<th>Mar’13</th>
<th>Apr’13</th>
<th>May’13</th>
<th>Jun’13</th>
<th>Jul’13</th>
<th>Aug’13</th>
<th>Sep’13</th>
<th>Oct’13</th>
<th>Nov’13</th>
<th>Dec’13</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Tanker drivers awarded punishment</td>
<td>15</td>
<td>14</td>
<td>39</td>
<td>29</td>
<td>15</td>
<td>43</td>
<td>16</td>
<td>21</td>
<td>10</td>
<td>14</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>No of Hours delayed Loading</td>
<td>2700</td>
<td>456</td>
<td>1092</td>
<td>1368</td>
<td>696</td>
<td>4560</td>
<td>2352</td>
<td>3000</td>
<td>816</td>
<td>744</td>
<td>1800</td>
<td>1032</td>
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<tr>
<td>No of drivers removed from service for repeated violations</td>
<td>1</td>
<td>Nil</td>
<td>1</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>4</td>
</tr>
<tr>
<td>No of drivers removed from service due to alcohol trace detection in breath</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>2</td>
<td>Nil</td>
<td>1</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
<td>Nil</td>
</tr>
</tbody>
</table>
### Encouraging results ..............

<table>
<thead>
<tr>
<th>S No</th>
<th>Month</th>
<th>Nil Violation days</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Jun’13</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Jul’13</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>Aug’13</td>
<td>9</td>
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<td>4</td>
<td>Sep’13</td>
<td>17</td>
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<td>5</td>
<td>Oct’13</td>
<td>10</td>
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<tr>
<td>6</td>
<td>Nov’13</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Dec’13</td>
<td>16</td>
</tr>
</tbody>
</table>

Nil Violation day means:

- No Tankers driven during night 11 PM to 5 AM
- No Truck crossed Daily driving hours – 10 hrs in 24 hrs
- No Driver violated rest requirement – 2 hrs (20 min rest) / 3 hrs (30 min rest) / 4 hrs (40 min rest)
- No Truck violated Speed limit

Now we are aiming at Nil violation months.............
Win Win for every stake holder……

**Drivers**
- Adequate rest
- Less / no fatigue
- Less risk
- Better quality of life – Feels like more of a human being (feedback)

**Transporter**
- Lower driver attrition rate
- Less breakdowns (adequate time for maintenance) – more truck availability
- Lesser wear & tear
- Reduced fuel consumption (best fuel efficiency at 40 to 50 Km/hr speed)
- Access to GPS – always aware about location of tankers
- Less accidents – Cost of accidents very high

**Contracting Company**
- Improved Logistic control
- Less stock outs / over stock
- Much better planning
- Improved ability to respond to customer
- Improved bonding with transporters

Our transportation rates are lower than industry even after adding the extra amount spent

Even with all the controls mileage of 5500 to 6500 Km per month possible

Dealing with new age educated transporters & app-savvy Drivers is a different experience
JRM & Mapping JRM findings in GPS for giving advance warning to Drivers on road

- JRM
  - Technical study of routes by Transportation experts
  - Identified risks such as narrow road, Blind curves, speed restrictions, narrow bridge, gradient, Parking locations etc
  - Mapped the inputs from JRM with GPS device
  - Generates alerts & warnings for drivers

- Eliciting feedback from Drivers after completion of each journey and using the information to inform other drivers

- Enroute surprise check by Company officials
<table>
<thead>
<tr>
<th>SN</th>
<th>Road details</th>
<th>Y/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bad Road condition, Potholes</td>
<td>√</td>
</tr>
<tr>
<td>2</td>
<td>Poor Visibility(In Evening) spot</td>
<td>X</td>
</tr>
<tr>
<td>3</td>
<td>High Traffic density</td>
<td>√</td>
</tr>
<tr>
<td>4</td>
<td>Many intersections</td>
<td>√</td>
</tr>
<tr>
<td>5</td>
<td>Number of Lanes/Dividers</td>
<td>√</td>
</tr>
<tr>
<td>6</td>
<td>Surrounding Schools/Hospitals/Market Place</td>
<td>√</td>
</tr>
<tr>
<td>7</td>
<td>Blind Spots</td>
<td>√</td>
</tr>
<tr>
<td>8</td>
<td>Circuitous routes</td>
<td>X</td>
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<tr>
<td>9</td>
<td>Steep curve Gradients</td>
<td>√</td>
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<tr>
<td>10</td>
<td>Accident prone Zones</td>
<td>√</td>
</tr>
<tr>
<td>11</td>
<td>Day Driving restrictions</td>
<td>√</td>
</tr>
</tbody>
</table>

**Conclusion**

1. Road Risk Profile – Med Risk Zone.
2. Two Lane bitumen tar road without dividers
3. Recommended Speed Limit - < 35km
4. Key Hazard Zones
   - Rush Area 101.64, 104.35
   - Gravel Road 106.08, 107.0km
   - Busy Intersection 100.83, 109.12
   - Rough & Uneven Shoulders 102.12, 107.92km.
Other Management systems for transportation safety monitoring

- Monthly Transport review at Head office level
- Quarterly Transport review at Corporate Office level
- Half yearly Transport activities review by Regional Office (Singapore)
- Audit by Paris & Singapore Team on Safety Management on Transportation
- Yearly Crisis Management mock drills involving transport accidents
- Quarterly meetings with transporters specifically to review safety
Other initiatives on LPG Tanker safety implemented by Total Oil

- Brake efficiency check meter
- Anti-Lock Breaking System being progressively installed (37% fleet covered)
- Enroute surprise checks
- Alcohol detection at plants and during enroute checks
- Annual Medical check up for Drivers
- Awareness programmes – Aids / de-addiction / Smoking / Dental & general hygiene
- Training Programme on Transport Safety & accident prevention for Transporter’s Managers
- TOIPL’s own Emergency Rescue Vehicle

LPG Transportation rates in India is not cheap.

Abroad transportation rates are inclusive of safety features in tankers.
Total Oil India is ready to:

- share our experience for anyone who needs
- offer help to others who would like to implement similar systems or
- work with others for Transportation Safety

Thank You