

Benefits of Risk Based Transport Operations: How ITS Can Contribute

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Presentation Structure

- Introducing risk based policy
- Case study: risk based policy including safety, environmental and productivity benefits
- Example of an ITS application that evaluates driver risk

Improving Safety Through Operations Risk Management

- Practiced by the provinces of Alberta and Saskatchewan
- Operators can utilize larger trucks to gain productivity improvements in exchange for more stringent risk-based operating requirements

How it Works

- Based on a “Special Permit System”
- Vehicle operations are controlled to minimize risk
- Restrictions related to time of day, weather, driver qualifications, safety practice and routing

Special Permit Systems

- Provide economic advantage that is a privilege not a right
- Can specify safety, maintenance and operational requirements beyond the norm
- Because they can be revoked due to poor safety performance, they engender an “enhanced” carrier safety mind set.

Factors Influencing Transport Risk

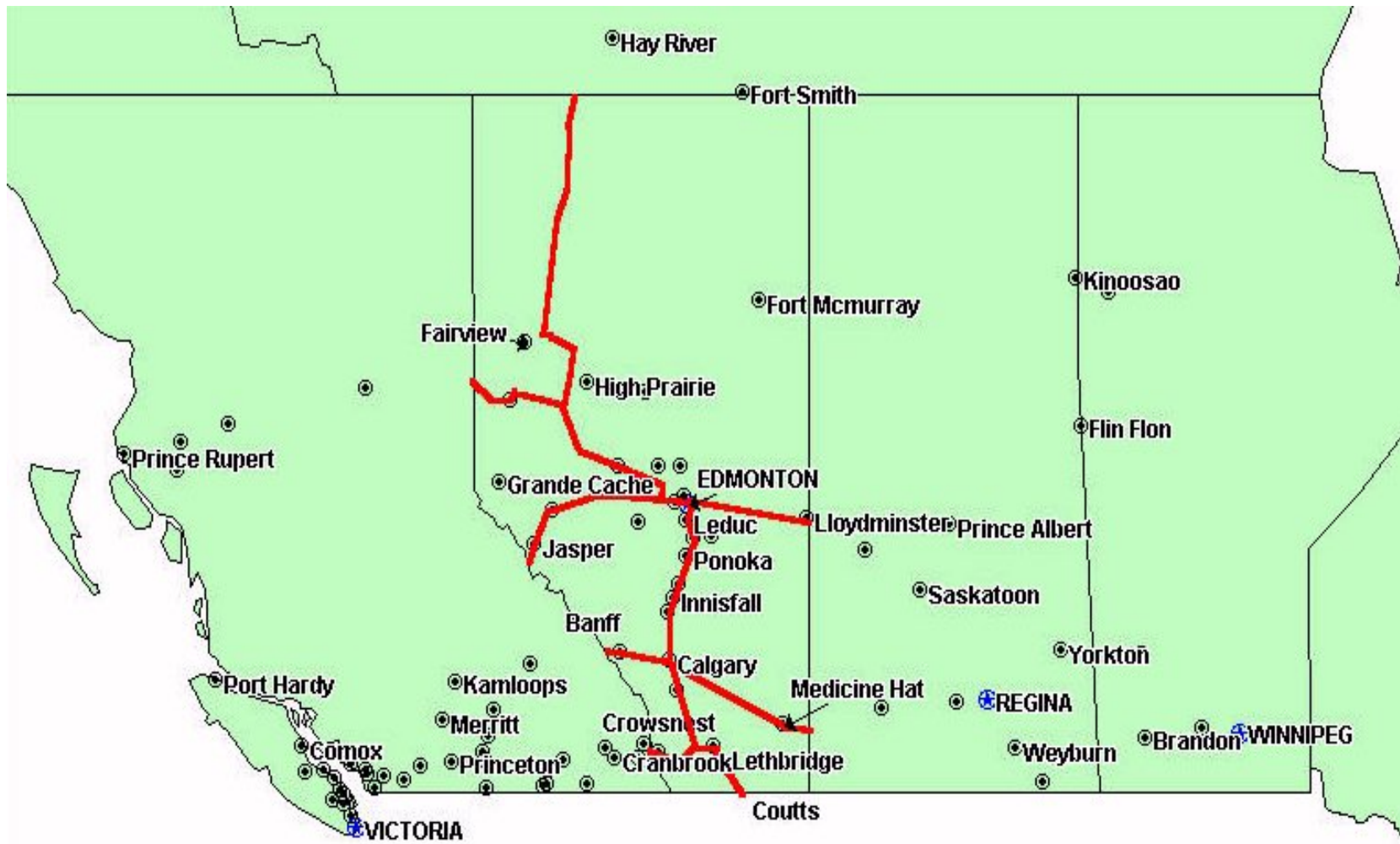
- Population density
- Traffic volumes/condition (e.g. vacation traffic)
- Congestion – work zones
- Road class
- Weather and road condition
- Road curviness (vertical & horizontal)
- Overtaking opportunities
- Commodity risk
- Operational factors
- In cab distraction and hours of service
- Driver and company experience

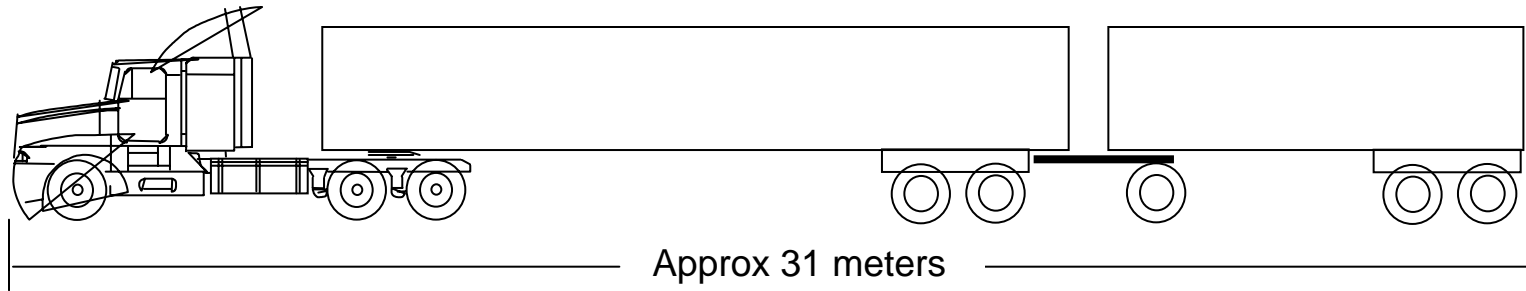
Measuring the Impact on Safety

- Study conducted on Alberta Canada special permit LCV operation
- First study to link and quantify the benefits of operation management to road transport safety
- The study was sponsored by the Alberta Government

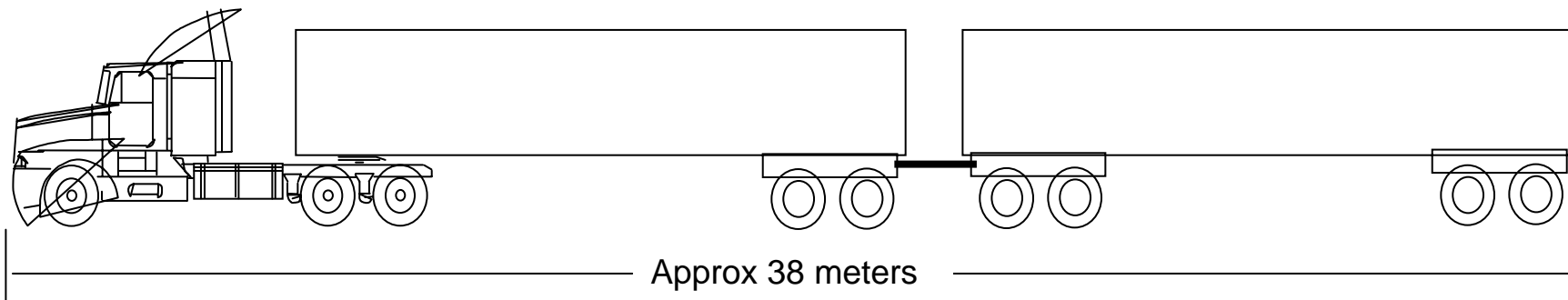
Alberta Study Concept

- Focus on a 2,800 km sub-network on which LCVs are permitted to operate
- The network was subdivided into discrete zones (excluding urban areas)
- Collision rates were determined for different vehicle classes within each zone
- All LCV collision reports were examined in detail to determine causal factors such as; adverse weather & road, vehicle dynamic & vehicle design factors, truck & private vehicle operational factors

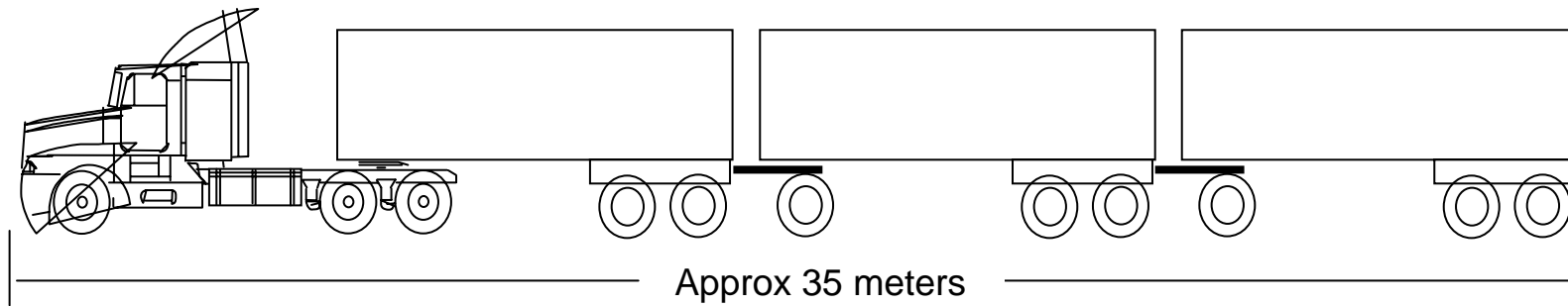




Rock Mountain Double



Turnpike Double



Triple

Exposure Measurements

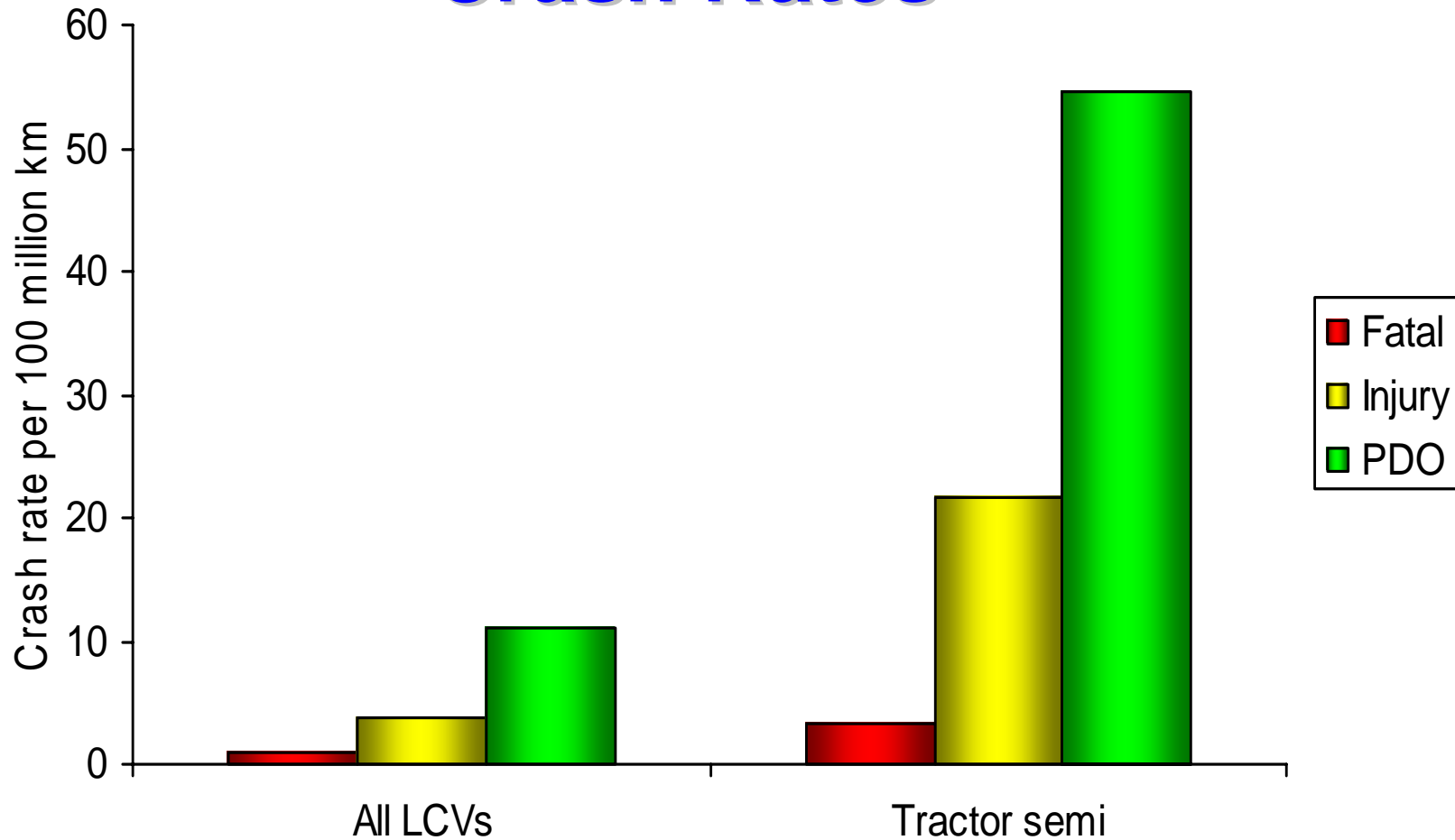
(Distance Traveled by Vehicle Type)

- **14 highway segments selected**
 - 9 two lane segments
 - 5 four lane segments
- **Annual Average Daily Traffic (AADT) counts were conducted for all vehicles**
- **A separate vehicle classification count was conducted to determine the mix of truck configurations (7 day 24 hour sample)**

LCV Collisions

- All collisions involving LCVs were studied in detail for the period (1995 – 1998)
- The analysis was used to determine contributing factors such as:
 - Overtaking maneuvers
 - Configuration related factors
 - Adverse weather and road factors
 - Natural factors (e.g. animal hits)
 - Driver related factors

Crash Rates



Best Practice LCV Benefits

Factors	Benefit
Truck km reduction	44%
Cost saving to shipper	29%
Reduction in fuel and green house gases	32%
Reduction in road consumption	40%
Exposure crash reduction	44%
Policy affected crash rate reduction	500%

Special Permit Management

- Meaningful enforcement is essential
- Highway safety and weight violation information should be linked to the enforcement program
- Regular incident reporting by carriers important to ensure maximum benefit
- The system should foster pride – it should be seen as a privilege and not a right
- Acceptance into the program should have a minimum performance threshold

What the study tells us

- There is a very large safety benefit associated with risk based transport policy (approx. 5 times improvement)
- The contribution of the various risk factors to safety improvement is not well understood
- however the influence of driver behavior is clearly a significant component

How ITS Can be Used to Reduce Driver Risk

How It Works

- Video-based
- Computer vision detects lane markings, determines position
- Connects to ECM & vehicle signals



Lane Departure

- Moderate = 10cm over line → Audible Warning
- Significant = 30cm over line → Video Capture
- Video clips include 5 seconds before threshold & 10 seconds after event is clear



Rapid Deceleration

- Moderate = 12 kph/s → Data Capture
- Significant = 18 kph/s → Video Capture



Horn Use

- Horn Use → Video Capture



Weekly Performance Metrics

LOOKOUT RISK REPORT

From 18 Jun 2006 -to- 24 Jun 2006

Sample
Lookout Report

Overview

Truck	Last Offload	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
		Moderate	Significant	Moderate	Significant	E Horn	Mute		
100	26 Jun 2006	23	1	91	56	3	0	4299	3600
104	23 Jun 2006	19	1	85	28	0	15	4169	1300
108	23 Jun 2006	34	0	23	17	4	0	3217	700
107	24 Jun 2006								600
109	24 Jun 2006								400
105	24 Jun 2006								300
115	23 Jun 2006								200
110	24 Jun 2006								100
112	21 Jun 2006	2	0	23	5	0	1	3118	100
101A	21 Jun 2006	3	0	0	0	0	0	1101	0
103	24 Jun 2006	1	0	0	0	1	4	30	--

Calculates risk value per driver
 • Weighted average # events * extent

High Risk

[To Top](#)

Truck 100 : Significant Events

Per driver detail & links to videos

Truck	Date	Time	Event Type	Speed1 (Kph)	Speed2 (Kph)	Elapsed (mm:ss)	Max Rate	Video Clip
100	23 Jun 2006	03:17:04	Lane					Play
100	23 Jun 2006	03:17:01	Lane					Play
100	18 Jun 2006	13:32:40	Lane					Play
100	18 Jun 2006	11:59:52	Decel	29	16	00:01	-18	Play
100	18 Jun 2006	11:11:57	Lane					Play
100	18 Jun 2006	11:07:04	Lane					Play
100	18 Jun 2006	11:02:05	Lane					Play
100	18 Jun 2006	09:39:29	Lane					Play

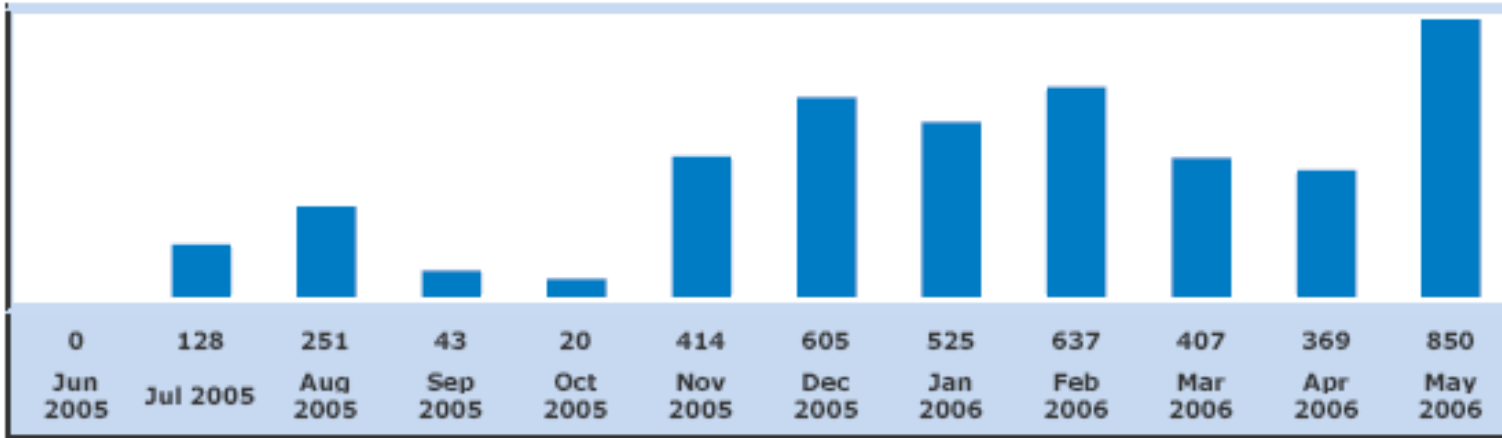
Monthly Summary

LOOKOUT SAFETY SUMMARY

01 May 2006 -to- 31 May 2006 - Fleet Risk Value = 850

Sample
Lookout Report

Fleet Risk Values



Note: The risk assessment is a statistical analysis of data gathered by Lookout. It does not take into consideration road, traffic, weather, equipment or other conditions that may affect driver performance. Additionally, Lookout may not capture all events or may include false events. The risk value incorporates event weighting calculations which may not appropriately represent the relative risk levels. The weighting may be adjusted periodically without notice. Vehicles that have travelled less than 500 km in this period are not included in the risk value calculation.

Overview

Highest Risk		Lowest Risk	
Truck	Risk Value Per Km	Truck	Risk Value Per Km
100	6000	102	6
104	2600	112	100
113	900	114	100
108	700	101A	200
103	500	115	200

Two Drivers Pulling up Fleet Risk

How It's Used: Case Study 1

Fix Bad Habits (Experienced Driver)

10 Days from 24 Feb 2006 -to- 05 Mar 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
DriverA	10	1	87	47	1	0	5342	1700
-	16	1	60	50	11	0	3963	
-	12	0	8	17	0	17	3535	
-	6	1	21	21	3	15	2371	
-	20	0	32	14	0	0	3266	700
-	11	0	18	16	0	0	3450	600
-	12	0	11	8	1	2	4787	300
-	12	0	20	10	7	0	4678	200
-	27	0	2	1	1	3	3887	200
-	5	0	15	5	1	1	5292	100
-	10	0	26	10	0	0	4992	100
-	3	0	0	1	4	4	2667	100
-	17	0	0	0	101	0	4524	0
-	0	0	0	0	0	0	0	0

Identified problems

See Improvement in 1 Week

LOOKOUT WEEKLY RISK REPORT

10 Days from 03 Mar 2006 -to- 12 Mar 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
-	16	1	54	29	3	1	3864	1600
-	7	0	20	15	0	23	4454	800
<u>Driver A</u>	9	0	58	32	0	0	4774	600
-	42	2	15	10	1	0	4070	
-	44	1	10	15	19	0	4135	
-	8	0	31	16	0	10	3694	
-	13	0	28	12	0	2	4614	500
-	8	0	12	7	1	0	3229	200
-	6	1	16	8	1	1	3912	100
-	26	0	6	4	132	0	3871	100
-	16	0	10	2	2	0	4055	100
-	35	0	1	0	2	0	4396	100
-	1	0	3	2	1	0	5372	0
-	0	0	0	0	0	0	0	0
-	4	0	2	1	3	1	2810	0

Corrected behavior



Track for Lasting Improvement

LOOKOUT RISK REPORT

10 Days from 10 Mar 2006 -to- 19 Mar 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
-	13	1	95	45	5	1	2529	1400
-	8	0	14	12	0	20	3530	600
-	34	1	24	17	12	0	4043	600
-	14	0	3	6	0	0	3270	500
-	9	2	20	10	0	3	3236	500
-	7	0	29	13	0	2		
-	0	0	3	5	1	0		
-	29	0	10	7	164	0		
-	16	0	0	1	0	3		
Driver A	4	0	15	7	0	0	4501	100
-	9	0	2	1	0	0	2911	100
-	6	1	4	0	0	0	1045	100
-	34	2	0	0	2	0	3975	100
-	8	0	6	1	0	0	3250	0
-	0	0	0	0	0	0	0	0

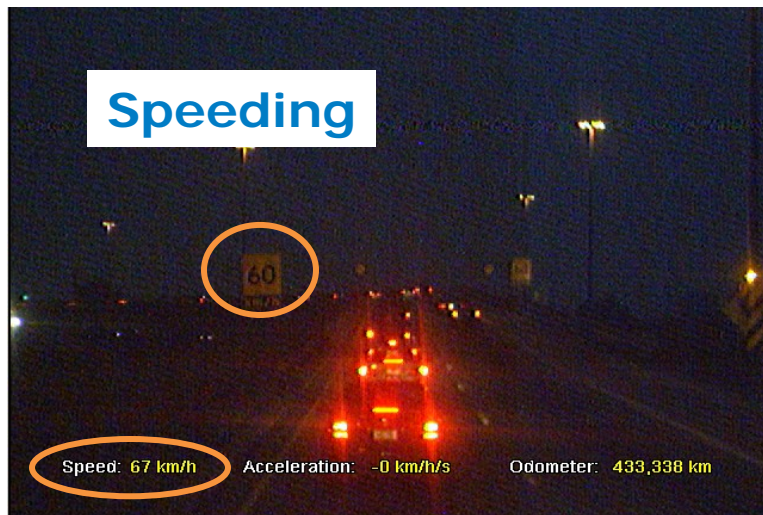
Tracking to ensure changes continue



Case Study 2

Teach Good Practices (New Driver)

- 1st drive – 3 dangerous hard-braking events
- Driving the truck like a car
- Reviewed videos with trainer
 - What did you do wrong?
 - What is the correct practice for next time?



See Improvement on Next Trip

- 2nd drive – brought home 1 hard-braking event
- Follow-up review with trainer
- Subsequent drives – 0-1 events

LOOKOUT RISK REPORT

10 Days from 24 Mar 2006 -to- 02 Apr 2006

- Fleet retained driver (were considering firing)
- Reduced risky behavior

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
106	9	0	13	8	0	0	3288	200
101	9	0	31	8	2	0	4864	100
114	31	0	0	1	1	0	4596	100
107	20	0	5	0	7	0	4001	0
110	11	0	4	0	19	0	3982	0



Case Study 3

Early Detection of Problems

LOOKOUT RISK REPORT

From 26 Mar 2006 - to 01 Apr 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
111	14	2	12	18	1	17	3739	1000
105	12	0	40	40	2	0	5297	900
104	4	0	15	10	4	32	3104	700
108	32	3	8	16	13	0	3563	700
100	21	1	28	11	0	0	2095	500
113	11	0	31	22	0	0	3924	400
107	15	0	28	10	1	0	2423	300
109	43	0	13	2	210	0	2805	300
112	7	0	0	2	3	1	2423	300
106	8	0	13	8	0	0	3283	200
101A	8	0	18	6	1	0	3939	100
114	29	0	0	1	1	0	4593	100
103	13	0	0	0	0	1	2619	0
115	20	0	5	0	7	0	3997	0
110	11	0	4	0	19	0	3981	0

In the safe zone

Increased Risk Detected

LOOKOUT RISK REPORT

From 25 Apr 2006 - to 01 May 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
104	7	0	9	33	2	60	2409	2300
100	44	2	91	26	0	0	4289	1600
105	19	1	93	61	0	0	5915	1000
107	23	1	15	4	1	0	2406	600
113	8	0	54	35	0	0	3907	600
115	14	0	22	7	0	0	3327	400
111	10	0	9	7	0	0	2733	400
106	7	1	16	8	0	0	2547	300
108	25	1	17	8	7	0	3594	300
109	52	0	16	5	0	0	3635	300
103	5	0	6	2	0	0	1074	100
114	17	0	4	1	0	0	3743	100
101A	11	0	3	2	0	0	4137	0
110	13	0	1	0	7	0	4035	0
112	13	0	0	0	3	1	4006	0

In Caution Zone

Immediate Attention Required

LOOKOUT RISK REPORT

From 07 May 2006 - to 13 May 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
100	22	1	79	67	2	0	2848	6900
104	13	1	81	38	0	42	4349	2400
111	20	0	32	16	0	3	3951	900
113	20	0	64	37	0	0	4046	700
103	7	1	20	13	0	0	2732	500
108	38	0	22	23	6	0	4422	500
109	43	3	15	14	0	0	4128	500
106	13	0	44	21	0	0	4432	400
107	29	0	42	10	0	0	4040	300
101A	7	0	17	10	0	0	4678	100
105	9	0	38	10	1	0	4813	100
107	8	0	34	12	1	0	4436	100
114	23	0	2	1	3	1	4080	100
110	12	0	7	0	12	0	4261	0
112	6	0	0	0	3	3	1886	0

Serious Risk,
Intervention
With Driver

- Met with driver
- Reviewed videos
- Trained on correct practices

Immediate Improvement

LOOKOUT RISK REPORT

From 21 May 2006 -to- 27 May 2006

Overview

Truck	Rapid Deceleration		Lane Departure		Horn		Km	Risk Value Per Km
	Moderate	Significant	Moderate	Significant	E Horn	Mute		
104	8	0	64	33	0	36	3667	2800
108	38	1	18	20	6	0	3298	900
113	14	0	64	35	0	3	3582	700
100	10	0	11	10	1	0	1637	600
106	16	0	51	19	1	0	4336	500
109	43	1	20	12	0	0	3319	500
107	27	2	19	7	2	0	2583	400
103	33	0	36	9	0	0	4111	300
111	25	1	0	2	0	1	3723	200
105	11	0	40	7	0	0	5043	100
107	5	0	6	3	1	0	2419	100
112	22	1	30	2	2	2	4494	100
110	8	0	3	1	5	0	3335	0
114	22	0	4	0	0	0	3651	0
101A	0	0	0	0	0	0	0	--

Demonstrated Improvement

Case Study 4

Find & Fix Excessive Weaving

- Videos showed weaving due to
 - Driver keeping gaze too close to the front of truck
 - Tracking on both lane markers
- Reviewed good lane tracking practices with driver
- Monitoring Risk Report for improvement



Case Study 5: Detect Fatigue Problems

Truck 200 : Significant Events

Truck	Date	Time	Event Type	Speed1 (Kph)	Speed2 (Kph)	Elapsed (mm:ss)	Max Rate	Video Clip
200	19 May 2006	21:00:26	Lane					Play
200	19 May 2006	21:00:22	Lane					Play
200	19 May 2006	21:00:14	Lane					Play
200	19 May 2006	20:59:55	Lane					Play
200	19 May 2006	20:59:51	Lane	Evening 19th				Play
200	19 May 2006	20:59:26	Lane					Play
200	19 May 2006	20:57:13	Lane					Play
200	19 May 2006	15:28:40	Lane					Play
200	17 May 2006	21:52:00	Lane					Play
200	17 May 2006	20:12:07	Lane					Play
200	17 May 2006	19:25:05	Lane	Evening 17th				Play
200	17 May 2006	19:22:14	Lane					Play
200	16 May 2006	15:17:15	Lane					Play
200	15 May 2006	19:50:06	Lane					Play
200	15 May 2006	19:32:27	Lane					Play
200	15 May 2006	18:57:20	Lane					Play
200	15 May 2006	17:50:02	Lane	Evening 15th				Play
200	15 May 2006	17:18:39	Lane					Play
200	15 May 2006	16:38:05	Lane					Play

- Compared with satellite trip report
- Found lane departures increased after hours of driving
- Met with driver
- Discussed hours of service
- Discussed fatigue management
- Monitoring Risk Report for results

Concluding Comments

- Transport safety performance is highly sensitive to risk management
- Case studies indicate that driver behavior can be measured and improved through the use of innovative ITS application
- Research is required to determine the net benefit gain from such technology and how it can be most effectively implemented