Beaconing signalization and blind pedestrians'veer on snow-covered pavement

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BACKGROUND

Veering outside of Crosswalks

- A common problem for blind pedestrians
- Audible beaconing has been found to be effective for reducing this veer when other guidance cues are absent.
- Audible beaconing involves walking toward a far-side "homing" speaker mounted at a pedhead at crosswalks that are equipped with accessible pedestrian signals (APS).

Veering on Different Surfaces

- Veering and audible beaconing at crosswalks have only been studied on clear pavement.
- There are reasons to believe that walking in snow may exacerbate veering, which may, in turn, lead a blind pedestrian further from a crosswalk.
- This experiment compared veering on clear pavement with veering on snow-covered pavement, with and without audible beaconing.

Research Questions

- For blind pedestrians, is audible beaconing as effective on snow-covered pavement as it is on clear pavement?
- Does walking in snow increase blind pedestrians' veering?

Methods

Experiment Site

- The experiment site was an empty parking lot at WMU campus

Participants

- 11 legally blind adults
- Normal hearing
- Used a long cane as primary mobility aid
- Experienced snow travelers

Beaconing APS

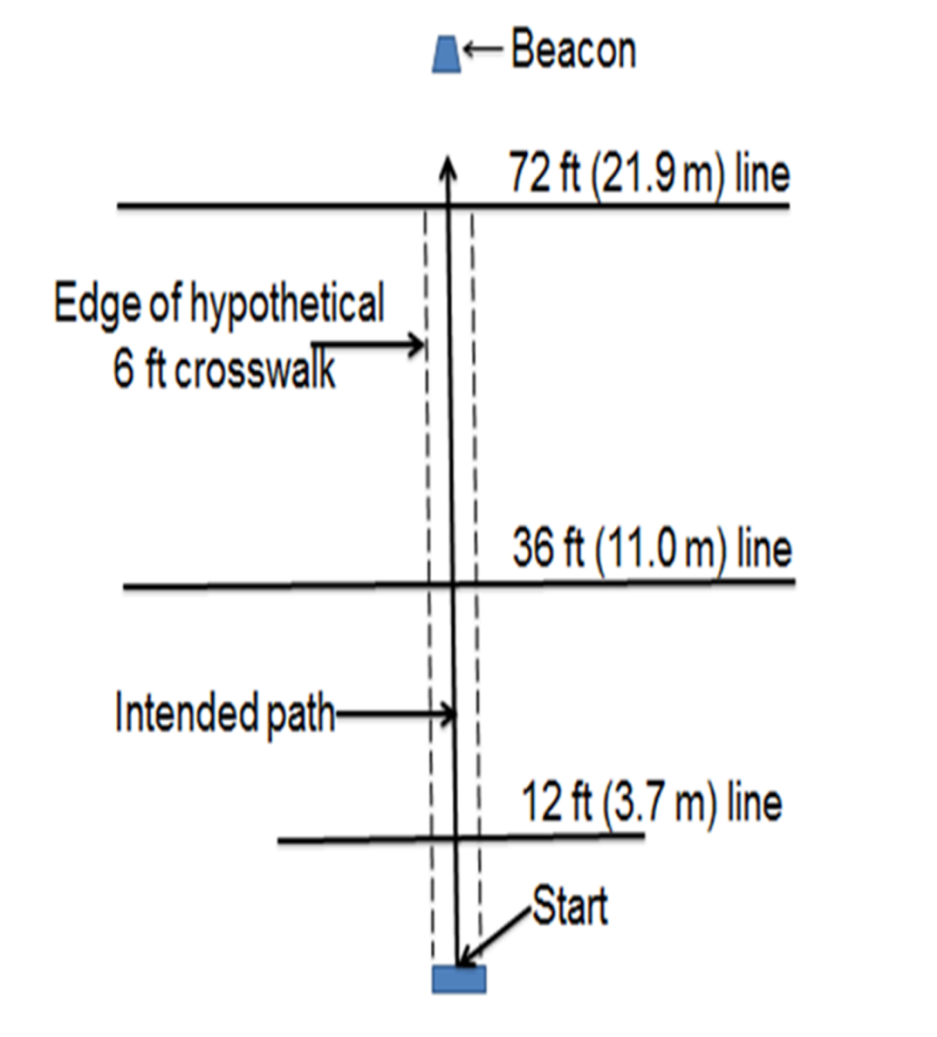
- Functionally the same as that evaluated in three previous simulation and crosswalk studies of beaconing APS

Beaconing APS

- Loudspeaker mounted 9 ft above the ground
- Emitted sound at 1 Hz with a fundamental frequency of 880Hz with added harmonics, compliant with MUTCD requirements for audible tones used as walk indications
- Beacon's sound level was 82dBA at 1 m

Experiment Procedure

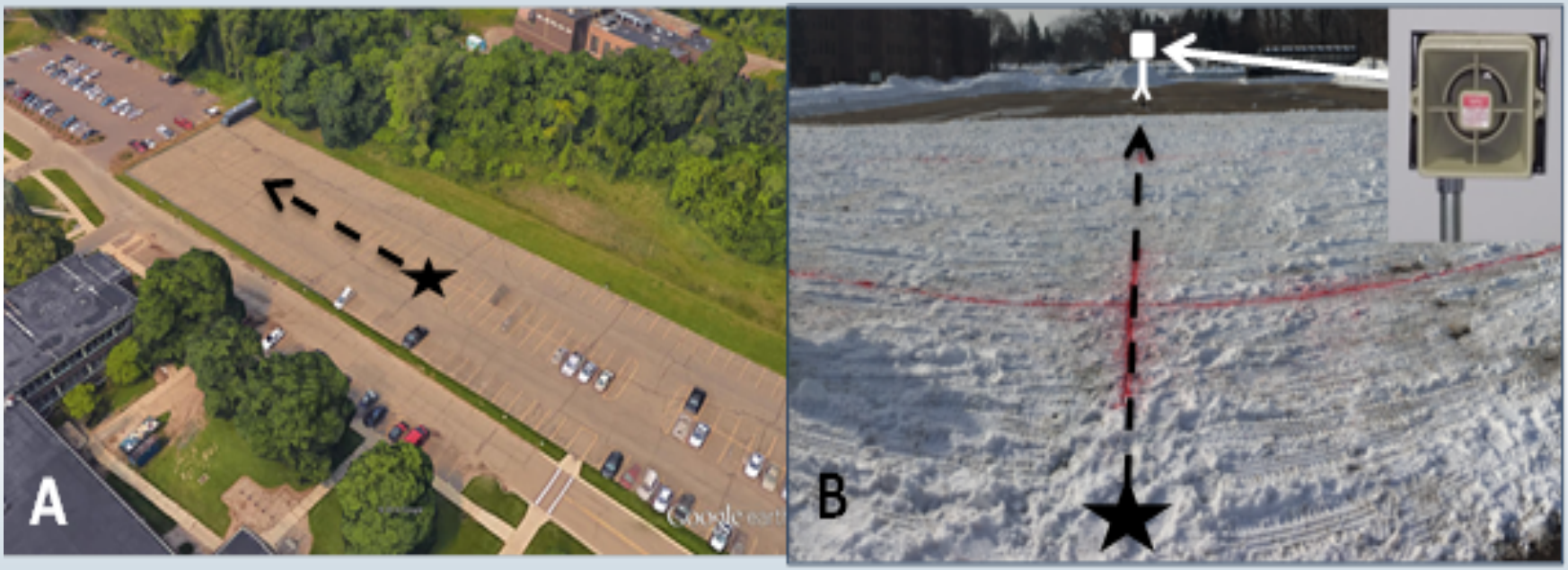
- After aligning in the direction of the simulated crosswalk, participants attempted to walk a straight path for 72 ft.
- Participants were asked to walk at their typical walking speed.
- No feedback about the direction or extent of veering was given until the end of the experiment.



Measures

- Participants' distance and direction from the intended path at 12 ft, 36 ft, and 72 ft from Start.
- These represent typical widths of one, three and six traffic lanes.

Walking Surface Conditions



A: Clear pavement condition

B: Snow-covered pavement condition

Snow-covered Surface

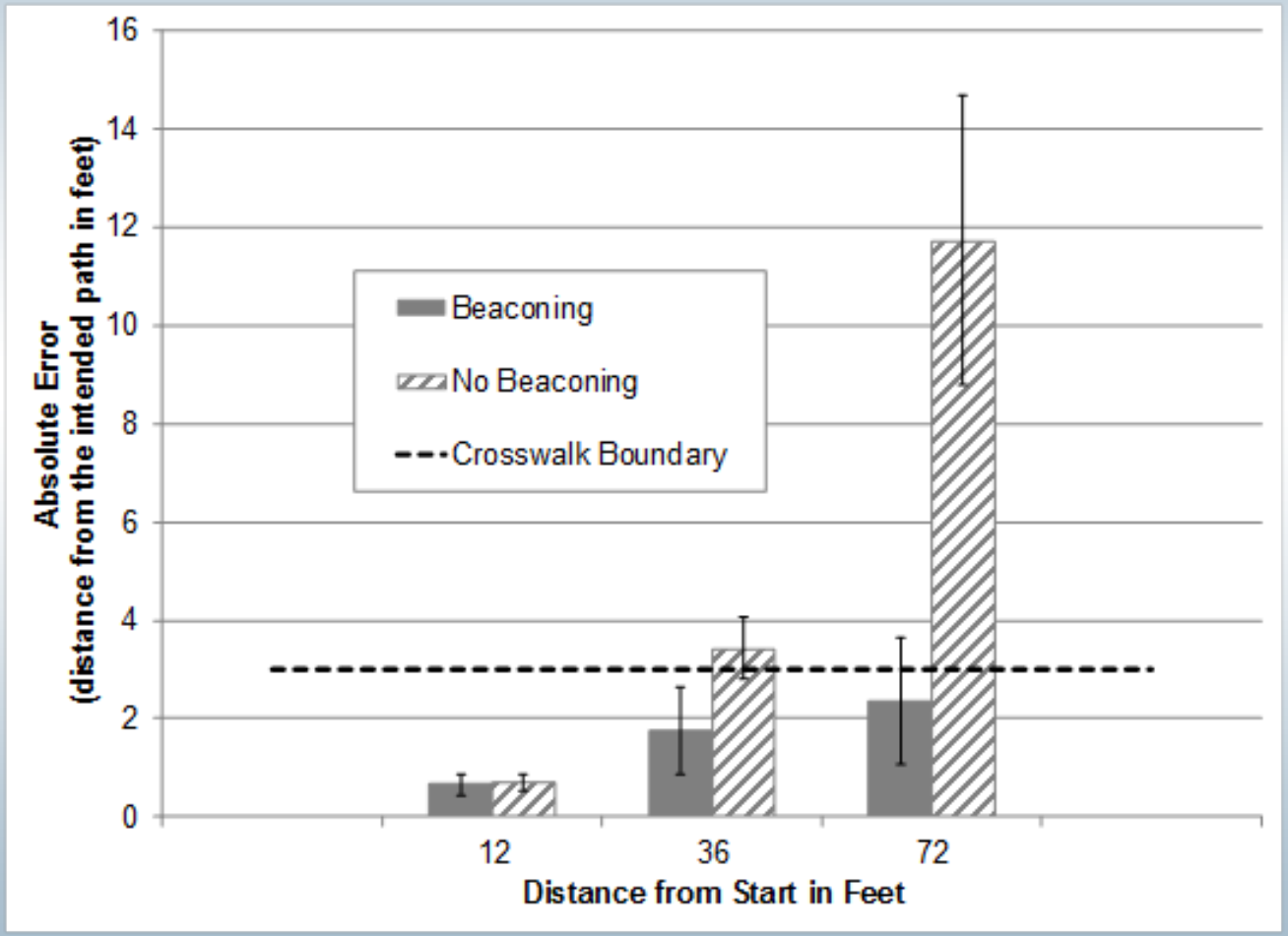
- Depth of 5”
- Tire ruts perpendic ular to the line of travel

Experimental Conditions

- For each of the two walking surface sessions, there were a block of 10 trials with the beacon ON and a block of 10 trials with the beacon OFF.
- In the beacon condition, the beacon was activated at the far end of the simulated crosswalk four seconds after the participant began walking.

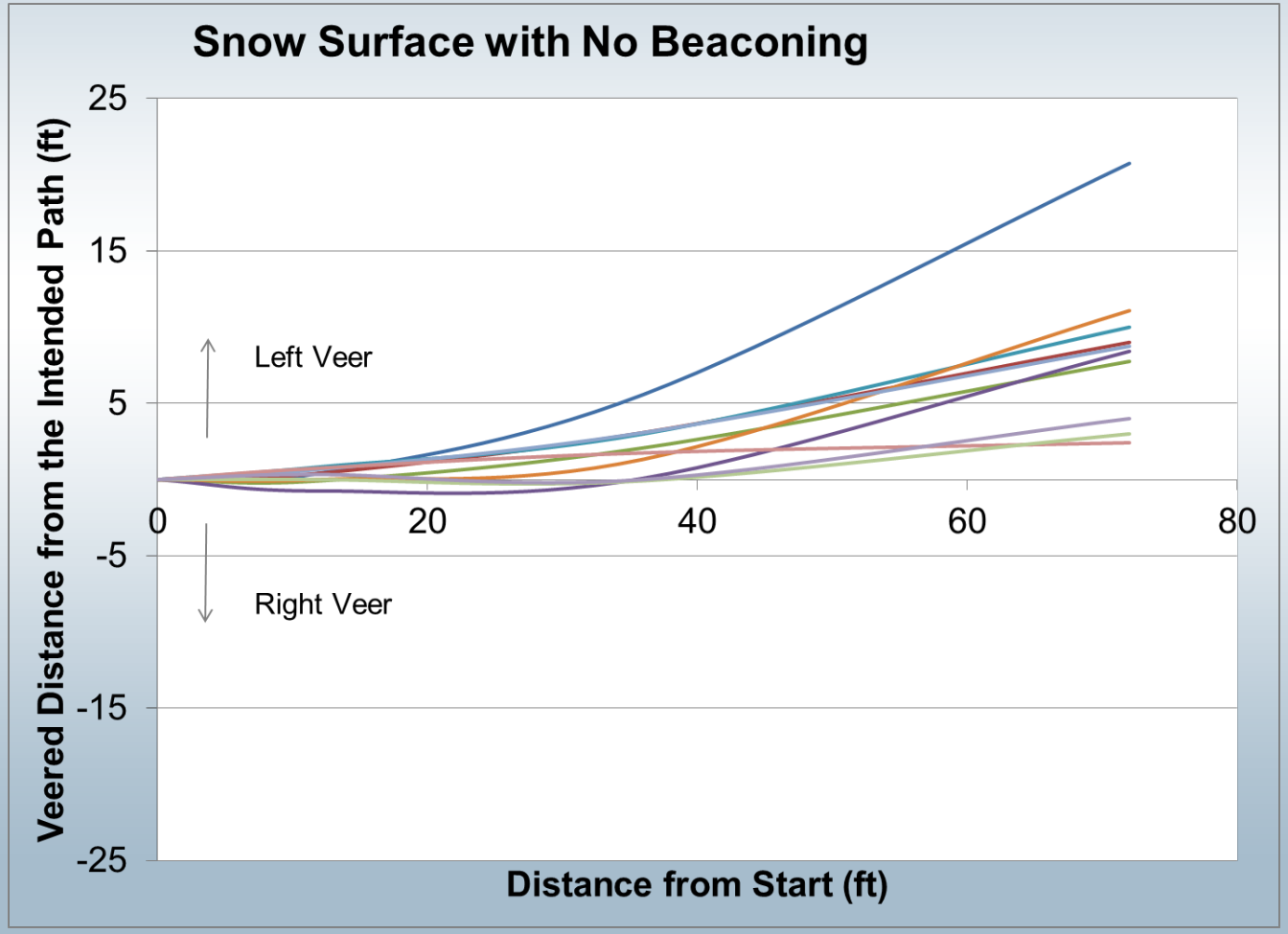
Results

Veering with and without beaconing

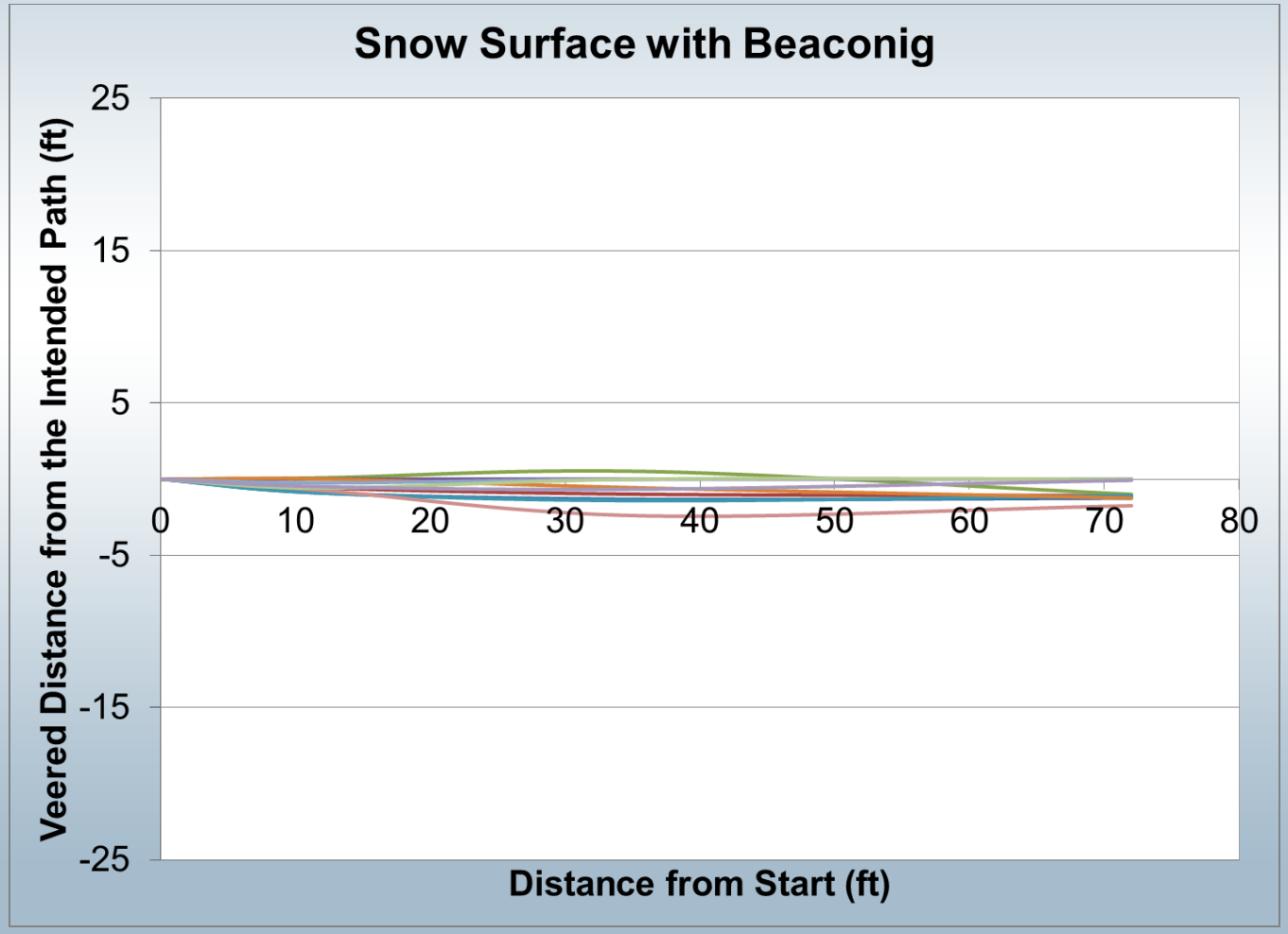


Notes. Dashed line represents the boundary of a 6 ft hypothetical reference crosswalk. Error bars indicate 95% CI.

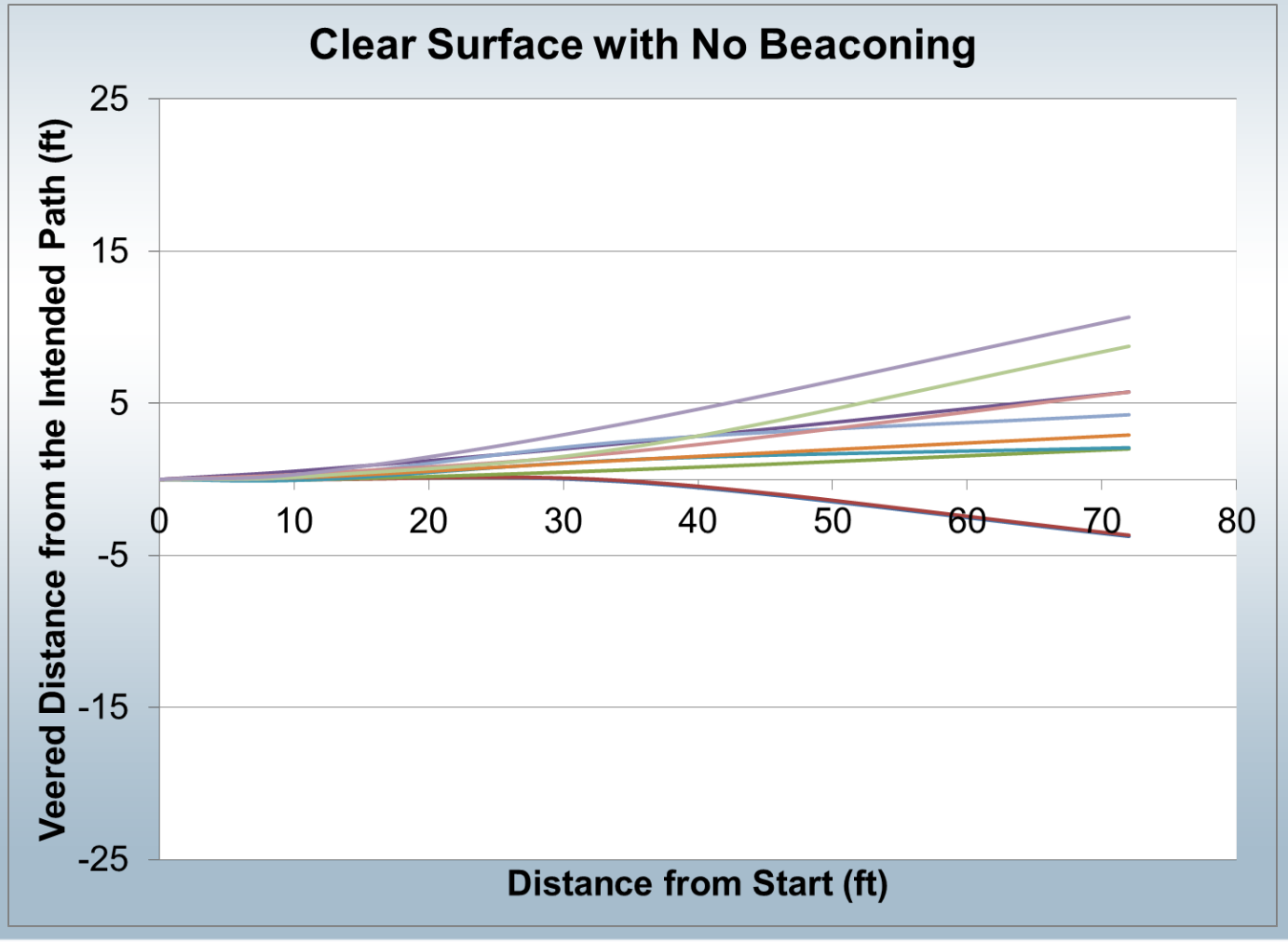
Walk Trajectories (snow no beacon)



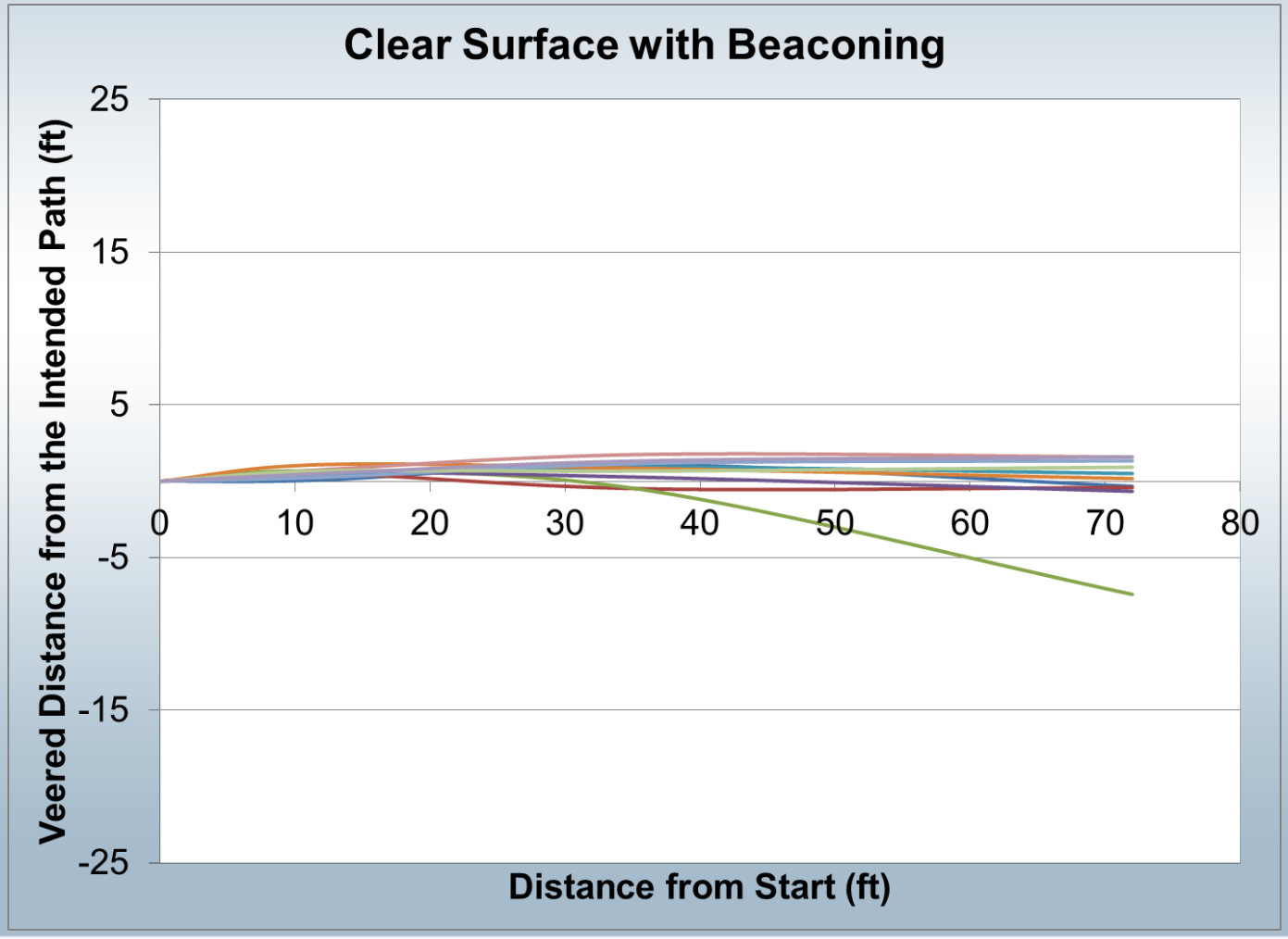
Walk Trajectories (snow beacon)



Walk Trajectories (clear no beacon)



Walk Trajectories (clear beacon)



DISCUSSION

Discussion

- Key findings
  - Audible beaconing was as effective when walking in snow as when walking on clear pavement.
  - Beaconing significantly reduced veering at 36 ft. and 72 ft. from the starting point, enabling participants to remain within a simulated crosswalk.

Discussion

- Surprising finding
  - The finding that snow did not increase veering was interesting given the findings of some other studies that examined the relationship of stepping and veering.

Practical Implications

- At single-lane crosswalks, veering is probably not a major problem for blind pedestrians who are initially well-aligned.
- A treatment to reduce veering (such as auditory beaconing) appears to be necessary to help blind pedestrians remain within crosswalk boundaries for crossing streets with 3 or more lanes.

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