



M-19 Crash Testing DVD

Viewing Tips and Instructions

Total Run Time: 9:39 min.

Important Note to Instructors:

Realize that this subject material may be sensitive to students who have been in vehicle accidents or known friends or family injured or killed in accidents. It is recommended that teachers discuss this ahead of time so that students may approach teachers in private with particular concerns.

Instructional Tips: (Ideas for Viewing, Journaling, or Assessment)

- While viewing a particular clip ask the students to explain
 1. how the clip illustrates Newton's First Law of Motion, and
 2. how the clip illustrates the concept of pressure (particularly for clips involving seatbelts.)
- Remind students that the clay passenger and wooden vehicle are separate objects. Newton's First Law is applied to each object individually. Although the head and body are connected by the neck, the clips also show how they generally behave as independent masses.
- The concept of "inertia" may also be used to explain the motion of the clay passengers. Help the students realize that inertia is a property of matter and is not a force.
- Ask the students to suggest improvements that could be made to reduce injuries of the clay passengers (i.e. head rests, seatbelts, etc.)
- How do the clips illustrate motion concepts (especially acceleration)? Use the clips to introduce Newton's Second Law of Motion by asking students to identify the forces causing the acceleration.

Assessment Tip:

If viewing equipment is readily available, ask students to analyze one or more clips as part of a quiz or test.

Technical Information/DVD Viewing Information

The DVD contains 12 video clips filmed using a digital camera. Most clips were filmed using a shutter speed of 1000 frames/s. Clips were edited using iMovie 3.0. Each video clip is shown in real time so that students can appreciate the small time frame in which the collisions take place. Some of these time frames are noted in the clip index. Following the real time clip, a succession of still clips allows for "frame-by-frame" analysis just before and after the collision. Using a DVD remote control to pause and slow video adds additional flexibility.

Crash Clip Index

Bus and Car Collisions

1. Real Time Crash: Bus and Car Collision/Whiplash
2. Anatomy of a Crash: Bus and Car Collision/Whiplash

Notes: Ratio of bus mass to car mass is approximately 3:1 (Car passenger constructed from featherweight modeling clay.) Contact time between bus and car < .01s. Full whiplash (head upright to horizontal) occurs in .01s following impact. A head rest could help reduce injury.

3. Real Time Crash: Bus and Car Collision #1/Effect on Bus and Car Passengers
4. Anatomy of A Crash: Bus and Car Collision #1/Effect on Bus and Car Passengers

Notes: Ratio of bus mass to car mass is approximately 2:1 (Car passenger constructed from regular non-hardening modeling clay.)

Viewing Tip: Ask students to focus on the position of the head of the car driver in relation to the vertical black line. Students will notice that the head stays stationary at the beginning of the impact demonstrating inertia for an object at rest.

5. Real Time Crash: Bus and Car Collision #2/Effect on Bus and Car Passengers
6. Anatomy of A Crash: Bus and Car Collision #2/Effect on Bus and Car Passengers

Viewing Tip: Now ask students to focus on the position of the heads of the bus passengers before and after impact. Students will notice that the heads continue to move forward when the bus is slowed due to the impact with the car demonstrating inertia for objects in motion.

7. Real Time Crash: Bus and Car Collision #3/Side Impact/No Lapbelt
8. Anatomy of A Crash: Bus and Car Collision #3/Side Impact/No Lapbelt

Notes: Again, ask students to focus on the position of the head of the driver in relation to the vertical black line. A dramatic demonstration of inertia of a stationary object. Also observe the effect of not wearing a seatbelt - driver slides from under shoulder belt.

Car Collisions with Stationary Barrier

9. Real Time Crash: Front Impact/No Seatbelt #1
10. Anatomy of A Crash: Front Impact #1/No Seatbelt #1

Note: Contact time between car and barrier < .01s. Time between impact of car and impact of passenger on the barrier approximately .02 s. Striking example of the inertia of an object in motion.

11. Real Time Crash: Front Impact/No Seatbelt #2
12. Anatomy of A Crash: Front Impact/No Seatbelt #2

13. Real Time Crash: Front Impact/Lapbelt only
14. Anatomy of A Crash: Front Impact/Lapbelt only

- 15. Real Time Crash: Front Impact/Lap and Shoulder Belts
- 16. Anatomy of A Crash: Front Impact/Lap and Shoulder Belts

Note: The seatbelts provide the unbalanced force to slow the passenger. However, the head continues to move forward and whiplash in the neck is observed.

- 17. Real Time Crash: Front Impact/Loose Seatbelt
- 18. Anatomy of A Crash: Front Impact/Loose Seatbelt

- 19. Real Time Crash: Front Impact/Wire Seatbelt
- 20. Anatomy of A Crash: Front Impact/Wire Seatbelt

Note: Compare the injuries sustained from to the wire seatbelt to those from ribbon seatbelt (Clips 15-16) due to the differences in pressure. (Assuming other variables stay about the same in the two situations.)

- 21. Real Time Crash: Front Impact/Seatbelts Fail
- 22. Anatomy of A Crash: Front Impact/Seatbelts Fail

- 23. Real Time Crash: Front Impact/Head & Body Not Connected
- 24. Anatomy of A Crash: Front Impact/Head & Body Not Connected

Note: Although the car, body, and head move together as the car moves down the ramp, they behave independently when upon impact with the barrier.