Need for Speed?

Vehicle speed is an important factor of roadway safety. Students will explore how speed is related to the design of a street and learn that travel speed is a decision made by drivers. Students will discover how a driver's ability to stop is related to human biology and principles of physics and how this translates into the distance needed for a driver to see a pedestrian and stop. Students will learn about these concepts by measuring their own reaction time then calculating laying out stopping distances given different conditions.

Format:
60-75-minute activity in a classroom setting

Audience:
Middle school-age students

Supplies

- Computer projection
- Masking tape
- Calculators (1 per student pair)
- Standard 12-inch rulers (1 per student pair)
- Measuring tape x 4
- Scrap paper to record reaction time trials
- Optional: clipboards

Supplemental Materials Provided

- Visual aid: PowerPoint file with 11 images of street scenes with different speed limits (8 labeled and 3 unlabeled for guessing).
- Handout: 4 handouts of sample local news stories.
- Handout: Science World reaction timer template (3 per sheet).
- Handout: 12 handouts with sight stopping distance activity.

To Do in Advance

✓ Identify long/wide hallway or outdoor space (at least 450 feet in length). If you have less than 400 feet available, do not offer the last 3 sight stopping distance handouts for the 50 mi/hr scenario.

✓ Print handouts.

✓ Test computer projection.

✓ Load PowerPoint.

✓ Open browser window with online street imagery of meeting place (e.g., Google Streetview).

✓ Review "The Why and How Behind the Concepts" in the Primer.

FHWA-SA-20-089

Introduction to Concept and Activity

These concepts should be reinforced by the lesson leader the during activities.

- The faster someone is driving when a crash occurs, the more severe the impacts. People outside of vehicles are disproportionately injured over those protected inside the vehicle. Street designs that lead to even a small speed reduction can result in fewer and less severe crashes.
- The design of the street signals to drivers how fast (or slow) they should be driving. The design of streets can be changed to encourage people to drive slower. Slower drivers need less time than faster drivers to see and react to a person crossing the street.

Greetings and Icebreaker (5 minutes)

Activity Part 1 (15 minutes): Introduce the relationship between street type and driving speed by expanding upon the Introduction to Concept.

Sample discussion:
The speed limit tells drivers the maximum speed they are allowed to drive on a given road, but there are also cues in the design of the road and the surrounding environment that make it feel more or less comfortable for drivers to drive fast. Imagine that I ask you to run on a balance beam. How different would it then feel if I asked you to run on a path that had grass on each side? What about if that path now has buildings and other people walking on either side of you?

Think about the times when you have ridden in a car. Do you think the driver is always traveling at or below the speed limit? When do you think they might choose to drive over the speed limit?

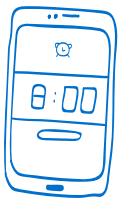
Show the browser window with the street-view of an adjacent street. Ask students what they see that might encourage a driver to travel faster? What would make drivers slow down?

Use visual aid with street images showing speed limits. Ask students what clues these scenes offer for how fast the drivers might be driving. Next, show the last three images while asking students to guess the speed and describe their reasoning.

Activity Part 2 (15 minutes): Next each student will spend a few minutes reading a news story about a traffic crash in which a person walking was injured or killed. Ask students to consider what was (or was not) mentioned about the factors involved in the crash (i.e., where, when, who) and more specifically, how the topic of speed was mentioned. Ask a few students to share their observations and then help synthesize key points for the group.

Key message: Speed is always a factor. Each street has a maximum speed limit that can be enforced by police/sheriffs/troopers, but it is still up to the person driving to decide how fast they *should* be driving given conditions such as weather, lighting, and the presence (or expected presence) of other vehicles, pedestrians, and bicyclists.

Optional: If your students would like an additional reading about the way news outlets cover traffic crashes, specifically crashes involving pedestrians and bicyclists, check out the academic article "Does news coverage of traffic crashes affect perceived blame and preferred solutions? Evidence from an experiment." from the Transportation Research Interdisciplinary Perspectives. Available at: https://doi.org/10.1016/j.trip.2019.100073



Activity Part 3 (5 minutes): Introduce the concept of reaction time.

Sample discussion:
There are two components in the ability of a driver to bring their vehicle to a stop once they see a person walking across the road (or some other event or object that requires stopping).

First, the driver must perceive the need to stop. The vehicle is still traveling during the time it takes

the driver's brain react (i.e., the eye sends a message to the visual cortex in the brain, which perceives that an event is taking place. The visual cortex sends a message to the motor cortex to initiate the foot pressing the brake pedal).

Second, the vehicle must physically come to a complete stop. This is dependent upon many variables including the speed at which the vehicle is traveling, the mass of the vehicle, the condition of the vehicle (i.e., quality of the tires, brakes, gears, etc.), the condition of the pavement, and even the acceleration of gravity.

Next, students will measure their reaction time and use those data to calculate the stopping distance for different conditions and speeds.

Optional: To offer more information on the science behind reaction time, check out the "Reaction Time Ruler" activity from Science World, available: https://www.scienceworld.ca/resource/reaction-time-ruler/

Activity Part 4 (10 minutes): Ask students to pick a partner for the ruler drop reaction time test. Distribute a reaction timer to each pair. Remind students: "this activity is not simply measuring your reflex; it is measuring the response time to something that you see."

Directions:

- Each student in the pair needs to complete six trials of the drop test – three with their right hand and three with their left hand.
- Record the time on the drop timer for each trial. Each pair should have 12 trials. When complete, each person should calculate and record their average drop time.
- Catcher rests their arm on the edge of a table or desk and spreads their thumb and index finger about 4 centimeters apart.
- Dropper holds the ruler near the highest number and positions the 0 so that it is level within the top of the catcher's open fingers.
- Dropper releases the ruler within five seconds and the catcher tries to pinch the ruler as fast as possible and then does not move their fingers.
- Catcher records the nearest time notch in seconds.
- Repeat five more times and then switch roles. The dropper should always vary the time of dropping within the five-second "drop-zone."

If time allows, ask: What trends did you notice in your reaction times across the trials? What factors might affect someone's reaction time, in general? What factors might increase the reaction time specifically of drivers? For context, mention that 2 or 2.5 seconds are often used as the "standard" reaction time in the field of road design and transportation safety. How does that compare to what you observed today?

Optional: The distance the reaction timer travels before it is caught has been converted to time using the equation $d = 1/2at^2$ where a is acceleration due to gravity. Rather than giving the students the conversion, you could ask them to solve for time using the distance on the ruler.

Activity Part 5 (10 minutes): Distribute a stopping distance calculation handout to each student and tell them that each sheet is different, but it includes the directions they need to complete the activity. Below is the equation students will see on their handout:

Stopping Sight Distance (SSD)*

$$SSD = vt + (v^2/30(a/g))$$

v = velocity when brakes are applied (given on the handout. Students will convert from mi/hr to ft/s by multiplying by 1.47)

t = time to perceive the need to stop (student's reaction time measured in seconds)

a = driver deceleration of the vehicle (given on the handout)

g = acceleration of gravity (first, ask students if anyone knows this number. Answer: 32.2 ft/s^2)

*This equation assumes a road without grade. The next part has an optional activity where students can explore how grade effects SSD.

Activity Part 6 (15 minutes): Ask students to gather their handouts and writing implements and move to the designated hallway or outdoor space. Mark a starting spot for each speed (20, 30, 40, and 50 mi/hr). Students will take turns using the measuring tape and masking tape to measure and mark the stopping distance for their given conditions and write their name or initials on the tape. Ask students to compare results amongst themselves or ask everyone with the same speed to gather at their marking and report the deceleration assumption included in their calculation. If more than one student had the same handout, ask about their reaction time so students can observe the difference.

Ask a few questions to wrap-up: What do you think will happen to these calculations if a driver is traveling uphill? Downhill? What happens when drivers are traveling above the posted speed limit (recall the images from the beginning of the lesson and the differences between the speeds shown on the floor, i.e., 30 mi/hr+ on a street that should be maximum 20 mi/hr)? What about in different weather conditions? Light conditions? If the driver is tired or impaired by drugs or alcohol? Many of these reasons are why the fields of road design and transportation safety assume a reaction time of 2 or 2.5 seconds.

Optional: Bring clipboards to the designated space. Present students with the revised equation that incorporates grade. Randomly assign students to incorporate a -6%, -3%, 3%, or 6% grade into their calculation.

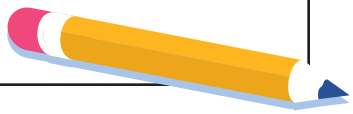
$$SSD = vt + (v^2/2g(30 + G))$$

G = grade of the road (for example, for a 3% uphill add 0.03 to the acceleration of gravity).

Ask for volunteers to add or subtract distance from their original measurement on the ground.

Optional: Ask students to model the grade using materials available in the classroom. This will help them visualize the changes associated with their new calculations.

Notes



Student Handout: Activity 2 - News Story 1

NEWS

Driver hits, kills pedestrian on east side as pedestrian deaths continue to increase city-wide

Police are investigating a fatal crash on the east side Saturday evening. Shortly before 7 p.m., police were called to the 2500 block of North Main Street on a report of driver striking a pedestrian. Police say a 46-year-old man was attempting to cross Main Street between a bus stop and the Walgreens when the driver struck him with his car. The injured pedestrian was unresponsive at the scene and reportedly died on the way to the hospital. Police say the driver was not impaired and remained at the scene.

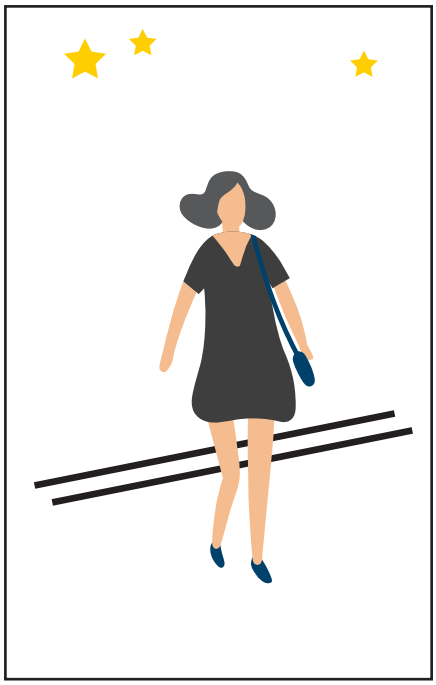
This is the eighth death of a pedestrian in the city this year, an increase of 20% from last year at this time. Three pedestrians have died on this stretch of Main Street, which, despite being a busy shopping area, has high traffic speeds and a lack of streetlights. Source: https://www.sciencedirect.com/science/article/pii/S2590198219300727#bbb0005

Write your observations here

Student Handout: Activity 2 - News Story 2

NEWS

Pedestrian dies after being struck on Highway 205 in Marion Valley



MARION VALLEY — A Raeford City woman died Thursday night after being struck by a driver while she was attempting to cross Highway 205 on foot.

According to reports from the Department of Public Safety, Maria Elena Jacinto, 33, was pronounced dead at Amity Regional Hospital in Northfork.

The accident took place around 9:41 p.m. in the vicinity of Highway 205 Pinegrove Drive in Marion Valley. Reports indicate that a Jeep SUV struck Jacinto. The driver told troopers he had just crossed the state line while returning from a conference, traveling south on Highway 205, when Jacinto appeared in front of him on the roadway. He said he could not stop in time to avoid the accident.

The name of the driver has not been released. The accident is under investigation by the Department of Public Safety. The Marion County Sheriff's Office assisted at the scene.

Write your observations here

Student Handout: Activity 2 - News Story 3

NEWS

Woman struck by vehicle on Franklin Avenue succumbs to her injuries Tuesday evening

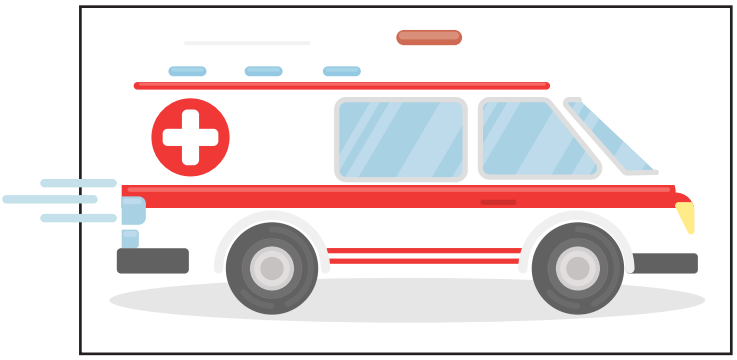
GREENVILLE — A pedestrian who was struck by a vehicle while crossing a poorly lit area on Franklin Avenue Monday night succumbed to her injuries after being transported to a local hospital.

Police report the crash occurred on Franklin Avenue between Lassen Drive and Interstate 75 at about 8:15 p.m. when a 42-year-old woman walking south across Franklin Avenue was struck by a 2009 Ford truck driven by an 18-year-old man who was traveling east on Franklin.

The woman was attempting to cross the road in the middle of the block and was not using a marked crosswalk, police say.

The driver of the pickup truck remained on scene following the crash and was cooperative with police.

Alcohol or excessive speed are not considered to be contributing factors in the crash. The incident is still under investigation by Greenville police but, at this time, no charges are expected in this case.



Greenville police, fire and ambulance responded to the scene. The woman was transported to Greenville Regional Medical Center where she was pronounced dead shortly after arrival.

The name of the victim will be released once her family has been notified, police said.

Write your observations here

Student Handout: Activity 2 - News Story 4

NEWS

Pedestrian injured by SUV driver on Williams Highway at Lebanon Pass Road

LANGSTON — A crash involving a pedestrian has closed Williams Highway at Lebanon Pass Road, according to Langston police.

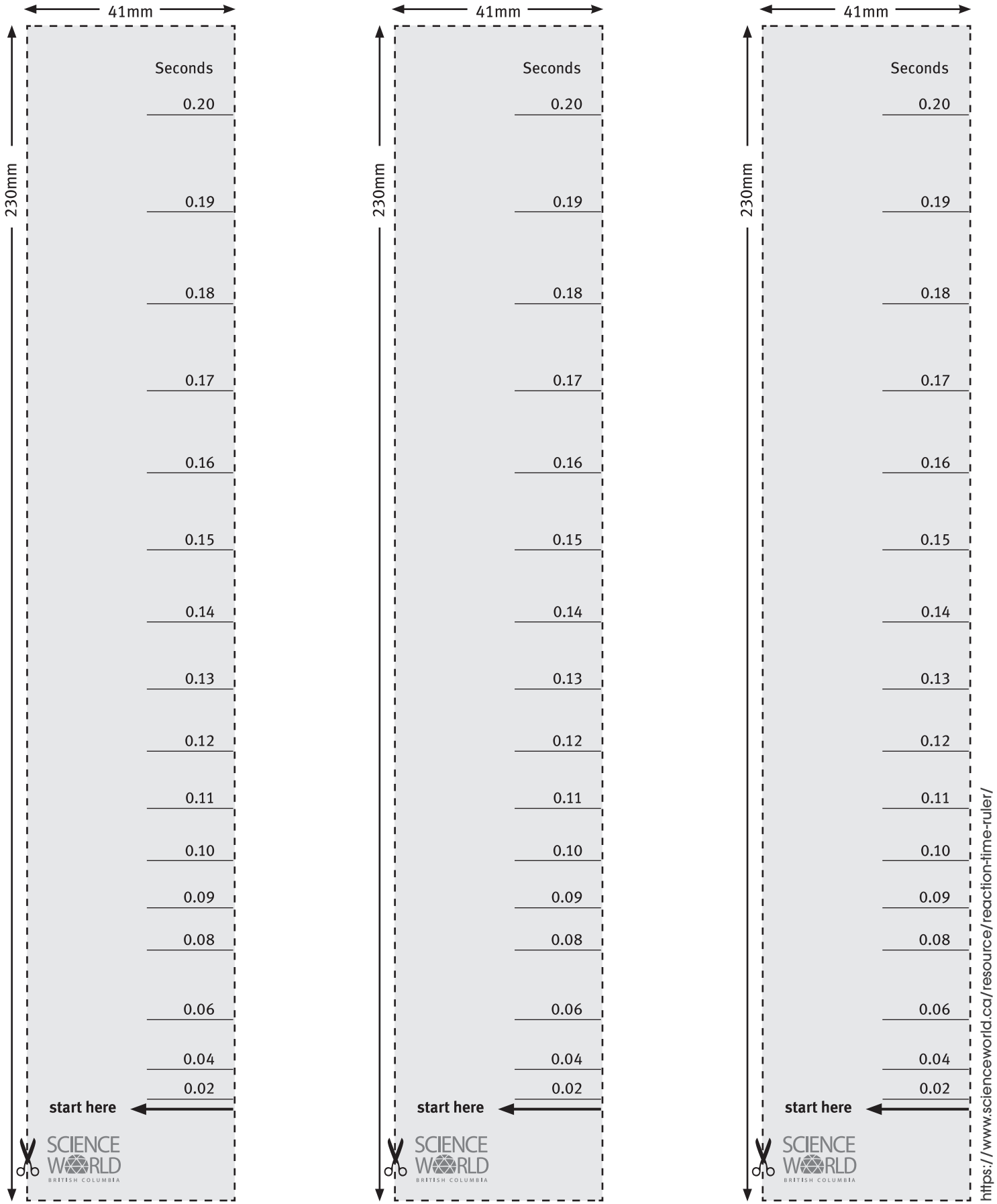
A woman was in a crosswalk when she was hit by a man in an SUV turning right onto Williams Highway. The driver administered first aid until police and the Rock County Emergency Medical Services arrived at the scene. The pedestrian suffered serious injuries and was taken to a hospital.

Speed and alcohol are not factors, police said. The police did not comment on whether they thought driver distraction was a factor, but they mentioned that the pedestrian was wearing dark clothing. The incident remains under investigation.

A detour has been established on Turner Avenue from 50th to 125th. Police ask that you avoid the area.

Write your observations here

Student Handout: Activity 4 - Reaction Timer



41mm
230mm
Seconds
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SCIENCE WORLD
BRITISH COLUMBIA

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SCIENCE WORLD
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https://www.scienceworld.ca/resource/reaction-time-ruler/

Instructor Handout: Activities 5 & 6 - Stopping Sight Distance

Note to Lesson Leader: There are 12 handouts, each with a unique combination of velocity and deceleration rate (see key below). If you have more than 12 students, duplicate handouts will allow students to see during Activity Part 6 how different reaction times result in different stopping distances while holding other variables constant.

Handout Key

Velocity	Deceleration Rate		
	20 ft/s	11.2 ft/s	2 ft/s
20 mi/hr	Handout 1	Handout 2	Handout 3
30 mi/hr	Handout 4	Handout 5	Handout 6
40 mi/hr	Handout 7	Handout 8	Handout 9
50 mi/hr	Handout 10	Handout 11	Handout 12

Sample Solution (for parameters on Handout 5)

$SSD = vt + (v^2/30(a/g))$

v = 30 mi/hr x 1.47

= 44.1 ft/s²

t = assume 0.15 seconds

SSD = 44.1 x 0.15 + (44.1² / 30 (11.2/32.2))

= 6.6 + (1944.8 / 30 (0.35))

= 6.6 + (1944.8 / 10.4)

= 6.6 + 187

SSD = 193 feet

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 1

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 20 miles per hour and with a deceleration rate of 20 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **20 feet per second would be an urgent stop in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is so abrupt that it may not be comfortable for passengers**. Regardless of the velocity, this means that your driver is decelerating the vehicle **20 feet per second for each second** that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 2

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 20 miles per hour and with a deceleration rate of 11.2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **11.2 feet per second would be braking action in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is comfortable for the driver and passengers even on wet pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **11.2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 3

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 20 miles per hour and with a deceleration rate of 2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **2 feet per second would be braking action in a truck that is comfortable for the driver and passengers on dry pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 4

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 30 miles per hour and with a deceleration rate of 20 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **20 feet per second would be an urgent stop in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is so abrupt that it may not be comfortable for passengers.** Regardless of the velocity, this means that your driver is decelerating the vehicle **20 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 5

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 30 miles per hour and with a deceleration rate of 11.2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **11.2 feet per second would be braking action in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is comfortable for the driver and passengers even on wet pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **11.2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 6

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 30 miles per hour and with a deceleration rate of 2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **2 feet per second would be braking action in a truck that is comfortable for the driver and passengers on dry pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 7

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 40 miles per hour and with a deceleration rate of 20 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **20 feet per second would be an urgent stop in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is so abrupt that it may not be comfortable for passengers.** Regardless of the velocity, this means that your driver is decelerating the vehicle **20 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 8

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 40 miles per hour and with a deceleration rate of 11.2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **11.2 feet per second would be braking action in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is comfortable for the driver and passengers even on wet pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **11.2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 9

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 40 miles per hour and with a deceleration rate of 2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **2 feet per second would be braking action in a truck that is comfortable for the driver and passengers on dry pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **2 feet per second for each second** that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 10

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 50 miles per hour and with a deceleration rate of 20 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **20 feet per second would be an urgent stop in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is so abrupt that it may not be comfortable for passengers.** Regardless of the velocity, this means that your driver is decelerating the vehicle **20 feet per second for each second** that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 11

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 50 miles per hour and with a deceleration rate of 11.2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **11.2 feet per second would be braking action in a standard passenger vehicle (example: 4-door car, minivan, small pick-up truck) that is comfortable for the driver and passengers even on wet pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **11.2 feet per second for each second** that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area

Student Handout: Activities 5 & 6 - Stopping Sight Distance Handout 12

Now that you have measured your average reaction time, you will use that number to calculate stopping sight distance (SSD).

$$SSD = vt + (v^2/30(a/g))$$

Your assignment is to calculate SSD for a vehicle traveling 50 miles per hour and with a deceleration rate of 2 feet per second using the equation above.

Key:

v = velocity (definition: the speed and direction of motion of an object). In your case, this will be the velocity the vehicle is traveling when the brakes are applied. Convert your assigned velocity to feet per second by multiplying by a conversion factor of 1.47.

t = time to perceive the need to stop (your average reaction time from the ruler drop test)

a = driver deceleration of the vehicle. Deceleration is a complex variable that depends on factors such as the weight to power ratio of the vehicle, pavement conditions, and the urgency with which the driver applies the brakes. **2 feet per second would be braking action in a truck that is comfortable for the driver and passengers on dry pavement.** Regardless of the velocity, this means that your driver is decelerating the vehicle **2 feet per second** for each second that passes until the vehicle comes to a stop.

g = acceleration of gravity, 32.2 ft/s^2

Work area