

Evacuation Behaviors in Tsunami Drills



OKLAHOMA STATE UNIVERSITY



Chen Chen • Oklahoma State University, Fire and Emergency Management, chen.chen10@okstate.edu

Haizhong Wang • Oregon State University, School of Civil and Construction Engineering,

Lori Cramer • Oregon State University, School of Public Policy,

Dan Cox • Oregon State University, School of Civil and Construction Engineering,

Alireza Mostafizi • Oregon State University, School of Civil and Construction Engineering,



Challenges

Evacuation behaviors during tsunami such speed, route choice, decision, are difficult to study due to lack of data

Method

Using evacuation drills to collect spatial trajectories of evacuees by GPS embedded mobile devices to better understand evacuation behaviors and to improve tsunami evacuation preparedness and resilience

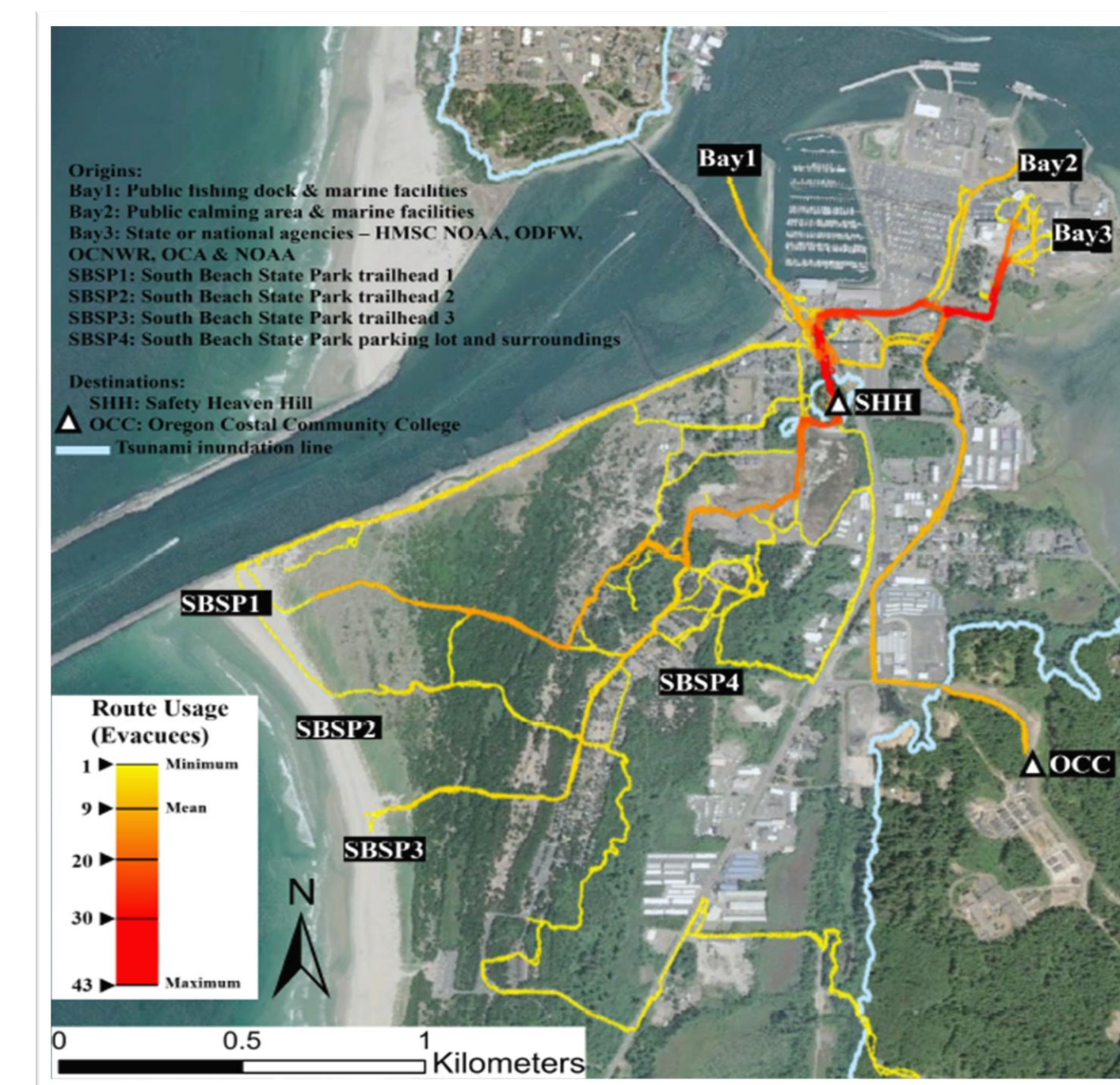
Takeaway

1. Empirical trajectory data;
2. People's walking speed during the evacuation drills;
3. Speed-slope relationship and to inform evacuation modeling and planning;
4. Evacuees' speed was significantly negatively associated with slope, time spent during evacuation, rough terrain surface, walking at night, and distance to destination;
5. Post-drill surveys revealed the importance of the drill as an educational and assessment tool;
6. The drill procedures, designs, and the use of technology in data collection provide evidence-driven solutions to tsunami preparedness and inspire the use of drills in other types of disasters such as wildfires, hurricanes, volcanoes, and flooding.

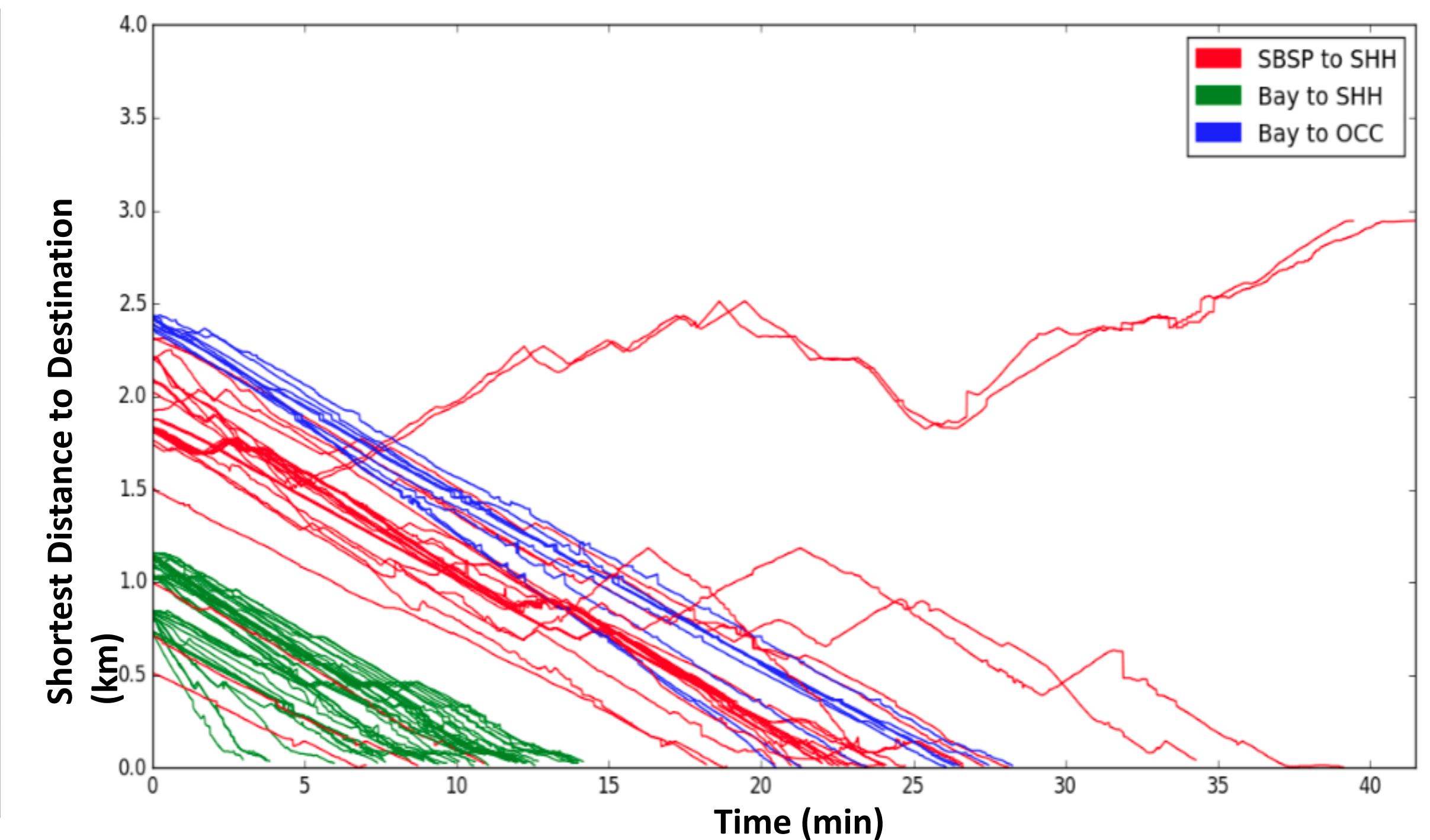
DATA COLLECTION



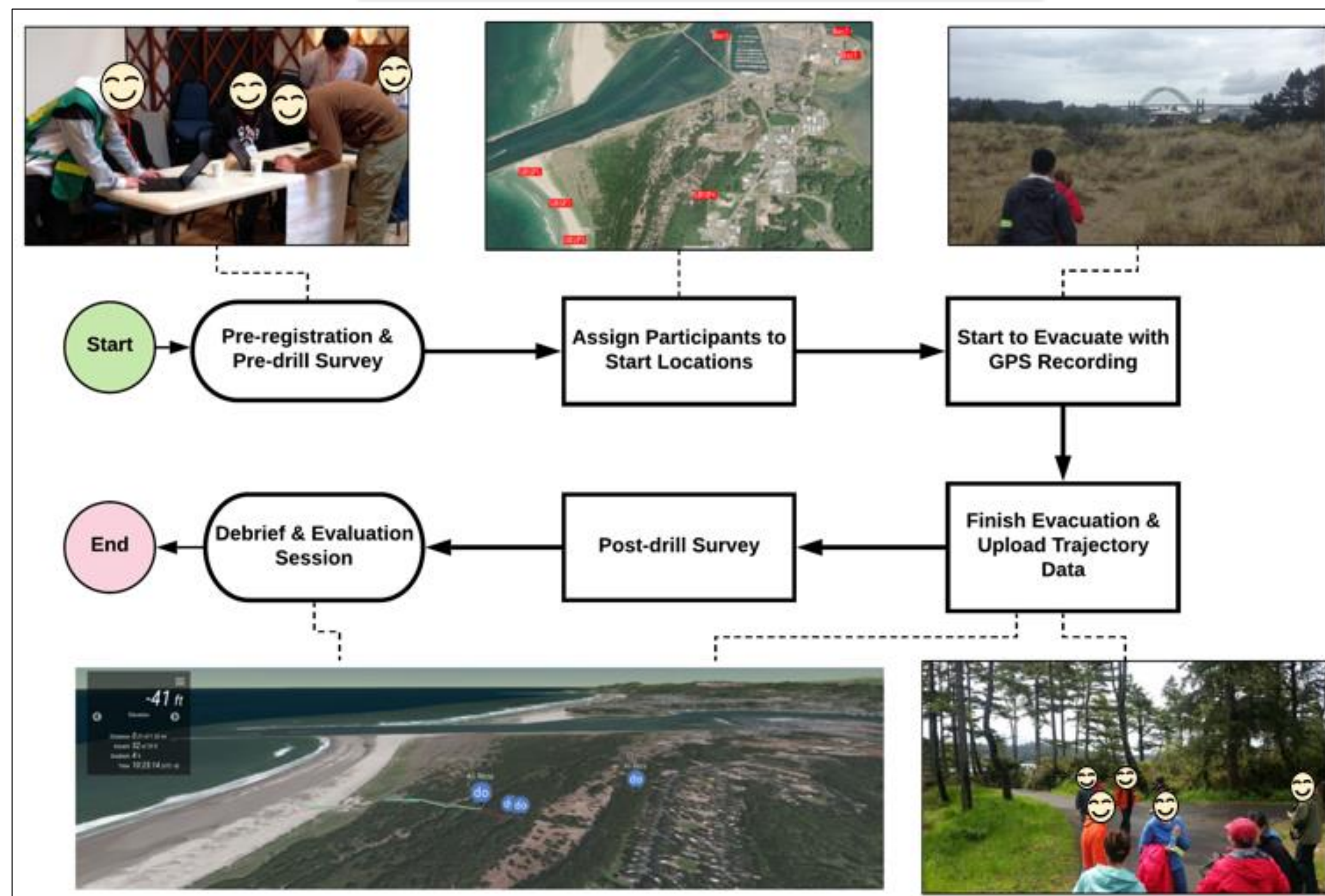
Recorded content:
GPS trajectory
• Route choice
• Speed
• Time



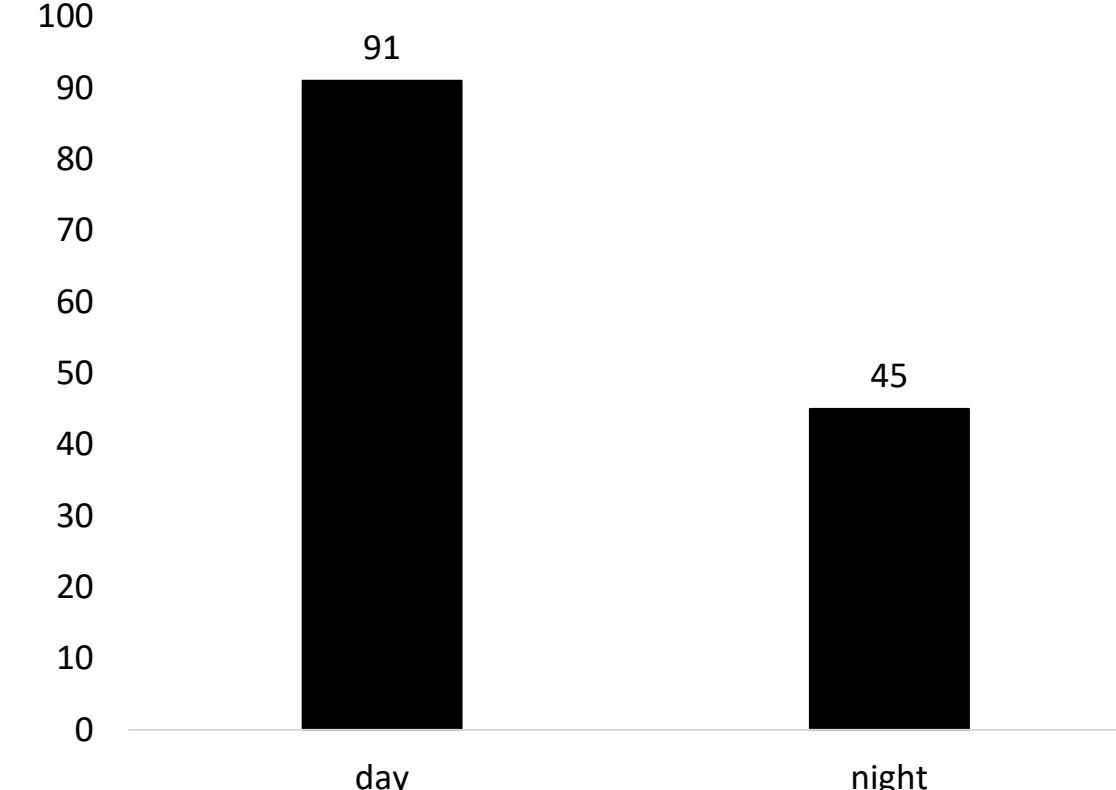
Evacuation Space-time Plot



DRILL PROCESS



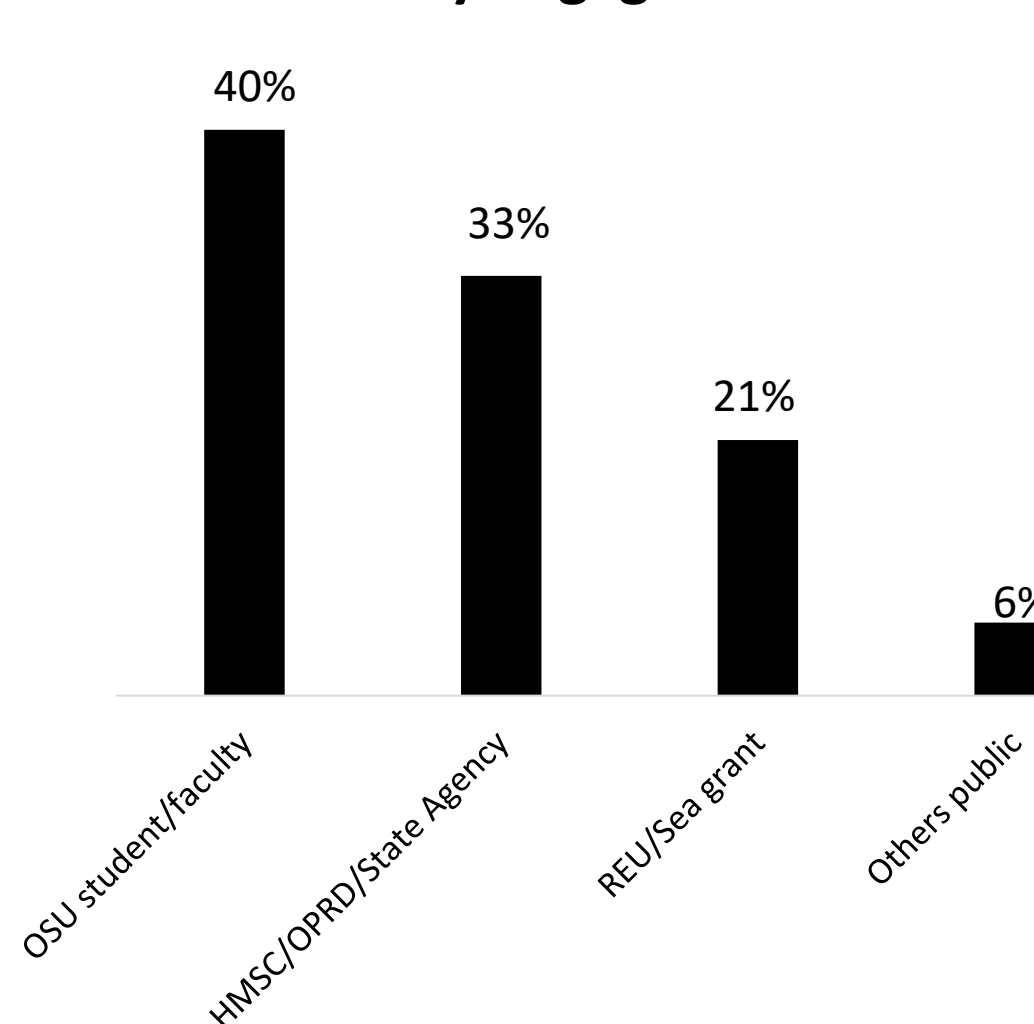
Participants by Night/Day Time Drills



Participants by Date

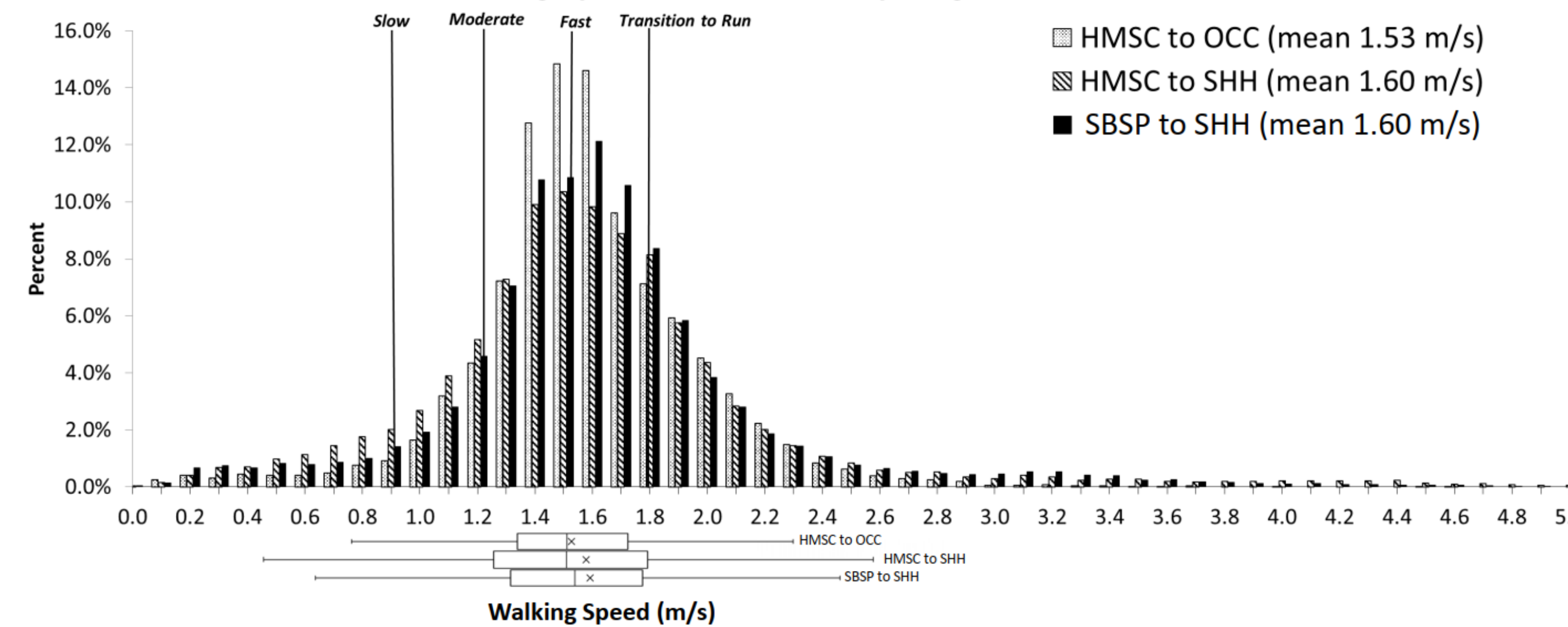


- Partnership with agencies
- 6 drills
- 136 participants
- Night/day
- Diverse participants
- Data collection via GPS App
- Community engagement

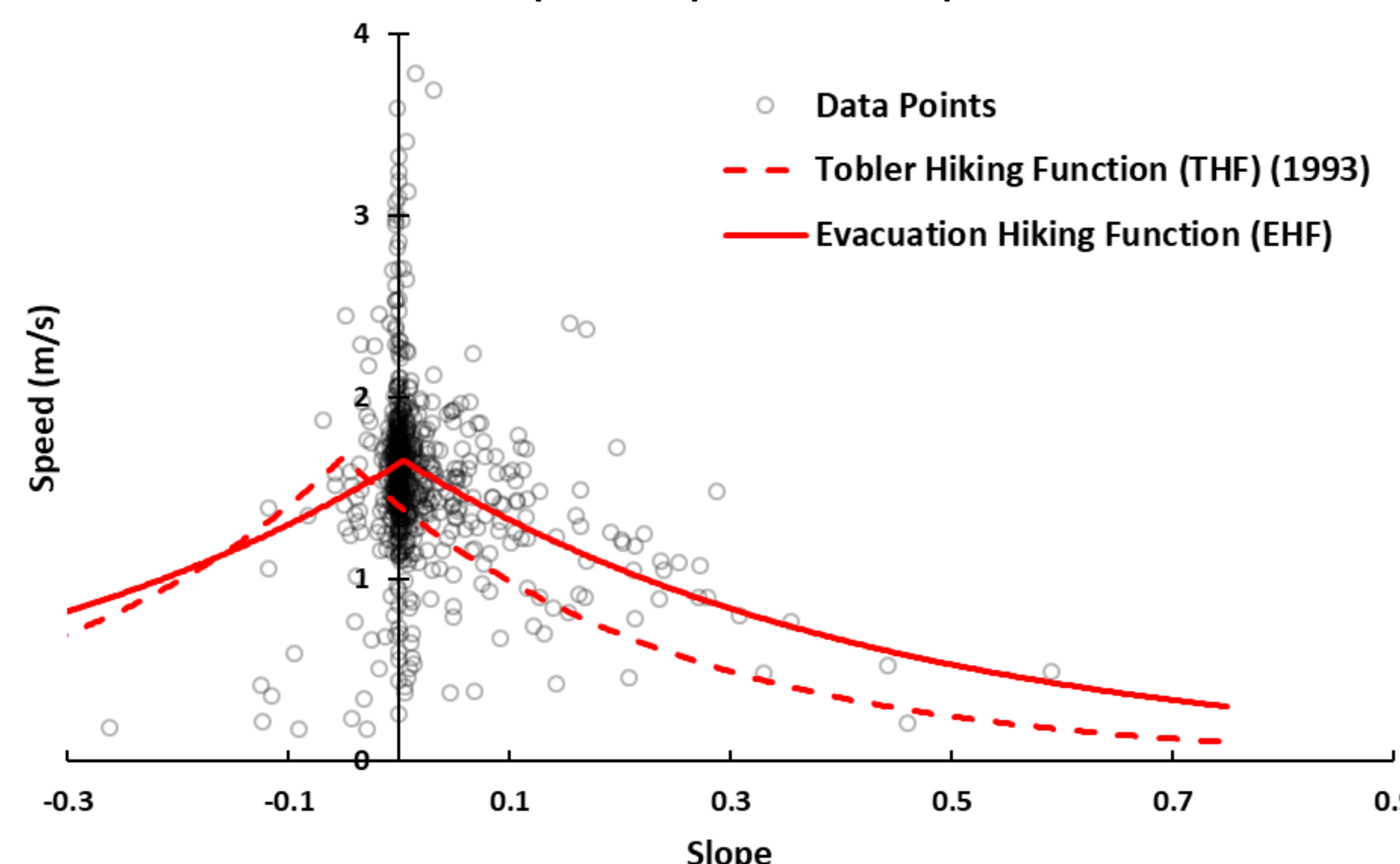


RESULTS

Walking Speed Distribution by Origin-Destination



Speed-Slope Relationship



Impact Factors on Evacuation Speed

Variables	Coefficients	Std. Error	Standardized Coefficients
(Constant)	1.86	0.02	-
Time (seconds)	-0.0002***	0.00001	-0.17
Elevation (meter)	-0.004***	0.0004	-0.05
Terrain (natural)	-0.11***	0.01	-
Agency	0.006	0.006	-
REU	0.21***	0.01	-
Night	-0.21***	0.01	-
SBP to SHH	0.08***	0.01	-
BAY to OCC	0.04**	0.01	-
Shortest Distance (meter)	-0.0001***	0.00001	-0.10
Slope	-0.78***	0.02	-0.14

Dependent variable: walking speed. Model is significant at 0.001 level ($F = 370, p < 0.00$)
Significance level: *0.05, **0.01, ***0.001

Impact on Milling time (Combining with Evacuation Simulation)

