Module 5.4

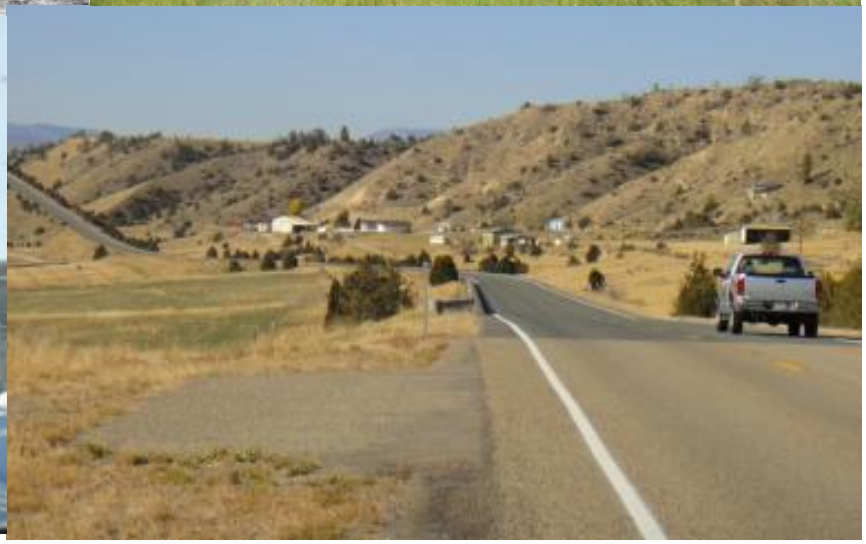
Managing Risk with Vehicle and Highway Design

Managing Risk - Objectives

Students are expected to describe:

- the crash survival features incorporated into highway and vehicular design;
- collision types and actions to control the consequences of a crash;
- how improved highway and vehicle technology helps minimize the consequences of a crash.

Vehicle and Highway Risks



Is driving safe or dangerous?

Do you know someone who crashed?

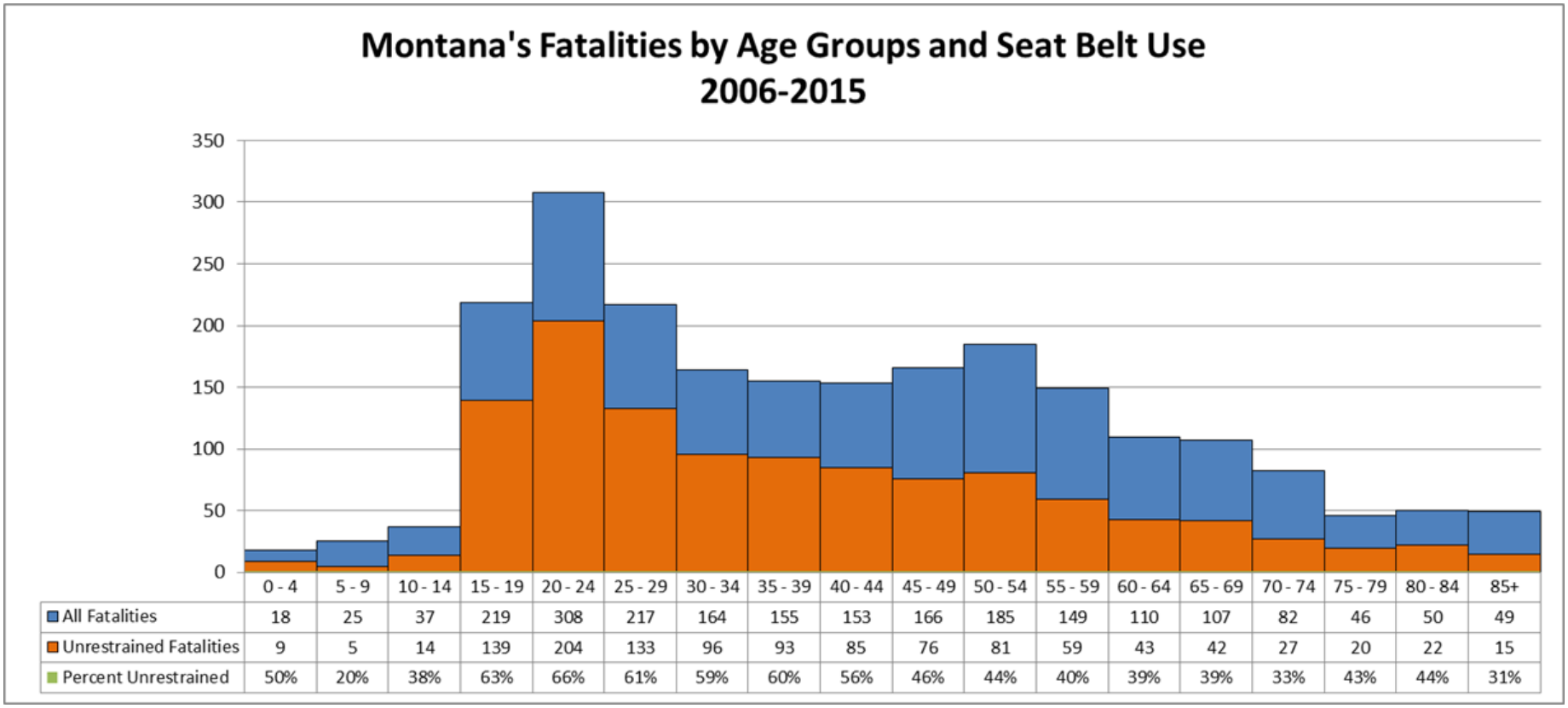
One in five drivers is involved in a serious crash

One in eight drivers is seriously injured

One in three have a friend or relative seriously injured or killed in a crash

Teens & Young Adults at Risk

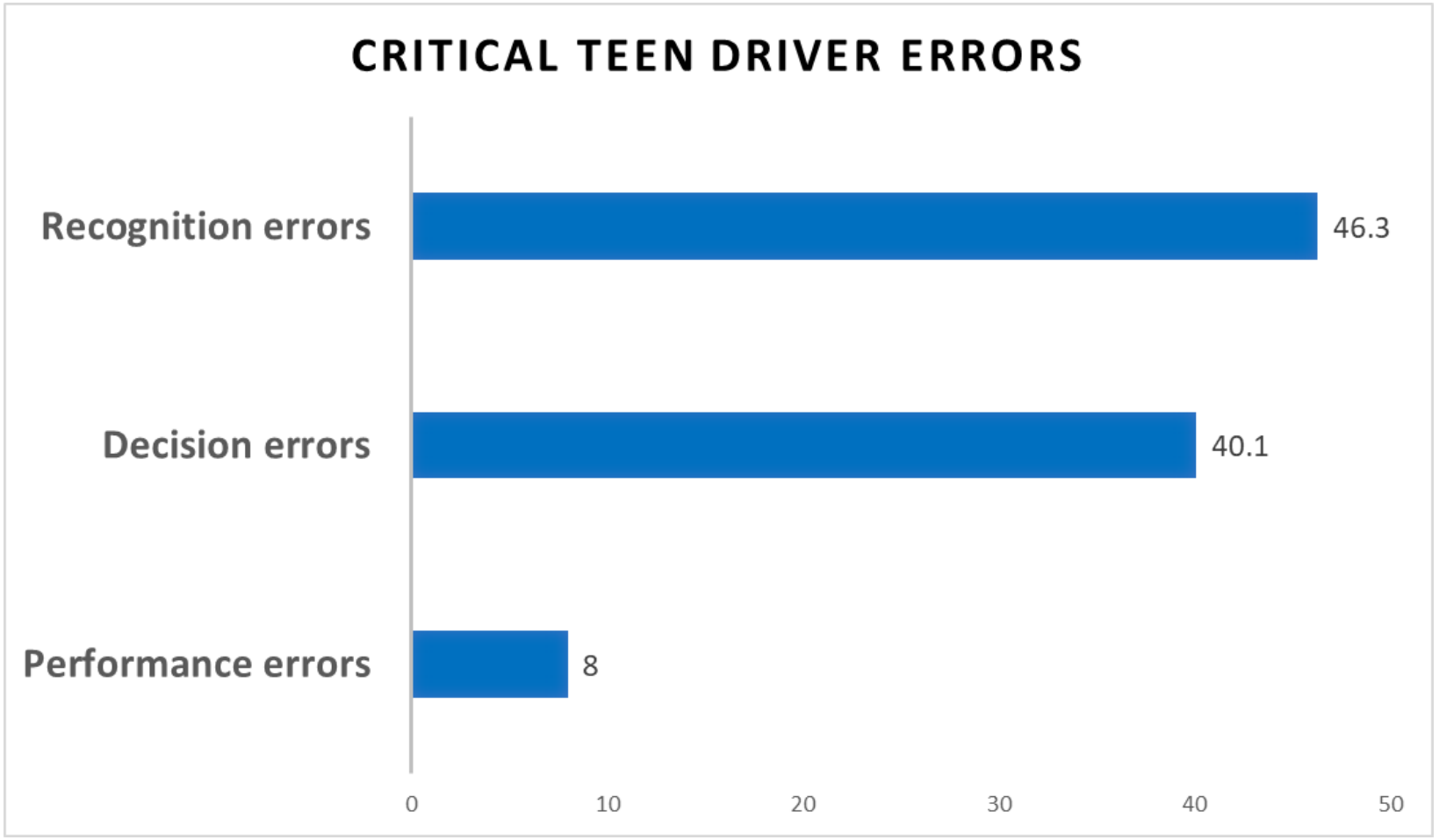
The deadly consequences of not buckling up



	0 - 4	5 - 9	10 - 14	15 - 19	20 - 24	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	65 - 69	70 - 74	75 - 79	80 - 84	85+
All Fatalities	18	25	37	219	308	217	164	155	153	166	185	149	110	107	82	46	50	49
Unrestrained Fatalities	9	5	14	139	204	133	96	93	85	76	81	59	43	42	27	20	22	15
Percent Unrestrained	50%	20%	38%	63%	66%	61%	59%	60%	56%	46%	44%	40%	39%	39%	33%	43%	44%	31%

The orange section of the graphs shows how many people were **not** wearing seat belts and died in a crash.

Driver error: 95.6% of crashes



Crashes involving 15 – 18 year old drivers

Driving Decisions

What are the risks facing young teen drivers?

- Inexperience
- Speed
- Distractions
- Fatigue
- Alcohol is involved in about 16% of fatal crashes involvin 16- and 17-year-old drivers.

These factors cause crashes, but what ***kills***?

Not wearing a seat belt …

Student Activity: Risk Factors

Risk on the road is complicated by….

Student groups of 2 or 3. Using the *Risk Factors Worksheet*:

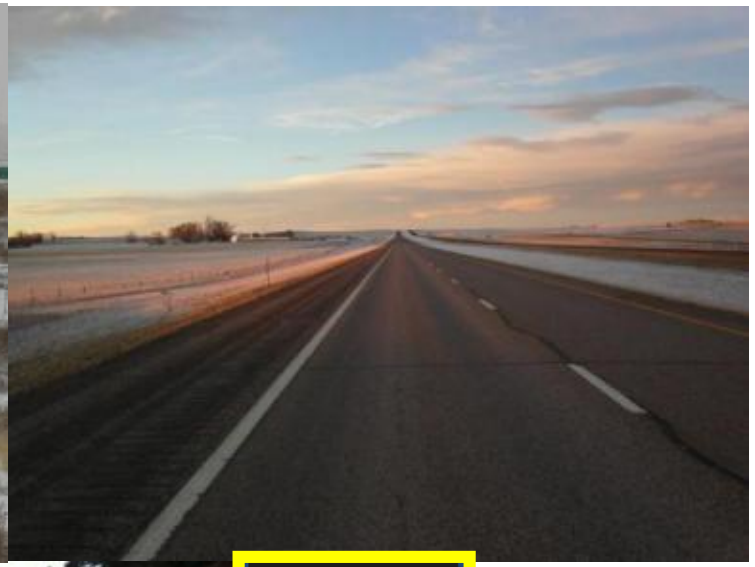
- List at least 10 driving risk factors
- Identify strategies to manage driving risks

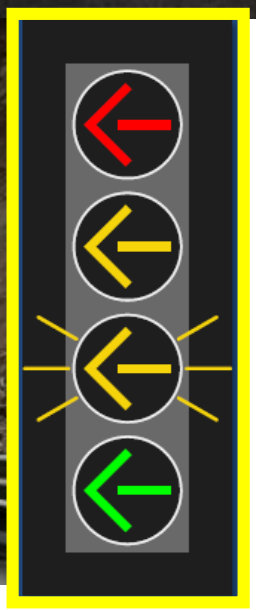
Risk = chance of injury, damage or loss

Engineering Road Safety Solutions

Improving Montana Roads and Bridges

Cable barriers, roundabouts and more

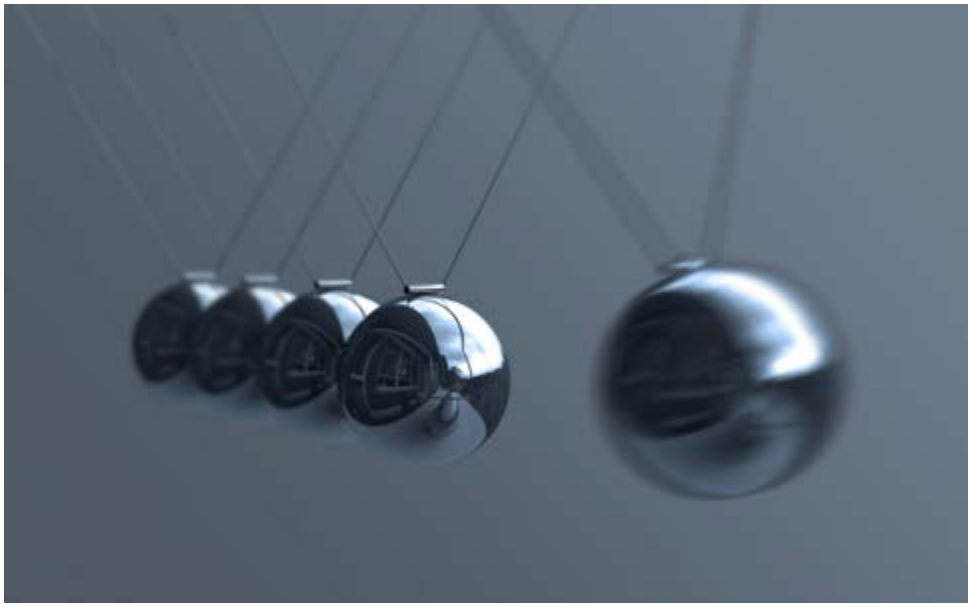




Crash Forces and Consequences

Three collisions in every crash:

- **Vehicle**
- **Body**
- **Internal Organs**



Collision Types

Rollover safety - cage intact.

Seat belt use saved teen drivers.

2009 Chevrolet Malibu vs.1959 Chevrolet Bel Air

2009 Chevrolet Malibu post-crash

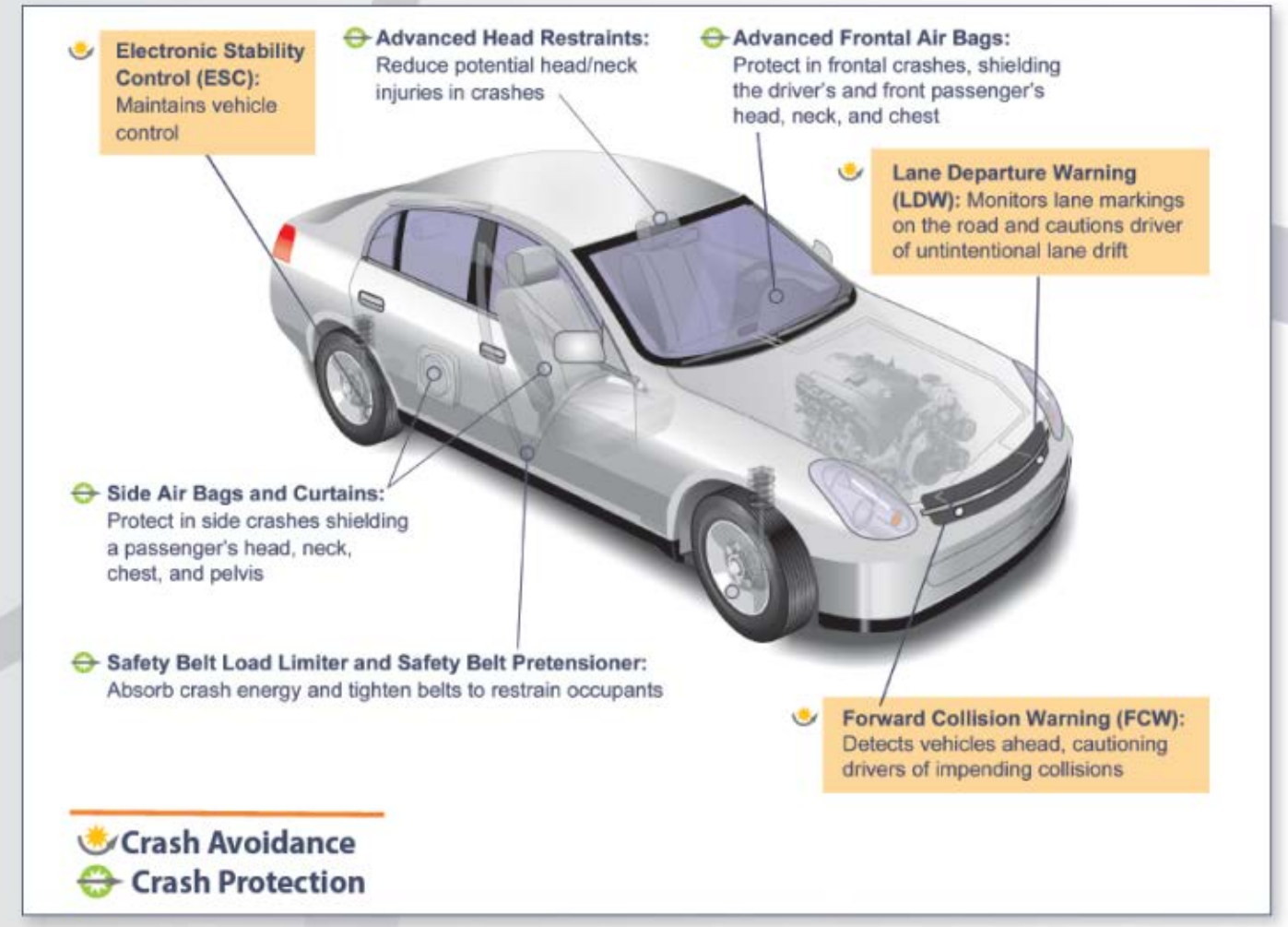
1959 Chevrolet Bel Air post-crash

In the crash test involving the two Chevrolets, the 2009 Malibu's occupant compartment remained intact (above left) while the one in the 1959 Bel Air (right) collapsed.

Technology:
Driving the Development of Safer Cars

5-Star Safety Ratings

More Stars. Safer Cars.



Will your next car or truck drive itself?

Developing Crash Prevention Technology

Self-driving cars* are

designed to assist drivers with specific tasks in *limited* environments.

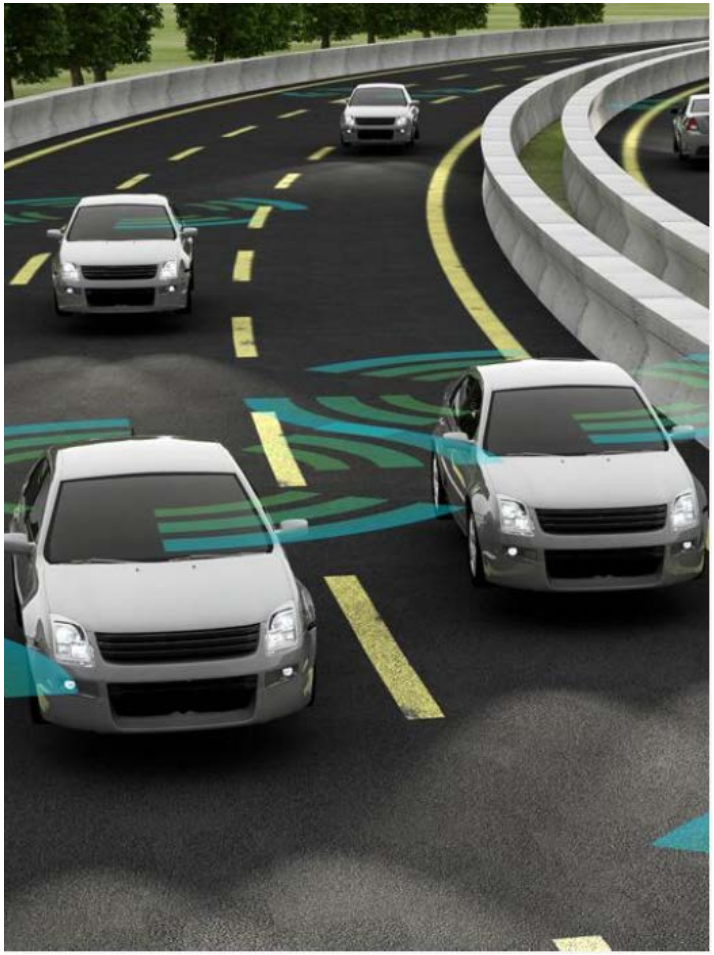
Where do they work?

When do they fail?

*skilled & attentive drivers still required

Tesla Superchargers in West Yellowstone, MT, 2018
Electric Car Charging Stations

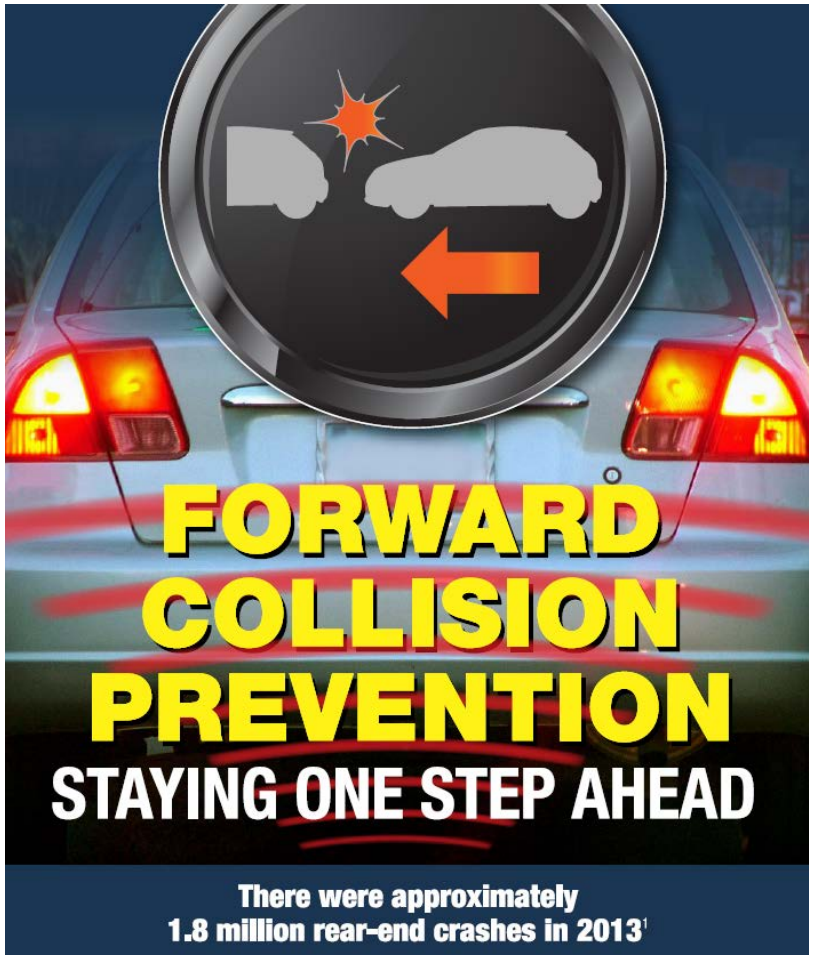
Automated Driving Systems*



- Automatic Emergency Braking
- Adaptive Cruise Control
- Lane Keeping
- Electronic Stability Control
- ABS Brakes
- Warnings

* Driver attention and engagement still required

Forward Collision Prevention



How does it work?

Scans the road and detects how far and fast the vehicle in front of you may be moving.

Forward Collision Warning (FCW) – Warns with beep or vibration.

Automatic Emergency Braking (AEB) Warns driver and applies the brakes to slow or stop the vehicle if the driver does not.

It does not work when …

These features are camera- or radar-based and can be **obstructed** by buildups of ice and snow or **"blinded"** by sunrise and sunset glare.

MyCarDoesWhat.org
Know More. Drive Safer.

Keeping You In Line

Lane Departure Warning & Lane Keeping

How do they work?

Cameras read lane markings on the road.

'Depart' from your lane unintentionally and…

- A warning sounds
- Dash light flashes
- Steering wheel vibrates

…alerting you to get back in your lane!

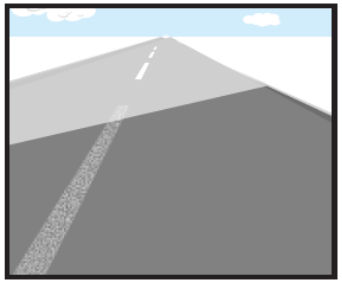
What happens if you ignore the warnings?

Lane Keeping Assist (if your car is equipped) will kick in and gently steer your car back toward the center of the lane

These features aren't perfect

They may not work if…

- Lane markers are blocked by snow, leaves, fog or other debris.
- Lane markers are faded, in disrepair or overly complicated



What happens if you want to change lanes?

Activating the turn signal cancels Lane Departure Warning and turning the wheel disables Lane Keeping Assist.

Adaptive Cruise Control (ACC)

How should you use ACC?

Accelerate to desired speed.
Turn ACC on.

Tell ACC how close you want to be to the vehicle ahead of you.

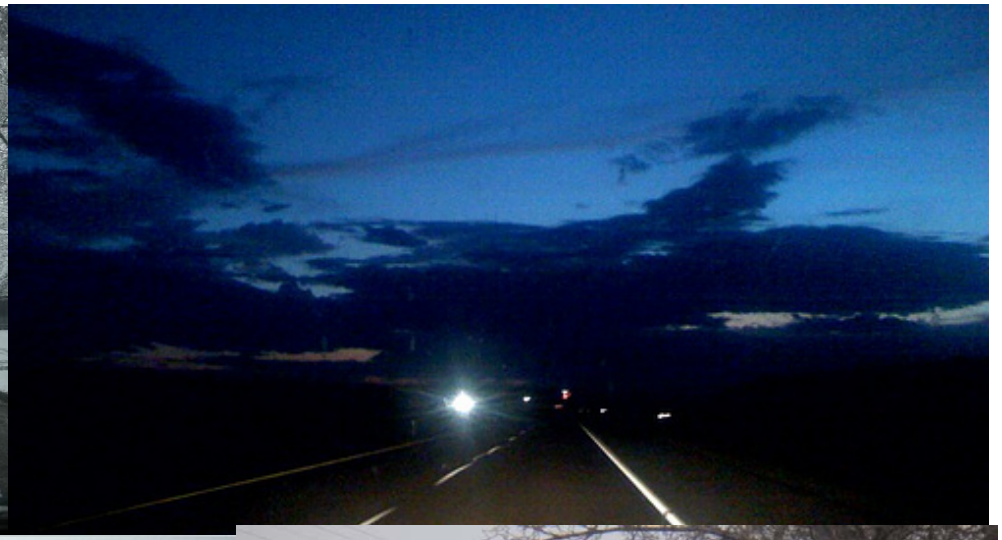
Set a bigger gap in poor weather or bad driving conditions.

Driver Decisions

- What actions can you take to avoid and control crash consequences?
- What will you do when a dashboard light flashes or a buzzer sounds?
- When you feel the rumble strips on the road, what do you do?

Highest lifetime crash risk is in the first year of driving.

Practice, practice, practice!



Practice driving at night and in different road and weather conditions.

Friction and Traction

Worn tire tread can keep you from stopping quickly and from controlling your vehicle.

Five-Star Drivers ★ Five-Star Vehicles Five-Star Roads

Montana Driver Education and Training

Standards and Benchmarks

1. **Laws and Highway System**
   - 1.1. know the laws outlined in the Montana Driver's manual;
   - 1.2. understand the laws outlined in the Montana Driver's Manual; and
   - 1.3. consistently demonstrate knowledge and understanding by responsible adherence to highway transportation system traffic laws and control devices.
2. **Responsibility**
   - 2.1. recognize the importance of making safe and responsible decisions for owning and operating a motor vehicle;
   - 2.2 demonstrate the ability to make appropriate decisions while operating a motor vehicle;
   - 2.3. consistently display respect for other users of the highway transportation system; and
   - 2.4. develop positive habits and attitudes for responsible driving.
3. **Visual Skills**
   - 3.1. know proper visual skills for operating a motor vehicle;
   - 3.2. communicate and explain proper visual skills for operating a motor vehicle;
   - 3.3. demonstrate the use of proper visual skills for operating a motor vehicle; and
   - 3.4. develop habits and attitudes with regard to proper visual skills.
4. **Vehicle Control**
   - 4.1. demonstrate smooth, safe and efficient operation of a motor vehicle; and
   - 4.2. develop positive habits and attitudes relative to safe, efficient and smooth vehicle operation.
5. **Communication**
   - 5.1. consistently communicate driving intentions (i.e., use of lights, vehicle position, and personal signals);
   - 5.2. adjust driver behavior based on observation of the highway transportation system and other roadway users;
   - 5.3. adjust communication (i.e., use of lights, vehicle position, and personal signals) based on observation of the highway transportation system and other users; and
   - 5.4. develop positive habits and attitudes for effective communication.
6. **Risk Management**
   - 6.1. understand driver risk-management principles;
   - 6.2. demonstrate driver risk-management strategies; and
   - 6.3. develop positive habits and attitudes for effective driver risk-management.
7. **Lifelong Learning**
   - 7.1. identify and use a range of learning strategies required to acquire or retain knowledge, positive driving habits, and driving skills for lifelong learning;
   - 7.2. establish learning goals that are based on an understanding of one's own current and future learning needs; and
   - 7.3. demonstrate knowledge and ability to make informed decisions required for positive driving habits, effective performance, and adaptation to change.
8. **Driving Experience**
   - 8.1. acquire at least the minimum number of BTW hours over at least the minimum number of days, as required by law, with a Montana-approved driver education teacher; and
   - 8.2. acquire additional behind-the-wheel driving experience with a parent or guardian's assistance in a variety of driving situations (i.e., night, adverse weather, gravel road, etc.).