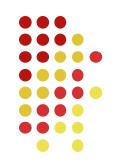
Future Iowa Safety Analysis/Analytics

An evolutionary leap forward, the missing link, and/or something else entirely?





Michael D. Pawlovich, Ph.D., P.E. Traffic Safety/Crash Data Engineer Iowa Department of Transportation Office of Traffic & Safety

Safety Goal:

Reduce Crashes & SAVE LIVES





Safety Analysis/Analytics



Zero Fatalities

A Goal We Can All Live With

2016 Iowa Traffic Fatality Count for 03/10/16

A fatality is considered "crash-related" when death occurs within 30 days of a crash. Because complex crash investigations can delay the official report of fatalities, the numbers for the most current months are preliminary and can change considerably.

Number of Fatalities Reported on this Day by Year

2046	53	5 Year Comparison (2011-2015)						
2016			Count	%				
2015	36	Increase from Last Year	17	47.22%				
2014	53	Increase from Low Year of Last 5 yrs.	19	55.88%				
2013	34	Decrease from High Year of Last 5 yrs.	-15	-22.06%				
2012	68	Increase from 5 Year Average	7	15.22%				
2011	37	Average fatalities year to date for this day (2011-2015)	46				

Monthly Fatality Count (2011 - 2015 figures are end-of-month totals)

MONTH	2016	2015	2014	2013	2012	2011
January	27	18	28	22	39	19
February	17	18	16	15	23	14
March	9	19	16	21	29	40
April		31	22	24	15	25
May		25	27	24	48	26
June		25	26	29	27	25
July		33	29	26	23	36
August		51	36	35	39	29
September		29	34	37	35	43
October		24	30	29	26	37
November		23	46	27	35	28
December	1	24	12	28	26	38
TOTAL	53	320	322	317	365	360

Fatalitie	es' Seat Belt Us	age - Year to Date	Comments
Belt usage	may change as additio	mal information is received	1 March fatality
15	With belt	31.25%	
24	Without belt	50.00%	
9	Unknown	18.75%	
5	Not applicable (Mo	otorcycle, Pedestrian, etc.)	
53	Total Fatalities		

For additional information, contact:

Dennis Kleen

FARS Manager & Driver Data

lowa Department of Transportation, Office of Driver Services

P.O. Box 9204, Dec Moines, IA 60308-9204

Telephone: 616-237-3164
Email: dennis.kieen@dot.lowa.gov

Fatalities





Iowa Severe Injury Trends

Number of Fatalities **Fatality Rate** 5-year Running Average

US Injury Crash Rate

71.19

67.13

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
446	405	443	388	450	439	446	412	371	390	360	365	317	322
1.46	1.29	1.40	1.21	1.43	1.38	1.42	1.33	1.19	1.23	1.15	1.16	1.01	1.00
459	447	446	425	426	425	433	427	424	412	396	380	361	351
1997 to 2001	1998 to 2002	1999 to 2003	2000 to 2004	2001 to 2005	2002 to 2006	2003 to 2007	2004 to 2008	2005 to 2009	2006 to 2010	2007 to 2011	2008 to 2012	2009 to 2013	2010 to 2014
1.55	1.48	1.46	1.37	1.36	1.34	1.37	1.35	1.35	1.31	1.26	1.21	1.15	1.11

Fatalities



Fatality Rate 5-year Running Average US Fatal Crash Rate 1.04 1.34 1.33 1.32 1.28 1.30 1.22 1.14 1.04 1.02 1.01 US Fatality Rate 1.51 1.54 1.48 1.44 1.45 1.41 1.36 1.25 1.15 1.11 1.10 1.13 1.10 2368 2232 1629 1545 1509 Major Injuries 2051 2173 2090 1889 1982 1841 1615 1644 1501 Major Injury Rate 7.77 7.12 6.49 6.80 5.95 6.30 5.95 5.16 5.21 4.78 5.16 4.90 4.67 6.64 5-year Running 3275 3057 2772 2481 2183 2087 2037 1995 1883 1794 1717 1646 1587 1566 Major Injury Rate 5year Running Average 11.08 6.33 5.25 5.04 4.94 10.14 9.06 7.99 6.96 6.60 6.00 5.71 5.48

57.55

56.12

54.47

51.31

51.97

51.93

75.25

55.11

79.66

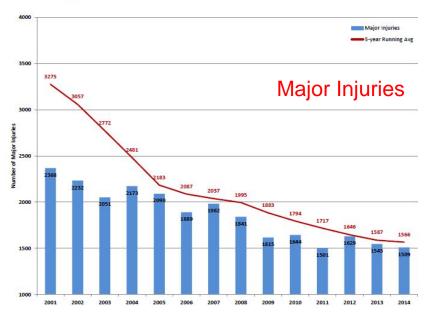
Major Injuries



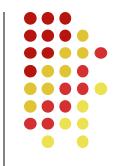
62.44

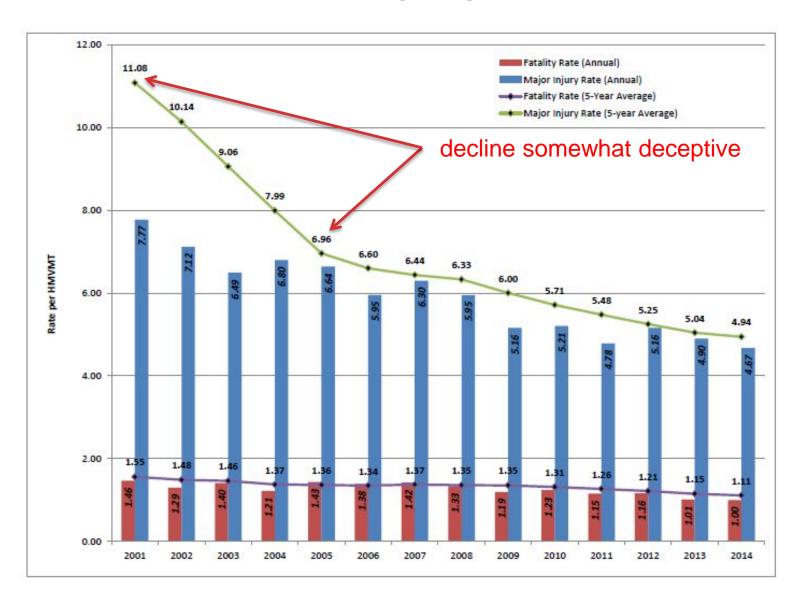
66.18

60.34

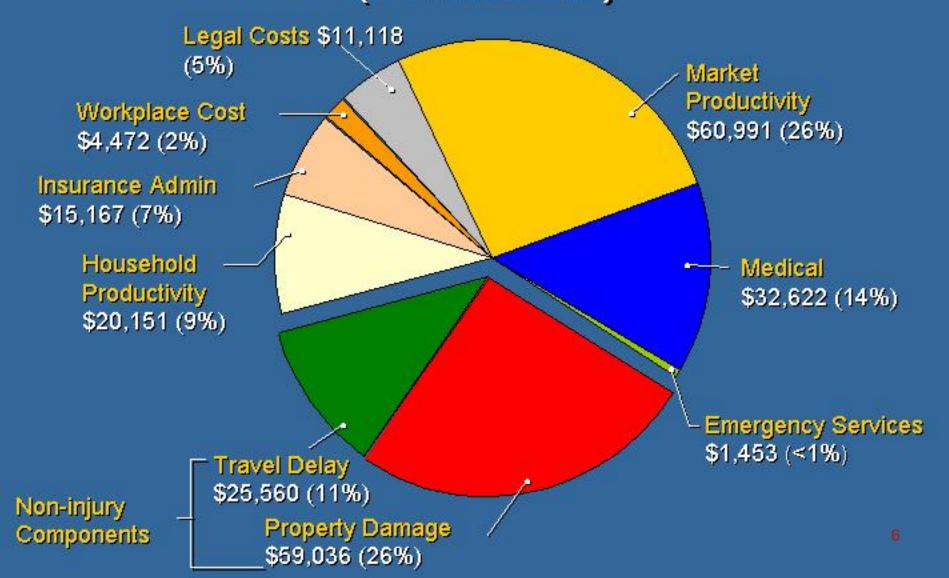


Iowa Severe Injury Rates



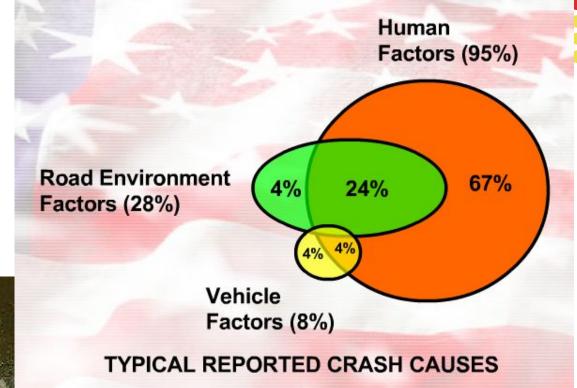


Cost of Motor Vehicle Crashes, 2000 (in millions)



Multi-faceted





Much relies on driver but doesn't relieve road and vehicle responsibility...



Why?

Safety Stakeholders lowa's 5Es (2006)



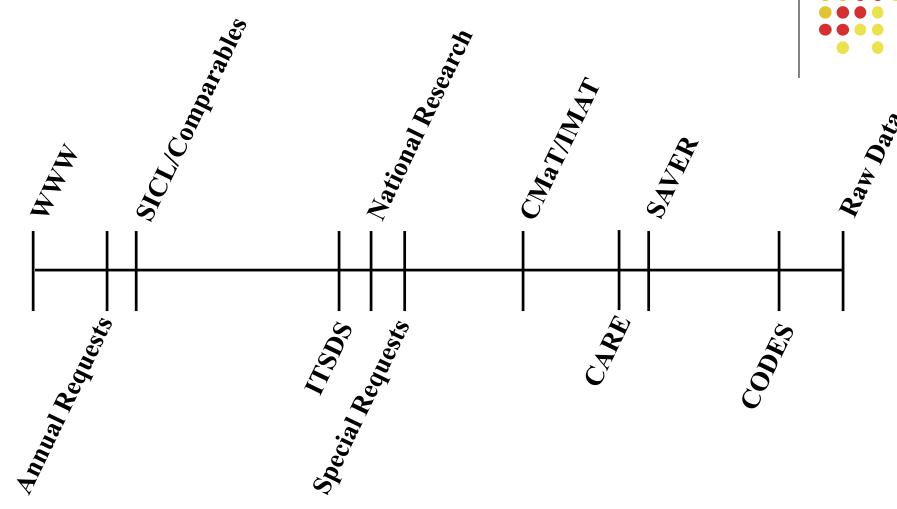
- Iowa DOT
 - ■Local Systems
 - ■Systems Planning
 - ■District Offices
 - **□**Transit
 - ■Rail
 - ■Transportation Data
 - ■Driver Services
 - ■Traffic and Safety
 - ■Motor Vehicle Division
- Iowa State Patrol
- Bandy Motorcycle Training
- Iowa-Illinois Safety Council
- Governor's Traffic Safety Bureau
- Iowa Northland Regional Council of Gov
- University of Iowa
 - Public Policy Center
 - Human Factors Research
 - College of Engineering
- Department of Public Health
 - Emergency Medical Services
- Iowa Department of Natural Resources
- State Farm Insurance
- Federal Motor Carrier Safety Administration
- State of Iowa Public Health

- MAPA
- Federal Motor Carrier Safety Admin.
- National Highway Traffic Safety Admin.
- Marion Police Department
- AARP Driver Safety
- North Iowa Area Council of Governments
- EMC Insurance Co
- United Parcel Service
- Office of the Iowa Attorney General
- Iowa State University
 - Center for Transportation Research and Education
 - Safety Circuit Rider
 - Iowa Traffic Safety Data Services
- Prosecuting Attorneys Training Council
- Cambridge Systematics
- Quality Traffic Control, Inc.
- 3M Company Traffic Safety Systems
- ABATE of Iowa
- Tips/Think First
- Safety Engineer Consultant
- Bi-State Regional Commission
- Iowa Health Systems
- Blank Children's Hospital

- Court and Juvenile Justice Planning (CJJP)
- Iowa Department of Public Health
- Customized Management Services
- CH2M Hill
- East Central Intergovernmental Association
- Iowa Pupil Transportation Association
- Department of Elder Affairs
- Iowa Association of School Boards
- Gold Wing Road Riders
- AAA Minnesota-Iowa
- Federal Highway Administration
- State Farm Insurance
- Iowa State Patrol
- MPO's
- RPA's
- APWA
- Iowa Attorney General's Office
- Office of the Governor
- AARP Driver Safety Program
- Blackhawk County Engineer
- Iowa Safety Educators Association
- Traffic Control Corporation

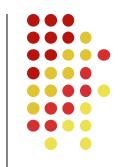
A Safety Analysis Continuum





Less — User Interaction — More —

Questions...(a few of many)



Many nice tools & resources with

Many nice features and more to add

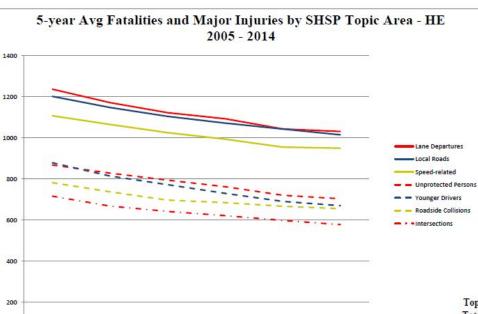
BUT

Do the users use/understand what they have?

Do they need/want everything they have?

Can they do it themselves?

How can we facilitate?



2008 - 2012

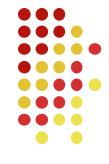
2010 - 2014

2005 - 2009

2006 - 2010

2007 - 2011

lowa 2010-2014



T	opic
T	otals

Younger Drivers Older Drivers Speed-related Impaired Driving Inattentive/Distracted Driving Unprotected Persons

Train Lane Departures Roadside Collisions Intersections Work Zones Local Roads Winter Road Conditions

Pedestrians Pedalcyclists

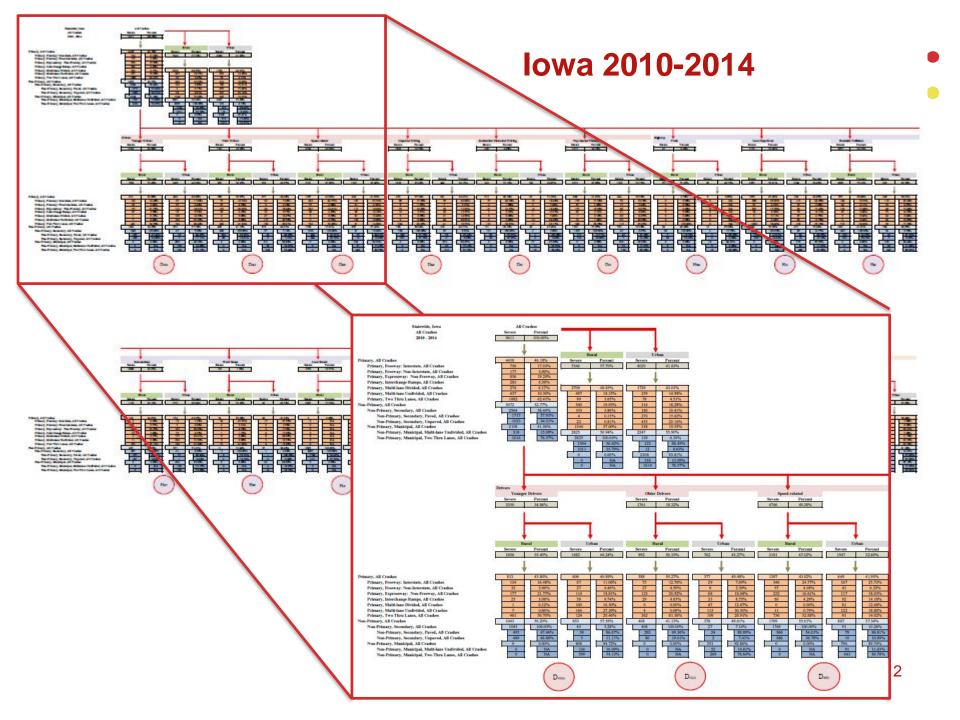
Motorcycles Heavy Trucks Other Special Vehicles

2010	- 2014

	Crash	1000		Injury		Severe
Fatal	Major	Severe*	Fatalities	Major	Severe*	Injury Rank
1584	6412	7996	1753	7858	9611	
436	2240	2676	497	2853	3350	5
361	1061	1422	395	1366	1761	9
809	3120	3929	901	3845	4746	3
452	1057	1509	515	1378	1893	8
49	327	376	59	410	469	14
797	2000	2797	896	2621	3517	- 4
						3
13	29	42	15	32	47	18
1061	3091	4152	1177	3976	5153	1
600	2182	2782	651	2626	3277	6
359	2056	2415	384	2504	2888	7
26	94	120	31	121	152	17
822	3523	4345	885	4187	5072	2
140	581	721	159	747	906	12
103	365	468	107	387	494	13
23	197	220	23	213	236	15
233	1122	1355	243	1272	1515	10
294	633	927	329	777	1106	11
49	99	148	52	124	176	16

^{*} Severe = Fatal + Major for both crashes and injuries, respectively.

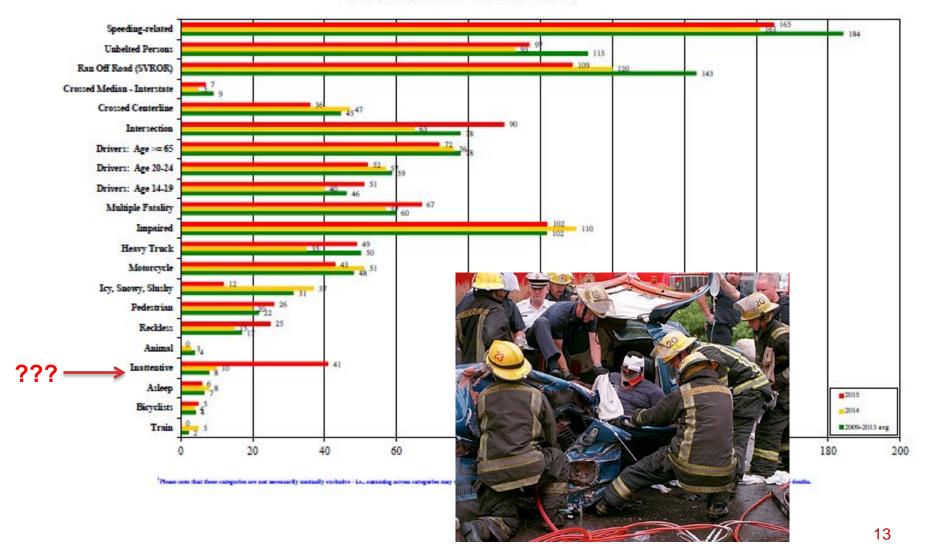




lowa 2014-2015



Iowa Fatalities Associated with Key Emphases - January thru December (by Jone Dept. of Thumportation - Office of Thaffic and Sadisty on February 15, 2016)



Traditional Data Sources



- GIS-based → LRS in-progress & nearly complete/updated
- Crash data (point) 10 years MMUCC 2001+ & MMUCC 4th
 - Crash, driver, vehicle, injury, workzone, derived, etc.
 - Timeliness vital
- Roadway data (line) –Redesign underway
 - Geometry, traffic, class, sufficiency, etc.
 - Vital to planning/safety activities
 - Intersection point, Interchange representation, Curve locations
- Rail (point & line)
- River (line)
- Structures (point)
 - Bridges, culverts, etc.
- Pavement data (line)
- Enforcement (point)
 - Local, citation, criminal, vehicle inspection, OWI
- Crash Outcome Data Evaluation System (CODES)
 - Hospital
 - Trauma
 - Crash

Crash Form (2001/MMUCC)

						ł					
						X					
		18				<u>+</u>	10				
	Sex	Unit No.	SeatigPostion	hijay Inte	Occupant Pintection	Airbag Deployment	Airbag Switch Status	Ejectim	Ejedim Paft	Trapped	
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		Înu	ported	y:			8				
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				Imis	oradl	y:		N 9			
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T	VBI# Year Make Model Style Iou	Repair of Replace	R E D	4. Address			Immported to		Inu	ported by:	_	L
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Code Sheet (2001/MMUCC)

Accident Environment

Location of First Harmful Event

1 - On Roadway

6 - Outside trafficway

Manner of Crash/Collision

4 - Angle, oncoming left turn

6 - Sideswipe, same direction

7 - Sideswipe, opposite direction

2 - Shoulder

4 - Roadside

9 - Uhknown

2 - Head-on

3 - Rear-end

5 - Broadside

0 - Imknown

1 - Daylight

9 - Unknown

01 - Clear

03 - Cloudy

02 - Partly cloudy

2 - Dusk

3 - Dawn

Light Conditions

4 - Dark, roadway lighted

5 - Dark, roadway not lighted

6 - Dark, unknown roadway lighting

Weather Conditions (up to two)

1 - Non-collision

3 - Median

5 - Gore



Injury Status

2 - Incapacitating

3 - Non-incapacitating

Occupant Protection

3 - Lap belt only used

Airbag Deployment

narrative)

5 - Not deployed

6 - Not applicable

Airbag Switch Status

1 - Switch in ON position

2 - Switch in OFF position

3 - No ON/OFF switch present

4 - Not applicable (motorcycle, bicycle, etc.)

1 - Not ejected/not applicable

2 - Through front windshield

3 - Through side window/door

5 - Through back window/tailgate

9 - Unknown

9 - Unknown

1 - Not ejected

0 - Unknown

Ejection Path

4 - Through roof

2 - Partially ejected

3 - Totally ejected

Ejection

2 - Shoulder and lap belt used

8 - Other (explain in narrative)

1 - Deployed front of person

2 - Deployed side of person

3 - Deployed both front/side

4 - Other deployment (explain in

4 - Shoulder belt only used

5 - Child safety seat used

1 - Fatal

4 - Possible

5 - Uninjured

9 - Unknown

1 - None used

6 - Helmet used

9 - Unknown

Initial Travel Direction (prior to coded Vehicle Action) 1 - North 2 - Fast 3 - South 4 - West 9 - Unknown Vehicle Action 01 - Movement essentially straight 02 - Turning left 03 - Turning right. 04 - Making U-turn 05 - Overtaking/passing

12 - Legally Parked

Point of Initial Impact

Front

09

05

10 Under-Carriage 99 Unknown

Most Damaged Area

99 - Ilhknown

08

07

06

Extent of Damage

2 - Minor damage

3 - Functional damage

4 - Disabling damage

9 - Unknown Underide/Overide

intrusion

5 - Severe, vehicle totaled

1 - None

1 - None

10 - Tractor/doubles 11 - Tractor/triples 06 - Changing lanes 12 - Other heavy truck (cannot

07 - Entering traffic lane (merging) 08 - Leaving traffic lane 09 - Backing 10 - Slowing/stopping

14 - Motorcycle 15 - Moped/All-Terrain Vehicle 11 - Stopped for stop sign/signal 16 - School bus (seats > 15) 17 - Small school bus (seats 9 - 15) 13 - Illegally Parked/Unattended

classify)

18 - Other bus (seats > 15) 88 - Other (explain in narrative) 19 - Other small bus (seats 9 - 15) 20 - Farm vehicle/equipment

21 - Maintenance/construction vehicle 22 - Train

88 - Other (explain in narrative) QQ . Ibloom

Cargo Body Type 01 - Not applicable

Truck Cargo Type: 02 - Van/enclosed box

03 - Dump truck (grain, gravel) 04 - Cargo tank OS . Flothed

06 - Concrete mixer 07 - Auto transporter 08 - Garbage/refuse

09 - Other truck cargo type (explain in narrative)

Trailer type: 10 - Small utility (one axle) 11 - Large utility (2+ axles)

12 - Boat 13 - Camper 14 - Large mobile home

15 - Oversize load 16 - Towed vehicle

Vehide Defect

01 - None

02 - Brakes

03 - Steering

04 - Blowout

06 - Wipers

08 . Evhanet

07 - Trailer hitch

09 - Headlights

10 - Tail lights

11 - Turn signal

12 - Suspension

99 - Unknown

17 - Pole 18 - Other trailer type (explain in narrative)

05 - Other tire defect (explain in

88 - Other (explain in narrative)

nerretime)

4 - Underride, compartment intrusion 99 - Uhknown unknown

02

5 - Override, moving vehicle 6 - Override, parked/stationary vehicle

2 - Underride, compartment intrusion

3 - Underride, no compartment

9 - Unknown

Traffic Controls 01 - No controls present.

02 - Traffic signals 03 - Flashing traffic control signal

04 - Stop signs

05 - Yield signs 06 - No Passing Zone (marked)

07 - Warning sign

08 - School zone signs 09 - Railway mossing device 10 - Traffic director

11 - Workzone signs 88 - Other control (explain in narrative)

99 - Unknown

Vehicle Configuration

01 - Passenger car 02 - Four-tire light truck (pick-up, panel)

03 - Van or mini-van 04 - Sport utility vehicle

E

05 - Single-unit truck (2-axle, 6-tire) 06 - Single-unit truck (>= 3 axles) 07 - Truck/trailer

13 - Motor home/recreational vehicle

Driver/Vehicle Characteristics

08 - Truck tractor (bobtail) 09 - Tractor/comistrailer

Q . Imlenoum Vision Obscured

Driver Condition

4 - Illness

1 - Apparently normal

2 - Physical impairment

3 - Emotional (e.g., depressed,

5 - Asleep, fainted, fatigued, etc.

8 - Other (explain in narrative)

alcohol/drugs/medications

angry, disturbed)

6 - Under the influence of

01 - Not obscured 02 - Trees/crops 03 - Buildings

04 . Embenlement 05 - Sign/billboard

06 - Hillcrest 07 - Parked vehicles

08 - Moving vehicles 09 - Person/object in or on vehicle 10 - Blinded by sun or headlights

11 - Frosted windows Avindshield 12 - Blowing snow 13 - Fog/smoke/dust.

88 - Other (explain in narrative) 99 - Unknown

Contributing Circumstances, Driver (up to two)

01 - Ran to 02 - Ran st 04 - Drivin

437 data elements 05 - Made 06 - Travel WITTON 07 - Crosse 08 - Lost Control

09 - Followed too close 10 - Swerved to avoid: vehicle, object_non-motorist_or animal in madway

11 - Over correcting/over steering 12 - Operating vehicle in an erratic. reckless, careless, negligent, or aggressive manner Failed to yield right-of-way:

13 - From stop sign 14 - From yield sign

15 - Making left turn 16 - Making right turn on red

signal 17 - From driveway 18 - From parked position

19 - To pedestrian

20 - At uncontrolled intersection 21 - Other (explain in narrative)

Inattentive/distracted by: 22 - Passenger 23 - Use of phone or other device

24 - Fallen object 25 - Fatigued/asleep

Other (explain innarative): 26 - Vision obstructed

27 - Other improper action 28 - No improper action

99 - Thlenown

Emergency Vehicles

Emergency Vehicle Type

1 - Not applicable

2 - Police 3 - Fire

4 - Ambulance 5 - Towing

6 - Military 7 - Maintenance 9 - Unknown

Emergency Status

1 - Yes, in emergency

2 - No not in emergency 3 - Not applicable

Hazardous Materials Released?

9 - Unknown

1 - Yes

2 - No 3 - Not applicable 9 - Unknown

(Cargo Only)

Iowa Department of Transportation

Workzone Related?

1 - Before work zone warning sign

3 - Within transition area for lane shift

4 - Within or adjacent to work activity

2 - Between advance warning sign

5 - Between end of work are a and

"End Work Zone" sign

8 - Other work zone area (explain in

(head-to-head traffic)

3 - Work on shoulder or median

4 - Intermittent or moving work

8 - Other type of work zone (explain

and work area

narrative)

2 - Lane shift/crossover

in narrative)

Workers Present?

9 - Unknown

1 - Lane closure

9 - Unknown

9 - Unknown

1 - Yes

2 - No

Location



99 - Uhknown

Surface Conditions 1 - Dry

2 - Wet. 3 - Ice 4 - Snow

5 - Shish 20 - Off-ramp 6 - Sand, mud, dirt, oil, gravel

7 - Water (standing, moving) 8 - Other (explain in narrative) in narrative)

9 - Unknown

12 - T - intersection

13 - V - intersection 14 - Five-leg or more

15 - Offset four-way intersection 16 - Intercection with room

17 - On-ramp merge area

18 - Off-ramp diverge area 19 - On-ramp

21 - With bike/pedestrian path 22 - Other intersection (explain

99 - Uhknown

Securence of Events Most Harmful Event First Harmful Event Pre-crash events:

Harmful Events

05 - Animal or object in roadway

06 - Evasive action (swerve, panic

08 - Cargo/equipment loss or shift

13 - Other non-collision (explain in

20 - Non-motorist (see non-motorist

26 - Other non-fixed object (explain

09 - Equipment failure (tires .

braking, etc.)

07 - Downhill runaway

brakes, etc.)

10 - Separation of units

11 - Overtum/rollover

narrative)

Non-collision events:

12 - Tackkmife

Collision with:

25 - Animal

type)

21 - Vehicle in traffic

roadway

22 - Vehicle in/from other

23 - Darked motor rehicle

24 - Railway vehicle/train

2 - Weather conditions 3 - Physical obstruction 01 - Ran off road, right. 02 - Ran off road, straight

4 - Dedestrian action 03 - Ran off mad left 5 - Glare 04 - Crossed centerline/median

6 - Animal in roadway 7 - Previous accident. 8 - Other (explain in narrative)

Roadway Characteristics

Contributing Circumstances,

Environment

1 - None apparent.

9 - Unknown Contributing Circumstances Roadway

01 - None apparent. 02 - Road surface condition

03 - Debris 04 - Ruts, holes, bumps

05 - Work Zone (construction, maintenance, utility)

06 - Worn, travel-polished surface 07 - Obstruction in roadway

08 - Traffic control device inoperative missing, obscured

09 - Shoulders (none, low, soft, high) 10 - Non-highway work

11 - Non-contact vehicle 99 - Unknown

Type of Roadway Junction/Feature Non-intersection:

01 - No special feature

02 - Bridge/overpass/anderpass 03 - Railroad crossing

in narrative)

Collision with fixed object: 30 - Bridge/bridge rail/overpass

31 - Underpass/structure support.

22 - Cultreet

33 - Ditch/embankment

34 - Curb/island/raised median

35 - Guardrail 36 - Concrete barrier (median

or right side)

37 - Tree

in narrative)

50 - Fire/explosion

51 - Immercion

52 - Hit and run

99 - Unknown

Condition

4 - Illness

9 - Unknown

1 - Apparently normal

2 - Physical impairment

3 - Emotional (e.g., depressed,

5 - Asleep , fainted , fatigued , etc.

8 - Other (explain in narrative)

alcohol/drugs/medications

angry, disturbed)

6 - Under the influence of

Misc. events:

38 - Poles (utility, light, etc.)

39 - Sign post 40 - Mailbox

41 - Impact attenuator 42 - Other fixed object (explain

Q . Ibloom

1 - Not trapped

2 - Freed by non-mechanical means 3 - Extricated by mechanical means

9 - Unknown

Non-Motorist

Туре 1 . Dedectries

2 - Pedelcyclist (bicycle, tricycle, unicycle, pedal car)

3 - Skater 8 - Other (explain in narrative) 9 - Unknown

Location (prior to impact) 1 - Marked crosswalk at intersection

2 - At intersection, no crosswalk 3 - Non-intersection crosswalk 4 - Driveway access crosswalk

8 - Other non-intersection (explain in narratitus) 9 - Unknown

1 - Entering or crossing roadway 2 - Walking, running, jogging, playing, cycling

3 - Working 4 - Pushing vehicle 5 - Approaching or leaving vehicle

6 - Playing or working on vehicle 7 - Standing

8 - Other (explain in narrative) Q. Ibloom

Safety Equipment 1 - Helmet

3 - Lighting

2 - Reflective clothing

4 - None

8 - Other (explain in narrative) 9 - Imknown

Contributing Circumstances

01 - Improper crossing

02 - Darting

03 - Lying or sitting in roadway 04 - Failure to yield right of way

05 - Not visible (dark clothing) 06 - Inattentive (talking, eating, etc.)

07 - Failure to obey traffic signs. signals, or officer

08 - Wrong side of road 88 - Other (explain in narrative) 99 - Unknown

16



Road Engineering Data Uses

(involving crash data)

Sefeta

- AASHTO-based topics
- Single-vehicle ROR
- Milled shoulder rumble strips
- 4' paved shoulder policy
- Offset right-turn lanes
- Passing lanes
- More/longer turn lanes
- Rural, 2-lane corridors
- Low cost improvements
 - Curve signs/chevrons
 - Curve improvements
 - High crash curve locations

- Candidate Safety Projects
 - Paved shoulders
 - Milled shoulder rumble strips
 - 2-lane shoulder widening
 - Severe crash 2-lane, rural roads
 - High crash curves
 - Centerline rumble strips
 - Cross-median, head-on
 - Severe crash intersections
 - Expressway intersections
 - Older driver-oriented improvements
 - (7 ROR-related)

Data Uses

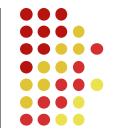
(involving crash data)

- Vehicle Occupancy
- Sufficiency System (DOT Planners)
- Safety Improvement Candidate Locations (SICL)
- Comparables road type, VMT/DEV, severity, trends
- Regional (county) analysis
- Safety Conscious Planning (Planning, MPOs/RPAs)
- Planning Study Evaluation Matrix (Systems Planning)
- Corridor Enforcement (GTSB/ISP)
- Older Drivers (GTSB/MVD/TAS)



- Problem ID (GTSB)
- Don't Veer for Deer (GTSB/SMS)
- Crash Facts (MVD ODS)
- School Age Pedestrians
- Rail Crossings
- Bridge considerations
- Workzone training
- Risk Management & Litigation
- Winter Maintenance
- CODES linkages
- Driver/Licensing Issues/Training
- Key Emphases Areas (per AASHTO)

Candidate Site Listings



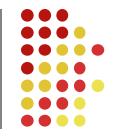
- 5% Severe Safety Needs
 - http://www.iowadot.gov/crashanalysis/fivepercent/fivepercent.htm
- Safety Improvement Candidate Listing (SICL)
 - http://www.iowadot.gov/crashanalysis/top200.htm

2001-2005 Statewide Intersection Safety Improvement Candidate Location (SICL) List
Listing and Description Data
(developed October 10, 2006)

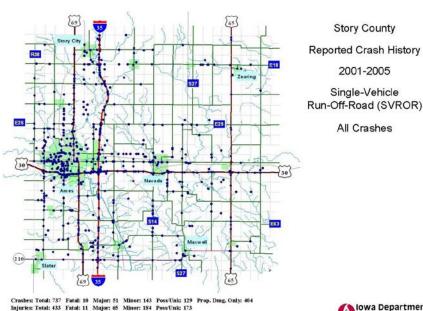
		Location Descriptors									
Statewide Candidate Listing Tie	County Number	County Name	Rural/Urhan	City Name	Federal or State Route Designation	Literal Destiption	Node Number	Intersection Identifier	Node Type	Intersection Type	Intersection Database Point ID
1	97	Woodbury	U	Sioux City	2	I-29 & US 77 (see #194 - 592222)	97411830	411832 Str		Gr Sep	592227
2	1	Adair	R		8	I-80 & IA 25	1438717	438817 Str	3	Gr Sep	14.5
3	82	Sciott.	U	D averport		US 6/Kimberly Rd & US 61/Welcome Way	8213 5781	0 Int		4-way, skewed	493523
4	82	Sc ott.	U	D averport	6	US61/Harrison St & Locust St	82133375	0 Int		4-vray	723047
5	77	Polk	U	Des Moines		oth Ave & Grand Ave	77128538	0 Int		4-игау	451027
6	77	Polk	U	Clive	100	US 6/Hirkman Rd & 128th St	0	0 Int		4-way, skewed	437493
7	57	Lim	U	Cedar Rapids	Ž.	42nd 3t & Edgewood Road	57228113	0 Int	8	4-игау	333507
8	70	Muscatine	U	Miss atine	6	US 61 & Hershey Ave (Musc atine)	70139242	0 Int		4-way	402953
9	77	Polk	U	Des Moines	0.3	7th St. & High 3t. 77128638 0 lbt 4-way		4-игау	456559		
10	34	Floyd	R		1	US 18 & Co Rd T24/Echo Ave (1.5 miles west of Fudd)	0	0 Int		4-way, skewed	193303

- County Profiles
 - http://www.iowadot.gov/crashanalysis/county.htm

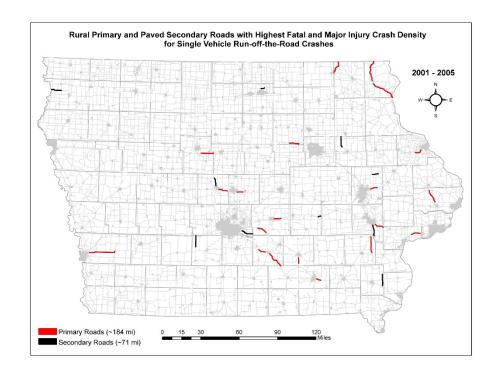
Crash Mapping



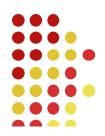
- Crash Analysis Tools (SAVER, CMaT, IMAT)
- 5% Severe Safety Needs
- County Profiles

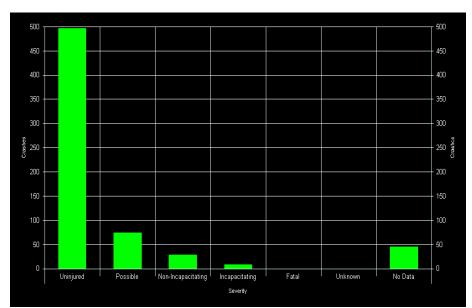


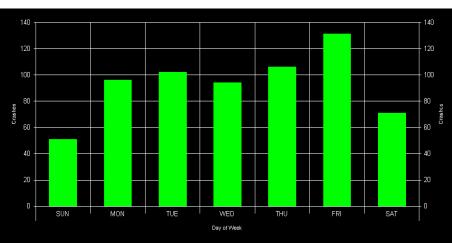
Notes: (none)



Frequencies (by Severity)







2001

Crashes: 1628 Fatal: 3 Major: 38 Minor: 219 Possible/Unknown: 316 PDO: 1052 Injuries: 848 Fatal: 4 Major: 47 Minor: 307 Possible: 476 Unknown: 14 2002

Crashes: 1719 Fatal: 5 Major: 32 Minor: 181 Possible/Unknown: 334 PDO: 1167 Injuries: 735 Fatal: 5 Major: 36 Minor: 228 Possible: 439 Unknown: 27 2003

Crashes: 1656 Fatal: 3 Major: 35 Minor: 145 Possible/Unknown: 342 PDO: 1131 Injuries: 746 Fatal: 3 Major: 45 Minor: 188 Possible: 477 Unknown: 33 2004

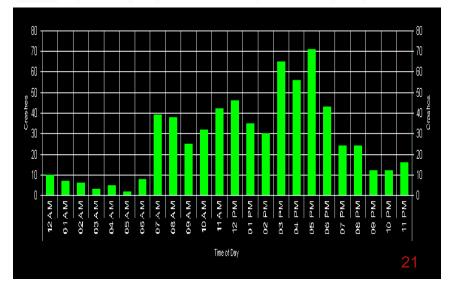
Crashes: 1748 Fatal: 5 Major: 33 Minor: 152 Possible/Unknown: 320 PDO: 1238 Injuries: 714 Fatal: 8 Major: 42 Minor: 202 Possible: 440 Unknown: 22 2005

Crashes: 861 Fatal: 2 Major: 22 Minor: 82 Possible/Unknown: 150 PDO: 605 Injuries: 354 Fatal: 2 Major: 24 Minor: 111 Possible: 204 Unknown: 13 4½-year Summary:

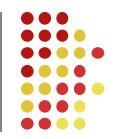
Crashes: Total: 7612 Fatal: 18 Major: 160 Minor: 779 Poss/Unk: 1462 PDO: 5193 Injuries: Total: 3397 Fatal: 22 Major: 194 Minor: 1036 Poss/Unk: 2145

Feature Count Report (Thursday, August 25, 2005 10:01:14 AM Central Daylight Time)

<u>produced</u> using: Iowa's Safety Analysis, Visualization, and Exploration Resource (SAVER)



Rate and Density



- Rate
 - $CR (seg) = N / [AADT x (Y x 365) x L] x 10^8$
 - $CR (int) = N / [DEV x (Y x 365)] x 10^6$
- Density
 - CD (seg) = N / L

Crash Rates per 100 Million Vehicle Miles of Travel (crashes/HMVMT) by Road System and Severity 4-year Averages: 2002 - 2005

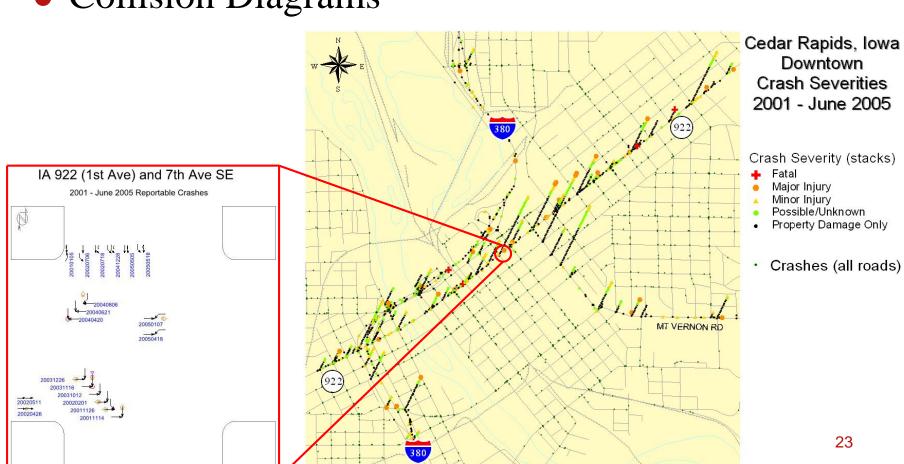
Road System	Fatal Crash Rates	Fatality Rates	Fatal + Injury Crash Rates	All Crash Rates
Rural		300000000000000000000000000000000000000	SASSESSED SERVICES	000000000000000000000000000000000000000
Interstate	0.44	0.59	11	42
Primary	1.31	1.46	27	93
US	1.28	1.46	26	92
Iowa	1.46	1.61	29	99
Secondary	3.45	3.79	86	241
Rural Totals	1.49	1.67	35	110
Municipal				
Interstate	0.54	0.70	35	111
Primary	1.17	1.28	98	305
US	1.19	1.33	101	309
Iowa	1.15	1.22	101	325
City Streets	1.11	1.22	142	465
Municipal Totals	0.82	0.92	91	299
State				
Interstate	0.47	0.62	18	63
Primary	1.25	1.39	48	156
US	1.23	1.40	49	159
Iowa	1.36	1.49	49	162
Local	2.06	2.26	116	363
State Totals	1.19	1.33	57	187

Note: Rural and Municipal breakdowns are based on Corporate Limits.

Source: Iowa Department of Transportation, Office of Traffic and Safety
June 21, 2006

Visual/analytical displays

- Stacking
- Collision Diagrams



Report Generation



- lowa Department Major Cause Summary Analysis Years: 2001 [12], 2002 [11], 2003 [7], 2004 [21] Crash Summary: Surface Condition Summary: Injury Summary: Fatal Major Injury Major Injury 2 Minor Injury 12 Minor Injury 14 Ice Possible Snow Possible/Unknown 10 Unknown Slush PDO 27 Sand/Dirt/Oil/Gravel Total Crashes Total Injuries Water Other Unknown TOT Property Damage: \$274,493 **Not Reported** AVG Property Damage: \$5,382 Total Crashes Major Cause Summary: 2 Animal Improper Backing Illegally Parked/Unattended 6 Ran Traffic Signal Ran Stop Sign 1 Swerving/Evasive Action Driver Gender: w Crossed Centerline Over-Correcting/Over-Steering Driver Cond: Normal 1 FTYROW: At Uncontrolled Intersection Downhill Runaway 3 FTYROW: Making Right Turn on Red Signal **Equipment Failure** Drive Contr 1: FTY making left turn Separation of Units Drivr Contr 2: Vision obstructed 2 FTYROW: From Stop Sign FTYROW: From Yield Sign Ran Off Road - Right Fixed Object: none 13 FTYROW: Making Left Turn Ran Off Road - Straight Ran Off Road - Left 1 FTYROW: From Driveway FTYROW: From Parked Position 2 Lost Control Inattentive/Distracted By: Passenger FTYROW: To Pedestrian FTYROW: Other (explain in narrative) 1 Inattentive/Distracted By: Use of Phone or Other Traveling Wrong Way or on Wrong Side of Rd 1 Inattentive/Distracted By: Fallen Object 2 Driving Too East for Conditions Inattentive/Distracted By: Fatigued/Asleep **Exceeded Authorized Speed** 1 Other (explain in parrative): Vision Obstructed 1 Made Improper Turn Oversized Load/Oversized Vehicle Possible Injuries: o Improper Lane Change Cargo/Equipment Loss or Shift Unknown Injuries: 4 Followed Too Close 4 Other (explain in narrative): Other Improper Action Discenarded Pailroad Signal Init Trav Dir: West Disregarded Warning Sign 1 Other (explain in narrative): No Improper Action Operating Vehicle in Reckless/Aggressive Manner **Not Reported** Veh Action: Stopped for sign/signal Configuration: Passenger car Selection Filter: Driver Age: 47 Driver Gender: w Driver Cond: Normal Drive Contr 1: none
 - lowa Department Crash Detail Report 2002007812 02/12/2002 08:14 EMERALD ISLE DR and SB/WB US 0006 / HICKMAN AVE Major Cause: FTY making left turn Roadway Type: Intersection: T - intersection Manner of Crash:Broadside Severity: ppn Surface Conditions: Drv Major Injuries: n Light Conditions: Daylight Minor Injuries: o Weather Conditions: Clear Possible Injuries: Drug/Alc Involved none Property Damage: \$3000 Number of Vehicles: 2 Unit 1 Unit 2 Init Tray Dir: South Veh Action: Turning left Essentially s Configuration: Van or mini-van Passenger car Driver Age: 50

Normal

unknown

Unit 2

Normal

Major Cause: Followed too close

Severity: ppn

Unit 1

Fatalities: 0

Maior Injuries:∩

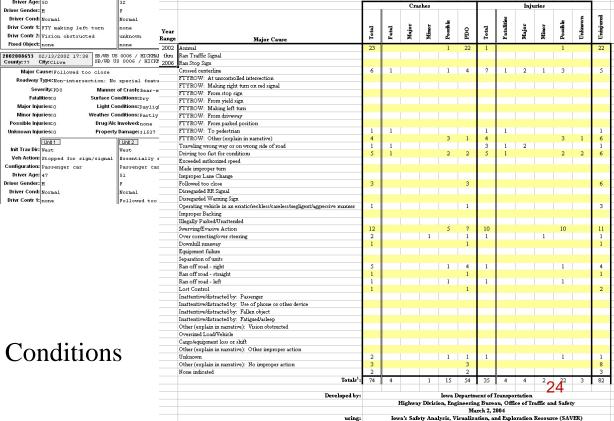
Minor Injuries: 0

- Animal-related
- Driver age (young & old)
- Impairment-related
- Fixed objects 2002-2006 Crash History

For the section of

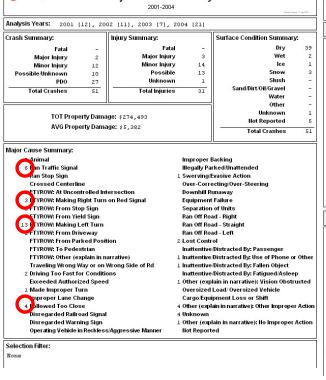
US 30 from 1000 ft East of Casino (305th/F Ave) to WCL of Toledo

In Tama County, Iowa



- Speed-related
- Vehicle types
- Day/Night
- Weather/Surface Conditions

Pattern Searching



Major Cause Summary



Drive Contr 2: Vision obstructed

Severity: ppn

Unit 1

Configuration: Passenger car

Veh Action: Stopped for sign/signal

Major Injuries: 0

Minor Injuries: n

Possible Injuries: o

Unknown Injuries: n

Init Trav Dir: West

Driver Age: 47

Driver Cond: Normal

Drivr Contr 1: none

Driver Gender: M

Major Cause: Followed too close

Roadway Type: Non-intersection: No spec

Manner of Cra

Light Conditio

Surface Conditio

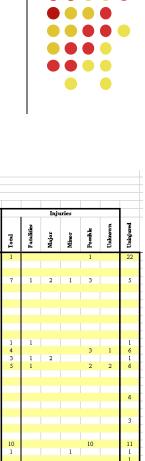
Weather Conditio

Drug/Alc Involv

Property Dama

Unit

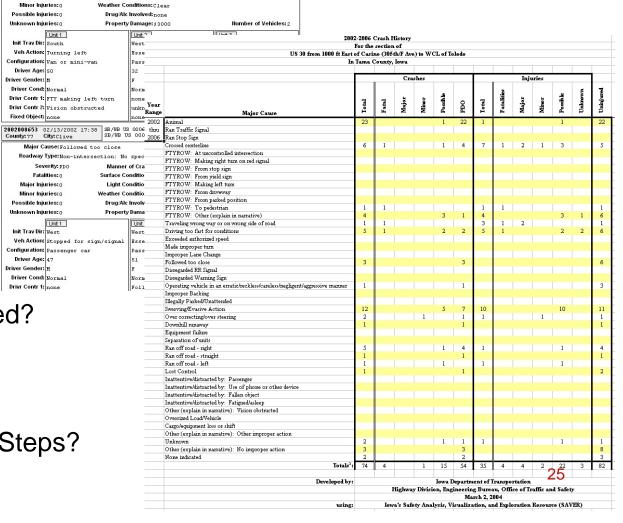
Fixed Object: none



- Further analysis required?
- Querying?

lowa Department

Revisit Prior Analytical Steps?



lowa's Progression

thod

^	
Ana	$1 \times 10 \times 10^{-1}$
$A \cup A$	1 W ~ I ~
<i>,</i> 11 1 1 4	ı y O1O

Mainframe ALAS

4000-

1970s

Former input method

Collection

PC-ALAS

1980s

APS

MARS/OIM

Issues/Problems

1990s

Dual effort

Access-ALAS (internal)

GIS-ALAS (external)

Intersection Magic

Iowa MMUCC

2000+

Iowa MMUCC

CMAT/Access-ALAS

SAVER + Magic Wands

2015+

MMUCC 4th Ed

web-SAVER

TAS

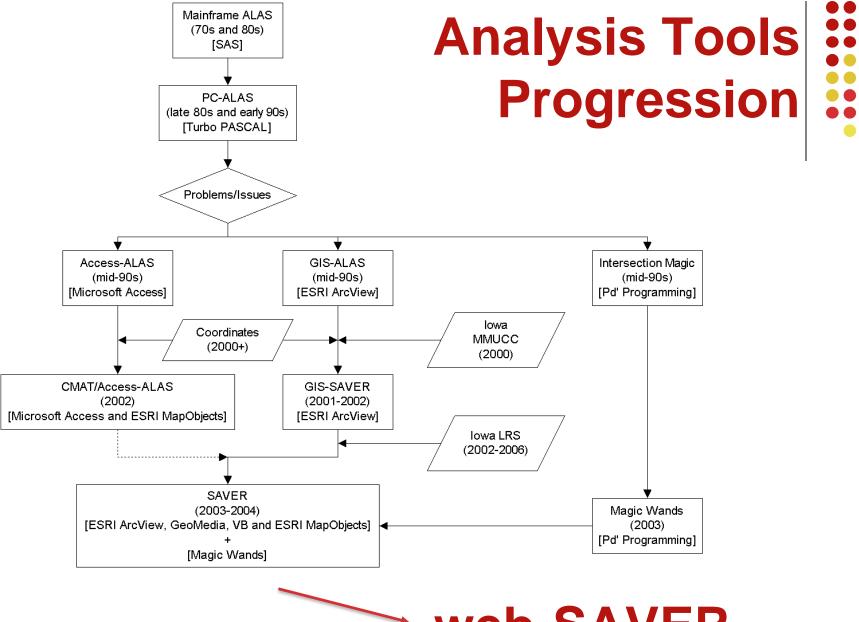
web-TraCS

TraCS

MVD

26

Advantage Safety



SAVER Live Demo

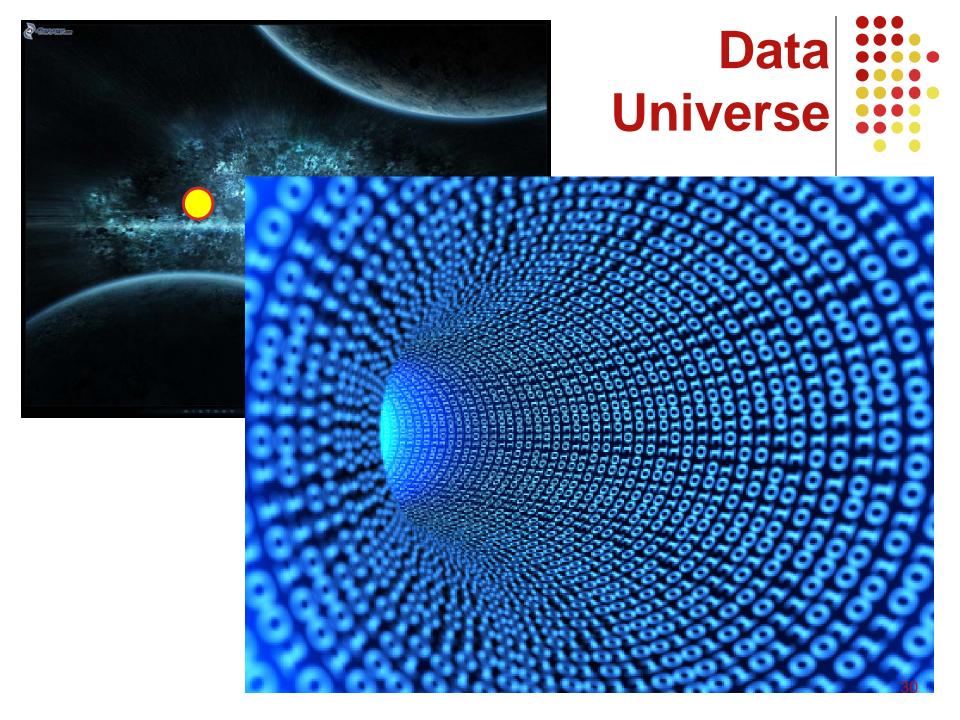
- web browser-based
- server/client-based
- GIS-based
- open access
- Safety Analysis, Visualization, and Exploration Resource (SAVER)

http://iowadot.greatarc.com/saver/



Alternative Analytical Options

- web-based information:
 - Traffic Safety Data and Analysis (TSDA)
 - http://www.iowadot.gov/tsda/
 - Zero Fatalities
 - http://ia.zerofatalities.com/
 - Safety Performance Measures
 - http://www.iowadot.gov/performance/safety.html
 - Iowa Traffic Safety Data Service (ITSDS)
 - http://www.ctre.iastate.edu/itsds/
 - others...canned, assistive, ad hoc



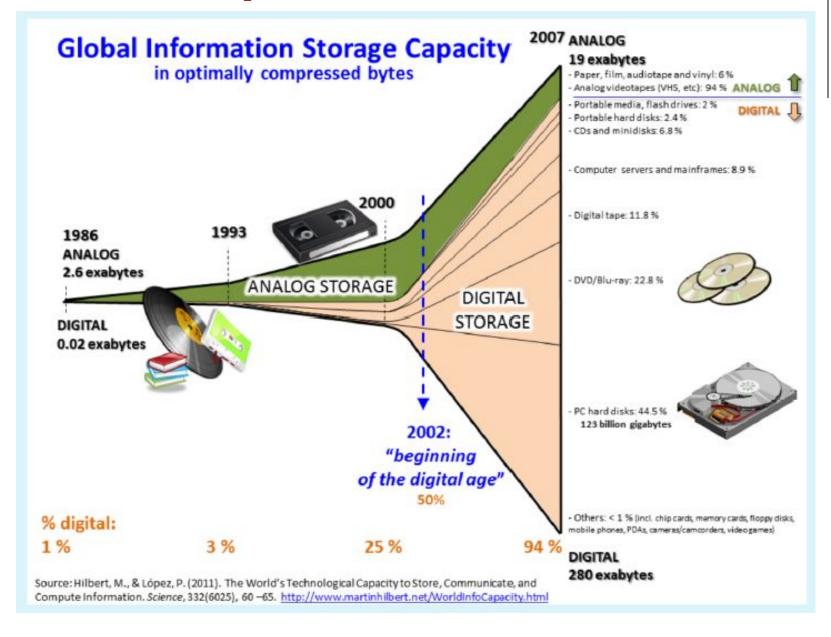
New Definitions



Data inflation

Unit	Size	What it means
Bit (b)	1 or 0	Short for "binary digit", after the binary code (1 or 0) computers use to store and process data
Byte (B)	8 bits	Enough information to create an English letter or number in computer code. It is the basic unit of computing
Kilobyte (KB)	1,000, or 2 ¹⁰ , bytes	From "thousand" in Greek. One page of typed text is 2KB
Megabyte (MB)	1,000KB; 2 ²⁰ bytes	From "large" in Greek. The complete works of Shakespeare total 5MB. A typical pop song is about 4MB
Gigabyte (GB)	1,000MB; 2 ³⁰ bytes	From "giant" in Greek. A two-hour film can be compressed into 1-2GE
Terabyte (TB)	1,000GB; 2 ⁴⁰ bytes	From "monster" in Greek. All the catalogued books in America's Library of Congress total 15TB
Petabyte (PB)	1,000TB; 2 ⁵⁰ bytes	All letters delivered by America's postal service this year will amount to around 5PB. Google processes around 1PB every hour
Exabyte (EB)	1,000PB; 2 ⁶⁰ bytes	Equivalent to 10 billion copies of The Economist
Zettabyte (ZB)	1,000EB; 2 ⁷⁰ bytes	The total amount of information in existence this year is forecast to be around 1.2ZB
Yottabyte (YB)	1,000ZB; 2 ⁸⁰ bytes	Currently too big to imagine

Data Explosion!





The Information Avalanche

Doubling the knowledge base:

1750 - 1900: 150 years to double

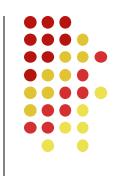
1900 - 1950: 50 years to double

1950 - 1960: 10 years to double

1960 - 1992: 5 years to double

By 2020, information will double every

73 days



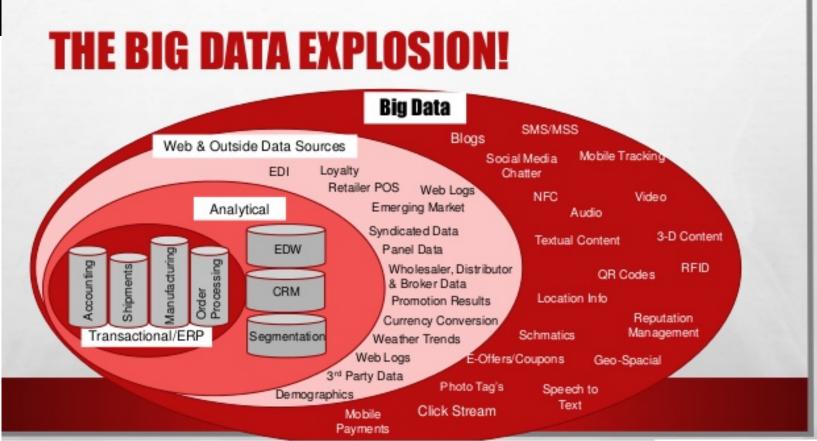
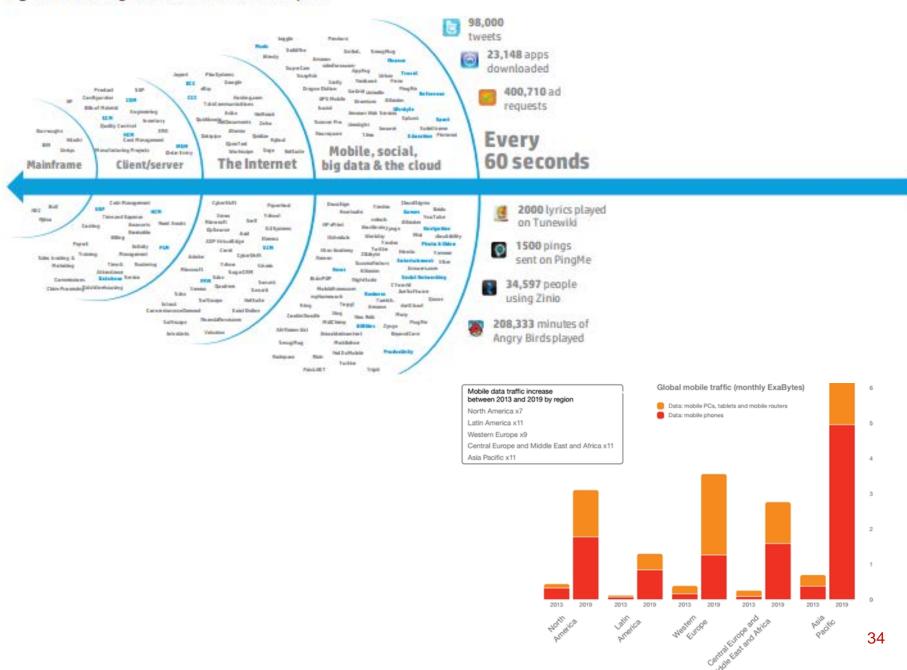
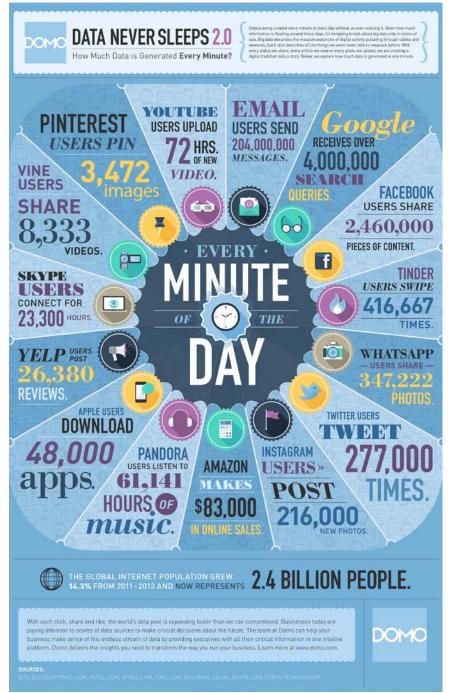
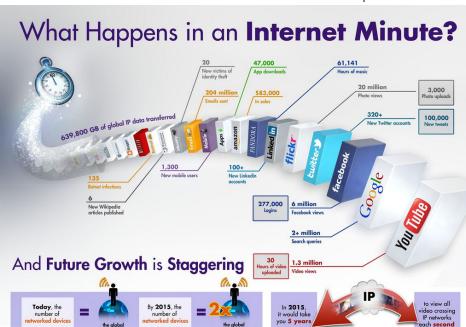


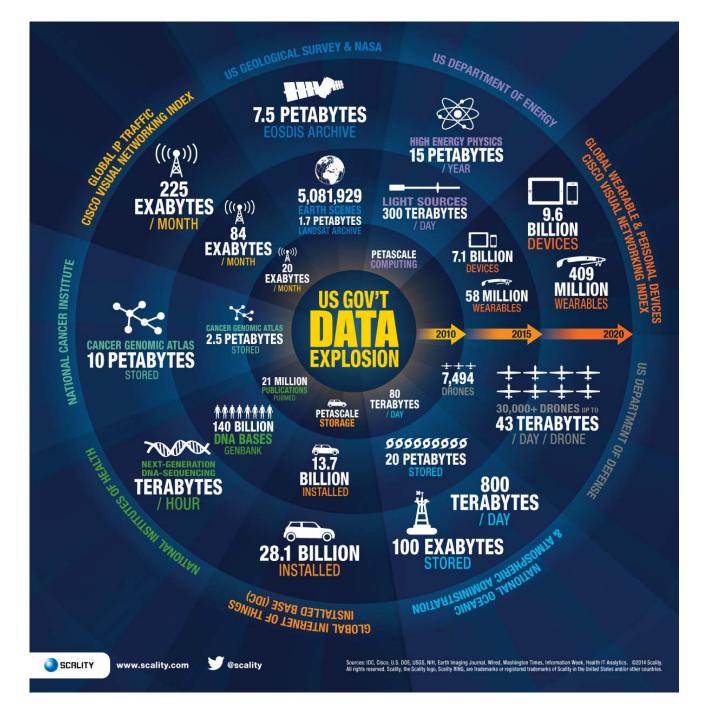
Figure 1. Data is generated at a much faster pace





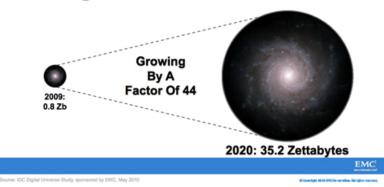






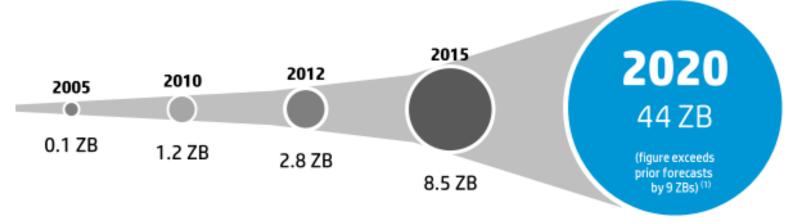


The Digital Universe 2009-2020





Data explosion outpacing technology



Next-generation competitive advantage delivered through:







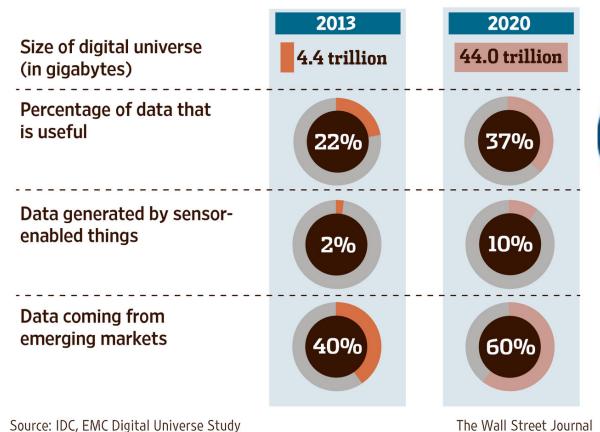
(1) IDC "The Digital Universe of Opportunities: Rich Data and the Increasing Value of the Internet of Things" April 2014

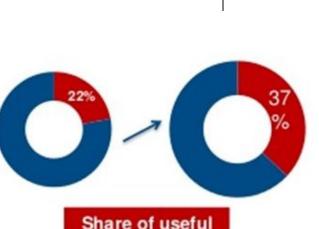
© Copyright, 2014 Hewlett-Packard, Development, Company, L.P., The information, contained herein is subject to change without notice.



Data Explosion

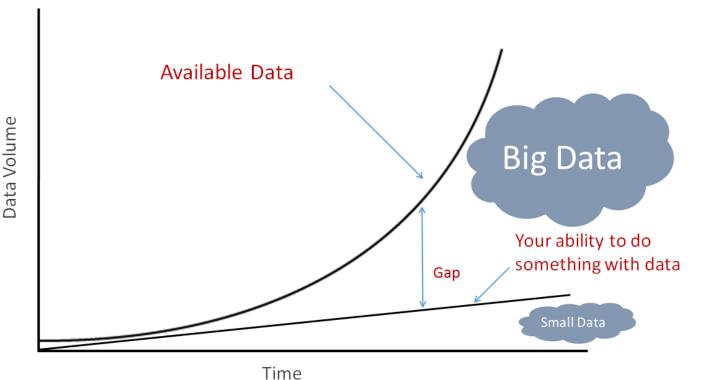
The amount of data created and copied annually—known as the digital universe—is projected to expand rapidly this decade, representing an opportunity and challenge for businesses.





data on total

Data Explosion

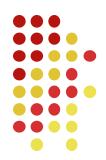


Iowa 2001 Crash Form: 201 fields 437 data elements

How much of these data used?

- Crash
- Road
- Other?

How much needs to be? How to determine? Who determines? Anyone?



Newly Developed/ Available Data (Iowa)

- Crash data (point) MMUCC 4th
 - New data fields
 - Timeliness stepped up and improving
- Roadway data (line) redesigned management and access system
 - Intersection database
 - Interchange database
 - Curve database
 - Horizontal
 - Vertical
 - Safety feature tracking
 - Segmentation
- Pavement data (line)
 - Improved collection and storage
 - Greater coverage
- Videolog
 - Improved collection and imaging
 - Greater coverage

How to incorporate and use to our advantage?

This list is incomplete!

- Sign
- Culvert
- Guardrail
- Lighting
- etc...

Potential Additional Data Sources

- Weather
 - Roadway Weather Information System (RWIS)
- Plow locations and activities

How to incorporate and use to our advantage?

- Driver
- Vehicle
- Citation
- Criminal History
- Emergency Medical Service (EMS)
 - Response
 - Outcomes
 - Facility proximity
 - Capabilities equipment and training

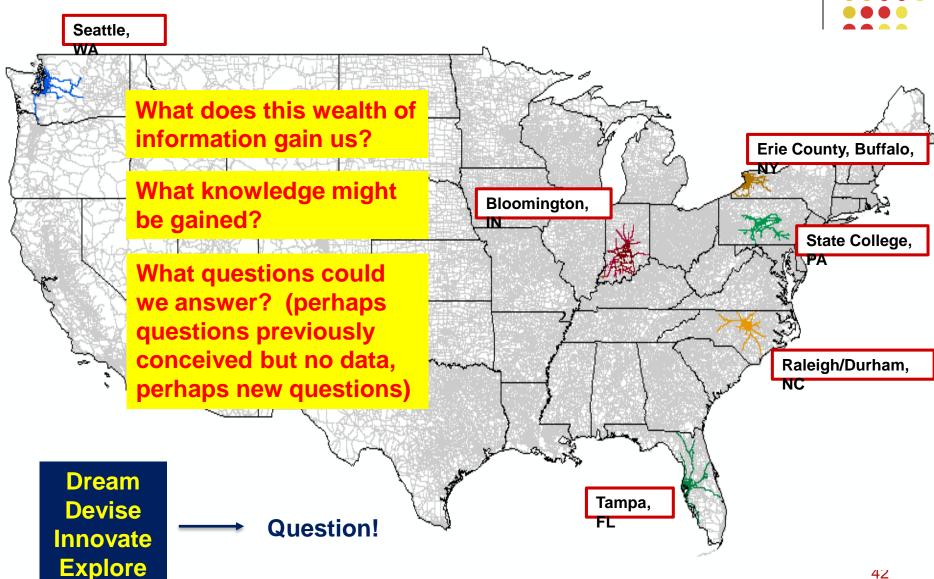
Are they available? (Can we obtain/access?)

- Social Media/Apps
 - Facebook
 - Twitter
 - WAZE
 - INRIX

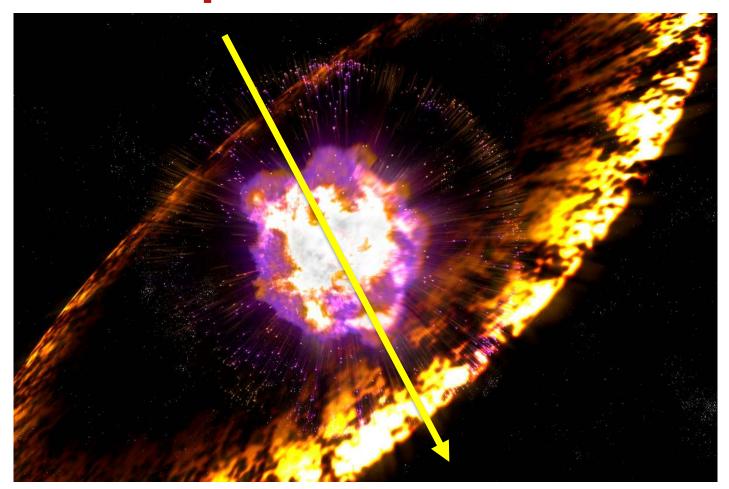
Should we utilize data from inadvisable activities?

What can they tell us? How do we sieve/filter?

SHRP 2 NDS and RID



Data Explosion!





Knowledge Explosion! ???

Trend Continuation



Zero Fatalities

A Goal We Can All Live With

2016 Iowa Traffic Fatality Count for 03/10/16

A fatality is considered "crash-related" when death occurs within 30 days of a crash. Because complex crash investigations can delay the official report of fatalities, the numbers for the most current months are preliminary and can change considerably.

Number of Fatalities Reported on this Day by Year

2016	53	5 Year Comparison (2011-2015)			
			Count	%	
2015	36	Increase from Last Year	17	47.22%	
2014	53	Increase from Low Year of Last 5 yrs.	19	55.88%	
2013	34	Decrease from High Year of Last 5 yrs.	-15	-22.06%	
2012	68	Increase from 5 Year Average	7	15.22%	
2011	37	Average fatalities year to date for this day (2011-2015)	46	

Monthly Fatality Count (2011 - 2015 figures are end-of-month totals)

MONTH	2016	2015	2014	2013	2012	2011
January	27	18	28	22	39	19
February	17	18	16	15	23	14
March	9	19	16	21	29	40
April		31	22	24	15	25
May	1 8	25	27	24	48	26
June		25	26	29	27	25
July		33	29	26	23	36
August		51	36	35	39	29
September		29	34	37	35	43
October		24	30	29	26	37
November		23	46	27	35	28
December	- 3	24	12	28	26	38
TOTAL	53	320	322	317	365	360

Fataliti	es' Seat Belt Us	age - Year to Date	Comments	
Belt usage may change as additional information is received			1 March fatality	
15	With belt	31.25%		
24	Without belt	50.00%		
9	Unknown	18.75%		
5	Not applicable (Mo	torcycle, Pedestrian, etc.)		
53	Total Fatalities			

For additional information, contact:

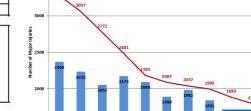
Dennis Kleen

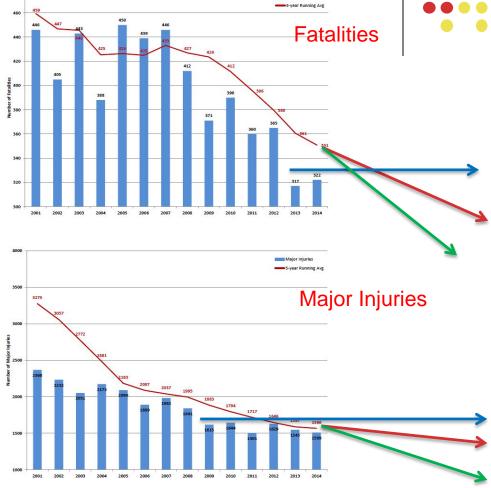
FARS Manager & Driver Data

lowa Department of Transportation, Office of Driver Services

P.O. Box 8204, Dec Moines, IA 60306-8204

Telephone: 616-237-3164 Email: dennic.kleen@dot.lowa.gov





Fatalities

Safety Goal: Reduce Crashes & SAVE LIVES



Safety Stakeholders



- Iowa DOT
 - ■Local Systems
 - Systems Planning
 - ■District Offices
 - **■**Transit
 - **□**Rail
 - ■Transportation Data
 - ■Driver Services
 - ■Traffic and Safety
 - ■Motor Vehicle Division
- Iowa State Patrol
- Bandy Motorcy le Training
- Iowa Illa pis Safe y Copycu
- C vel or Traffic Lafety Bureau
- Iow Northland Regional Council of Gov
- University of Iowa
 - Public Policy Center
 - Human Factors Research
 - College of Engineering
- Department of Public Health
 - Emergency Medical Services
- Iowa Department of Natural Resources
- State Farm Insurance
- Federal Motor Carrier Safety Administration
- State of Iowa Public Health

- MAPA
- Federal Motor Carrier Safety Admin.
- National Highway Traffic Safety Admin.
- Marion Polic Department
- AARP Driver Safe
- To th Iowa Area Council of Governments
- **EM** Insurance Co
- United Parcel Service
- Office of the Iowa Attorney General
- Iowa State University
 - Center for Transportation Research and Education
 - Safety Circuit Rider
 - Iowa Traffic Safety Data Services
- Prosecuting Attorneys Training Council
- Cambridge Systematics
- Quality Traffic Control, Inc.
- 3M Company Traffic Safety Systems
- ABATE of Iowa
- Tips/Think First
- Safety Engineer Consultant
- Bi-State Regional Commission
- Iowa Health Systems
- Blank Children's Hospital

- Court and Juvenile Justice Planning (CJJP)
- Iowa Department of Public Health
- Customized Management Services
- CH2M Hill
- East Central Intergovernmental Association
- Iowa Pupil Transportation Association
- Department of Elder Affairs
- Iowa Association of School Boards
- Gold Wing Road Riders
- AAA Minnesota-Iowa
- Federal Highway Administration
- State Farm Insurance
- Iowa State Patrol
- MPO's
- RPA's
- APWA
- Iowa Attorney General's Office
- Office of the Governor
- AARP Driver Safety Program
- Blackhawk County Engineer
- Iowa Safety Educators Association
- Traffic Control Corporation

Expand on the 5Es???



Engage EVERYONE Else



- Collegial & Collaborative → mutual benefit
- Expertise vs. Discovery-oriented
- Fostering w/ intent
- Learning, questioning, progressing

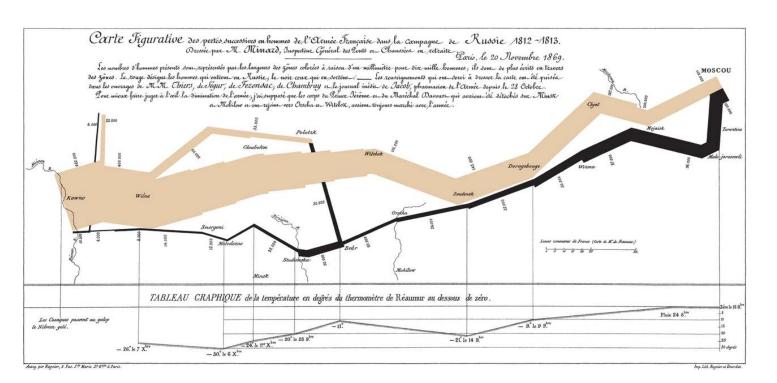


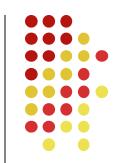
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Word Clouds

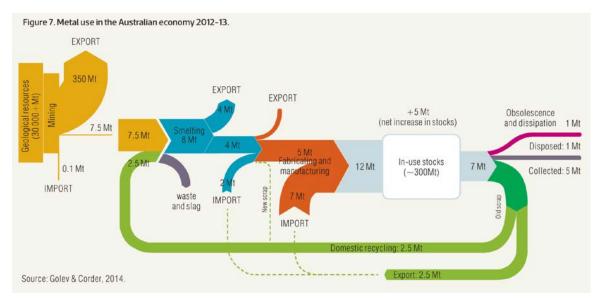






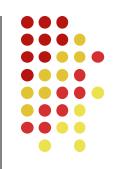


Sankey Diagrams



Decision Trees





Other options?



Open Slate

Future Safety Analysis/Analytics

Discussion:

- An evolutionary leap forward?
- The missing link?
- Something else entirely?
- Other comments...
 - better yet → questions????

How much needs to be? How to determine? Who determines? Anyone?



How to incorporate and use to our advantage?

Are they available? (Can we obtain/access?)

What can they tell us? How do we sieve/filter?

Should we utilize data from inadvisable activities?

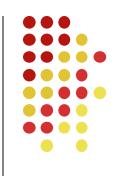
What does this wealth of information gain us?

What knowledge might be gained?

What questions could we answer? (perhaps questions previously conceived but no data, perhaps new questions)

Who?





In the end, should we just... Let the "robots"* drive?

* after ensuring application of the <a>Three Laws of Robotics