NHTSA'S PCAM TESTING AND DUMMY DEVELOPMENT

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Friday Session (Pedestrian and Child Safety)

PCAM Validation Testing

- Discuss preliminary PCAM results from testing production level vehicles and engineering prototypes.

This Session

- Test Maneuvers (Scenarios)
- Test Apparatus (Motion Control)
- Test Mannequin Development

PCAM – Pedestrian Crash Avoidance/Mitigation

NHTSA Initiated PCAM Research in 2011

Volpe –

- Crash analyses and assess the potential safety benefits of PCAM technology
- Completed
- Final Report – Pending NHTSA Review (FY14 – 2nd Quarter)

CAMP – GM, Ford, Mercedes-Benz, Continental, and Delphi

- Develop preliminary test methods (Scenarios, Mannequins, Control, etc.)
- Completed
- Final Report - Pending NHTSA Review (FY14 – 2nd Quarter)

NHTSA Internal Research – (ongoing)

- Baseline PCAM equipped production vehicles.
- Further Refinement of Test Scenarios, Mannequins, Motion Control, etc.
- Development of Objective Test Procedures

4,432 Pedestrian Fatalities (14% of total fatalities)

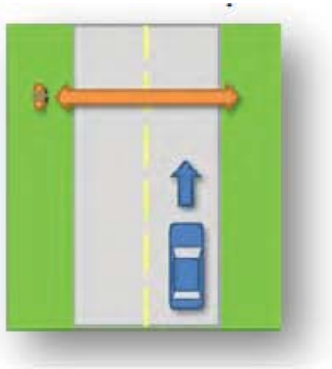
Pedestrians Killed	2010 (% Killed)	2011 (% Killed)
Rural	27%	27%
Urban	**73%**	**73%**
Intersection	21%	19%
Non-Intersection	**68%**	**70%**
Other	10%	10%
Daytime	32%	30%
Nighttime	**68%**	**70%**
Clear/Cloudy	**88%**	**88%**
Rain	9%	9%
Snow	1%	1%
Fog	1%	1%

Test Scenarios
Volpe Analysis – (2005–2009 GES Data)

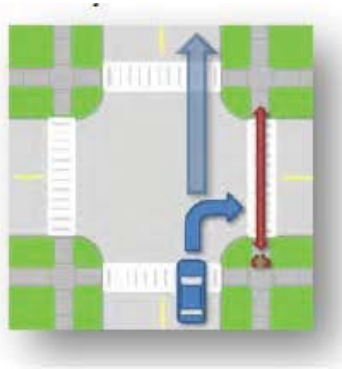
Top 20 pre-crash scenarios by functional years lost (FYL) can be grouped into 4 general scenarios (N = 139,000 Crashes)

Scenario	Cases	% Total FYL	Fatalities	%Fatalities ** (67% of the top 20 scenarios)
S1	115,000	84%	7,000	88%
S2	2,000	1%	16	<1%
S3	9,000	1%	0	0%
S4	13,000	10%	1,000	12%

S1

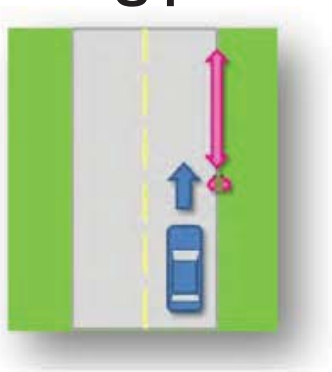


S2



S3

S4



** Note: Top 20 Scenarios represent 67% of estimated pedestrian fatalities

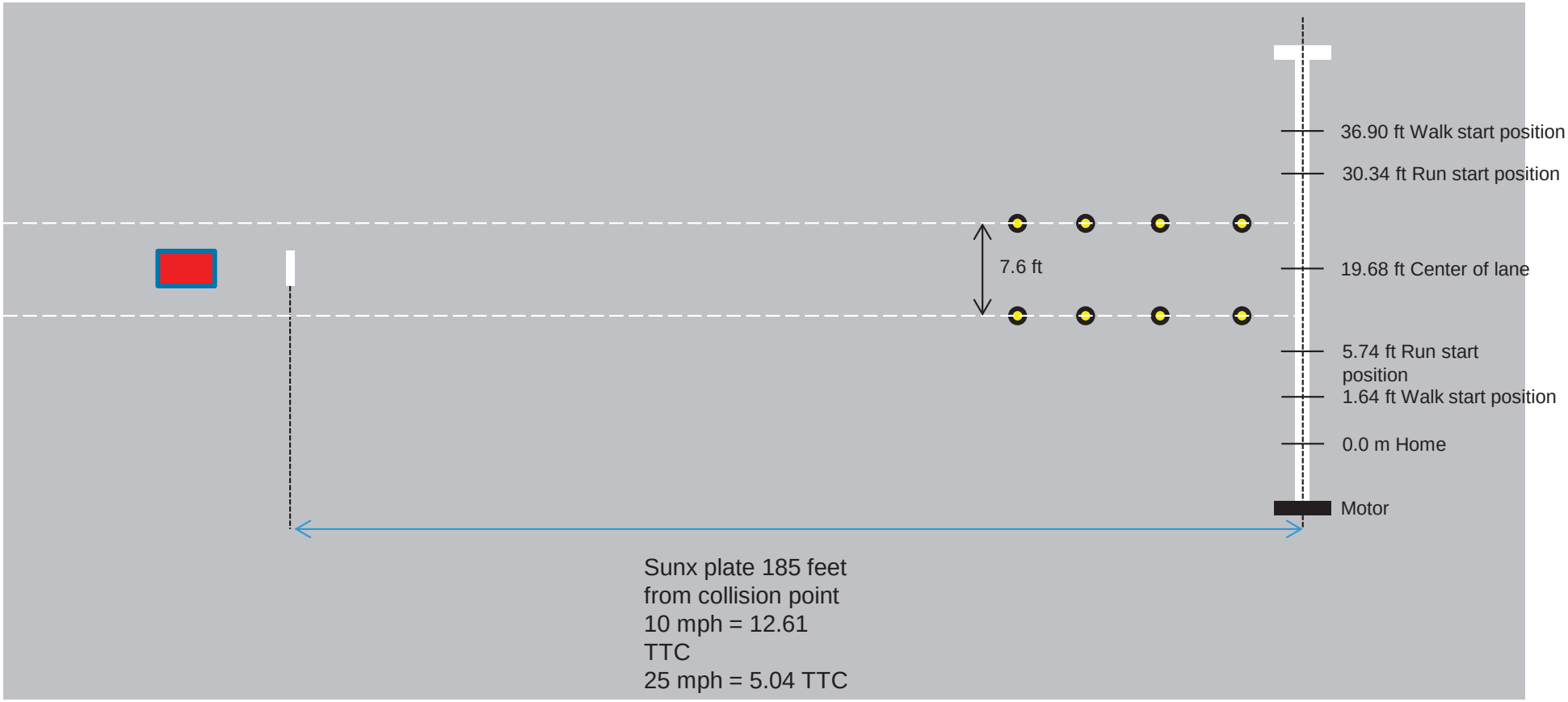
Test Matrix

	Pedestrian Direction				Light Conditions		Obstructions		Test Vehicle Speeds (mph)			Mannequin Speeds			PCAM Functions	
Test Scenarios	Right to Left	Left to Right	Toward Car	Away from Car	Day	Night	No	Yes	5	10	15/25	Static	Walk	Run	CIB	DBS
S1	x	x			x	x	x	x		x	x		x	x	x	x
S2		x			x		x		x	x			x		x	
S3	x	x			x		x		x	x			x		x	
S4			x	x	x		x			x	x	x	x	x	x	
S1-VRTC		x			x		x			x	x		x	x	x	
S4-VRTC			x	x	x		x					x	x	x	x	

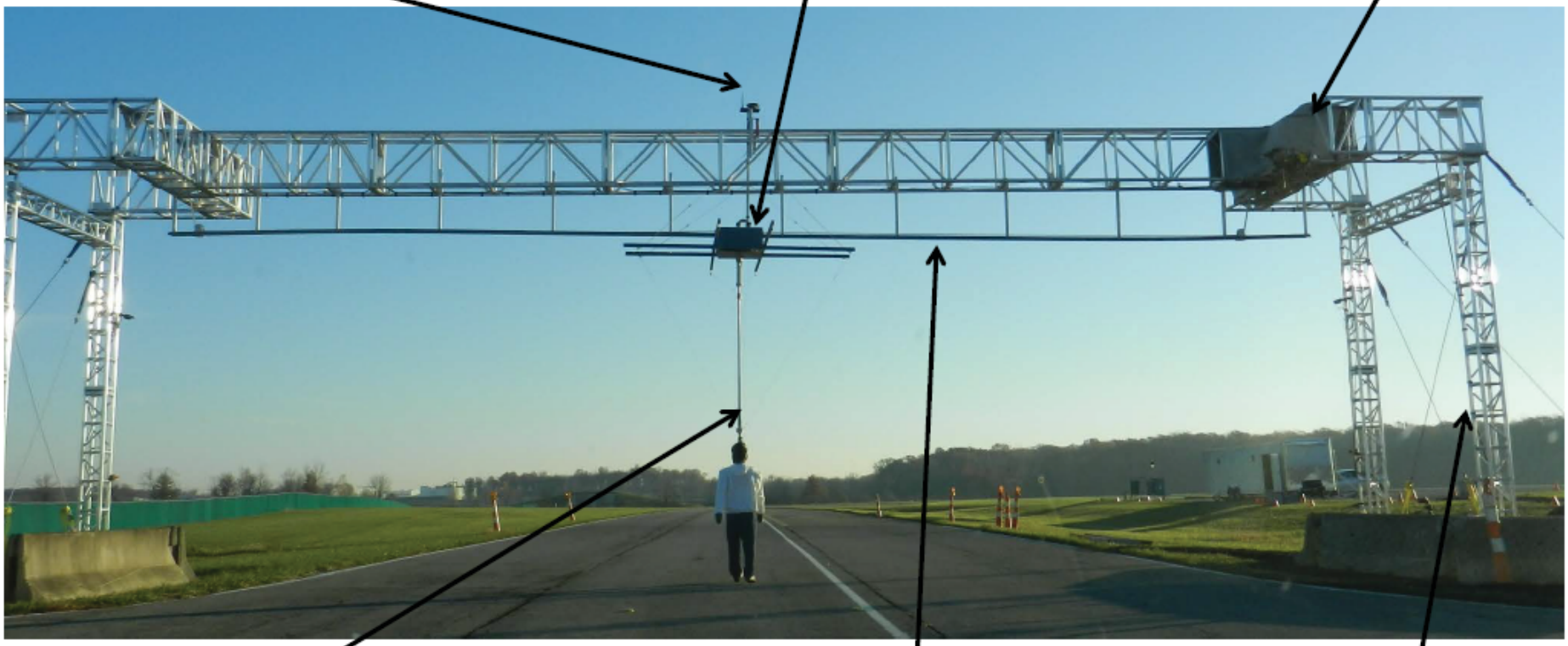
- Some vehicles did not perform all planned combinations due to observed sensing/performance limitations.
- Limited number of Dynamic Brake Support (DBS) tests were conducted.
- Conducted 7 different False Positive tests that will not be discussed today.

S1 Scenario


S1


36.90 ft Walk start position
30.34 ft Run start position
7.6 ft
19.68 ft Center of lane
5.74 ft Run start position
1.64 ft Walk start position
0.0 m Home
Motor
Sunx plate 185 feet from collision point
10 mph = 12.61 TTC
25 mph = 5.04 TTC

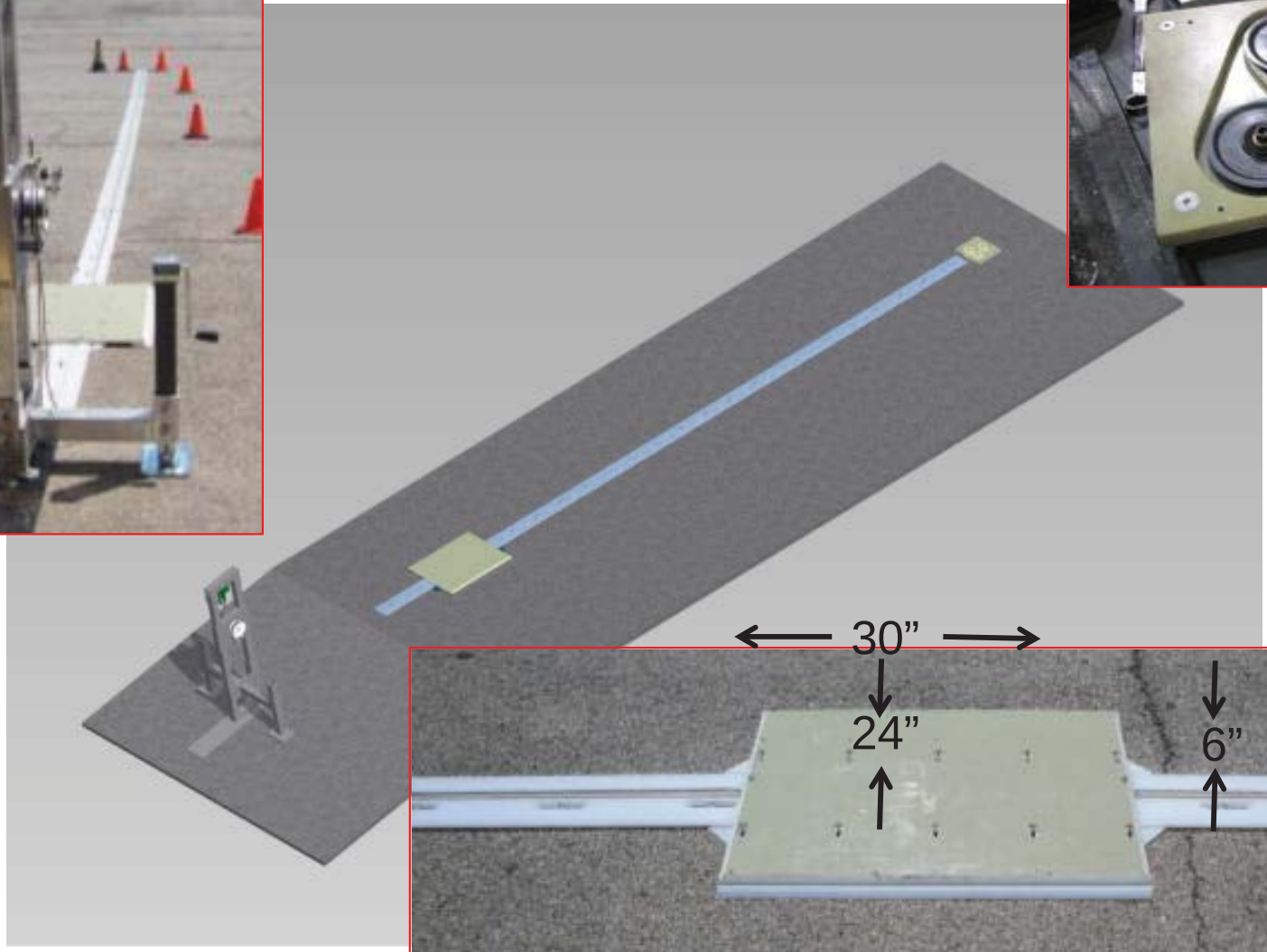
Overhead Setup



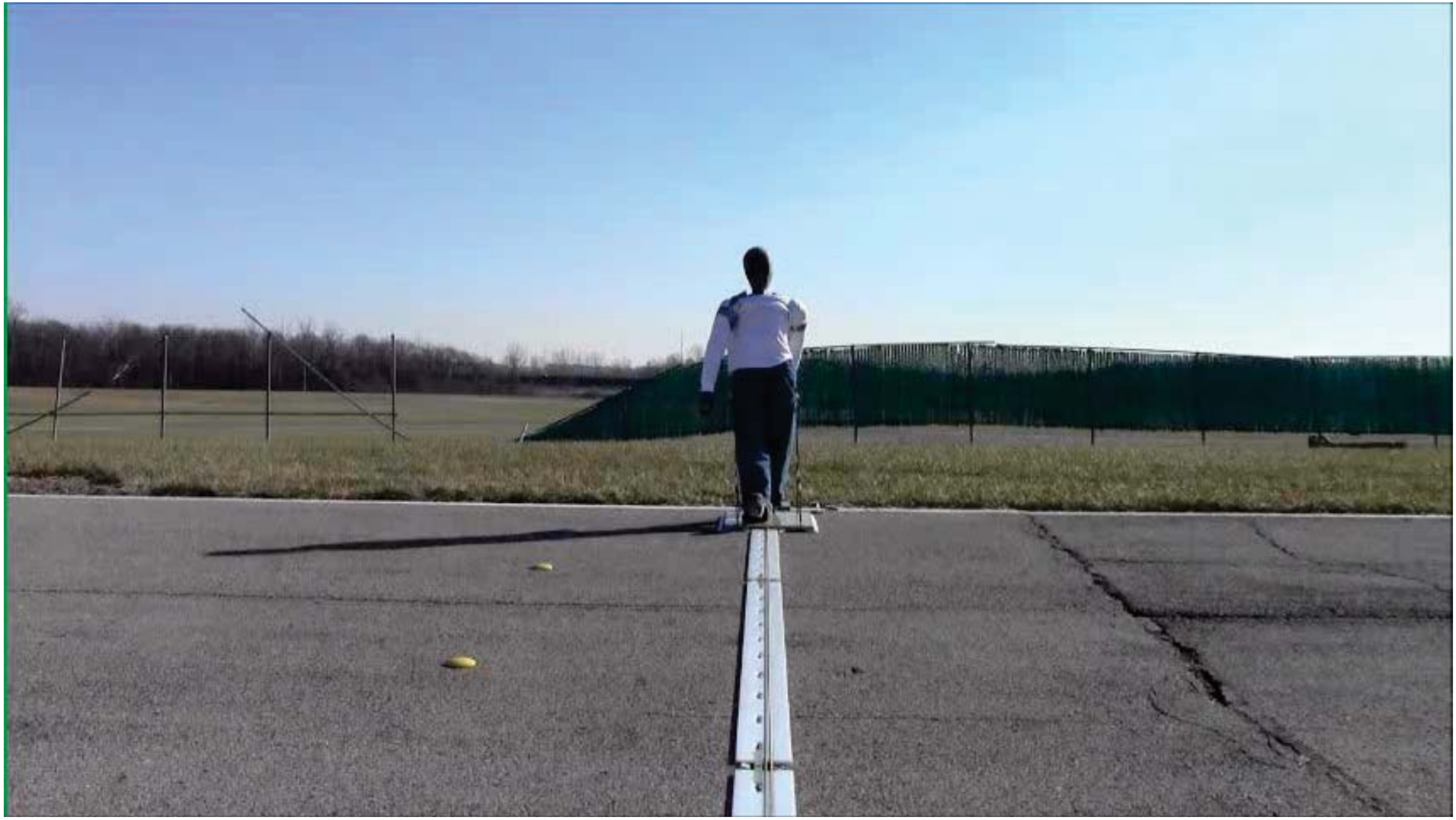
S1 Test – PCAM DISABLED
SV=16kph PedSpeed= 5kph

S1 Test
SV=16kph PedSpeed= 5kph

Ground Based Motion System



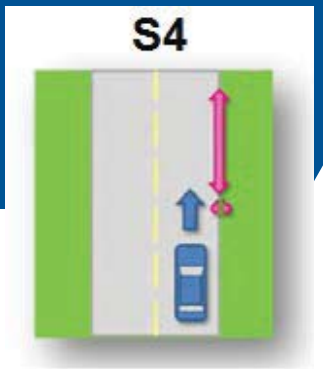
S1 Test
SV=16kph PedSpeed= 5kph

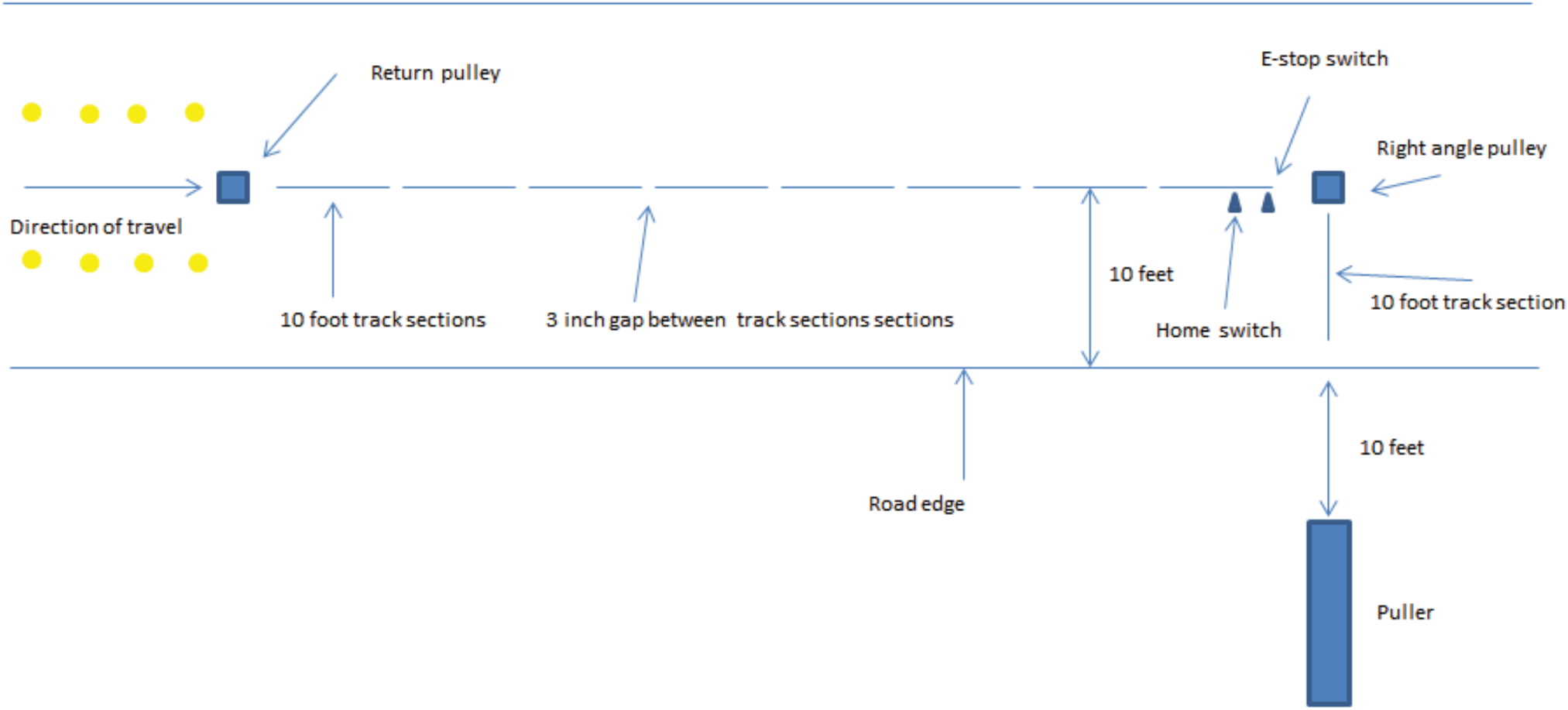


Non-Articulated Pedetrian Mount

S1 Test – NO PCAM
SV=40kph PedSpeed= 5kph

S4 Setup


S4


Return pulley
E-stop switch
Right angle pulley
Direction of travel
10 foot track sections
3 inch gap between track sections sections
10 feet
Home switch
10 foot track section
Road edge
10 feet
Puller

S4 Test
SV= 40kph PedSpeed= 5kph

S4 Test – DUSK/NIGHT
SV=40kph PedSpeed= 5kph

Mannequin Development

Ground Based vs. Overhead

Mannequin Characterization

Mannequin Attributes	Configurations Tested
Mannequin Shirt and Pant Colors	The following nine color combinations were evaluated (shirt/pants): 1. Dark Red / Blue 2. Dark Red / Beige 3. Dark Red / Black 4. White / Blue 5. White / Beige 6. White / Black 7. Yellow / Blue 8. Yellow / Beige 9. Yellow / Black
Arm Orientation	1. Both straight down 2. Both arms angled
Leg Orientation	1. Both Legs Straight (no spread) 2. Legs with Small Spread 3. Legs with Medium Spread 4. Legs with Large Spread
Pedestrian Direction	1. Pedestrian facing Left 2. Pedestrian facing Right 3. Pedestrian facing Towards 4. Pedestrian facing Away
Pedestrian Type	1. Adult mannequins PCAM #1 through #3 2. Adult mannequin, VRTC Test Rig #1 3. European display mannequin 4. Real human (close to 50% adult male)
Test Rig Mounting	1. PCAM rig with pole attachment 2. NHTSA platform base

Mannequin Characterization

1) Optical characteristics

- Clothing: white shirt and blue pants
- Extremities: arms angled, defined leg spread
- Orientations: facing to right or left, facing toward or away from vehicle
- Movement: crossing or parallel to vehicle path
- Mask provides facial features

2) Radar characteristics

- Radar reflectivity approximates 50% male adult

3) Noise factors*:

*Characteristics assessed under different environmental conditions to determine robustness to variation

- Three adult mannequins
- Time of day
- Weather conditions

Next Steps (CY 2014)

Mannequin Evaluation

- Non-Articulated Foam Mannequin
- 4a Non-Articulated Foam Mannequin
- Articulated Foam Mannequin
- TASI Articulated Mannequin with RADAR skin
- Others?

Child Mannequin Evaluation

- Non-Articulated Foam Child Mannequin
- 4a Non-Articulated Foam Child Mannequin
- TASI Articulated Child Mannequin with RADAR skin
- Others?

Further Refinement of S1 and S4 Test Procedures

- Position Accuracy and Control
- Offset Impact Tests

Testing Additional PCAM Equipped Vehicles

QUESTIONS?

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