

Distal Lower Extremity Fractures

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San Diego CIREN Lower Extremity Incidence Rates

- Total Number of SD Cases in CIREN database = 142 (1996 - 1999)
- 56 Patients with leg fxs
 - 39% of SD Cases have leg fxs

San Diego CIREN Lower Extremity Incidence Rates

- 75% of patients with leg fxs had lower leg fxs (42)
- 52% of all patients with lower leg fxs were distal (22)

Distal Lower Extremity Fx Demographics

- Survival rate for all patients with ankle fractures was 90%
- 26% of the patients with ankle fractures had bilateral fractures
- 65% involved cars 1995 and newer

Distal Lower Extremity Fx Demographics

Type of Impact

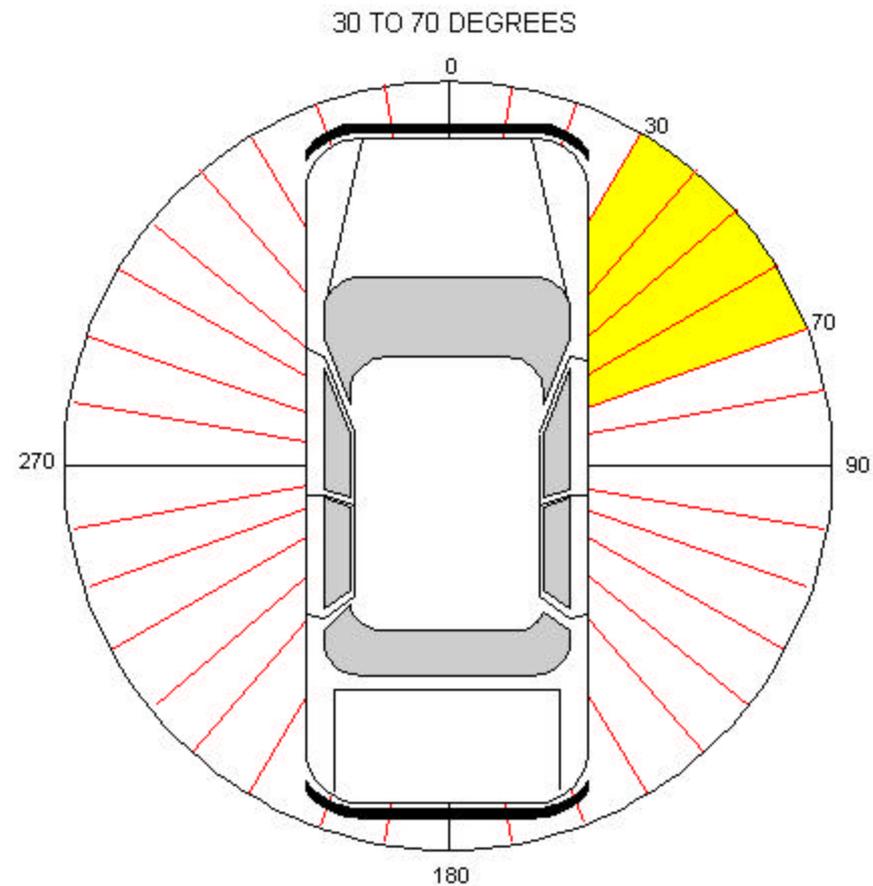
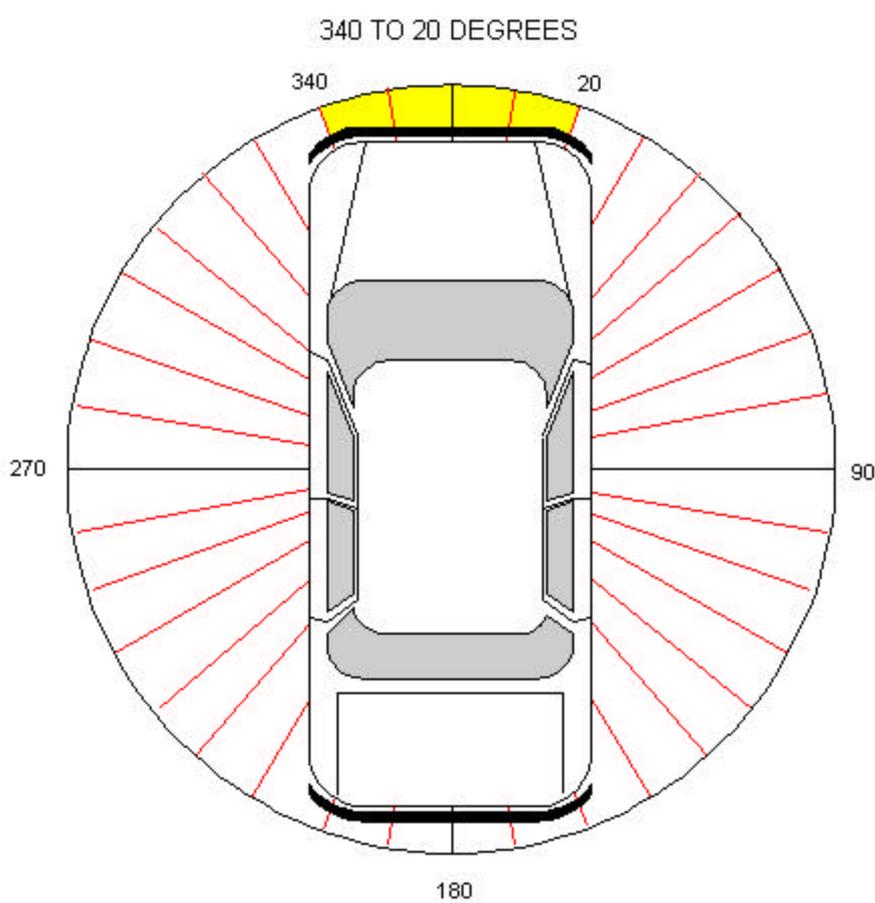
- 74% of the cases involved a barrier-type impact
- 26% of the cases involved a narrow impact

Distal Lower Extremity Fx Demographics

PDOF

- 85% of the cases had a PDOF between 340° and 20°
- 15% of the cases with PDOF between 30° and 70°

Principle Direction of Force



Distal Lower Extremity Fx Demographics

Toe Pan Intrusions

- 32% cases with no intrusion
- 26% cases with ≤ 20 cm.
- 26% cases with 21 to 40 cm.
- 16% cases with >40 cm.

Distal Lower Extremity Fractures

**San Diego CIREN
Case Presentation**

Case #1



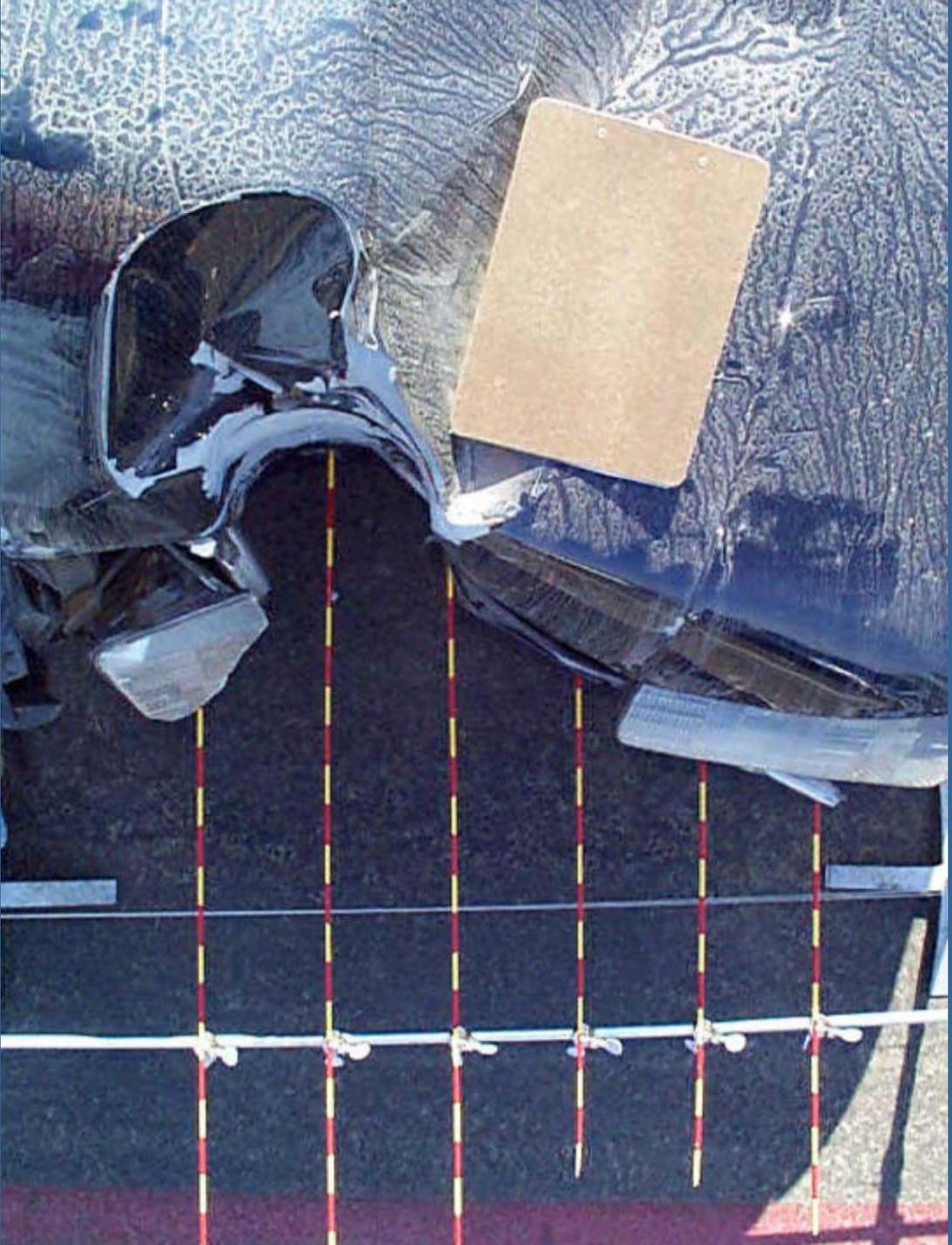
V1 - 1995 Saturn
4-door





Vehicle Data

- 1995 Saturn SL2
- Narrow Impact
- CDC: 12FZEN3
- Maximum Crush: 50 cm
- BES: 37km/hr 23m/hr
- Relevant Intrusions: None
- Patient contacts: Center console
(plastic panel deformed)







Vehicle Occupant

- 44 year old female
- Short stature - 5 feet, 130 pounds
- Right front passenger
- Possibly out of position
 - No recall of crash
 - Probably sleeping - no concussion, GCS=15 on scene

Patient Injuries

- Chest contusions
- Bilateral knee abrasions
- Left femoral condyle fracture
- Left comminuted, angulated, distal, tibia and fibula fractures
- Left patellar dislocation

The Shoes





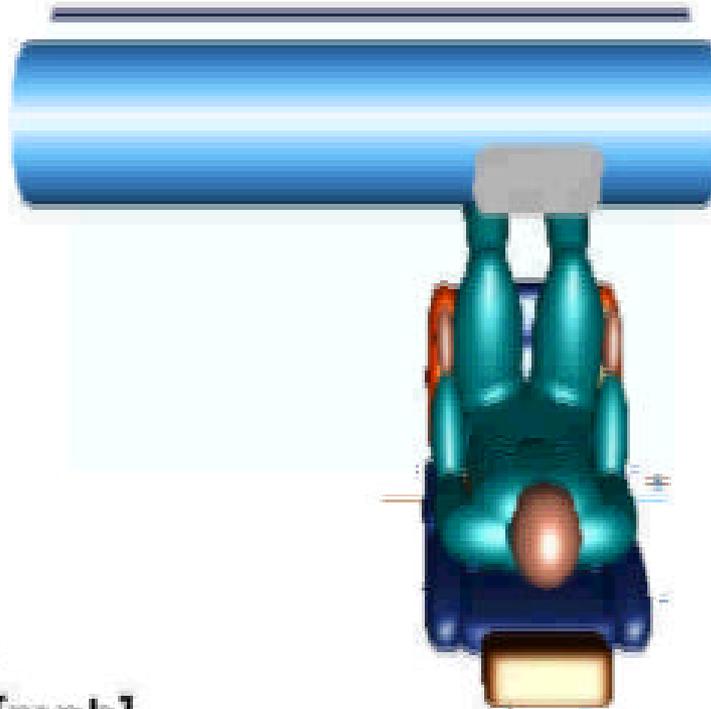
Injury Analysis

- Chest Contusions: Airbag/Direct
- Knee abrasions: Glove Box/
Direct
- L Patellar dislocation: Lower IP/
Direct
- L Femoral condyle: Lower IP/ Indirect
- L Distal tibia & fibula: Toe pan/Indirect

Patient Outcome

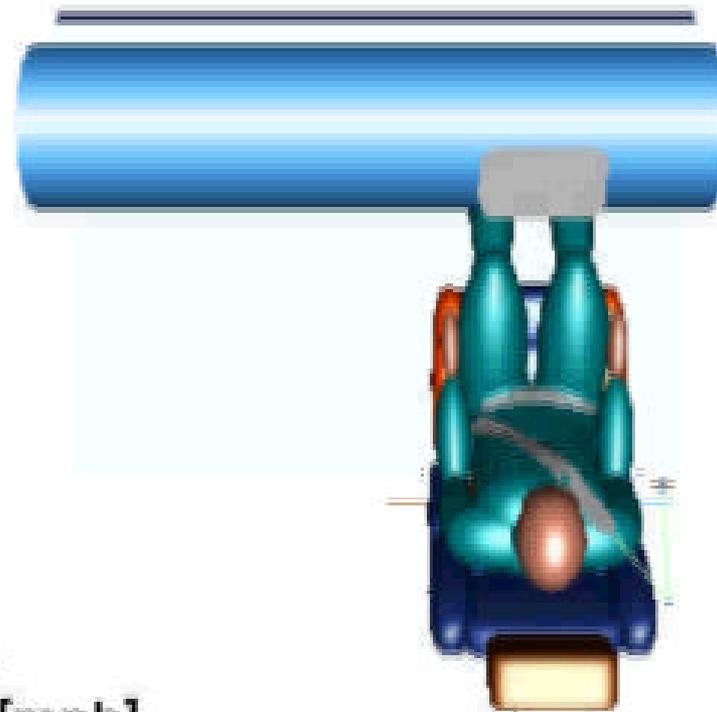
- Distal Tibia/Fibula fx - good outcome expected with few complications

Slow, overhead
unbelted



$t = 0.10$ s
 $v_1 = 23.5$ [mph]
 $v_2 = 0.0$ [mph]

Slow, overhead, belted



$t = 0.10 \text{ s}$
 $v_1 = 23.5 \text{ [mph]}$
 $v_2 = 0.0 \text{ [mph]}$

Slow, moderate,
unbelted



$t = -0.10$ s
 $v_1 = 23.5$ [mph]
 $v_2 = 0.0$ [mph]

Slow, moderate,
belted

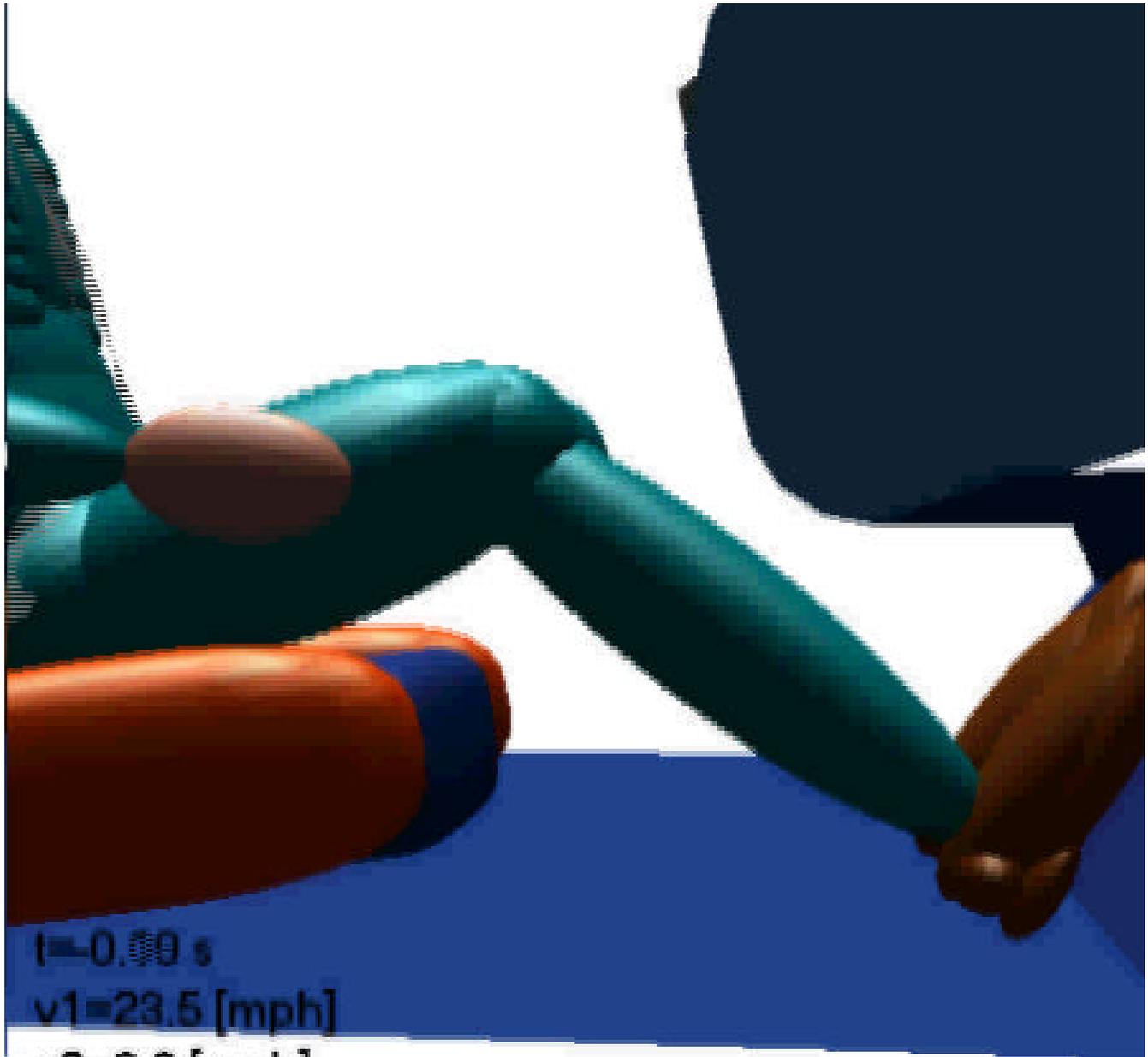


$t=0.10$ s

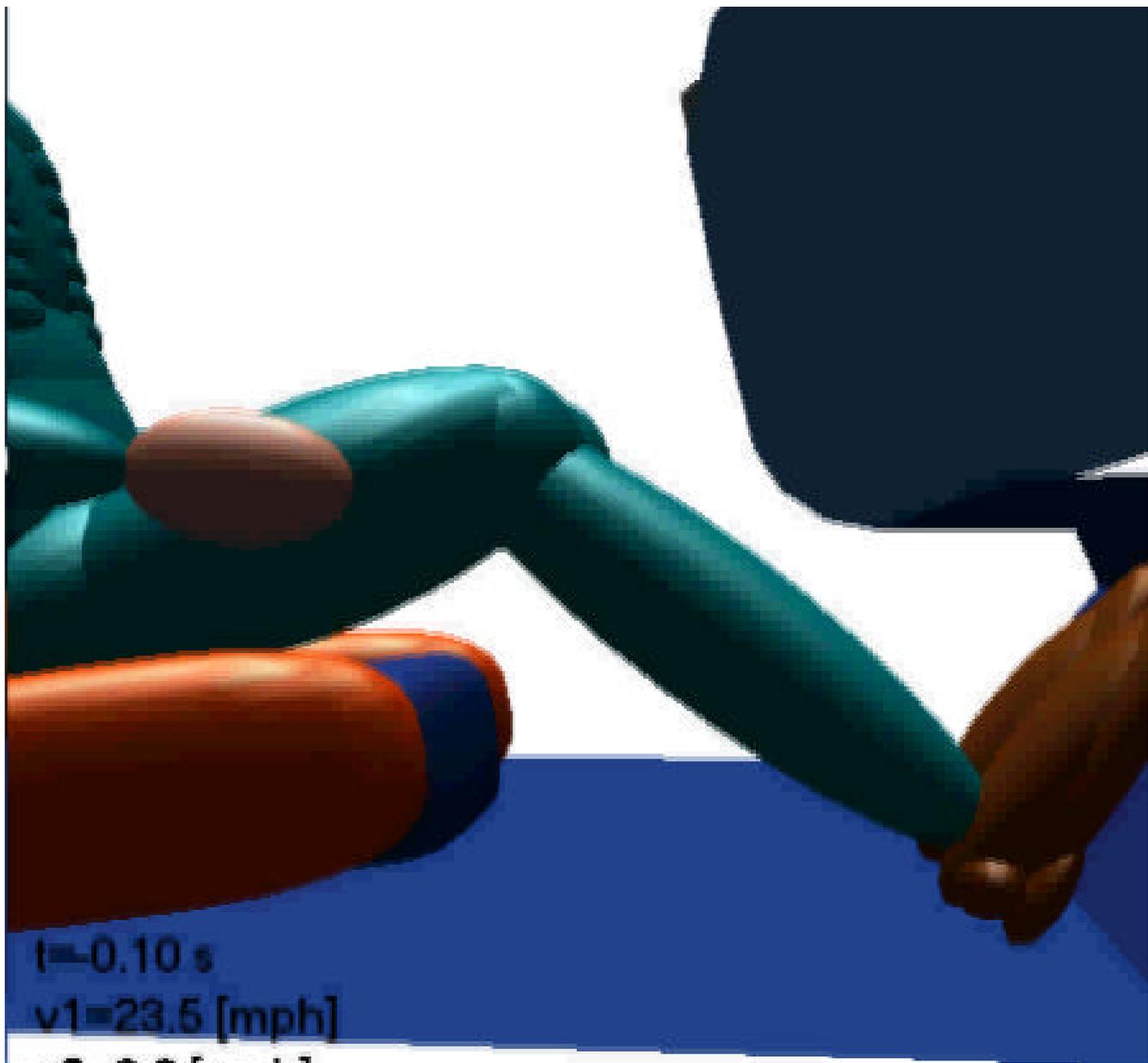
$v1=23.5$ [mph]

$v2=0.0$ [mph]

Fast, close,
belted



Slow, close,
unbelted

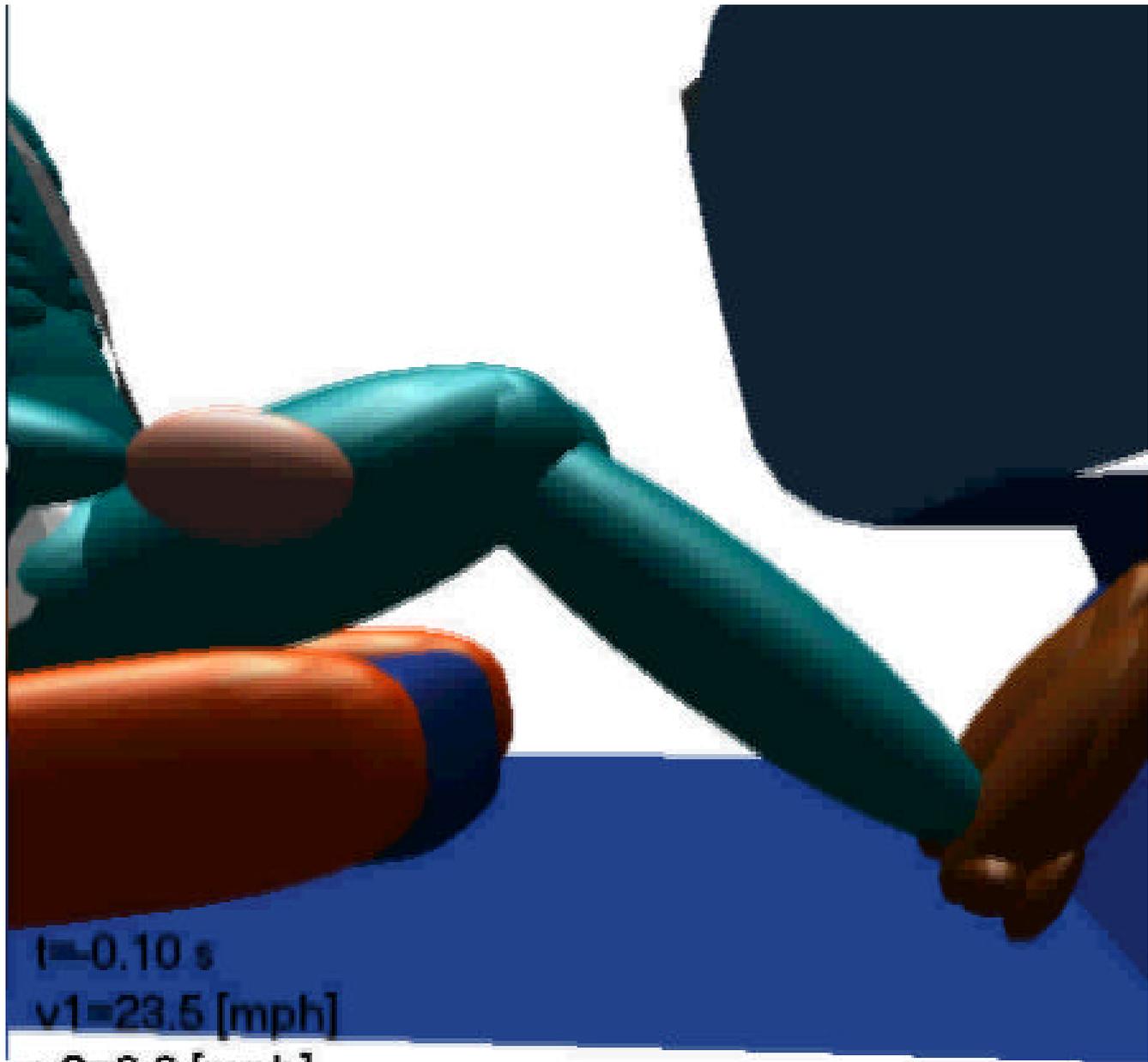


$t=0.10$ s

$v_1=23.5$ [mph]

$v_2=0.0$ [mph]

Slow, close
belted



$t = -0.10 \text{ s}$

$v_1 = 23.5 \text{ [mph]}$

$v_2 = 0.0 \text{ [mph]}$

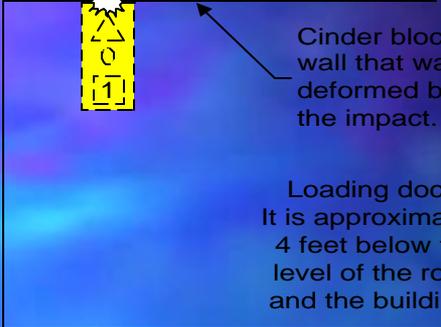
Distal Lower Extremity Fractures

San Diego CIREN
Case Presentation

Case #2



Building

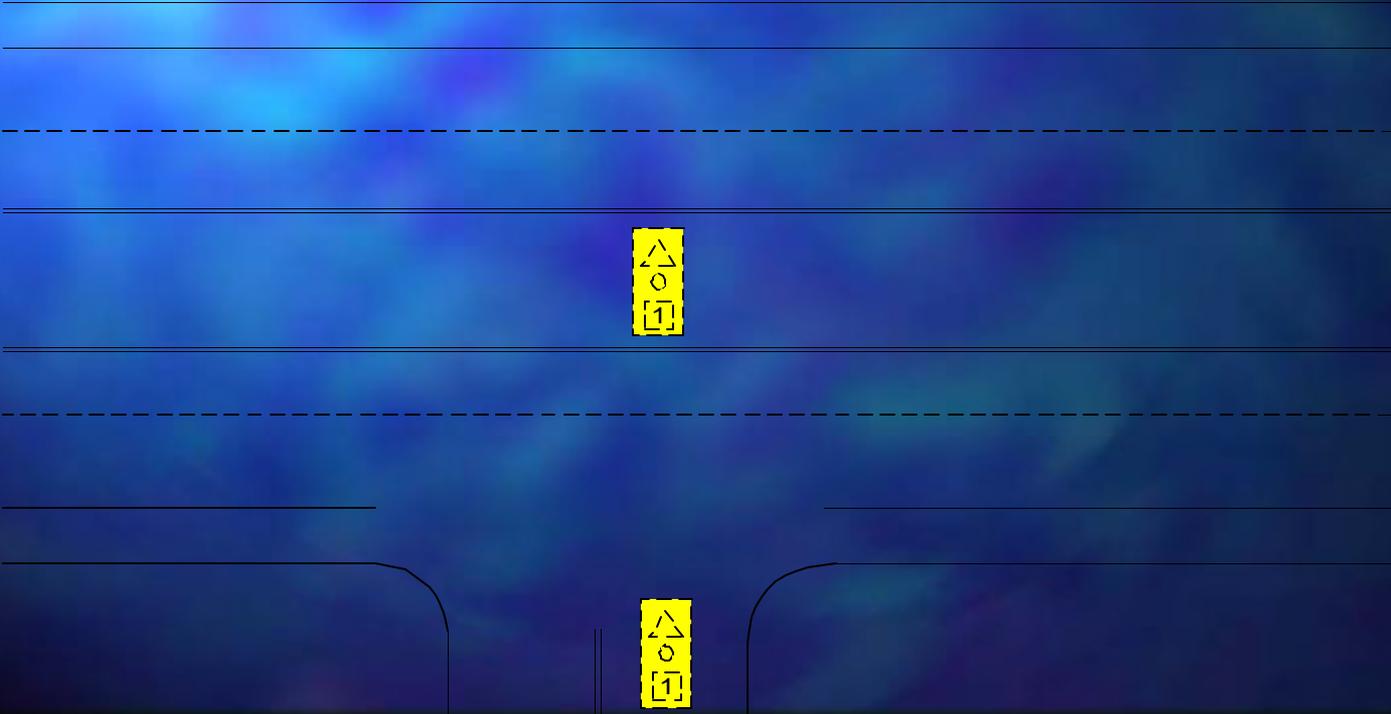


Cinder block wall that was deformed by the impact.

Loading dock.
It is approximately 4 feet below the level of the road and the building.



V1 - 1997 Ford Taurus







Vehicle Data

- 1997 Ford Taurus
- Barrier Impact
- CDC: 12FDEW4
- Maximum Crush: 96 cm
- BES: 99km/hr 62m/hr
- Relevant Intrusions: Steering assembly, IP, Toe Pan, Floor Pan, A-Pillar
- Contacts: SW, Knee bolster, shoe wedged in intrusion





Vehicle Occupant

- 41 year old male
- 5 feet eight inches, 190 pounds
- Driver
- Lap & Shoulder, Airbag Deployment

Patient Injuries

- Sternal fx with pneumothorax
- R distal femur & acetabular fxs
- L distal femur fx
- L distal fibula fx & ankle ligament disruption
- R comminuted calcaneus and 2nd & 3rd metatarsal fxs (at base)
- Contusions - chest and bilateral hands

Injury Analysis

- R & L femur fx:
 - Knee bolster/Compression/Bending
- Acetabular fx:
 - Knee bolster/Compression
- L distal fibula fx & ankle ligament:
 - Toe pan/Torsion & Bending
- R calcaneus & metatarsals:
 - Toe pan/Compression

Patient Outcome

- Calcaneus fx - common fx with high rate of complications and poor prognosis
- Ankle fx - minor injury with good outcome expected

Summary

- Distal lower extremity fxs have a spectrum of injuries & prognoses
- Torso can be restrained/positioned
- Lower extremity injuries may be affected by:
 - Intrusions
 - Foot tension - braced vs. relaxed
 - Foot position / proximity to pedals
 - Type of footwear
 - Body position

Conclusions

- Solutions to decrease injury incidence will be complex
- May require measures to limit intrusion
- May not be a single-mechanism solution
- May reflect additional padding and/or eliminate firmness