



Beneficial Designs

research/design/education

Designing beyond the norm to meet the needs of all people.

Peter Axelson

Beneficial Designs, Inc.

Minden, NV

Beneficial Design

Designing Beyond the Norm to Meet
the Needs of All People

Research
Design
Education

Stanford University

26 January 2017

Peter Axelson



Beneficial Designs' Mission Statement

Beneficial Designs works towards universal access through research, design, and education. We believe all individuals should have access to the physical, intellectual, and spiritual aspects of life.



Beneficial Designs' Mission Statement

We seek to enhance the quality of life for people of all abilities, and work to achieve this aim by developing and marketing technology for daily living, vocational, and leisure activities.





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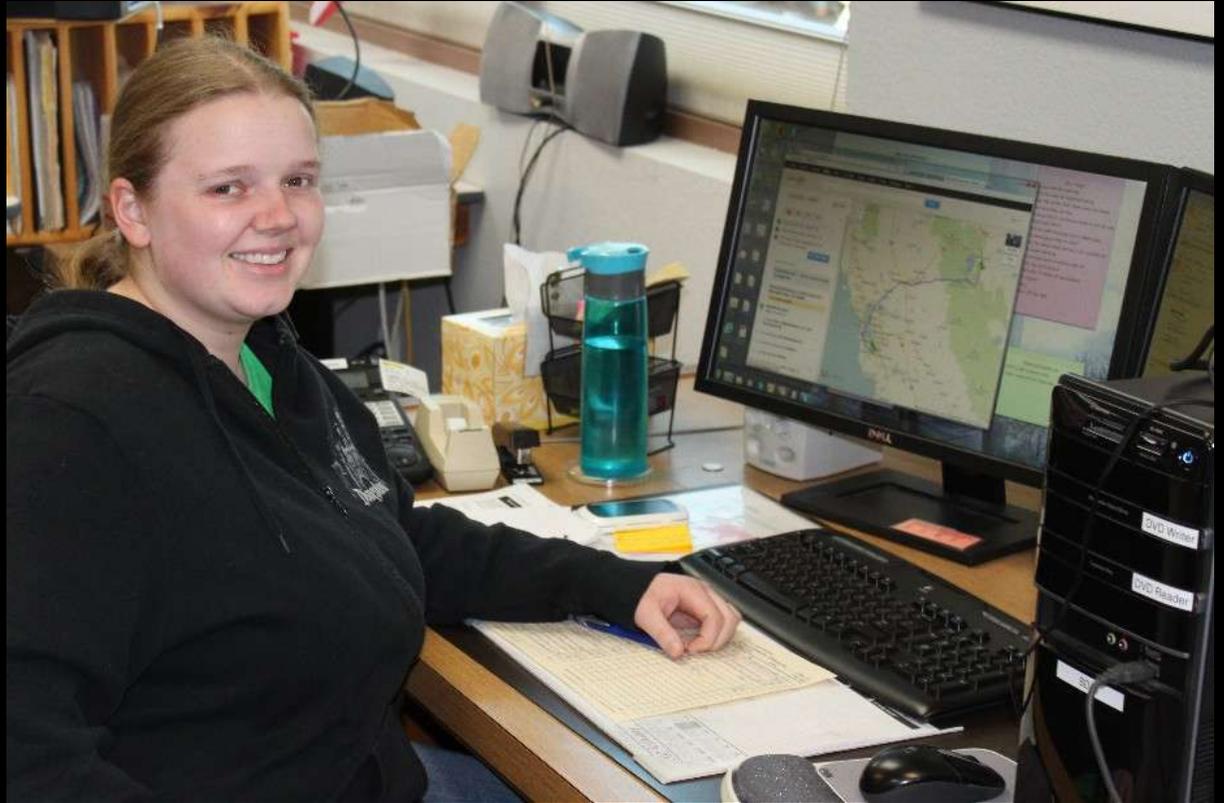


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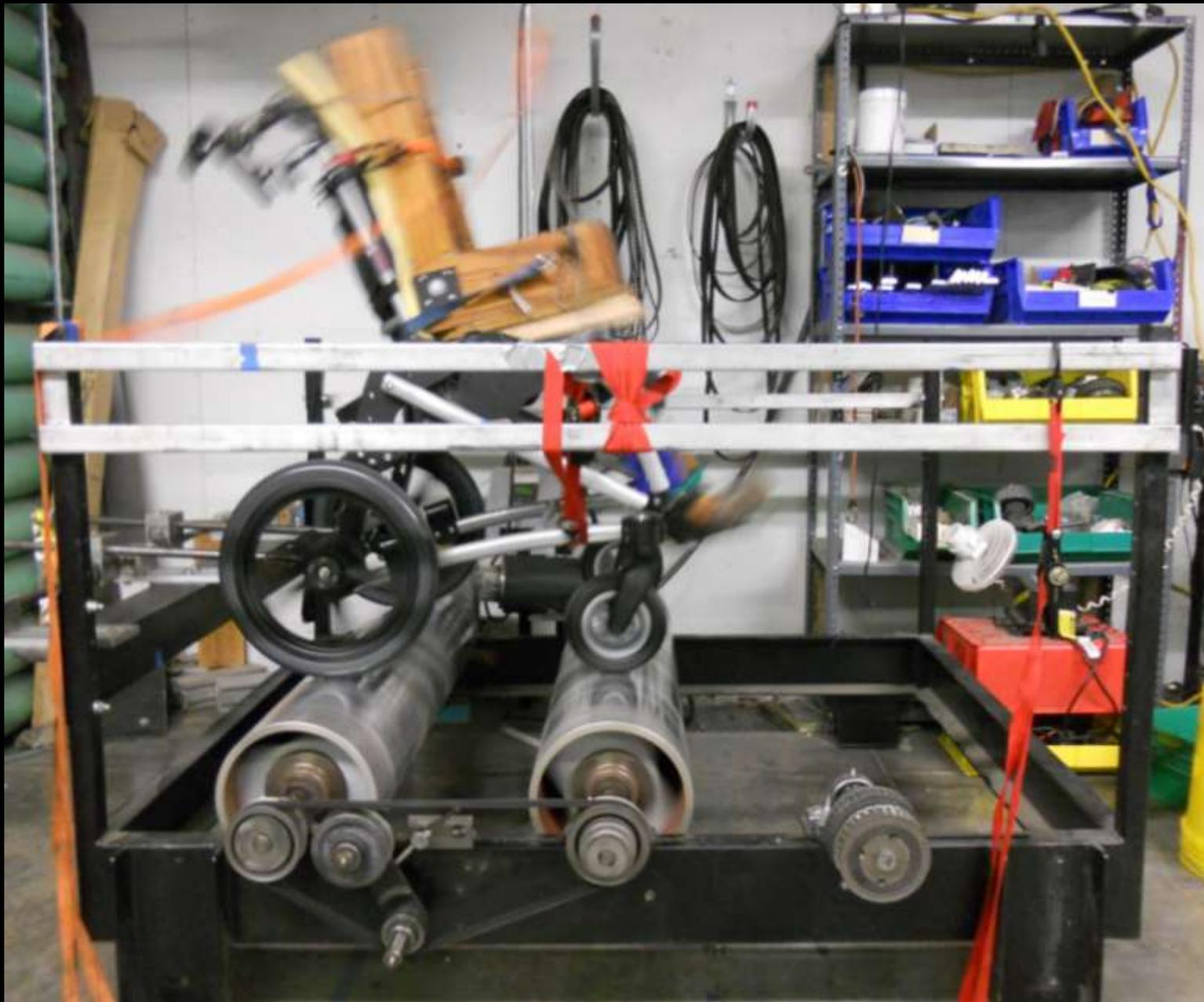














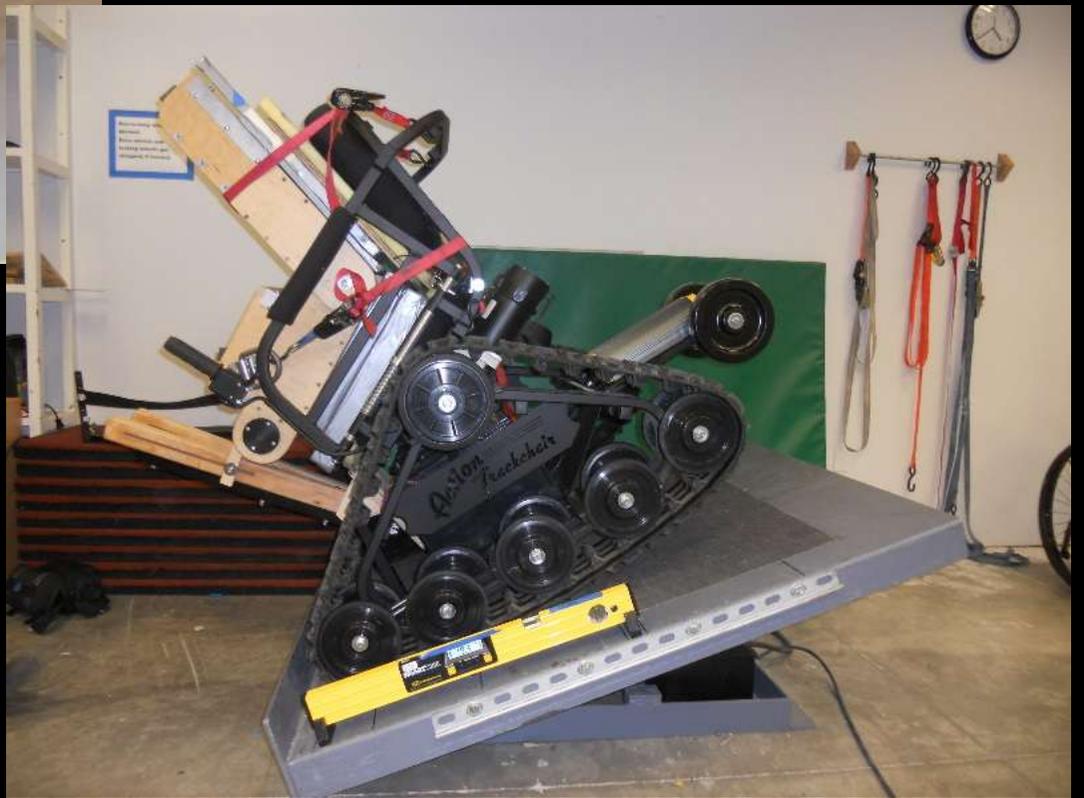






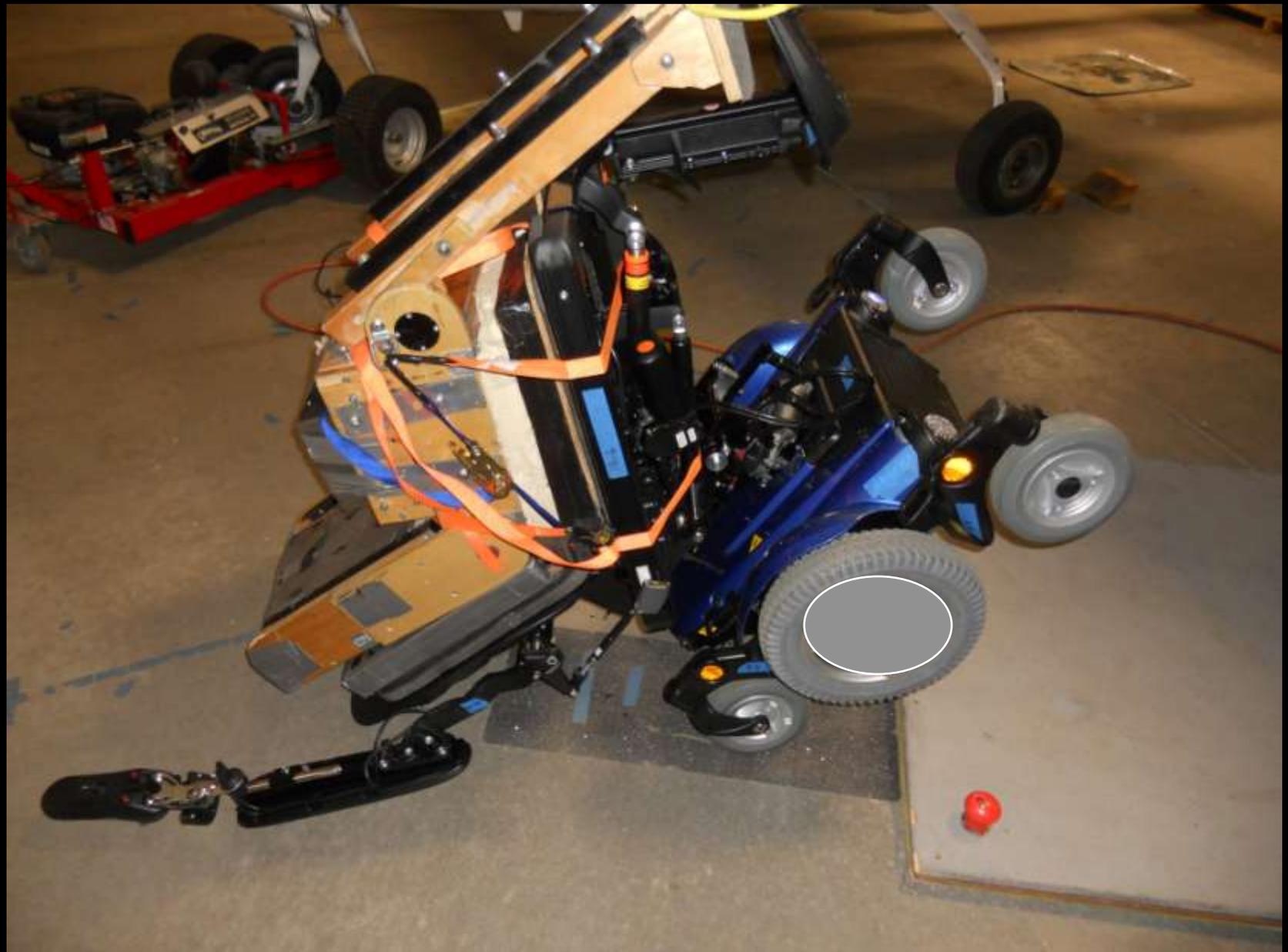












Design of Consumer Products

Product Development

Assessment of Products

Universal Design of Products

Product Development

Mainstream Products

Opportunity for Universal Design

Adaptive Products

Personal Technologies

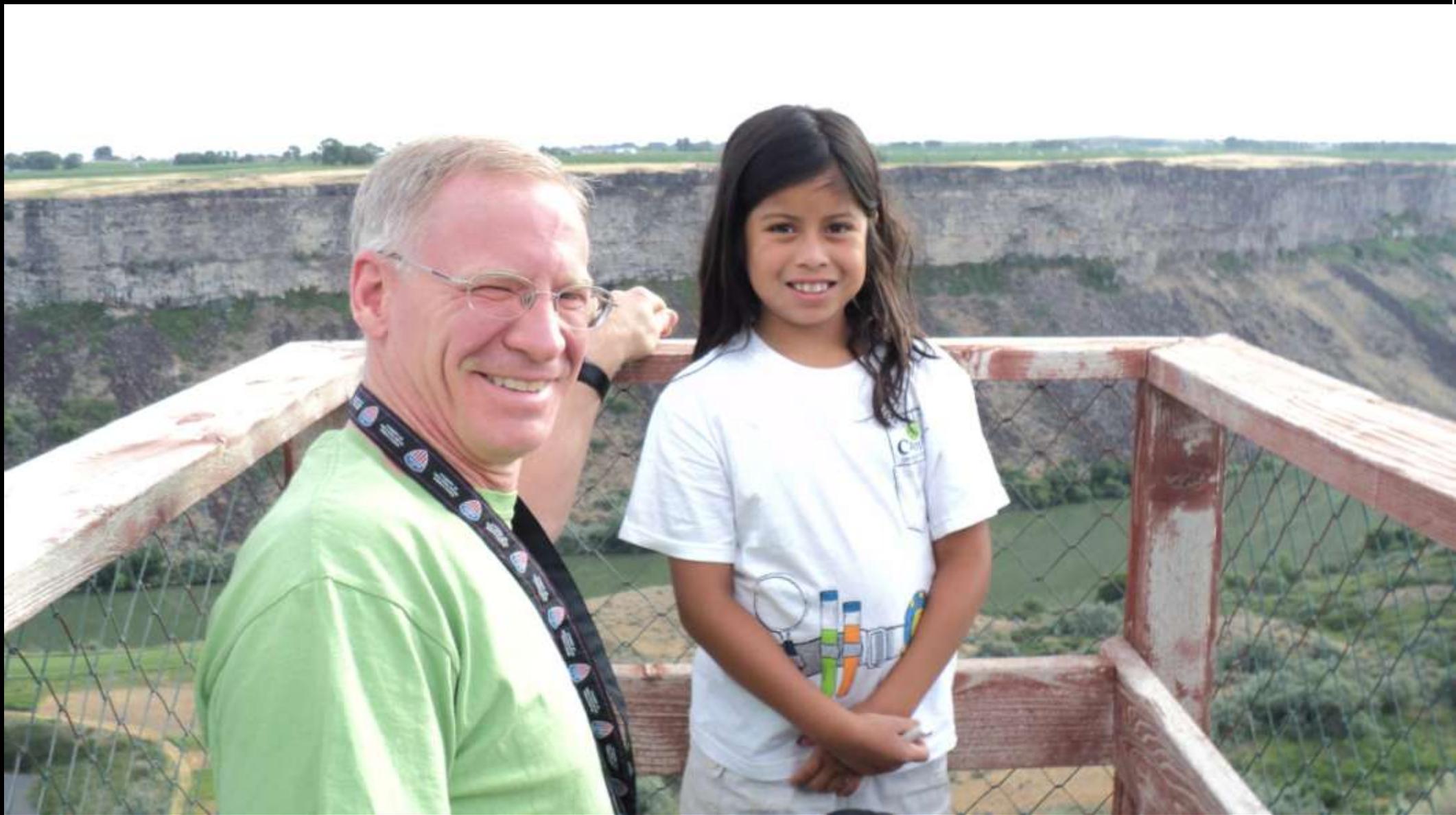
Activity Specific Technologies

Establishing Balance

Physical

Intellectual

Spiritual

















Sociological Dimension

Dependence

Independence

Interdependence





Personal Technologies

Activity-Specific Technologies

Environmental Technologies

Activity-Specific Technologies



Arroya Sit Ski





Mono Ski











Dynamic Seating Spring Assist

Cross Country Ski





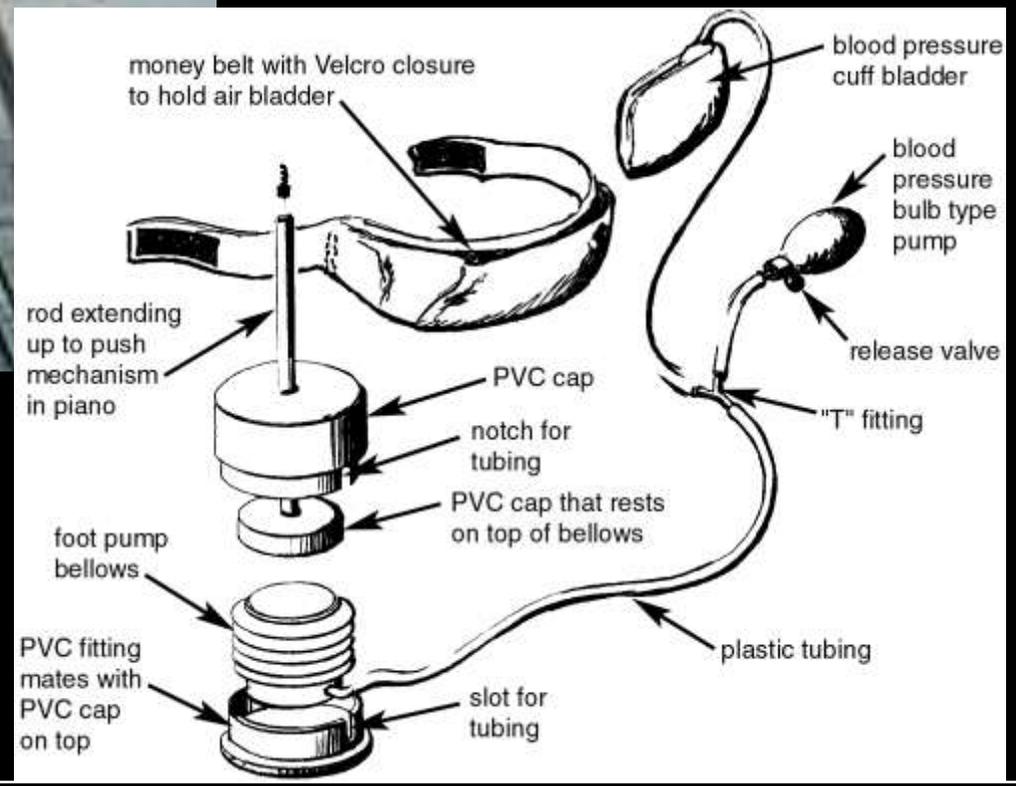


4.12.98

Pax Back

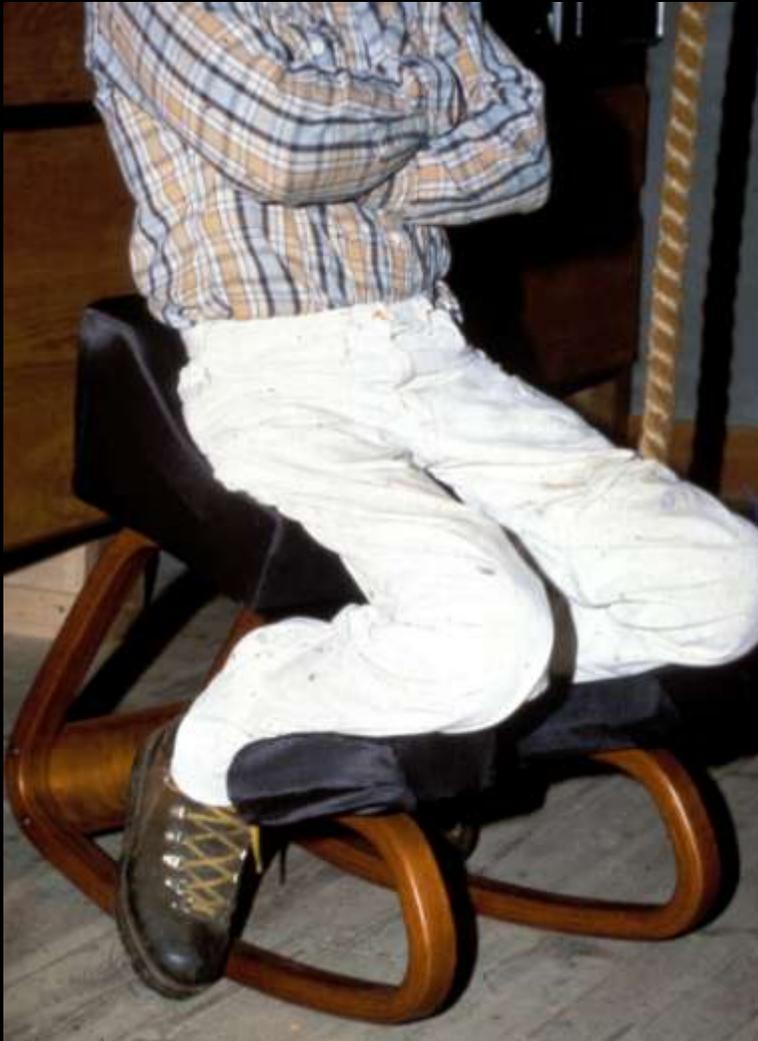


Available from
BES Rehab Ltd



Clutch, Brake and Gas on Hand Control





Dynamic Seating

Dynamic Seating





Hand Bike

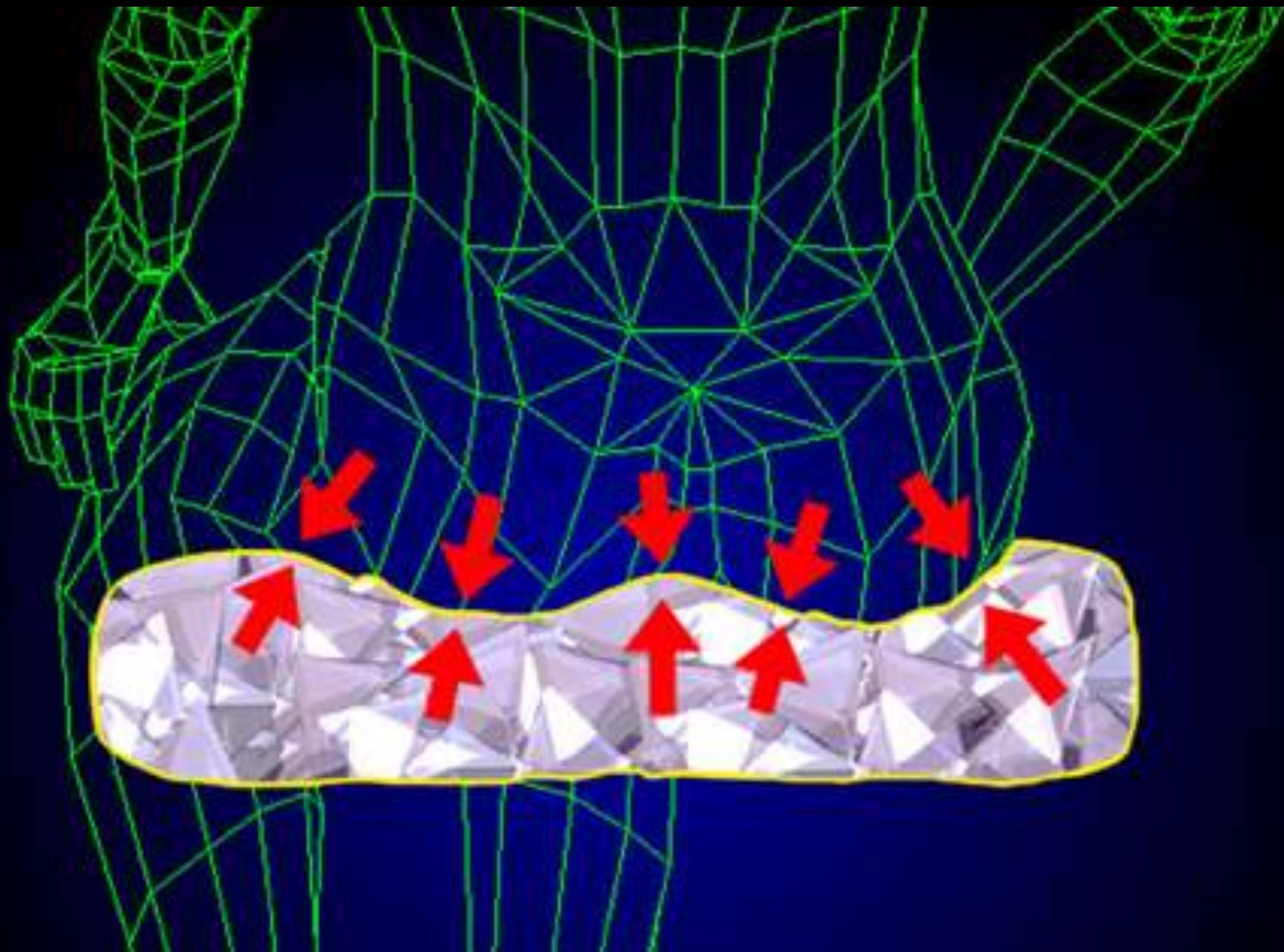


Hand Bike

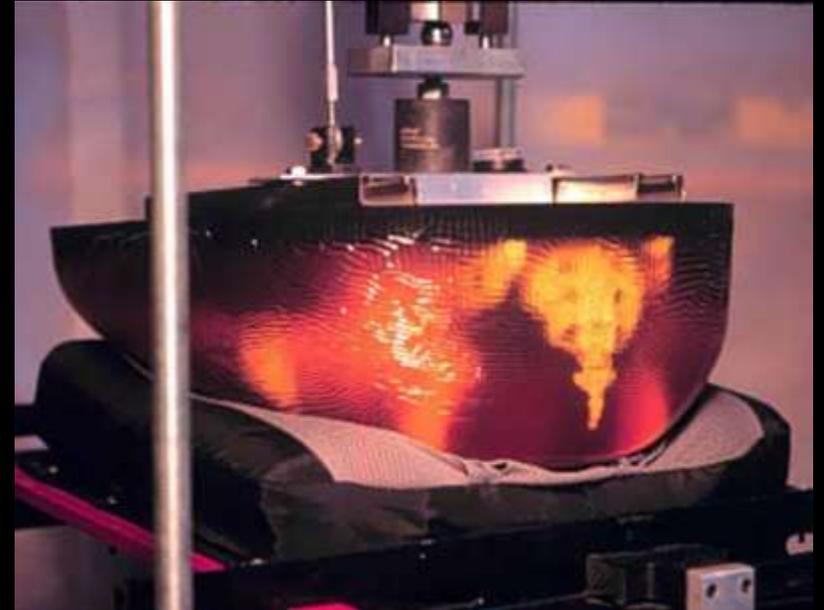


Contoured Seating

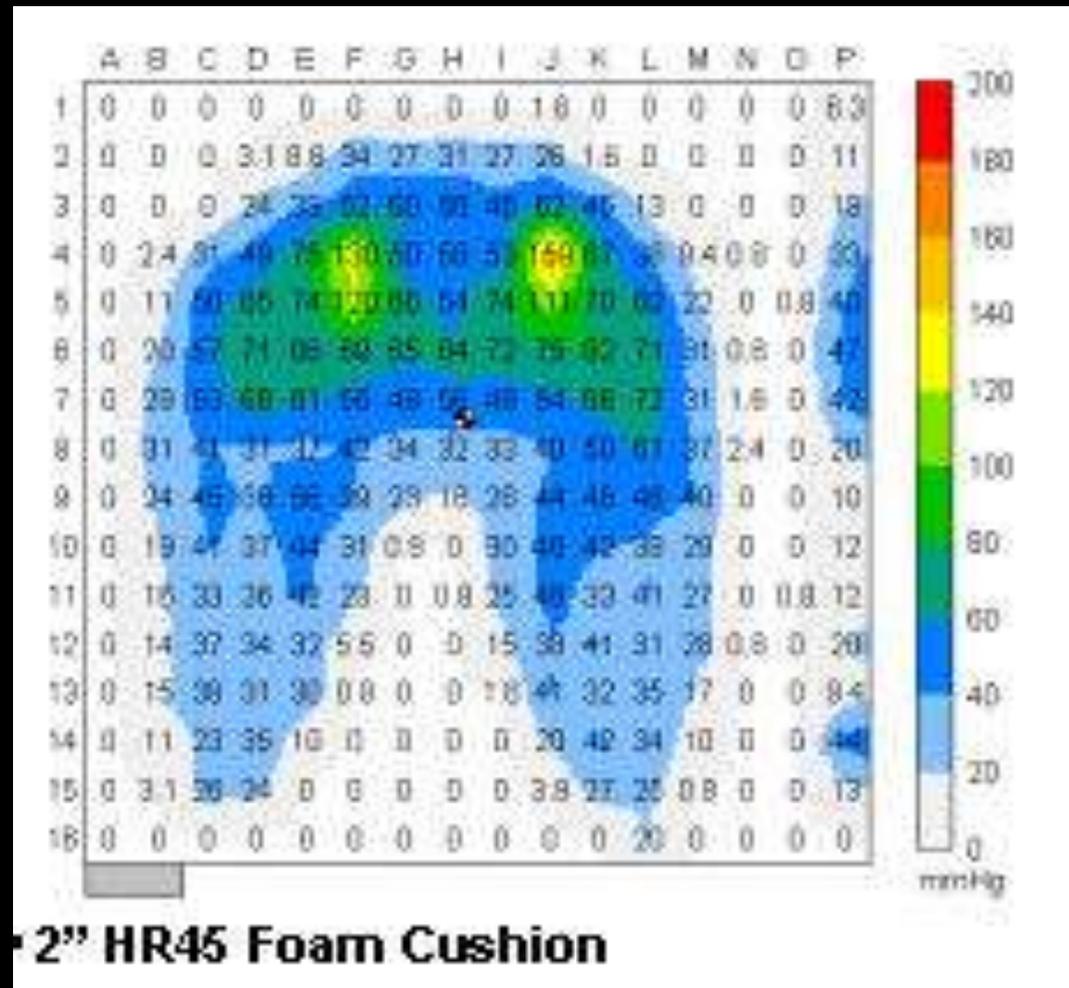


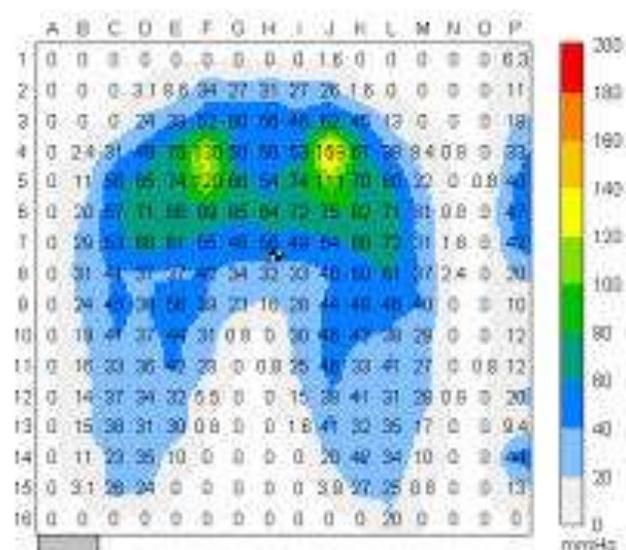


Seat Cushion Testing

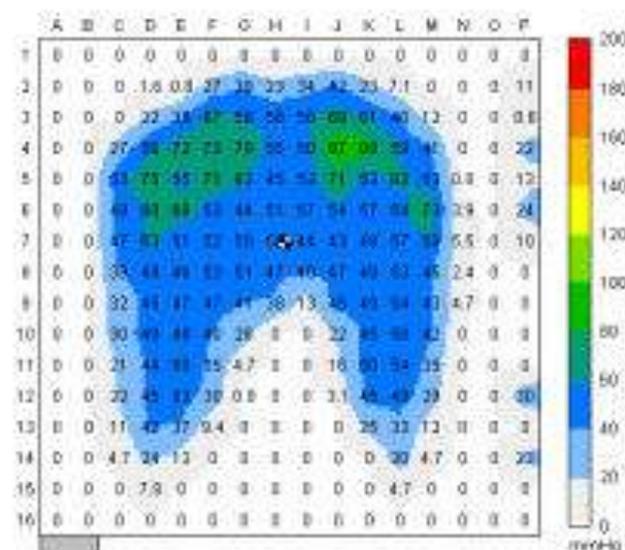


SKELI Used on Foam

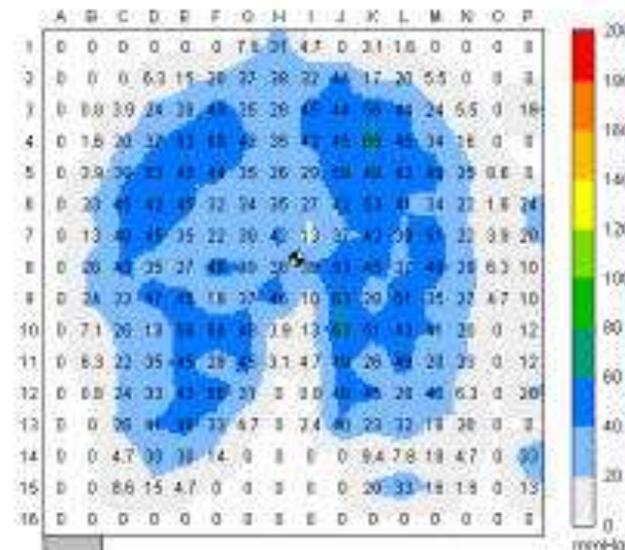




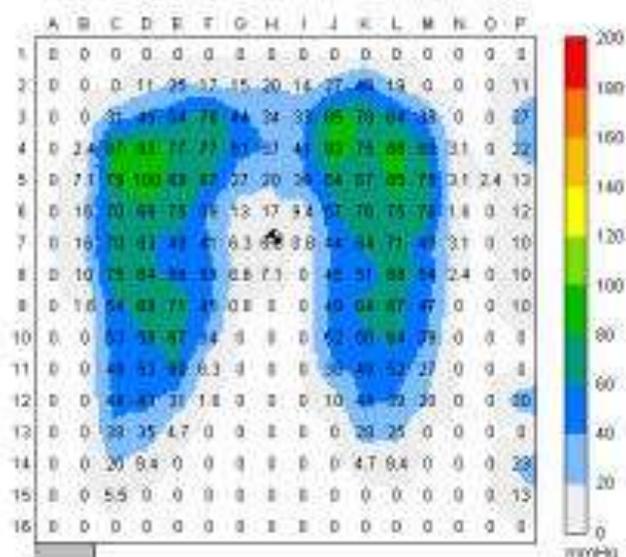
2" HR45 Foam



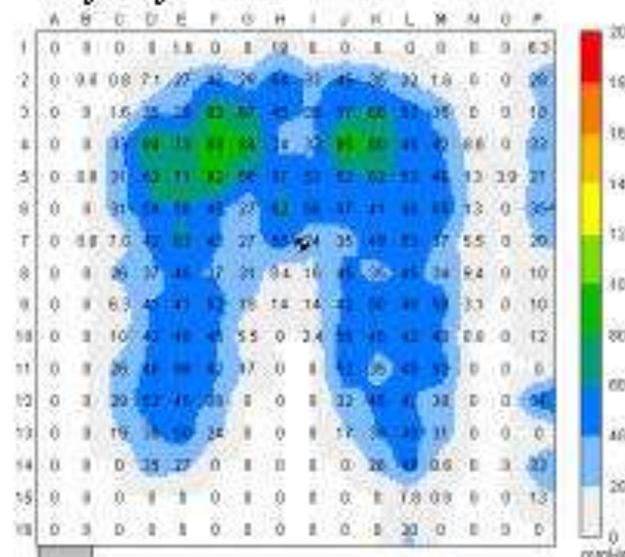
Jay 2 by Sunrise Medical



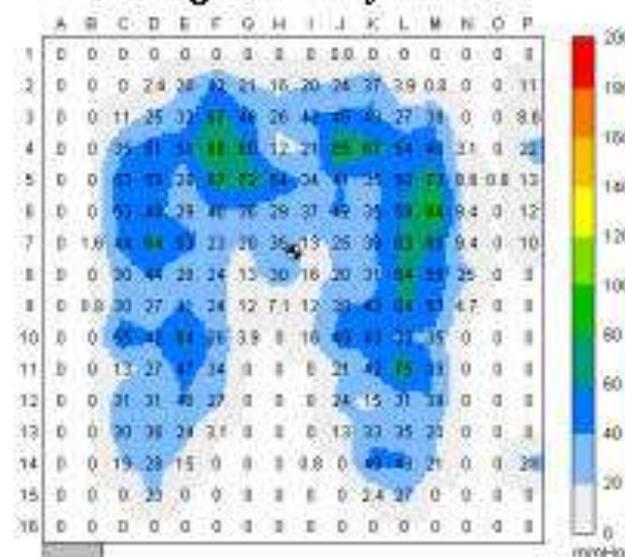
ROHO High Profile by ROHO Inc.



Contoured by Supracor



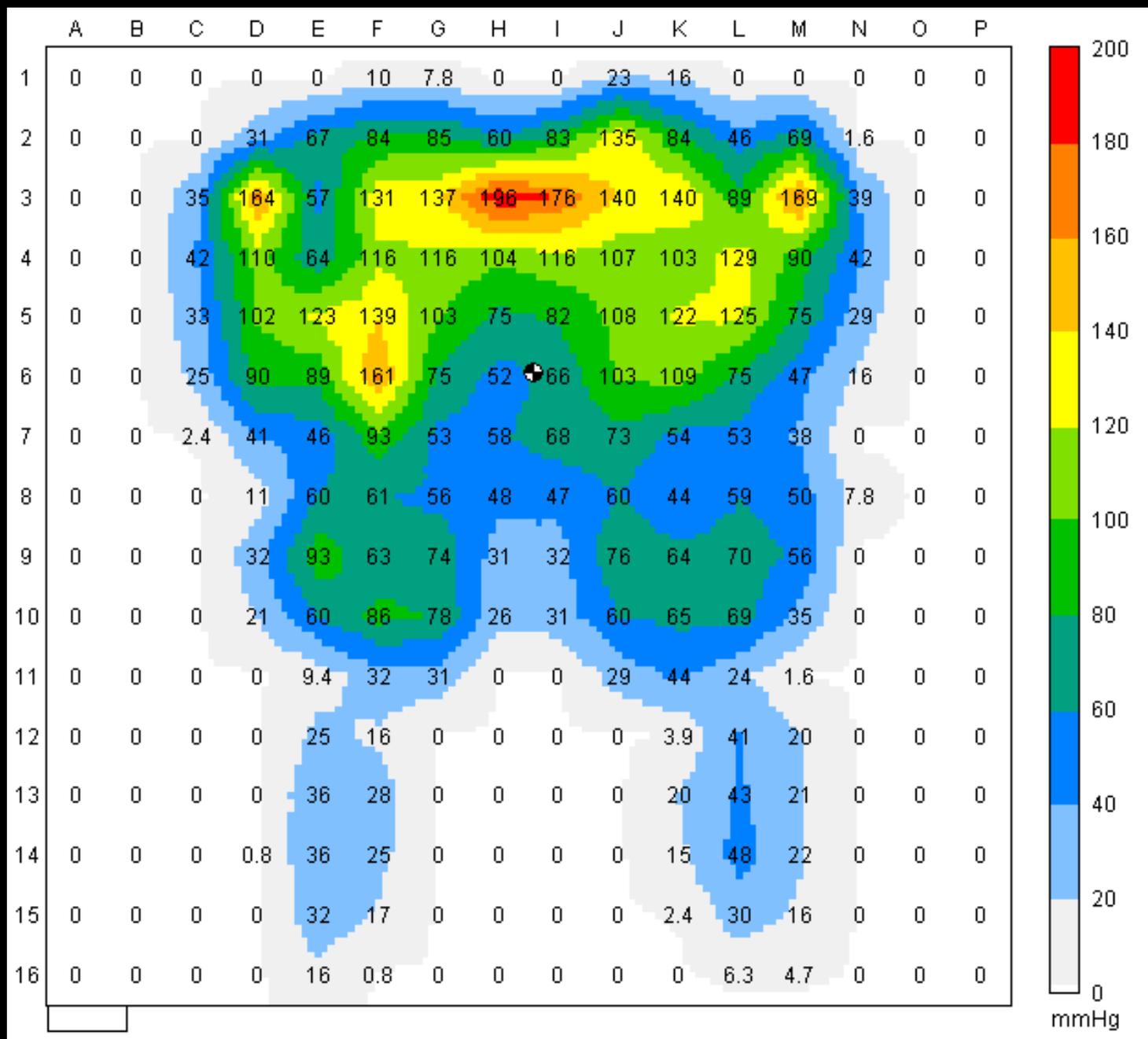
Model Pby Vicair



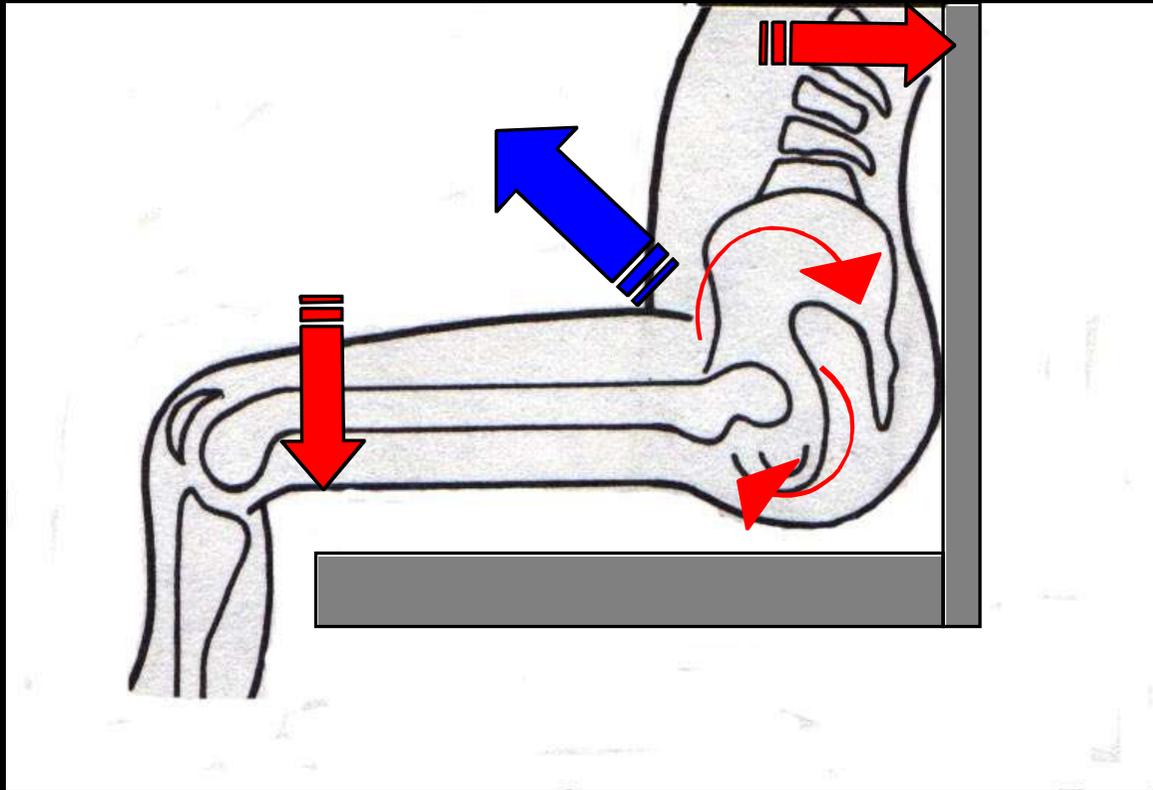
ASLI Prototype ISO Part 2 Shape



Pressure Measurements 15 Posterior Pelvic Tilt



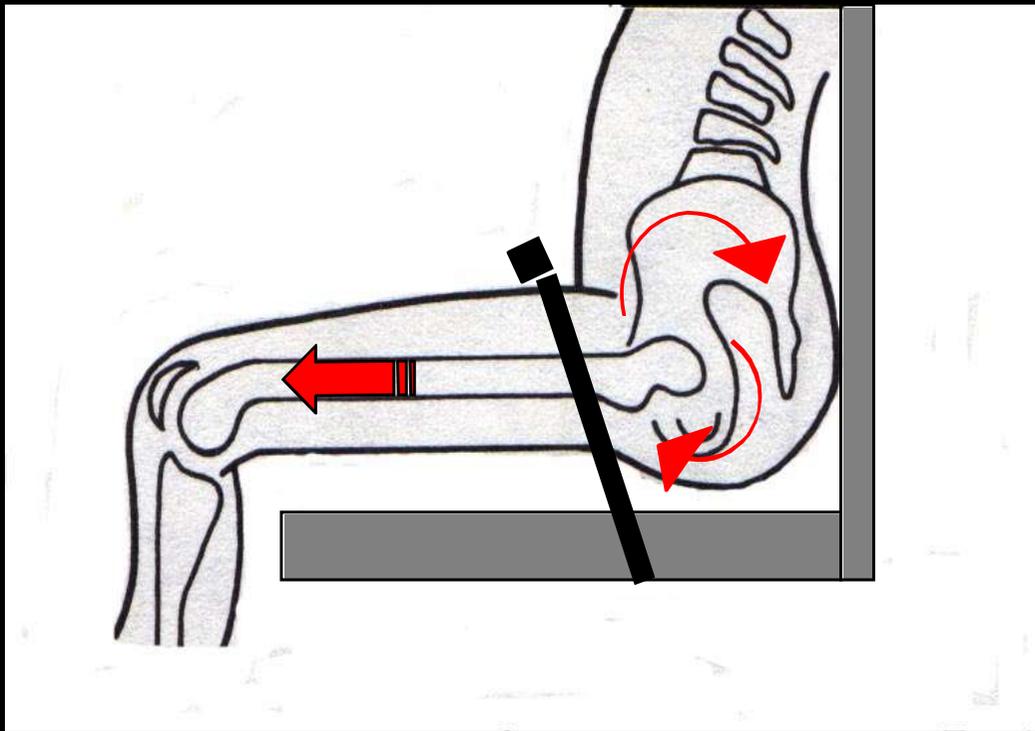
Pelvis Movement During Extensor Thrust Activity



Force at Thigh
and Backrest
During Extension

Pelvis Moves Up,
Out and Rotates

Variations of Belt Angle

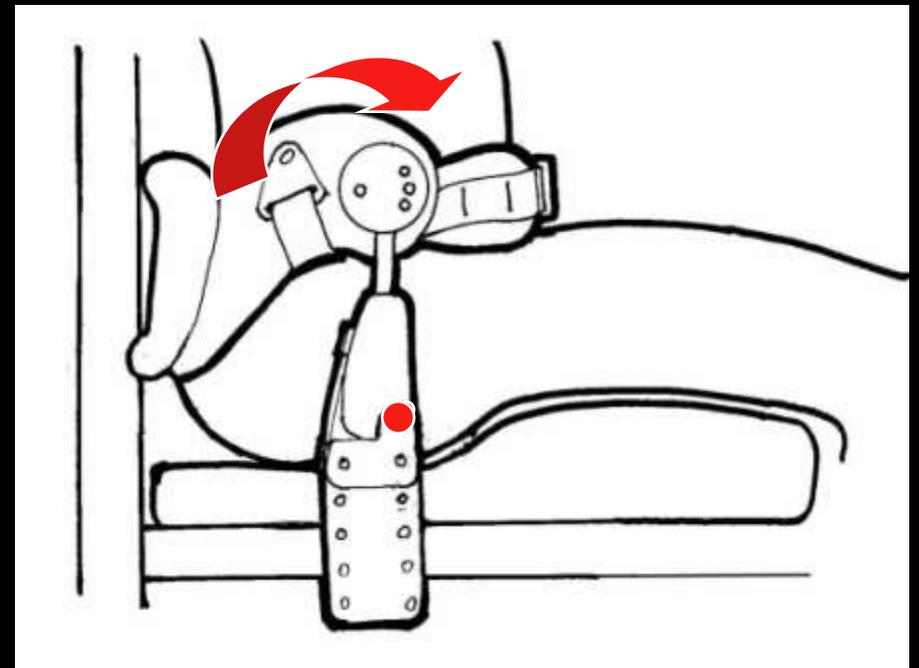
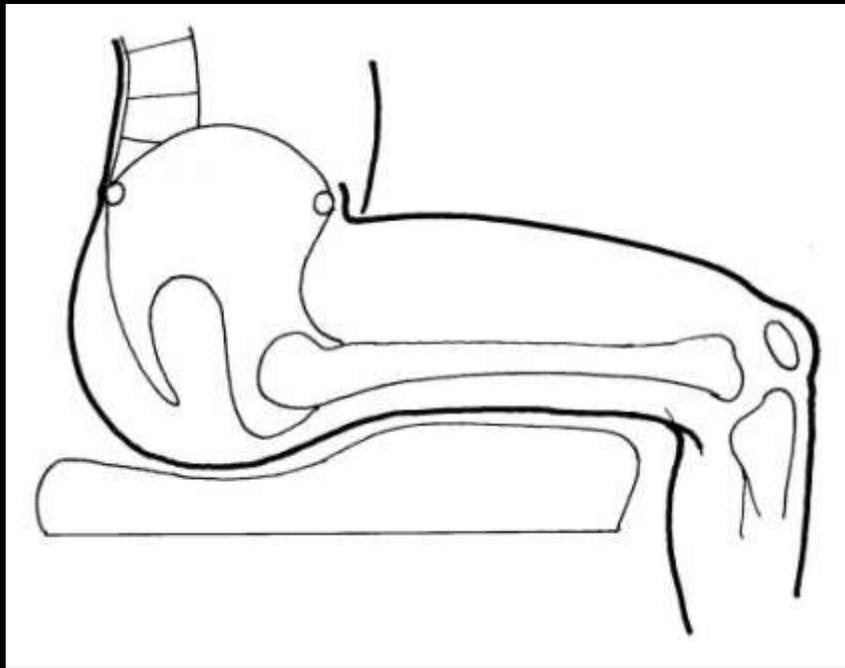


Downward Pull
Limits Upward
Movement

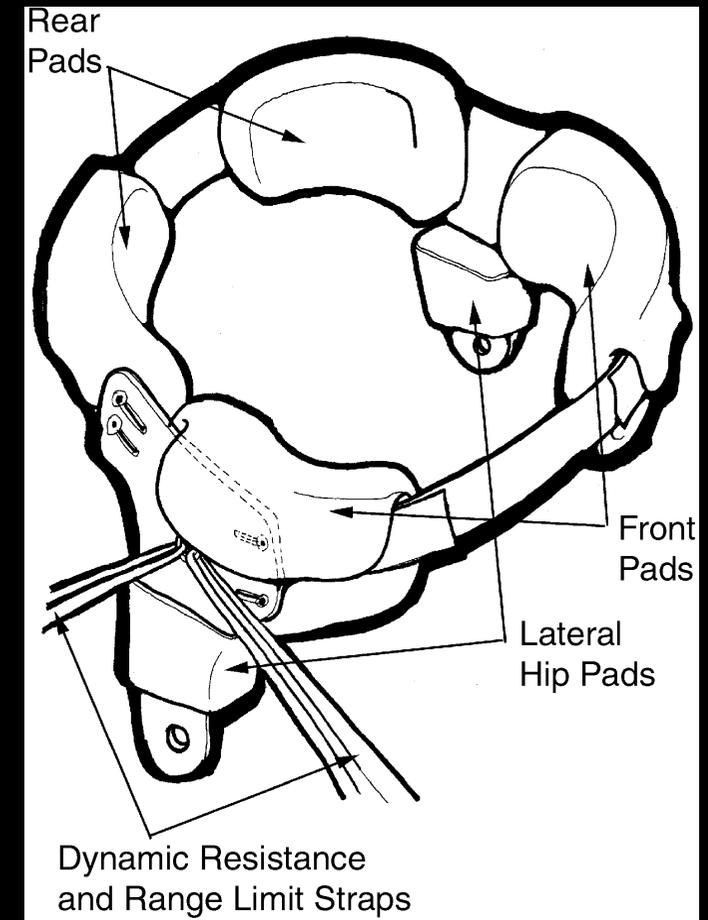
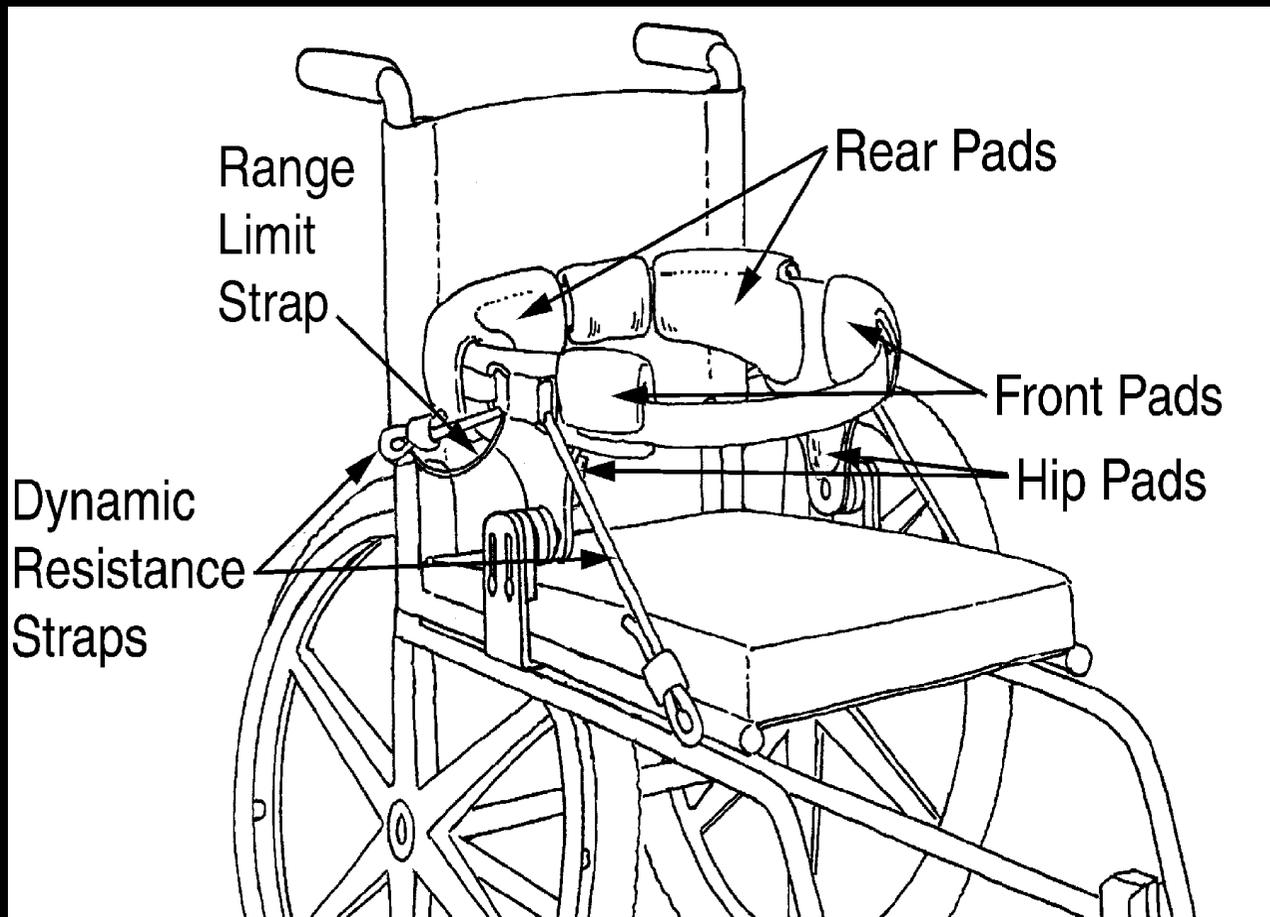
Allows Posterior
Pelvic Rotation

Limits Full Anterior
ROM

HipGrip Concept



HipGrip Ph1 - Prototype 2



What Is the HipGrip?



- Dynamic Pelvic Support
- Provides Pelvic Stability
- Allows Controlled Anterior Tilt ROM



HipGrip Test Fixture



Functional Forward Reach



Functional Reach Downward



HipGrip

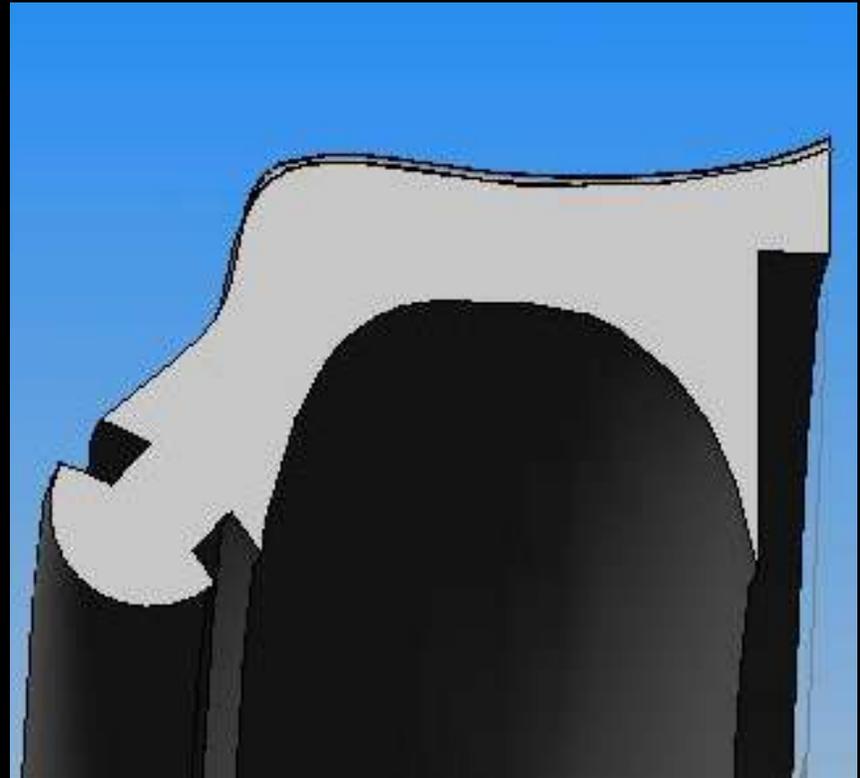
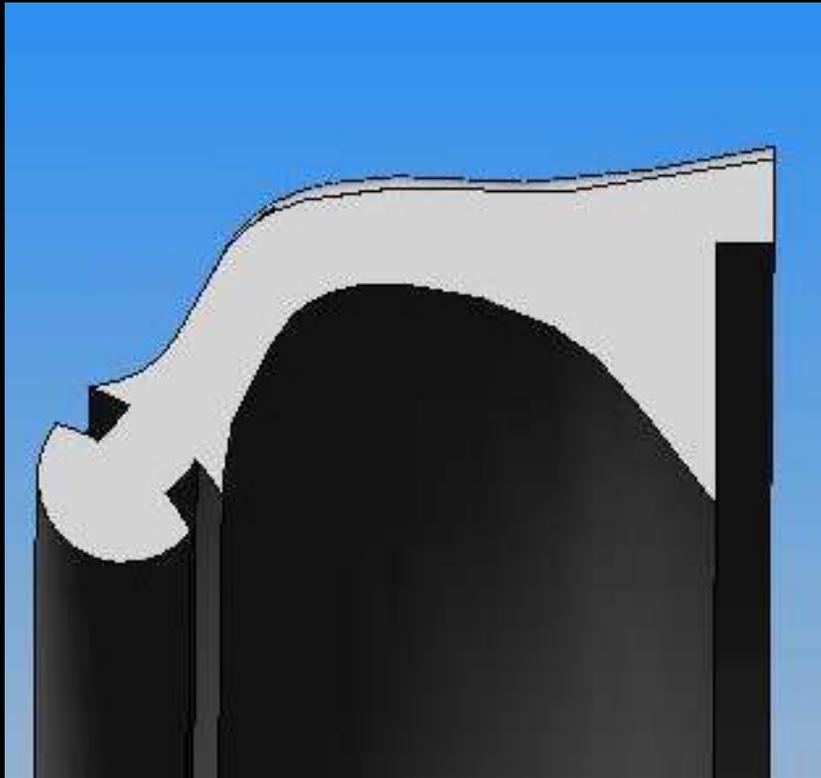


Available from
Bodypoint

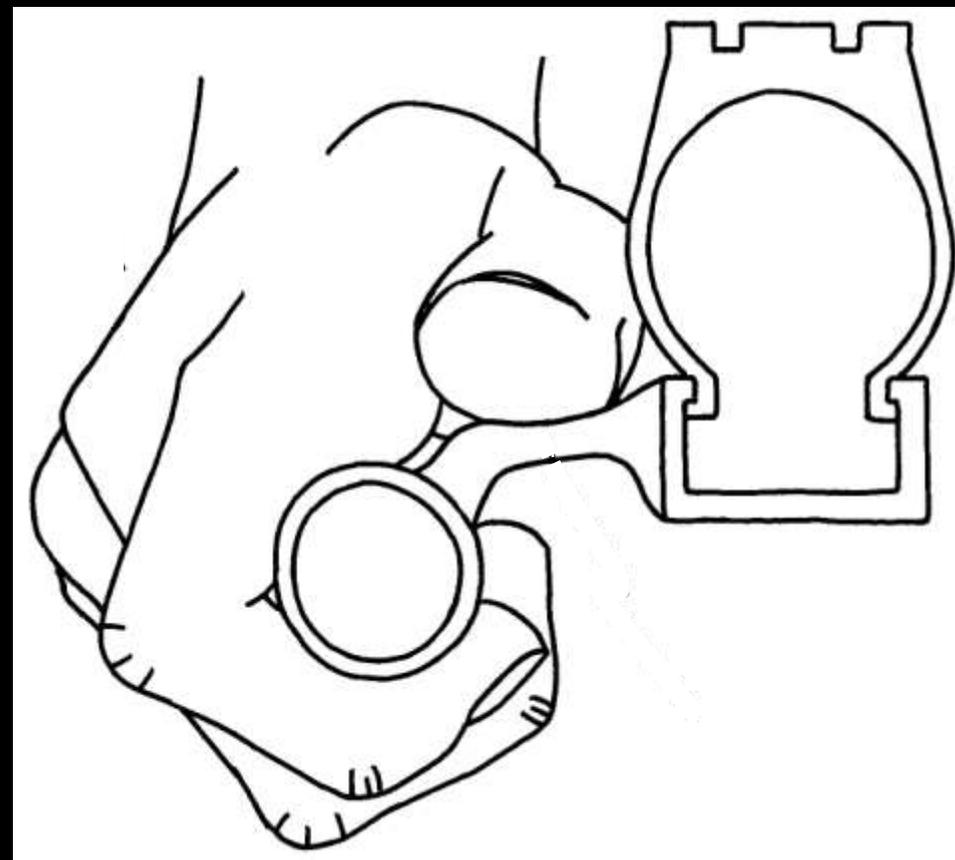
FlexRim – Combining the discrete compliant fasteners into one



**The best profiles were
fully developed and
tested**

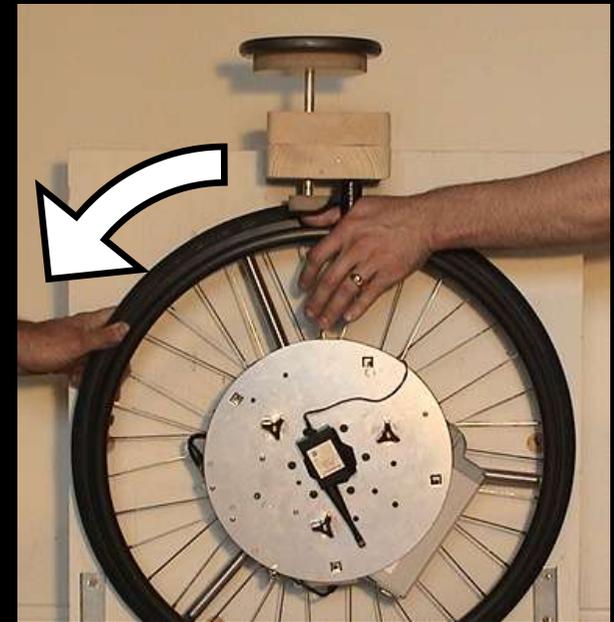


FlexRim Ergonomic Pushrim

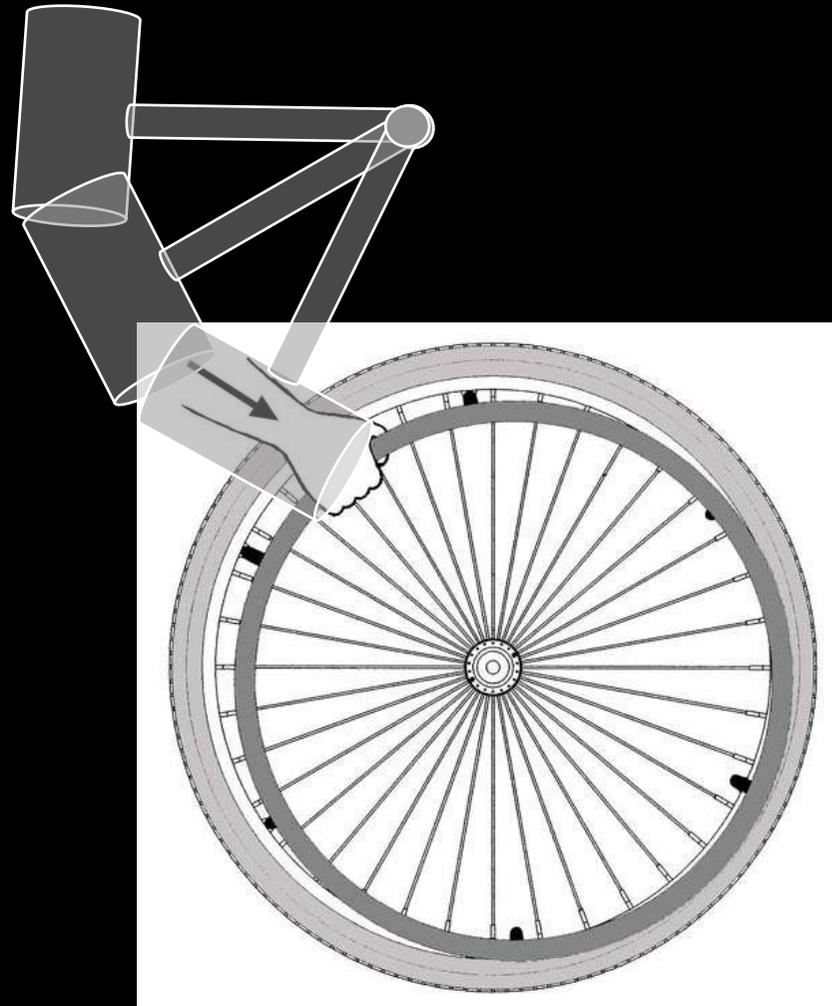


Frictional improvements

Preliminary tests show over a 2x increased frictional coefficient



Impact absorption



**Applied a 120 lb repetitive
load in one place until failure**



Baseline study – FlexRim

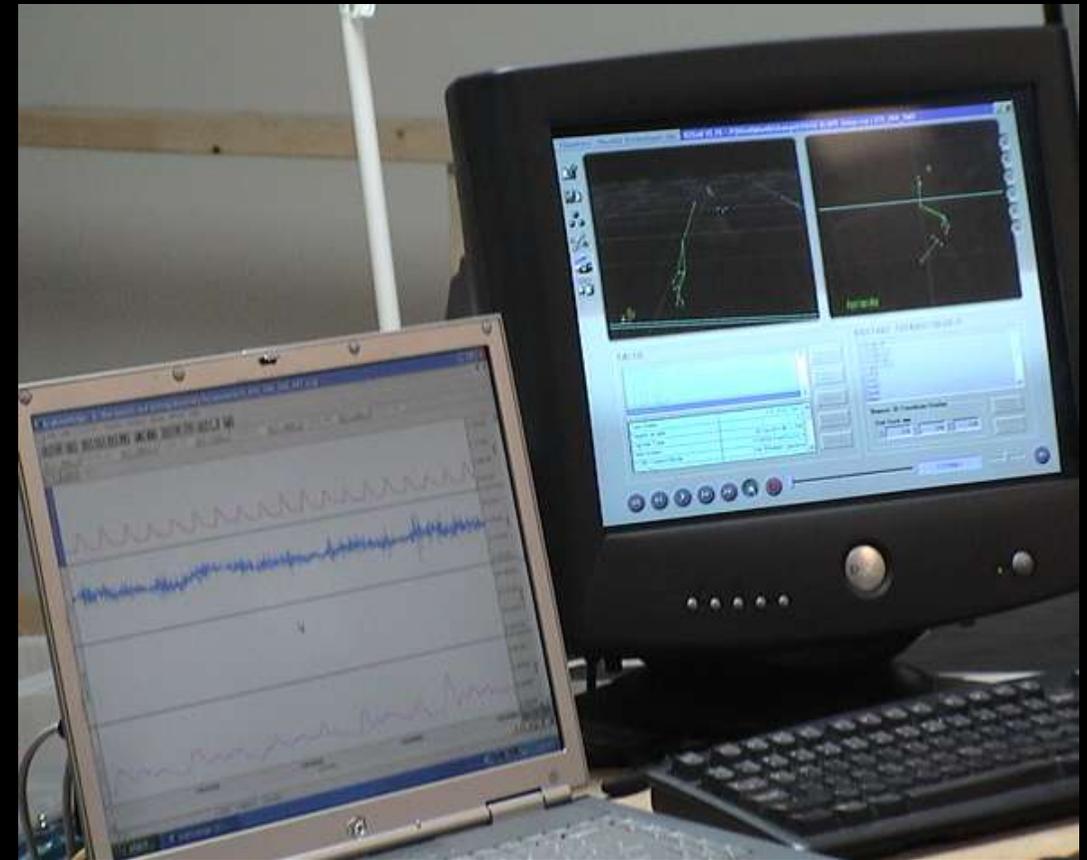
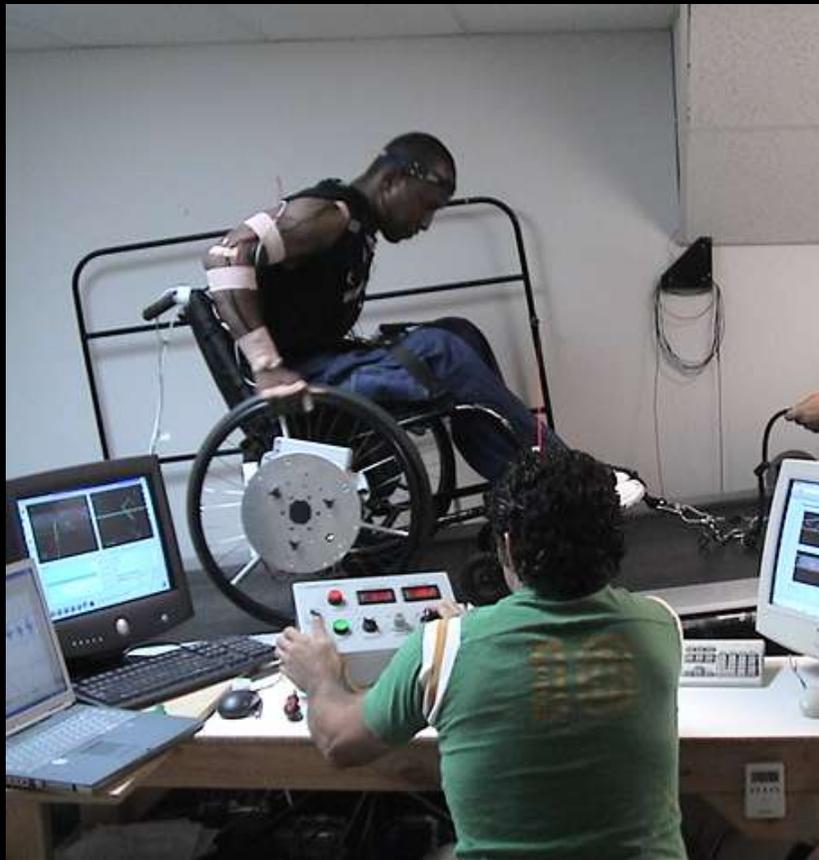


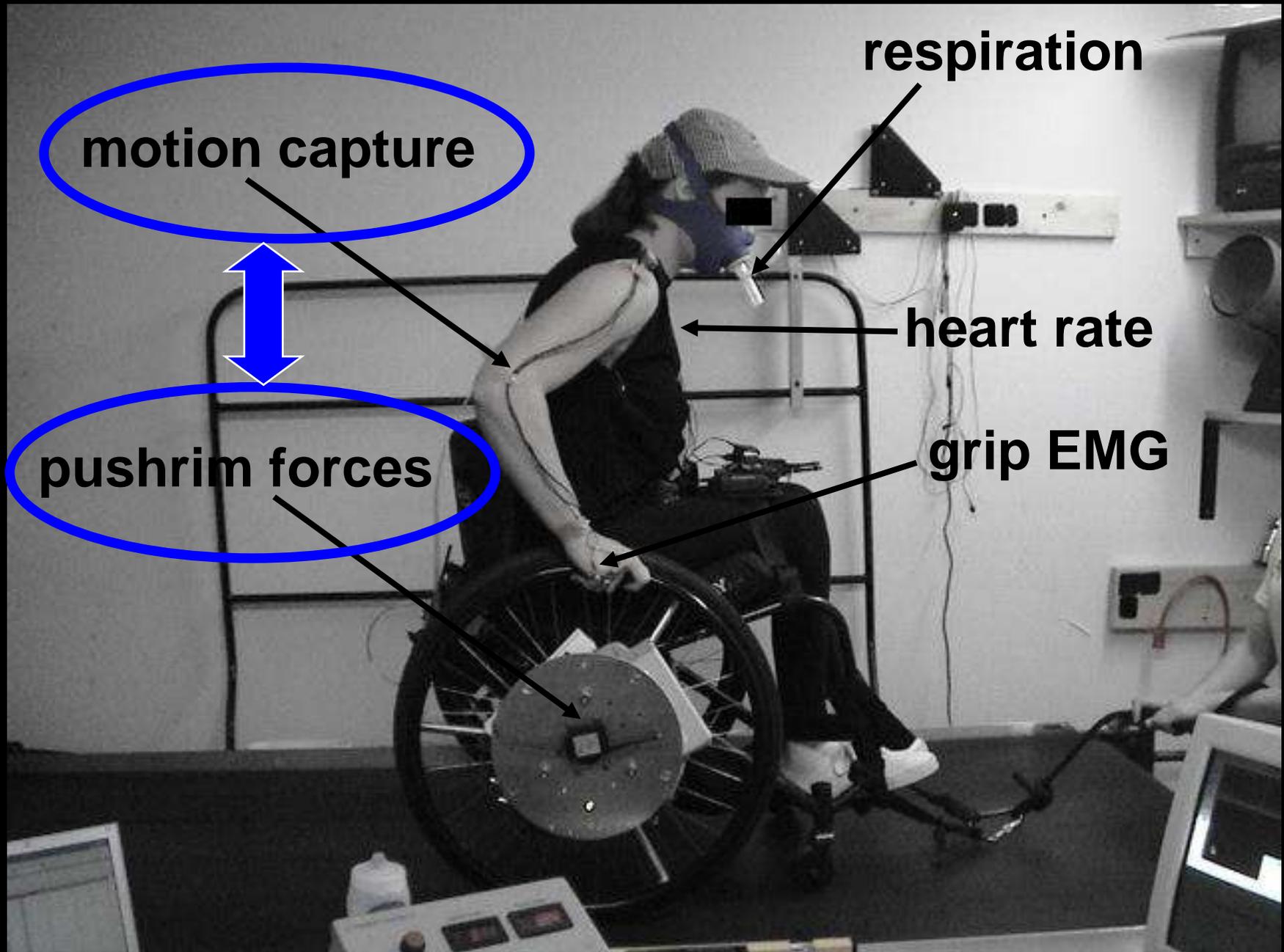
e



WICKIE RTR

Subjects are tested over a wide variety of usage environments





motion capture



pushrim forces

respiration

heart rate

grip EMG

FlexRim



Design

The FlexRim consists of a durable high friction rubber surface that spans between the aluminum pushrim and the wheel. The shape of the rubber is ergonomically designed to conform to your hand when gripped, making it the most comfortable pushrim you will ever use.

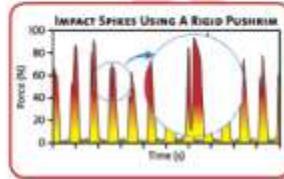


Because the rubber is flexible, the pushrim can compress to allow your wheelchair to squeeze through narrow doorways.



Overuse Injuries

Shoulder and wrist problems are very common among wheelchair users. Impact loading is one of the contributing factors. Your hands and arms absorb impact spikes when you first hit the pushrim, illustrated in the graph below.



- Reducing impact is one strategy recommended to help protect you from developing overuse injuries.

Impact Testing

Impact loading of the FlexRim was studied for a wide range of impact intensities.

- The FlexRim was found to consistently reduce impact loading by 10%.



Propulsion Testing

In lab testing, wheelchair users pushed with both a standard pushrim and the FlexRim on a research treadmill. Grip muscle activity, oxygen demand and power generated were all measured during propulsion and compared across pushrims.



Results of the testing were:

- Users required **12% less grip force** to push with the FlexRim.
- Overall **grip exertion was reduced by 15%**.
- On average users required **12% less oxygen** to push with the FlexRim than with a standard pushrim.
- Users generated **18% more power** when using the FlexRim.

The ergonomic benefits of the FlexRim have been published in numerous scientific journals and in a PhD dissertation at Stanford University.

FLEXRIM
BY INNOVATION
Advanced Ergonomics

Beneficial Designs
research/design/education

Designing beyond the norm to meet the needs of all people.

GripRim



Adaptive Canoe Seating









Methods - Endurance

MedGraphics VO2000
portable metabolic
system



Lateral Balance Test



Water Egress Testing





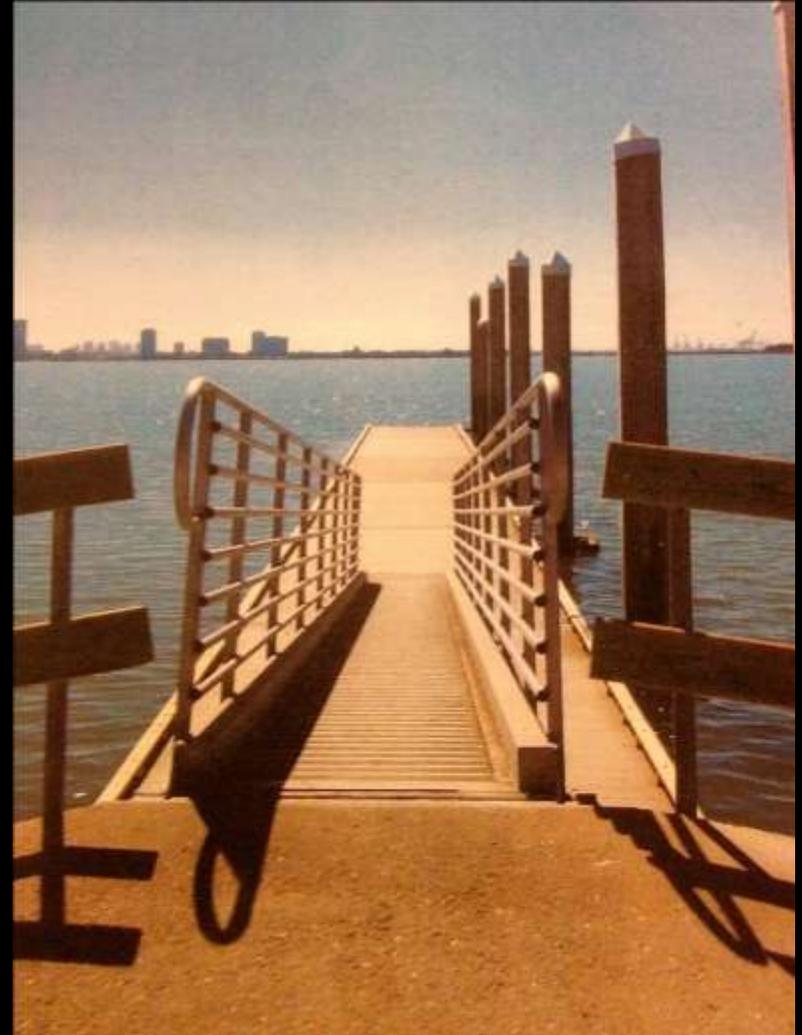
Wave Ski



Environmental Technologies

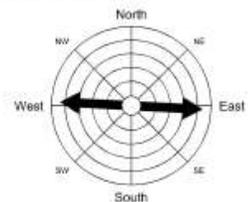
Things that do not move

Small Watercraft Launch Access



**Amenities & Allowed Uses:**

-  Boat launch
-  Drinking water
-  Canoe access
-  Fishing pier
-  Hand launch
-  Kayaking
-  Motorboating
-  Parking
-  Restrooms

Water Conditions / Exposure:**Fetch:****Current:**

Type: Tidal

Fluctuation: ~8 ft

Type: Tidal

Wave Height: < 1 ft

High Float Boat Launch Pier

San Francisco Bay Area Water Trail Program

**Water Trail Access Information****Access Route**

Parking to Launch Environment	
Length	+ 200 ft
Elev Loss	2 ft
Grade	
Typical	< 5%
Cross Slope	
Typical	< 2%
Tread Width	
Typical	> 10 ft
Surface	
Type	Asphalt/Concrete
Stability	Paved
Amount	100%

Water Access Route

Edge of Environment to Transfer Area	
Length	66 ft
Elev Loss	6.5 ft
Grade	
Typical	14%
Maximum	15%
Cross Slope	
Typical	< 2%
Tread Width	
Typical	98 in
Surface	
Type	Concrete/Composite Floating Dock Panels
Stability	Hard
Amount	100%

Transfer Area

Launch Type	Concrete Boat Launch / High Float Dock
Clear Space	
Length	Unlimited / ~60 ft
Width	~50 ft / 98 in
Grade	14% / 0%
Cross Slope	0% / 0%
Surface	
Concrete / Composite	
Height Above Water	0 / 19 in
Boat Orientation	Unlimited / Parallel

WARNING: Conditions may have changed since December 2012 when this facility was assessed. Temporary obstacles are not reported.

Signage created by Beneficial Designs Inc. using data collected by a certified trail assessment coordinator.

The State Coastal Conservancy is leading the implementation of the San Francisco Bay Area Water Trail (Water Trail) in close collaboration with the Association of Bay Area Governments (ABAG), the San Francisco Bay Conservation and Development Commission, and the Department of Boating and Waterways. The Water Trail is a growing network of access sites (or "trailheads") that will help people using non-motorized, small boats or other beachable sail craft, such as kayaks, canoes, dragon boats, stand-up paddle and windsurf boards, to safely enjoy single and multiple-day trips around San Francisco Bay.

<http://scc.ca.gov/2010/07/30/san-francisco-bay-area-water-trail/>

Universal Trail Assessment Process (UTAP)



Key UTAP Information

Length



Grade



Width



Surface



Cross
slope



Features &
Facilities



UTAP Assessment Team



UTAP – Implementation Status

Over 1200 people trained to lead UTAP
assessments

Over 155 trainers to teach UTAP
workshops

High Efficiency Trail Assessment Process



HETAP- Rollawheel





**Last Station Recorded**

25

Paved

Ice

Copy Surf. Data ->**Tread Width:****Surface Category:****Surface Type:****Distance:****Grade:****Cross Slope:****Current Station To Record**

25

in

Set MCW

Paved

Ice

7.2 Ft

-0.7 %

0.8 %

Record Station**Add Features****Return Home****Distance Hold****Manual Entry****View Data****Alarm Settings****Browse Images****New Segment****Current Segment:**

2 Joggin Lampe 2007-06-12

Outslope**Check Outslope Direction**

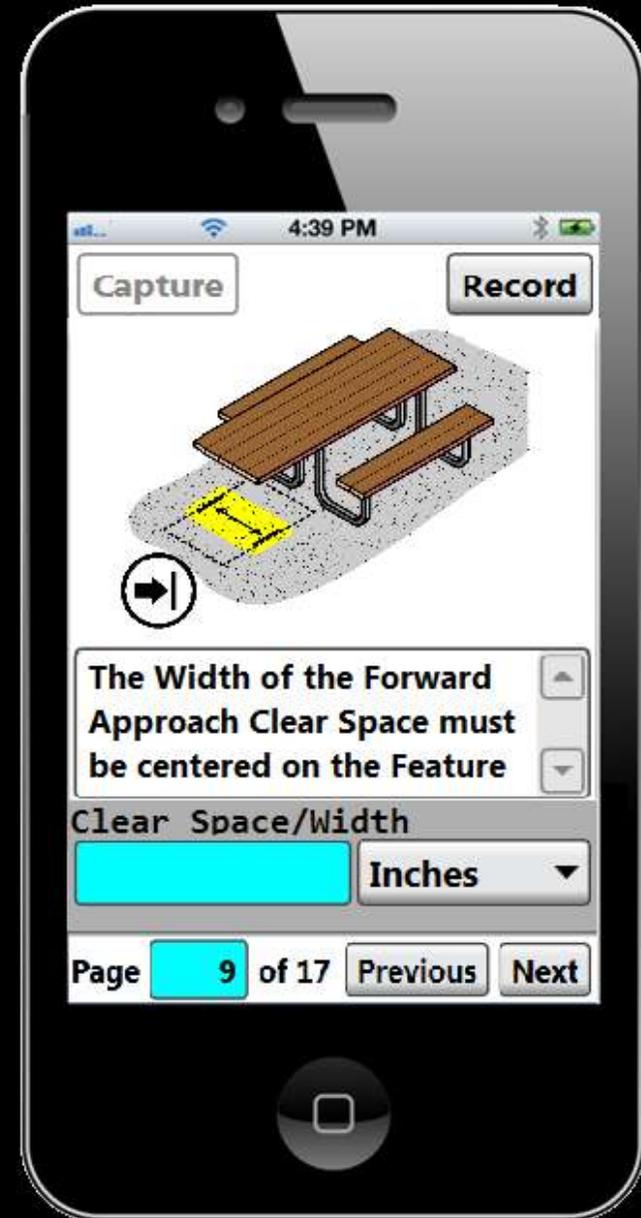
<- Left

Right ->

Vehicle Orientation **Forwards** **Backwards****Show Camera Preview****Compass Heading:** ° True**GPS Location and Status****Lat:****Lon:****Apprx. Err:****Elev:**

Error: Garmin GPS is not connected

Developed Outdoor Recreation Assessment Process



Outdoor Constructed Features

Bench

Camp Shelter

Cooking Surface/Grill

Fire Ring, Wood

Stove/Fireplace

Outdoor Rinsing

Shower

Parking Area

Picnic Table

Pit Toilet

Tent Pad/Platform

Toilet Building

Trash/Recycling

Receptacle

Utility/Sewage

Connection

Viewing Area at

Overlooks

Viewing Scope

Water Spout

Adjustable Height Cooking Grill



Water Pump with Closed Fist Operation



Water Pump Actuation Force

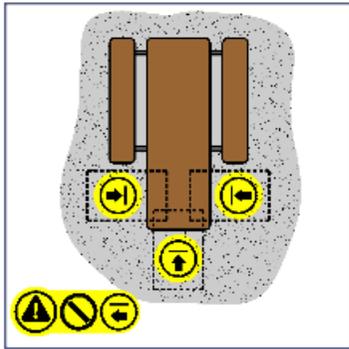


Water Pump Height Measurement



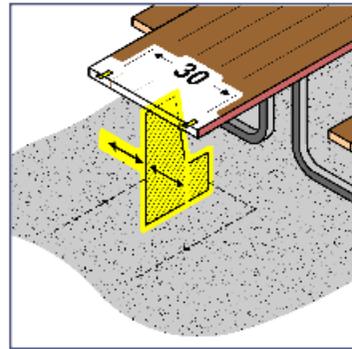
Picnic Table Clearance Space



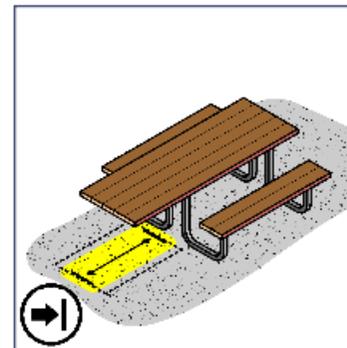


Specify the Approach Type

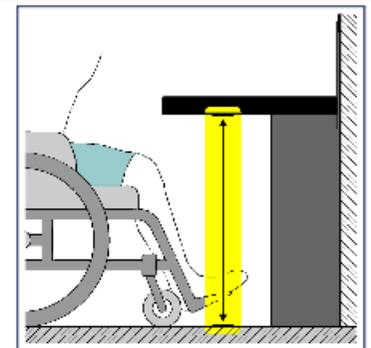
Verify that a Clear Space is positioned for Forward Approach to Tables



Using the appropriate profile, verify that the minimum clear space is provided below the table surface at each wheelchair space provided



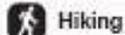
The Length of the Parallel Approach Clear Space must be centered on the Fixture



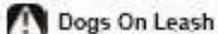
Measure the Vertical Distance from the Ground Surface to the top of the Knee Clearance

Tahoe Meadows Interpretive Trail

Length 1.5 mi (2.3 km)



Hiking



Dogs On Leash



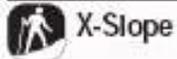
Grade

Typical Grade 2.3%

7% of the trail is 6%

327 ft (100 m) is 7%

6% grade is a standard ramp.



X-Slope

Typical Cross Slope 2.0%

99% of the trail is 3% to 5%

304 ft (93 m) is 6% to 10%



Tread
Width

Typical Tread Width

7.5 ft (2.3 m)

Minimum Clearance Width

42 in (107 cm)

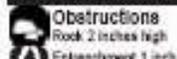


Surface
Type

Aggregate / Gravel

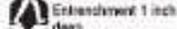
82% is Firm or better

1408 ft (429 m) is Soft or worse



Obstructions

Rock 2 inches high



Entrenchment 1 inch

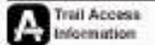
deep



Rock 2 inches high

NOTES: The conditions may have changed since any construction was completed. Beneficial Designs Inc. is not responsible for any damage to property or personal injury. Beneficial Designs Inc. is not responsible for any damage to property or personal injury.

For more information, please visit our website at www.beneficialdesigns.com or call us at 800-875-8758.

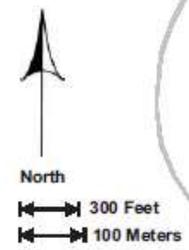
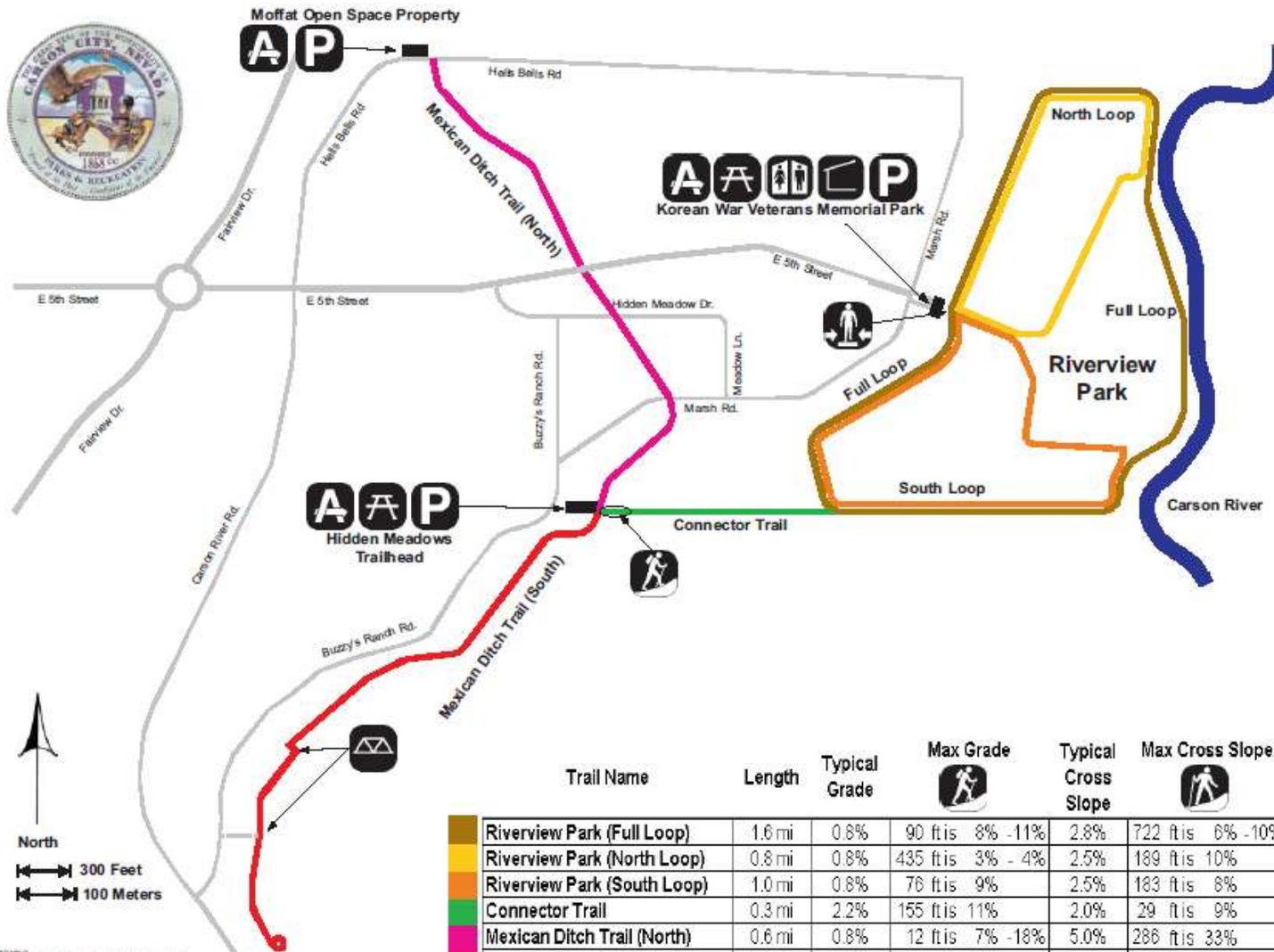


Trail Access
Information

Trail Access Informationin a Food Facts Label Format



Riverview Park / Mexican Ditch Trail System



MAP 081012
 This map was last updated on July 2022 when the Full Loop was removed. Any other trail updates, trail closures, trail rerouting, or other trail information will be posted on the Carson City Parks and Recreation Department website. Please visit our website for more information.
 Map created by Mountain Creek Trail Co. P.O. Box 1000, Reno, NV 89502-1000. Using data collected by a certified trail maintenance contractor.

Trail Use:

- Hiking
- Bicycling
- Equestrian
- Dogs Allowed per posted restrictions
- No Motor Vehicles Except City Maintenance Vehicles
- 16" Minimum Clearance Width Contact the Carson City Parks and Recreation Dept. at 887-2262 for gate access.
- Trail Access Information

Trail Name	Length	Typical Grade	Max Grade	Typical Cross Slope	Max Cross Slope	Typical Trail Width	Min Clearance Width	Surface Type
Riverview Park (Full Loop)	1.6 mi	0.8%	90 ft is 8% -11%	2.8%	722 ft is 6% -10%	11 ft	16 in	Aggregate / Gravel
Riverview Park (North Loop)	0.8 mi	0.8%	435 ft is 3% - 4%	2.5%	189 ft is 10%	10 ft	16 in	Aggregate / Gravel
Riverview Park (South Loop)	1.0 mi	0.8%	76 ft is 9%	2.5%	183 ft is 8%	12 ft	16 in	Aggregate / Gravel
Connector Trail	0.3 mi	2.2%	155 ft is 11%	2.0%	29 ft is 9%	12 ft	60 in	Aggregate / Gravel
Mexican Ditch Trail (North)	0.6 mi	0.8%	12 ft is 7% -18%	5.0%	286 ft is 33%	12 ft	60 in	Aggregate / Gravel
Mexican Ditch Trail (South)	0.6 mi	0.7%	74 ft is 3%	2.5%	212 ft is 10%	8 ft	60 in	Sand

A standard ramp has an 8% grade.

Washoe Lake State Park

TRAIL USE

- Hiking
- Bicycles
- Equestrian
- Dogs on Leash
- No Motor Vehicles

- No public access beyond viewing tower on Wetlands Loop February 1-July 15 to protect nesting habitat
- No bicycles allowed on Wetlands Loop
- No equestrians allowed on Wetlands Loop and Deadman's Creek Trail

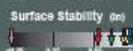
LEGEND

- Bridge
- Parking
- Restroom
- Picnic Area
- Boat Launch
- Drinking Water
- Maximum Grade
- Stair Viewing Tower
- Entrance Fee Station
- Horse Trailer Parking

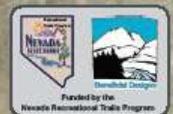
Trail Access Information

Trail Name	Length	Typical Grade	Maximum Grade	Typical Cross Slope	Maximum Cross Slope	Typical Tread Width	Minimum Clearance Width	Surface Type	Surface Firmness		Surface Stability	
									Typical	Worst	Typical	Worst
Beach Stroll	2.7 mi	1.6%	220 ft ls 8-9%	2.6%	473 ft ls 6-11%	42 ft	20 ft	Sand	0.98	1.00	2.01	2.03
Day Use Pathway	0.4 mi	2.2%	9 ft ls 9-15%	2.9%	333 ft ls 5-7%	6 ft	48 in	Asphalt	0.16	0.16	0.18	0.18
Deadman's Creek Trail	0.6 mi	7.5%	309 ft ls 16-28%	7.8%	296 ft ls 16-26%	26 in	16 in	Soil	0.17	0.18	0.46	0.57
Dune Trek	2.4 mi	9.2%	175 ft ls 35-49%	4.2%	217 ft ls 16-23%	32 in	18 in	Sand	0.77	0.80	1.93	2.00
East Loop	3.8 mi	2.0%	106 ft ls 8-15%	1.6%	35 ft ls 8-13%	43 in	18 in	Sand	0.41	0.53	1.06	1.59
North Loop	3.4 mi	1.6%	173 ft ls 10-27%	2.4%	200 ft ls 7-9%	60 in	24 in	Sand	0.47	0.68	1.14	1.62
South Loop	2.5 mi	1.6%	316 ft ls 5-6%	2.1%	738 ft ls 5-7%	60 in	24 in	Sand	0.35	0.43	0.71	0.96
Wetlands Loop	1.1 mi	1.3%	335 ft ls 5-11%	1.6%	28 ft ls 5-11%	7 ft	48 in	Aggregate/Gravel	0.23	0.27	0.61	0.67

WARNING: Trail conditions may have changed since January 2009 when these trails were assessed. Secondary trails are shown in black. Not all trails are mapped. Signage created by Beneficial Designs, Inc. using trail data collected by a certified trail assessment coordinator.



Rough Draft Only
2009-12-24
5 at 20x24 at south equestrian, north equestrian, entrance area, middle, Deadman's



Tahoe Meadows Interpretive Trail

Humboldt-Toiyabe National Forest
Carson Ranger District

FREE COPIES of this map can be downloaded from the Humboldt-Toiyabe National Forest website or by calling the US Forest Service Carson Ranger District at (775) 882-2766



To Reno NV

Mount Rose Summit Trailhead

Mount Rose Campground

Mount Rose Summit Trail

Tahoe Rim Trail

Tahoe Rim Trail

Mount Rose State Scenic Byway
NV Highway 431

To Relay Peak and
Brookway Summit

To Incline
Village

Tahoe Meadows Trailhead
Elevation 8730 ft

Easiest Path of Travel

Vieta

Steep
Grades

Tahoe Meadows
Interpretive Trail

You Are Here

TRAIL USES PERMITTED

- Hiking
 - Dogs on leash or under control of owner
 - Bikes allowed on dotted trails only
 - Equestrians allowed on dotted trails only
 - No Motor Vehicles
- Please stay on official trails

LEGEND

- Bridge
- Camping
- Parking
- Restroom
- Campground Fee

Trail Name	Tahoe Meadows Interpretive Trail	Mount Rose Summit Trail	Tahoe Rim Trail <small>(From Tahoe Meadows Trailhead to Spooner Summit Trailhead)</small>
Length	1.3 mi	5.0 mi	21.8 mi
Typical Grade	2.5%	10.7%	7.3%
Maximum Grade	1690 ft is 5 - 7%	1003 ft is 25 - 39%	1829 ft is 20 - 29%
Typical Cross Slope	2.1%	4.1%	3.2%
Maximum Cross Slope	304 ft is 5 - 10%	1711 ft is 10 - 20%	2433 ft is 10 - 20%
Typical Tread Width	8 ft	26 in	28 in
Minimum Clearance Width	42 in	12 in	18 in
Surface Type	Decomposed Granite	Soil	Soil
Typical Surface Firmness	0.18 in (Worst 0.22 in)	0.18 in (Worst 0.21 in)	0.17 in (Worst 0.19 in)
Typical Surface Stability	0.54 in (Worst 0.62 in)	0.57 in (Worst 0.74 in)	0.51 in (Worst 0.75 in)



WARNING: Trail conditions may have changed since July 2009 when these trails were assessed. Signage created by Beneficial Designs Inc. using data collected by a certified trail assessment coordinator.

Trail Access Information



Funded by the Nevada Recreational Trails Program

www.triaexplorer.org



HOME ABOUT US DEFINITIONS LINKS TRAIL ACCESS INFORMATION

TRAIL FEATURES
Customize your search by trail use and features.

TRAIL ACCESS
Find a trail to suit your ability. Search by grade, cross-slope and surface.

TRAIL MANAGEMENT
Authorized trail managers may add or edit trail information. Contact [Beneficial Designs](#).

CONTACT US



QUICK TRAIL SEARCH



Type in (a few letters of) a park or trail name:

OR

View trails by state:

PICK OF THE MONTH



Big Basin Redwoods State Park
Boulder Creek, CA

Features 2,000 year-old redwoods and over 50 miles of trails. Reservations required for camping. Phone: 831.338.8860

Have you ever finished a three hour hike in one hour? Have you struggled on a "moderate" trail? Have you ever encountered barriers on an "easy" trail? If so, you already know the benefits of having objective trail information. The Trail Explorer website conveys objective trail information in a unique [Trail Access Information](#) format to help trail users make informed decisions about which public lands to visit, and which trails will best meet their interests, abilities and desired experiences. Trail Explorer benefits all users, but is particularly helpful for individuals who may have specific trail needs, such as individuals with disabilities, older adults, parents with young children, and novice hikers.

Acknowledgement
Trail Explorer was designed by [Beneficial Designs](#) in collaboration with [American Trails](#), land management, and disability organizations and with the support of the US Department of Education.

[home](#) | [about us](#) | [definitions](#) | [trail access information](#) | [links](#) | [acknowledgments](#) | [disclaimer](#)

© Copyright 2001 Beneficial Designs 

Trails with desired access features



HOME ABOUT US DEFINITIONS LINKS TRAIL ACCESS INFORMATION

Click on the trail name for more information. Click on the column heading to sort by column.
9 trails found. Use the "Back" button on your browser to refine your selection.

Trail	Park	Nearest Town(s) State	Length	Uses	Typical Grade	Surface Firmness	Trail Information
Trail 10	McCormick's Creek State Park	IN	0.7 miles (1.1 km)	Hiking	3.3%	Firm	Trail 10 begins near the stairs on Trail 3. The trail follows McCormick's Creek downstream to the Old Statehouse Quarry and Trail 2. Depending on the season and water levels, that trail borders the creek, crosses the creek numerous times, or is completely in the creekbed.
Trail 8	McCormick's Creek State Park	IN	0.7 miles (1.1 km)	Hiking	2.3%	Paved	Trail 8 connects the campground to the swimming pool and Nature Center. Pine Bluff Shelter and picnic/playground area can be reached from the trail.
Trail A	McCormick's Creek State Park	IN	0.2 miles (0.3 km)	Hiking	2.2%	Firm	Trail A is a connector trail from the Class A campground to Trail 7.
Trail 6	Spring Mill State Park	IN	0.4 miles (0.7 km)	Hiking	2.3%	Paved	Trail 6 is a paved loop trail near the Virgil I. "Gus" Grissom Memorial.
Trail 7	Spring Mill State Park	IN	0.9 miles (1.5 km)	Hiking	3.3%	Firm	Trail 7 loops around the Oak Ridge Picnic Area and connects with Trail 7 Spur that leads to Trail 4.
Trail 7 Spur to Trail 4	Spring Mill State Park	IN	0.4 miles (0.6 km)	Hiking	3.9%	Firm	Trail 7 Spur connects Trail 7 from the Oak Ridge Picnic Area to Trail 4
Trail 10 Spur to Camels Back	Turkey Run State Park	IN	0.1 miles (0.2 km)	Hiking	0.9%	Firm	The spur to Camel's Back begins at the junction of Trail 10. The short trail ends at Camel's Back. There is an observation deck and bench.
Trail 11	Turkey Run State Park	IN	0.2 miles (0.3 km)	Hiking	3.1%	Firm	Trail 11 starts from the Service Road besides the Turkey Run Inn. A short hike about Turkey Run Hollow to the Lieber Memorial and Log Church.
Trail 7 Spur to Campground	Turkey Run State Park	IN	0.1 miles (0.2 km)	Hiking	3.3%	Firm	Connector trail between the Campground and Trail 7.



Develop standards for trail and sidewalk design



Architectural Barriers Act Outdoor
Recreation Access Guidelines
Public Rights of Way Access
Guidelines

ADA Recreation Trail

Grade

up to 30% of length $> 8.33\%$

5% for any distance

8.33% for 200 feet

10% for 30 feet

12.5% for 10 feet

14% for 5 feet in drains if cross slope $< 5\%$

ADA Recreation Trail

Cross Slope

5%

10% in drains if width > 42 inches

Rest Areas

60 inches length, trail width, 5% slope

Edge Protection

3 inches minimum height when provided

ADA Outdoor Access Route

Surface

firm and stable

Width

36 inches

exception 32 inches for up to 24 inches

Openings

< 0.5 inch sphere



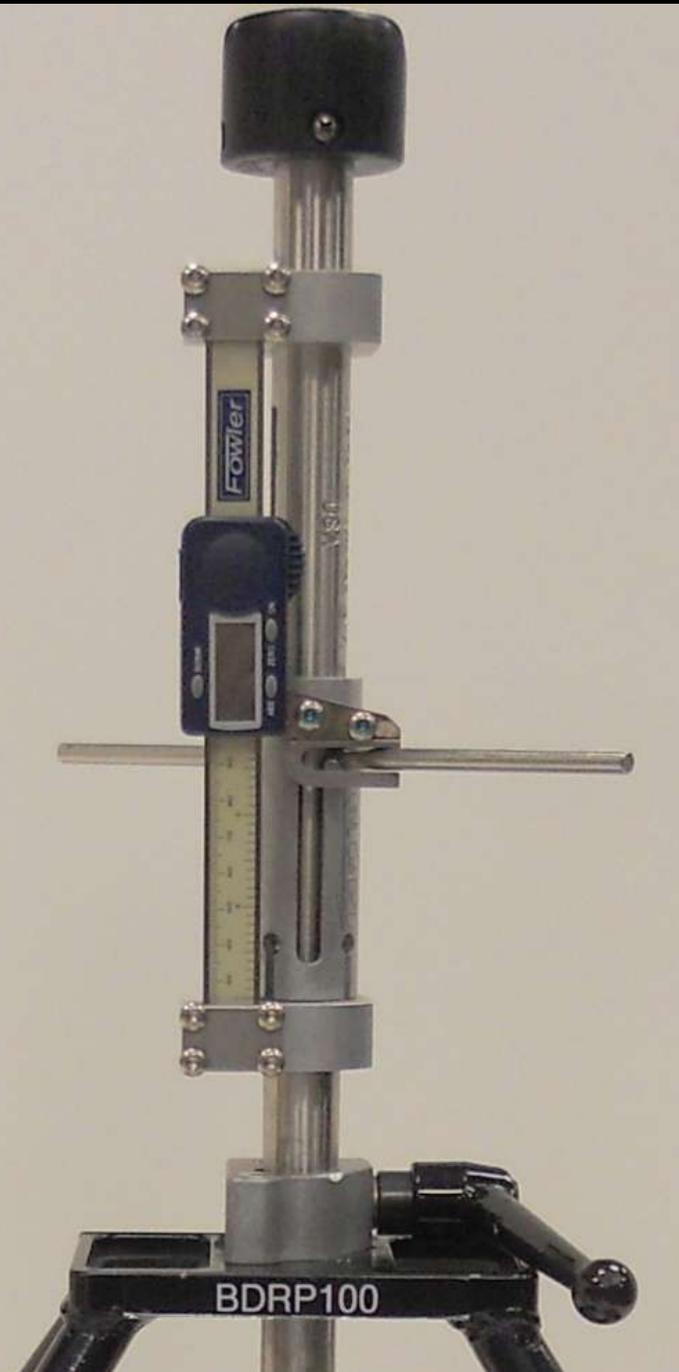
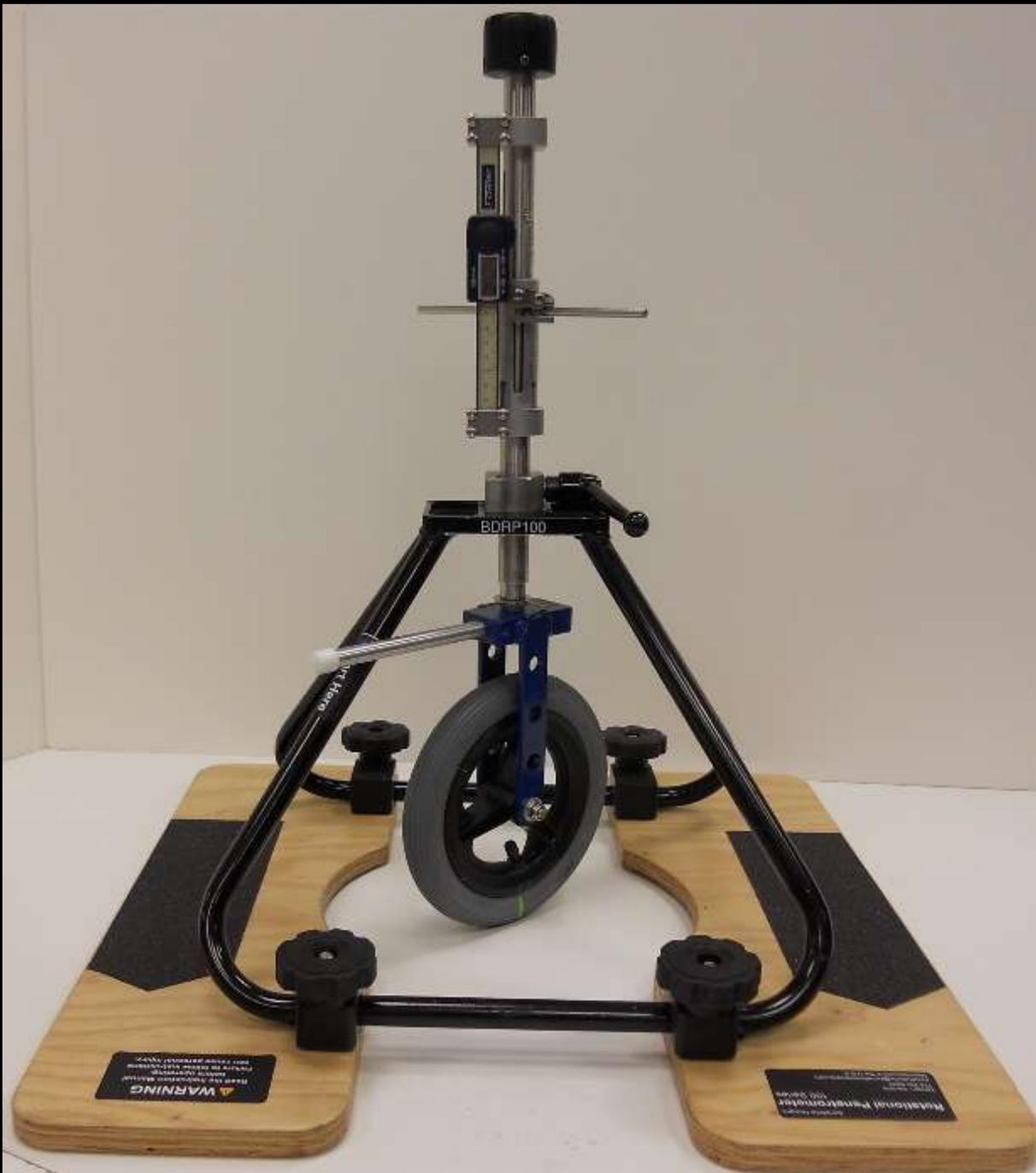


Rotational Penetrometer



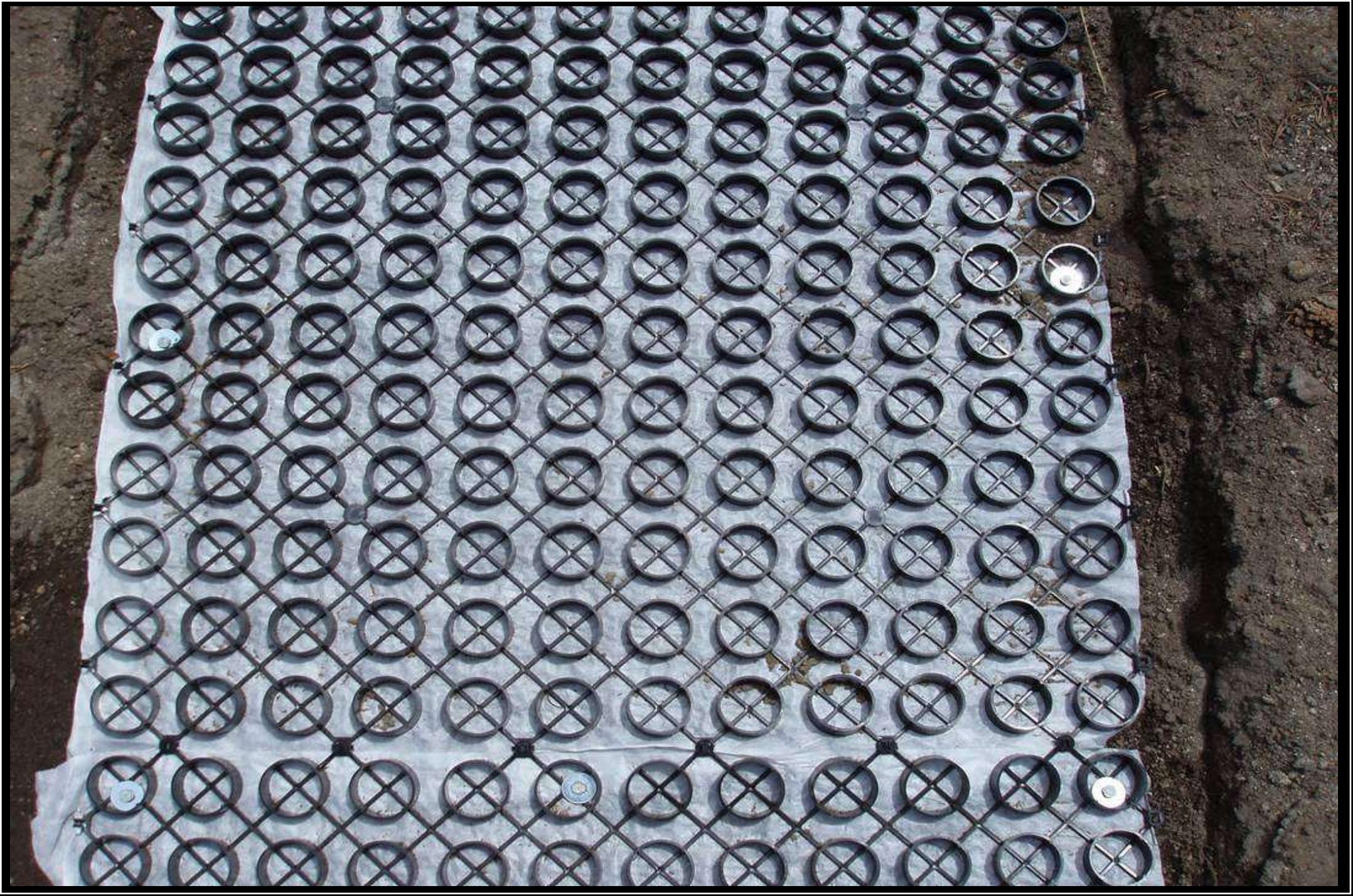
Objective surface
measurement device

Available from
Beneficial Designs



**Trail with firm
but unstable
sandy surface**

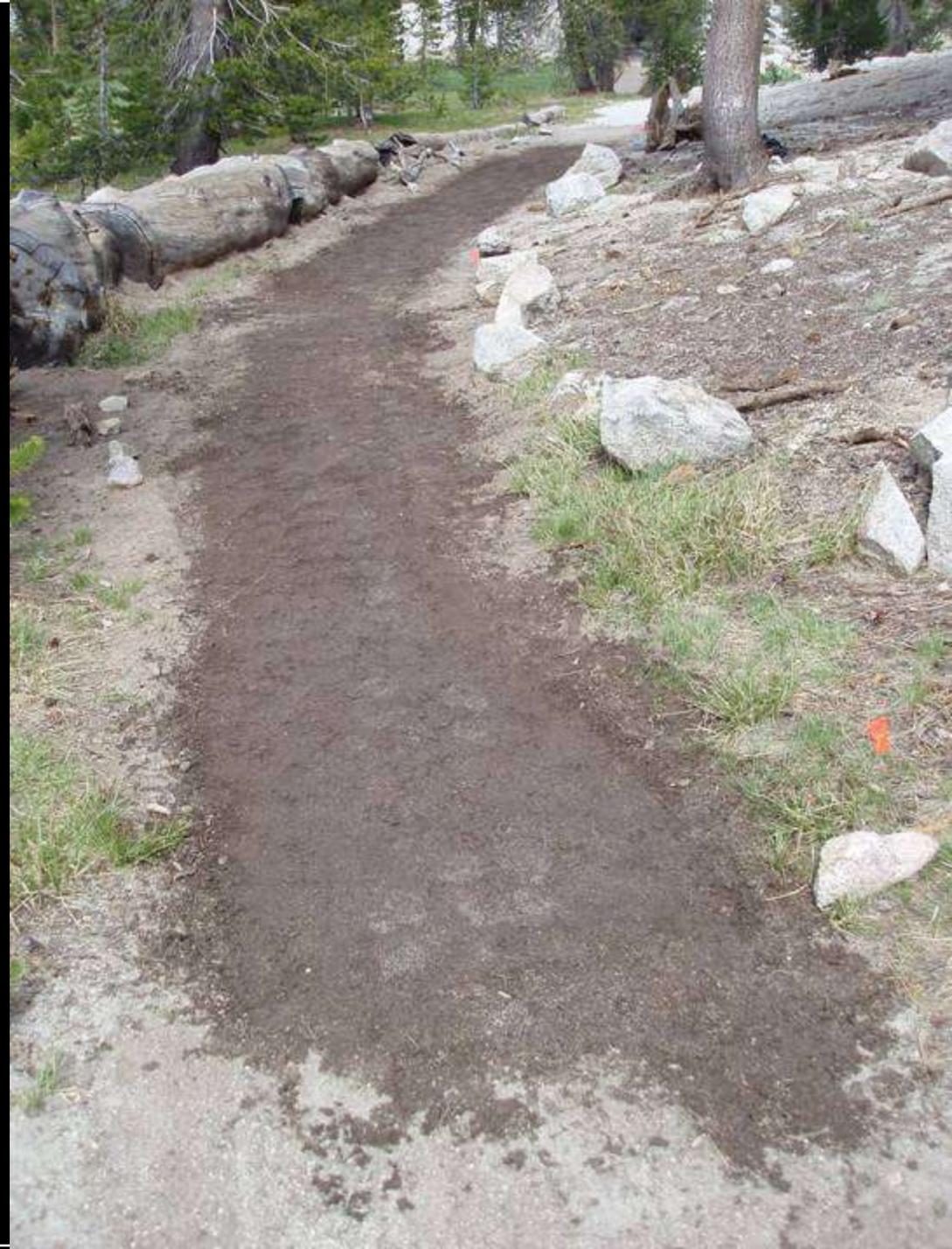






**Trail after
Installation
of surface
stabilizer**

Gravelpave2



Rotational Penetrometer Readings-Gravelpave 2

Before Application

Firmness Stability

0.18 0.77

0.17 0.87

0.17 0.77

0.18 0.88

0.18 0.79

0.18 Avg 0.82

After Application

Firmness Stability

0.17 0.37

0.17 0.38

0.18 0.42

0.17 0.35

0.18 0.40

0.17 Avg 0.38





BRIGHT TRANSITIONS

Project #: 216-2

Date: 4/27/09

Street Name: OLVA WEST Segment Name: * Distance: 233'9"

** N COUNTY ROAD TO MICKLAND*

N
S
E
W

N
S
E
W

9/16" 0.56

Sidewalk Assessment Process





Digital Measuring Wheel

Wireless

High accuracy
with resolution of
0.1 Inches (1 mm)



Digital Height Measuring Device

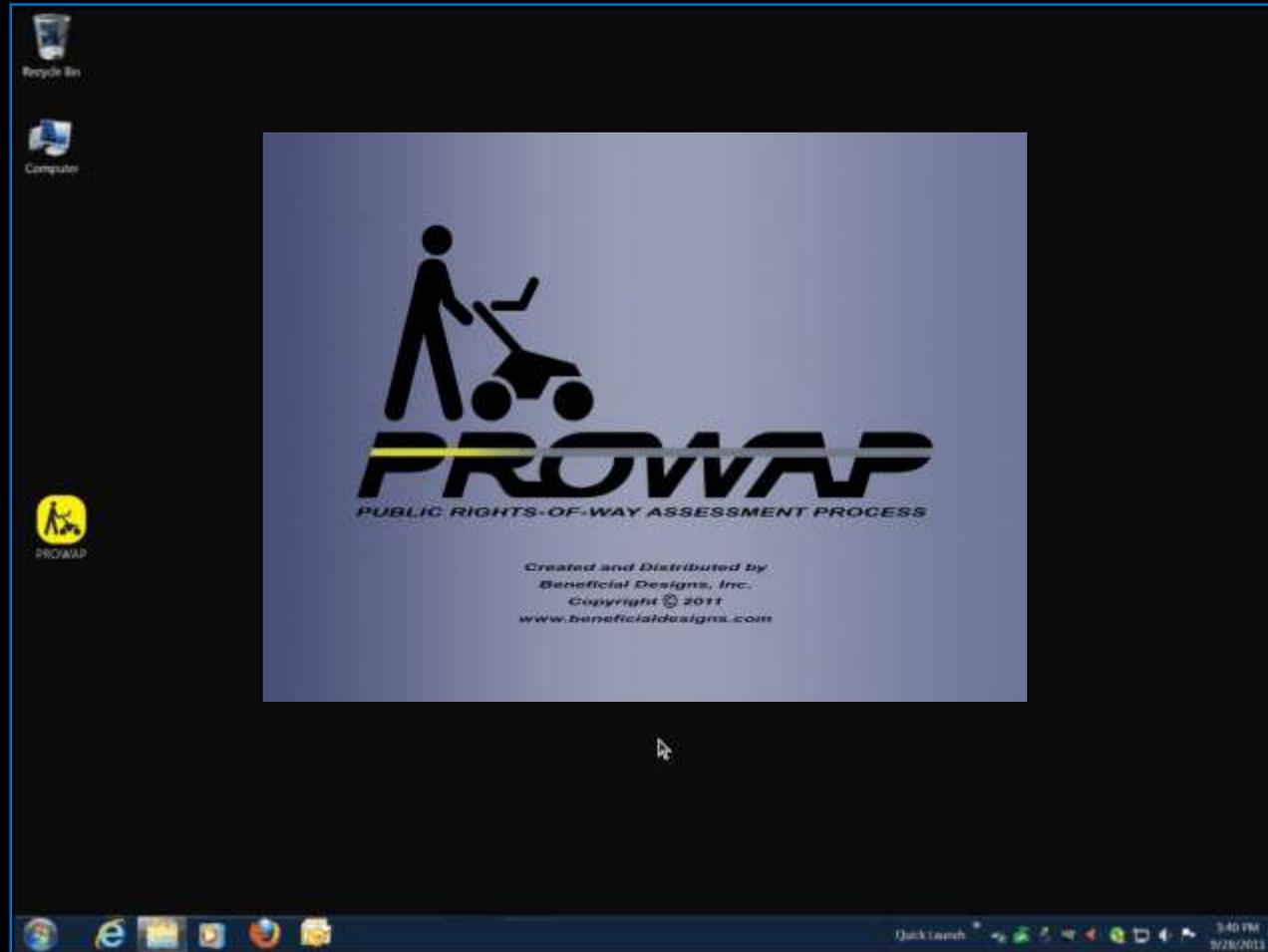
High accuracy

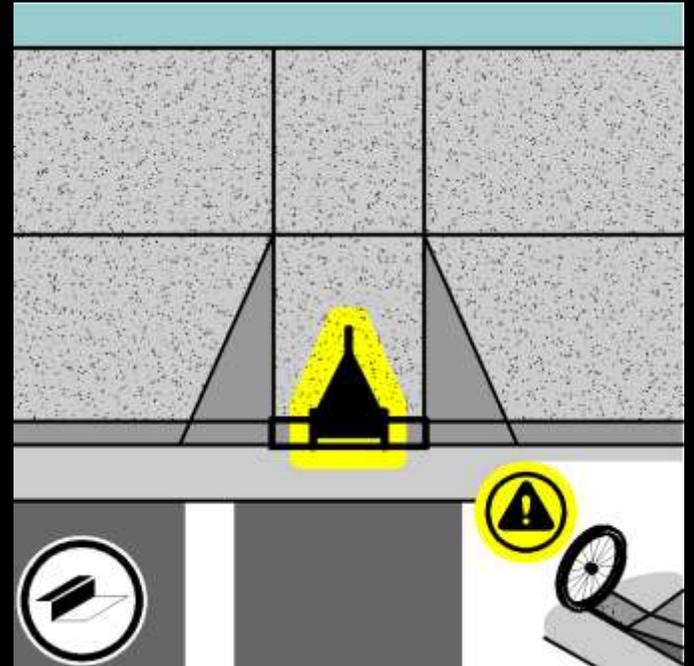
Fast measurement

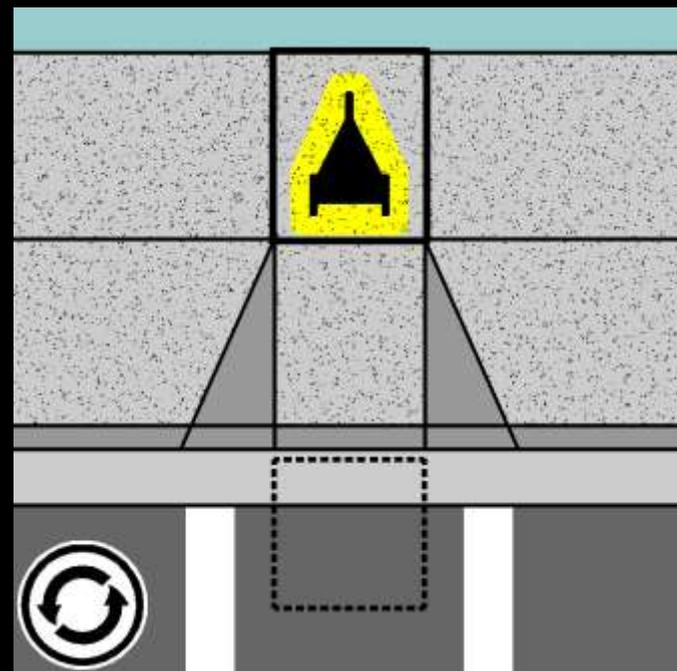
Resolution of
0.01 inches (0.1 mm)

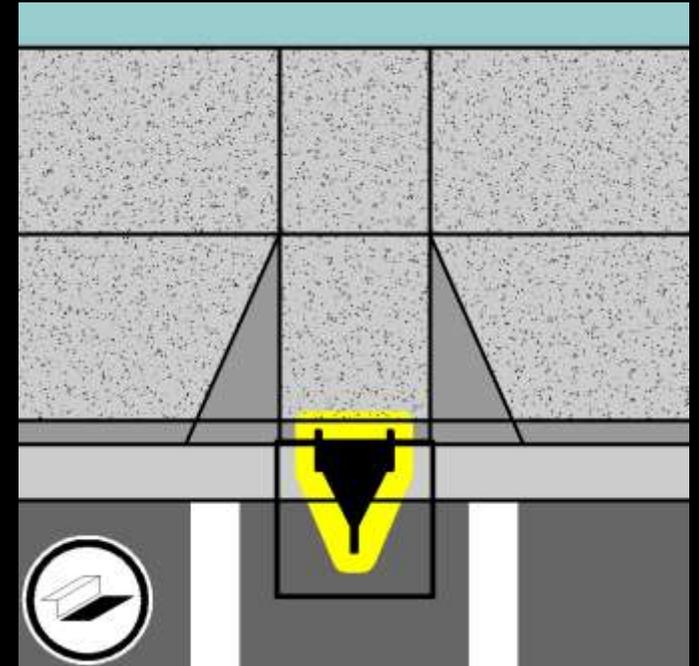


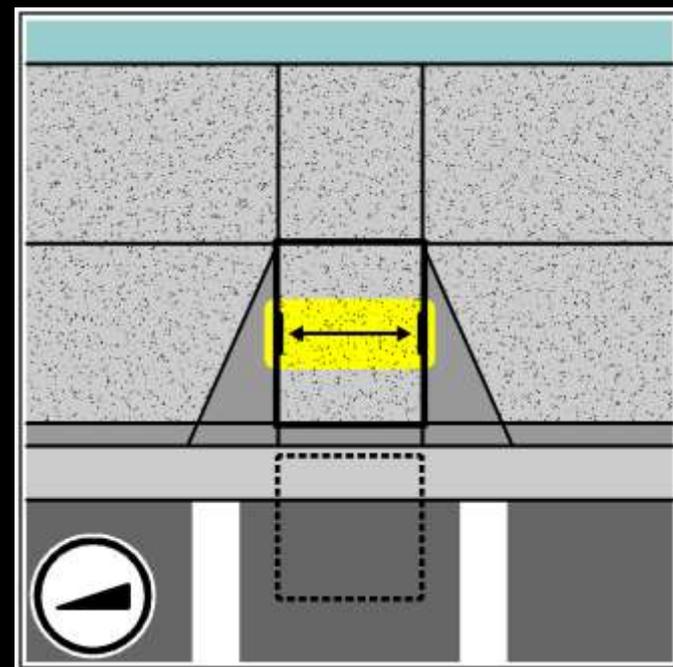
Data Collection Software

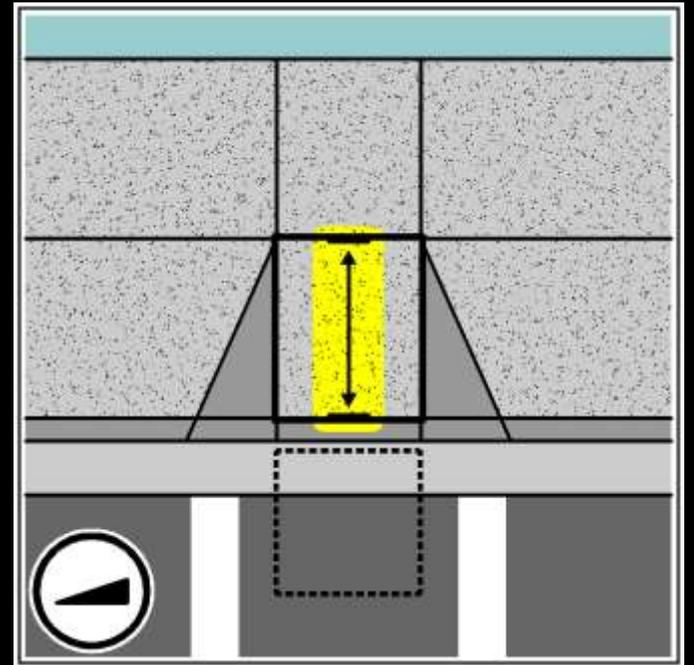








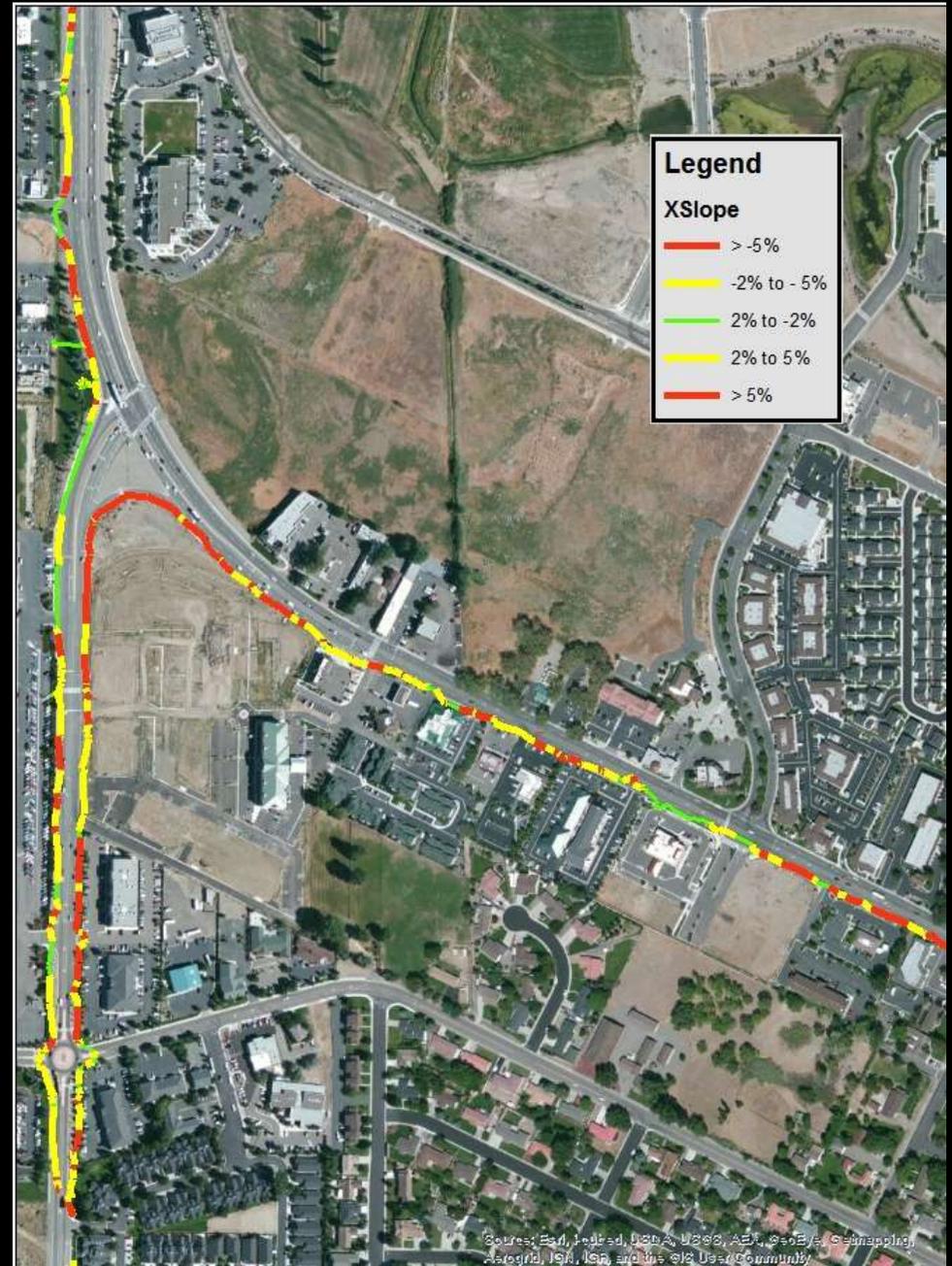




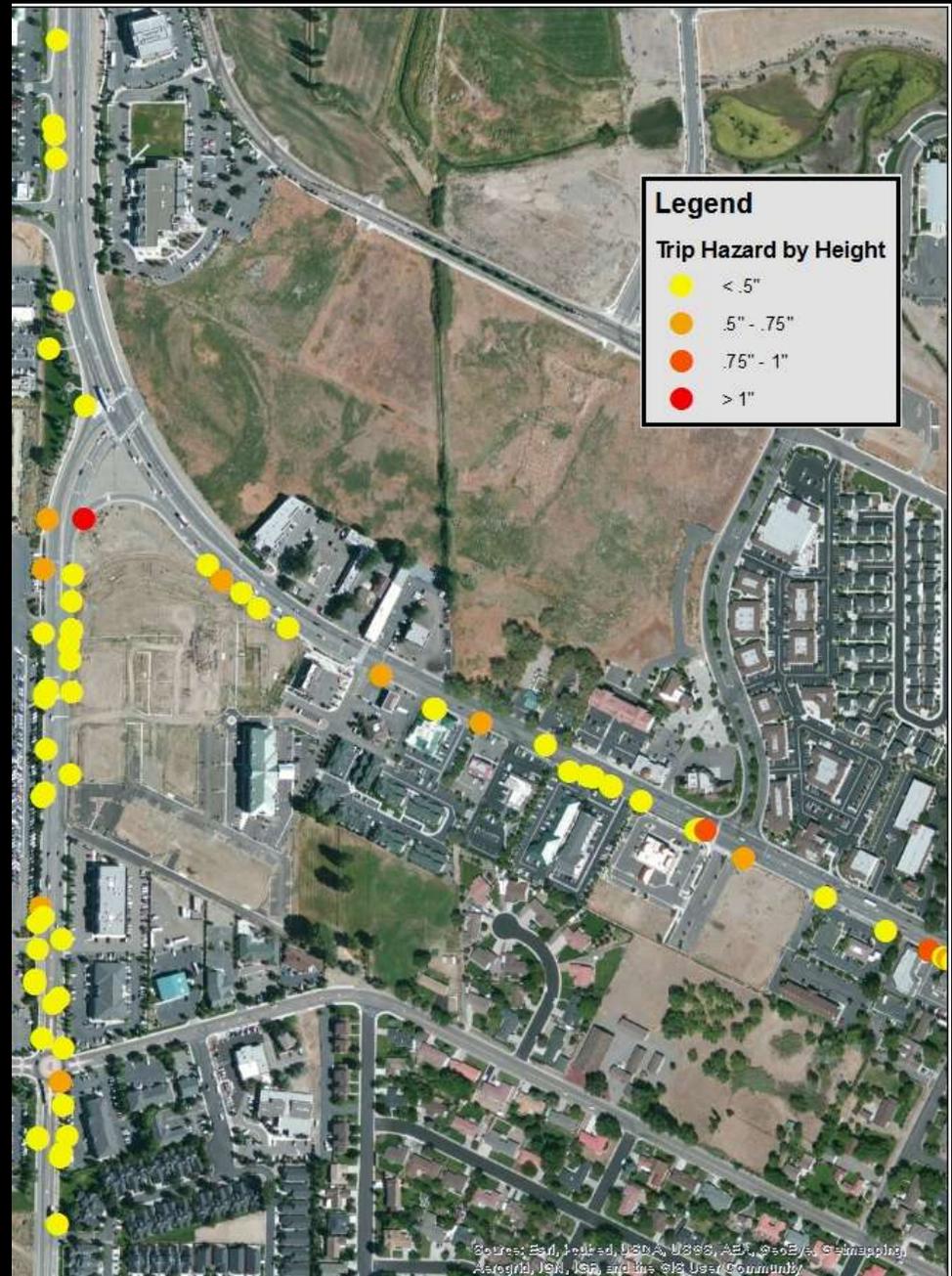
NDOT Right of Way in Minden, NV Tread Width



NDOT Right of Way in Minden, NV Cross Slope



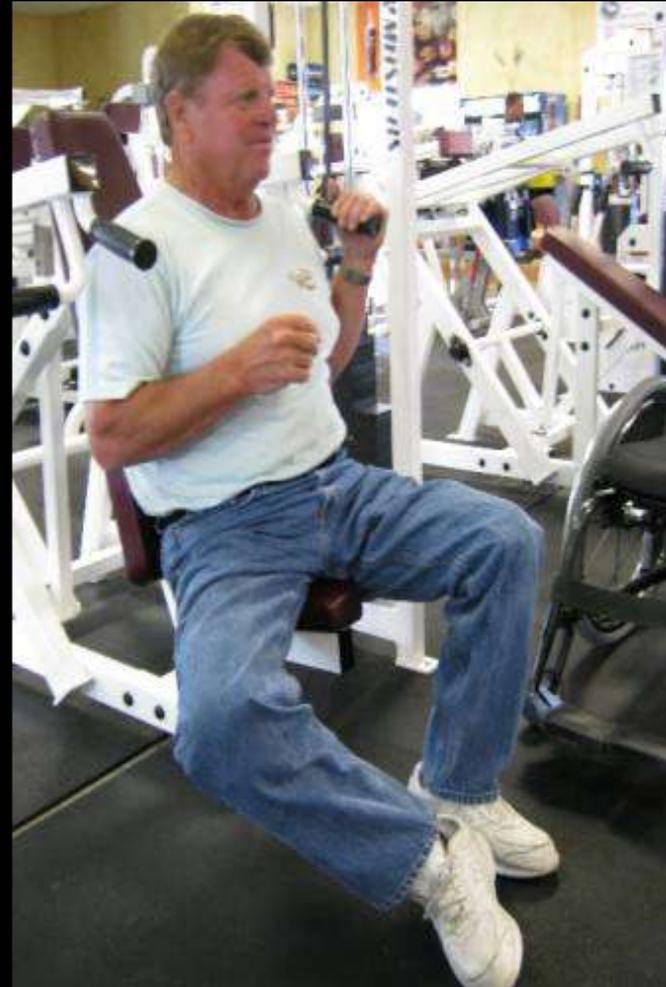
NDOT Right of Way in Minden, NV Tripping hazard height



Universal Design Standards for Products



Universal Design of Fitness Equipment (UDFE) Standards



Low Step-up Height Design









LifeFitness

UT OR PRESS QUICK START

Calories

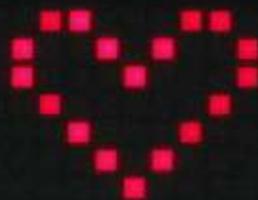
Distance

Time

Incline

Speed

Heart Rate



WARNING

Read and follow all instructions and warnings. Consult your physician prior to using this equipment. Follow all applicable safety rules and instructions. Keep children away from this equipment.

CAUTION: Contact a physician before using this equipment. Stop exercising if you feel pain, dizziness or short of breath.

CAUTION: RISK OF INJURY TO PERSONS - TO AVOID INJURY, STAND ON THE SIDEWALKS BEFORE STARTING TREADMILL. READ INSTRUCTION MANUAL BEFORE USING.

ATTENTION: Consult a physician before using this equipment. Stop your heartbeat and dizziness at least once every 15 minutes. Avoid use if you are dizzy.

When in panic: Stop using this equipment. Do not use the treadmill if you are dizzy or short of breath. Stop exercising if you feel pain, dizziness or short of breath.

POLAR
Heart Rate Monitor

Life Fitness, USA 1-800-225-3367
Life Fitness, UK 01753 603280
Life Fitness, AU 0143 576 576
Life Fitness, India 011-2611 9677
www.life-fitness.com

LifeFitness

UP OR PRESS QUICK START

Calories

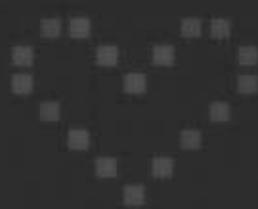
Distance

Time

Incline

Speed

Heart Rate



WARNING



Life Fitness, Inc. 30225 080
Life Fitness, Inc. 07/20/08
Life Fitness, Inc. 07/20/08
Life Fitness, Inc. 07/20/08
www.life-fitness.com

Read and follow all warnings and cautions. Always use proper technique and correct posture. Do not use any equipment if you are injured or have any medical conditions. Do not use any equipment if you are pregnant or have any other medical conditions. Do not use any equipment if you are under the age of 18.

CAUTION: RISK OF SLIPPAGE OR FALLING - BE SURE TO WEAR YOUR SHOES AT ALL TIMES. ALWAYS WEAR YOUR SEATBELT. ALWAYS WEAR YOUR SAFETY BELT. ALWAYS WEAR YOUR SAFETY BELT. ALWAYS WEAR YOUR SAFETY BELT.

ATTENTION: Do not use the console until you are seated. Always use the correct posture when using the console. Do not use the console if you are pregnant or have any other medical conditions. Do not use the console if you are under the age of 18.

Always use the correct posture when using the console. Do not use the console if you are pregnant or have any other medical conditions. Do not use the console if you are under the age of 18.

CLIMBING

Display

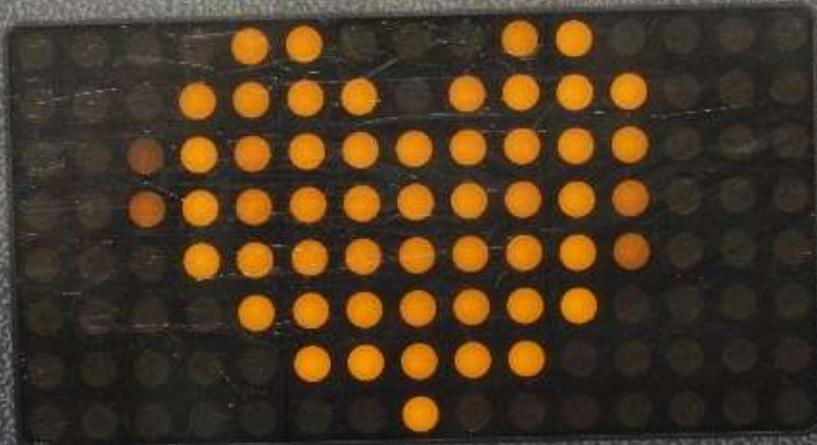
Time Remaining

Calories/Hour

Floors Climbed

Level

Climb Max



Speed

Programs

Manual	 Fat Burning	 Strength	 Endurance	 HR Control
Advanced Options				

1	2	3	
4	5	6	
7	8	9	
0	Clear	Start Enter	

CLIMBING

Display
▼

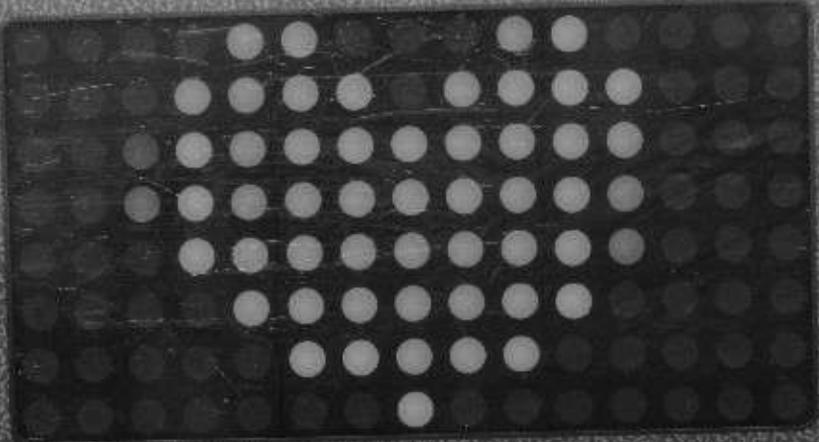
Time Remaining ●

Calories/Hour ●

Floors Climbed ●

Level ●

Climb
Max[®]



Speed



Programs

Manual ●

Fat Burning ●

Strength ●

Endurance ●

HR Control ●

Advanced Options ●

●

●

●

●

1

2

3



4

5

6



7

8

9

0

Clear

Start
Enter

Universal Design of Products used by persons with Cognitive Impairments

**Goal – To increase Access to
Technology
for People with Cognitive
Impairments**

A word cloud featuring various technology-related terms. The words are arranged in a roughly triangular shape, with the largest words at the top and smaller words at the bottom. The colors of the words range from dark green to light yellow. The most prominent words are 'email', 'smoke.alarms', 'cell.phones', and 'calendars'. Other visible words include 'cell', 'DVD', 'phones', 'ear.buds', 'screen.readers', 'social.networking', 'TV', 'stoves', 'music.players', 'headphones', 'laptop', 'toaster.ovens', 'internet', 'camera', 'audio.books', 'Internet', and 'video'.

cell email ear.buds
DVD phones smoke.alarms
cell.phones screen.readers TV
calendars social.networking
stoves music.players
laptop toaster.ovens headphones
internet camera audio.books
video Internet

Universal Design of Amusement Park Rides for Persons with Mobility and Sensory Impairments





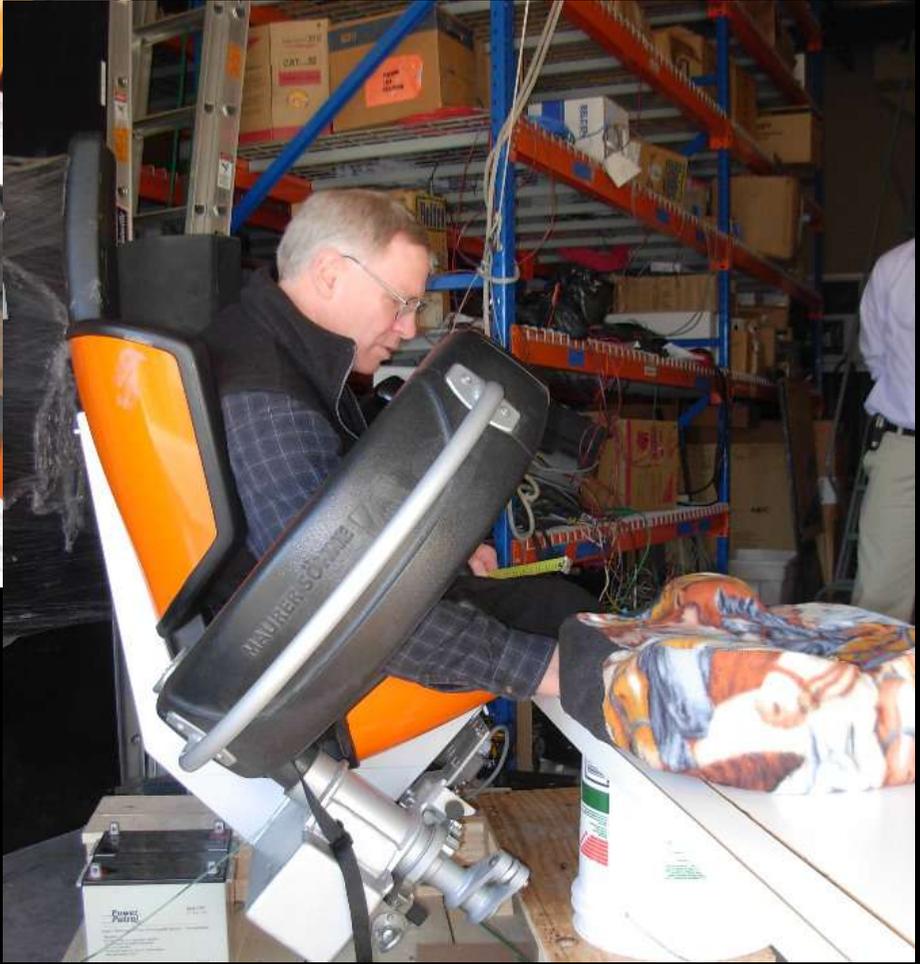










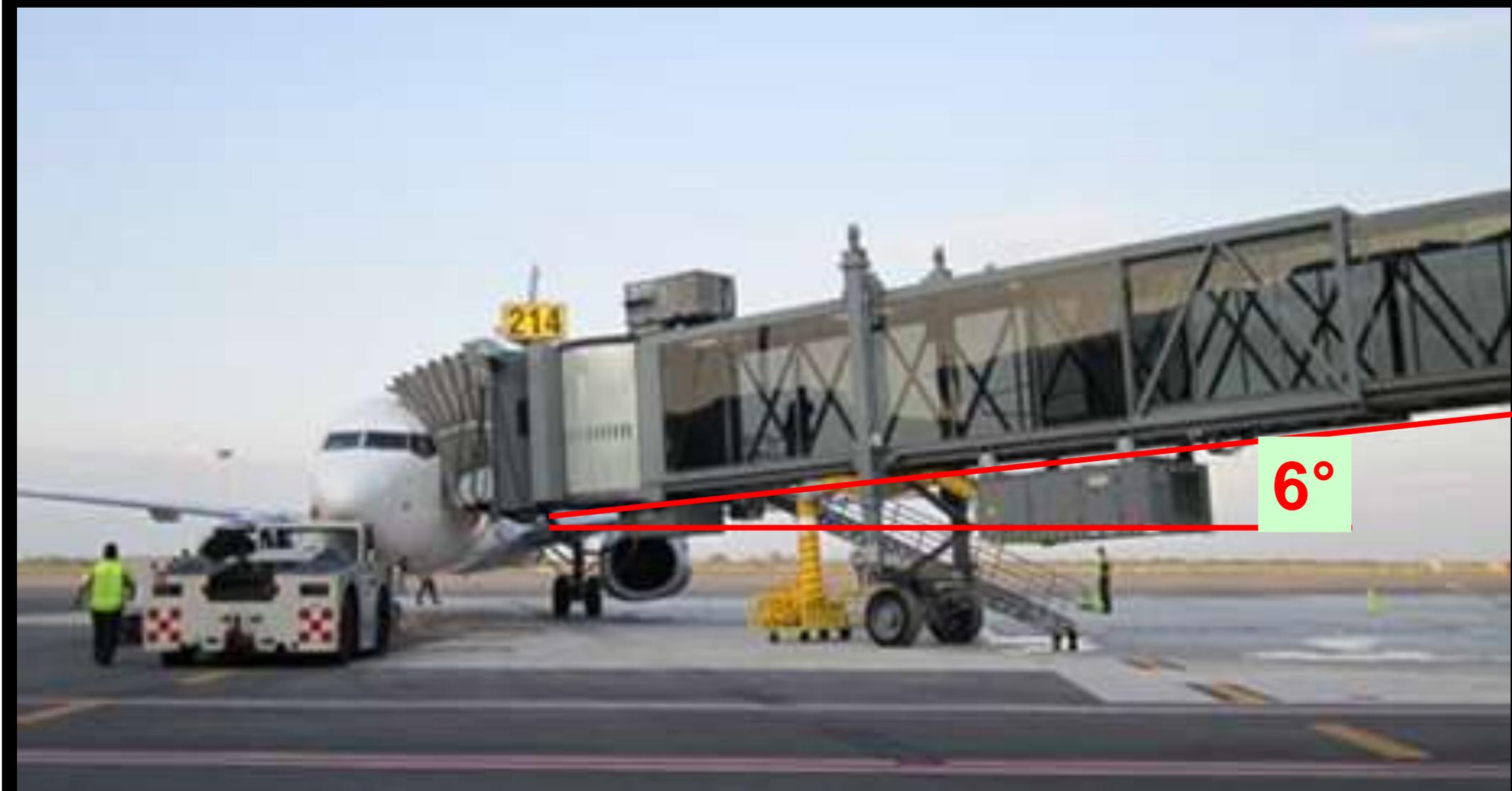




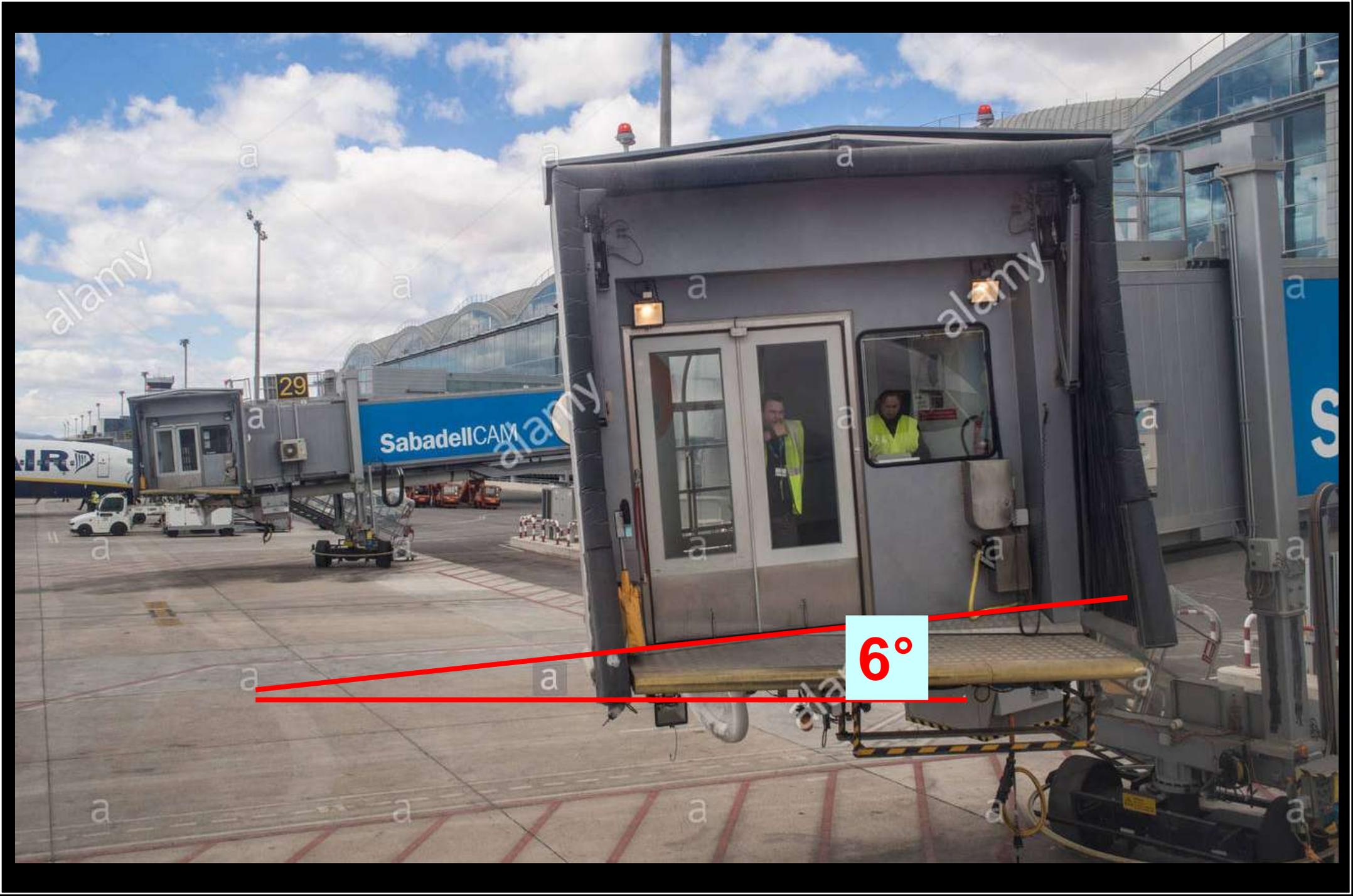


Aircraft Travel Issues for Non-Ambulatory Passengers





6°



6°

Transfer to Boarding Chair



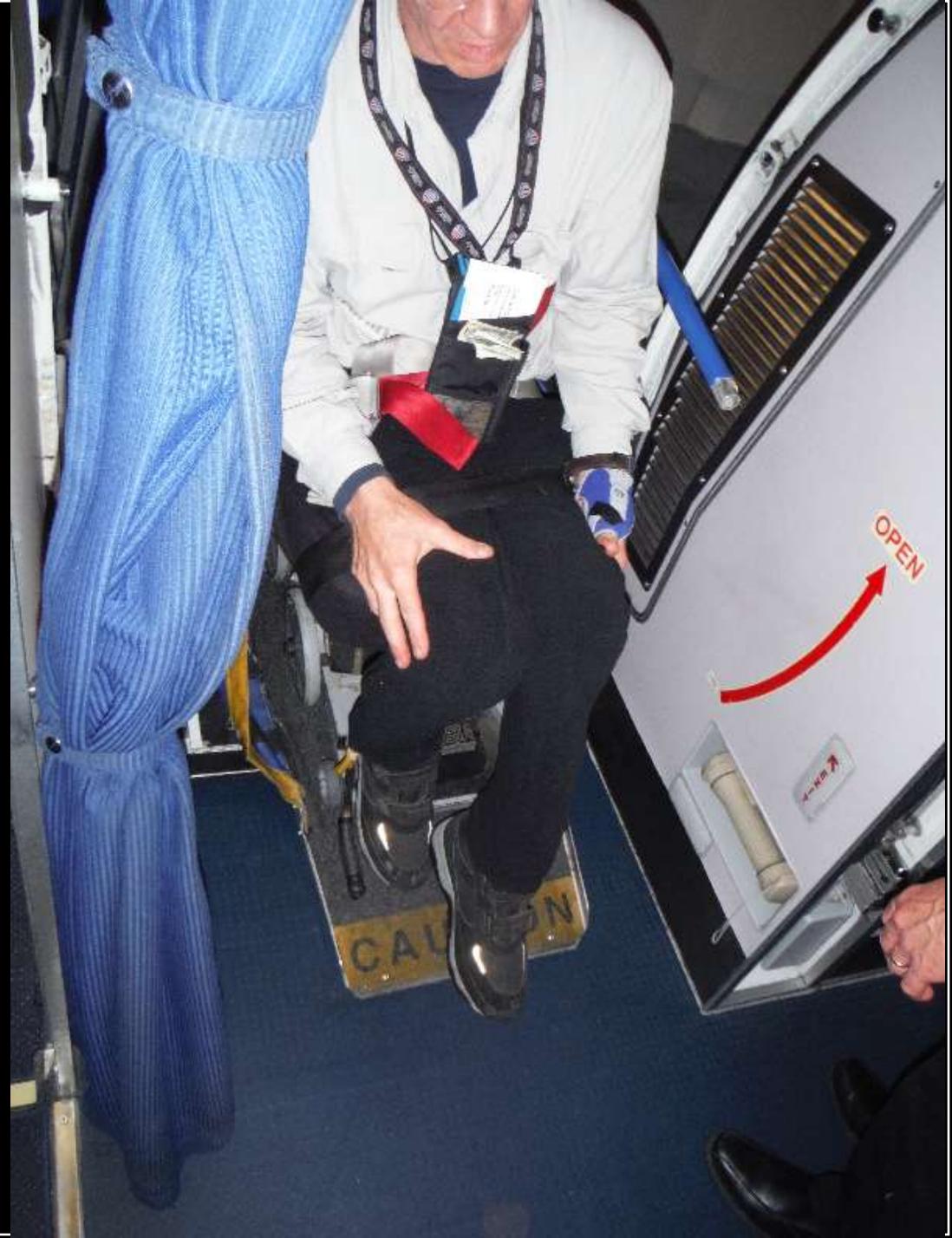
Boarding devices



**Requires a
transfer to an
aircraft
boarding chair**



**Boarding chairs
have inadequate
seating and
foot support**



**Attendant
operated
boarding chairs
require
dependence
on airport
attendants**



Dangerous Environment

Over 300 non-ambulatory
passengers have been surveyed

12% have tipped over laterally in
boarding chairs because of this
problem

Causation is Jetway bubble area
cross-slope of 6 to 14 degrees

Boarding chairs have to be narrow
and tip over at 7.5 degrees



Aircraft Compatible Wheelchair

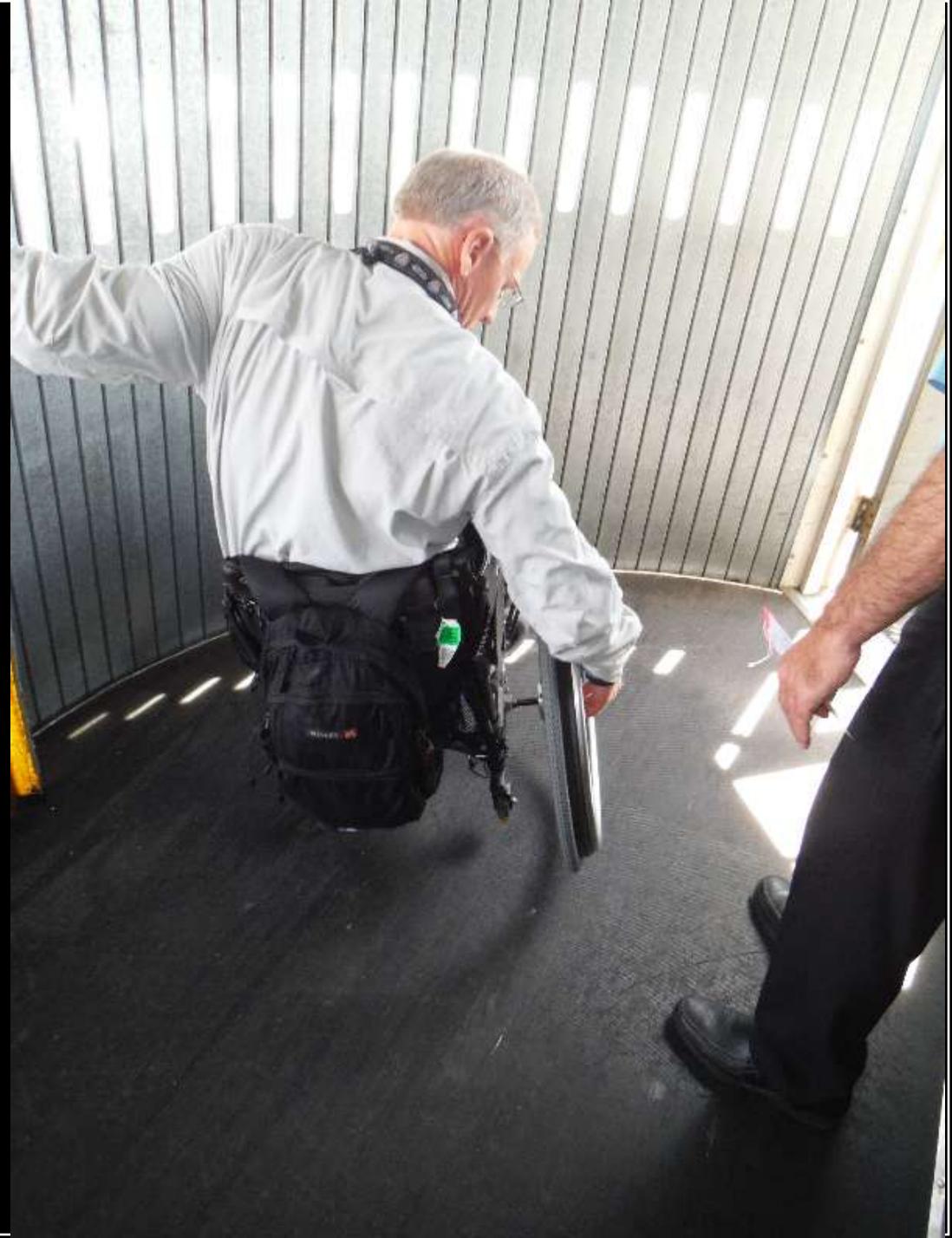
**Aircraft Boarding
Using a
Personal
Aisle Chair

Removable
Wheels**



**Aircraft Boarding
Using a
wheelchair with
narrow accessory
wheels**

**Fewer
Transfers**



Aircraft Seating Using a Personal Aisle Chair

Feet Remain
Secure



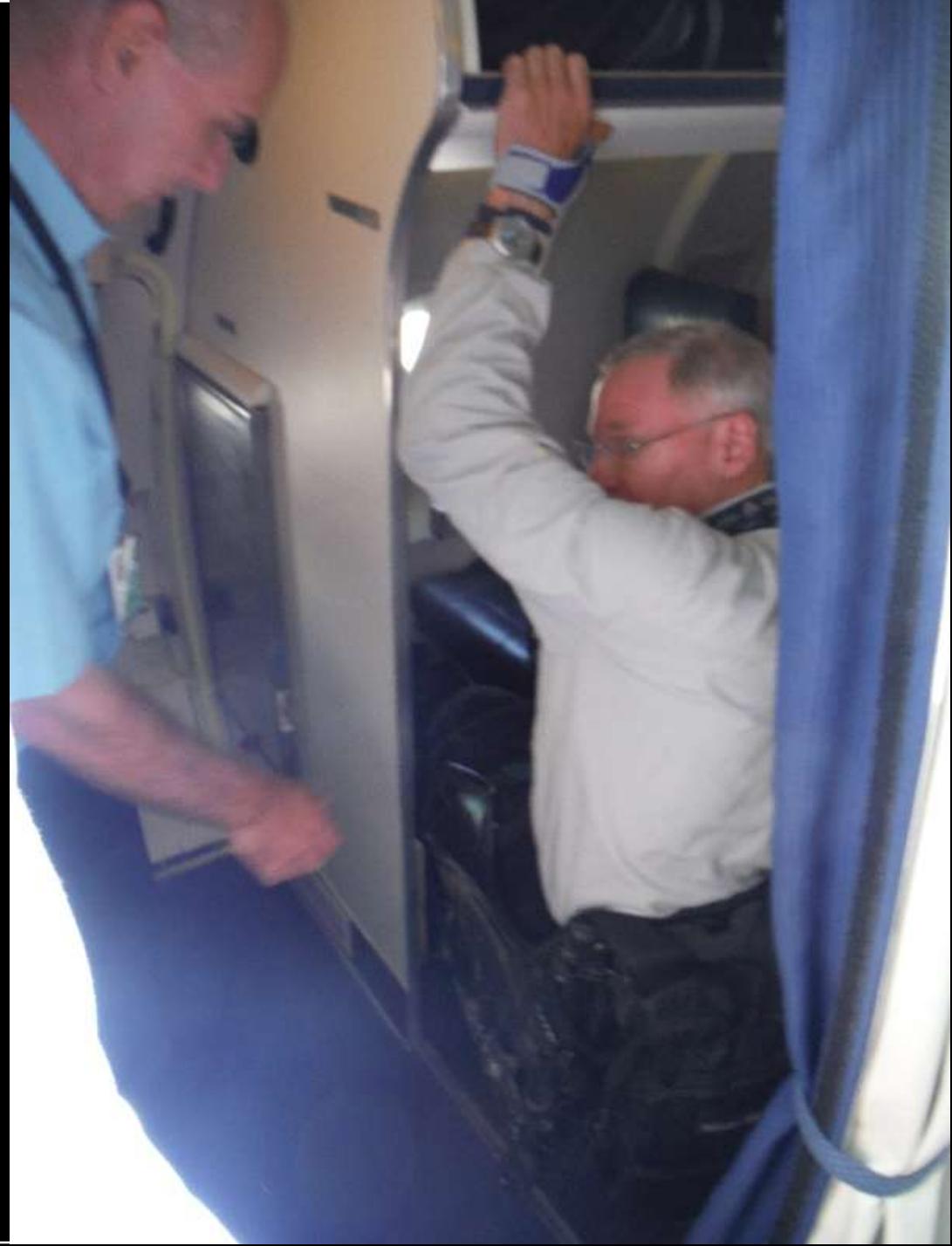
Aircraft Seating Using a Personal Aisle Chair

Allows for
More
Independent
Boarding

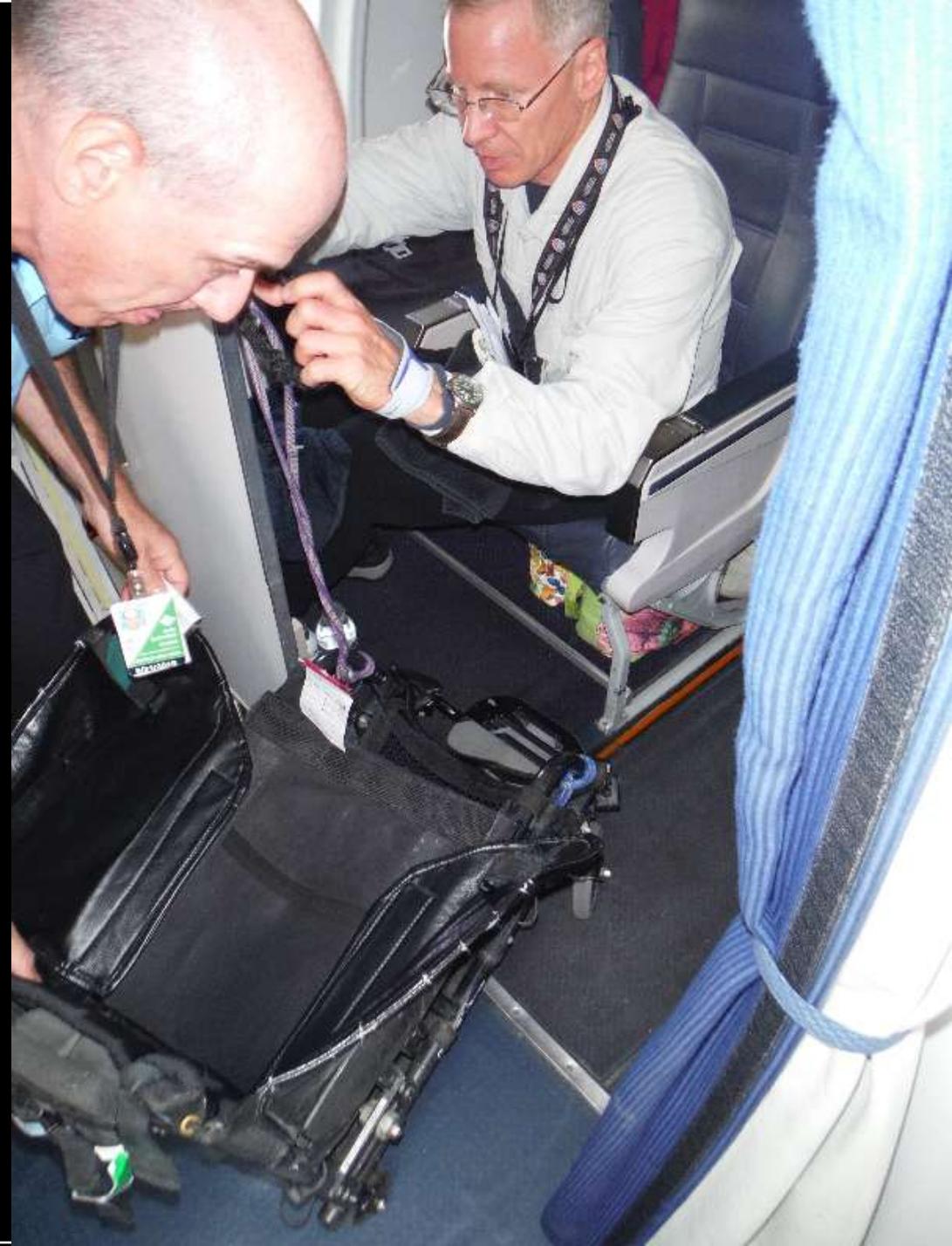


Aircraft Seating Using a Personal Aisle Chair

**A Single
Transfer using
overhead shelf
to assist transfer**

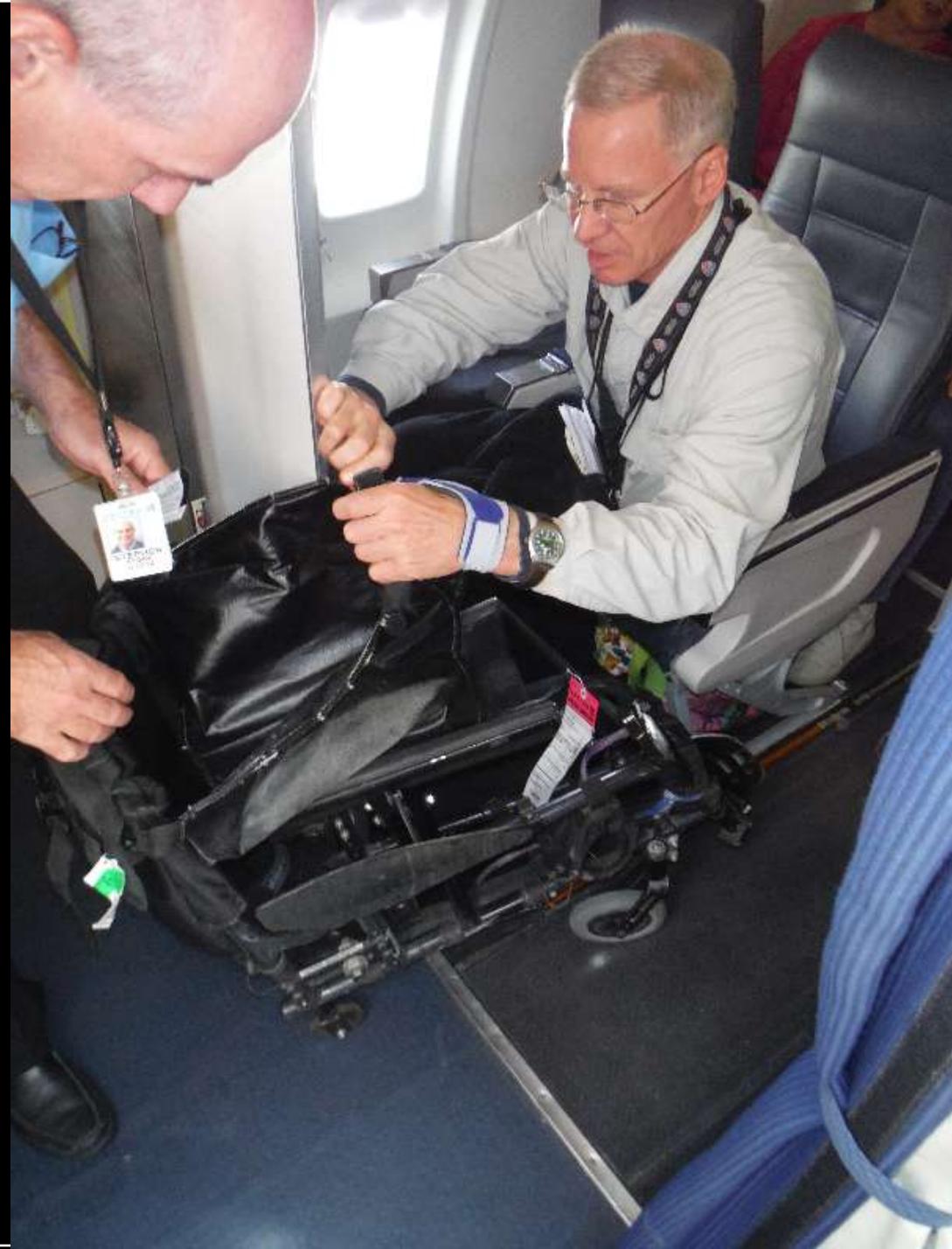


Aircraft Seating Using a Personal Aisle Chair

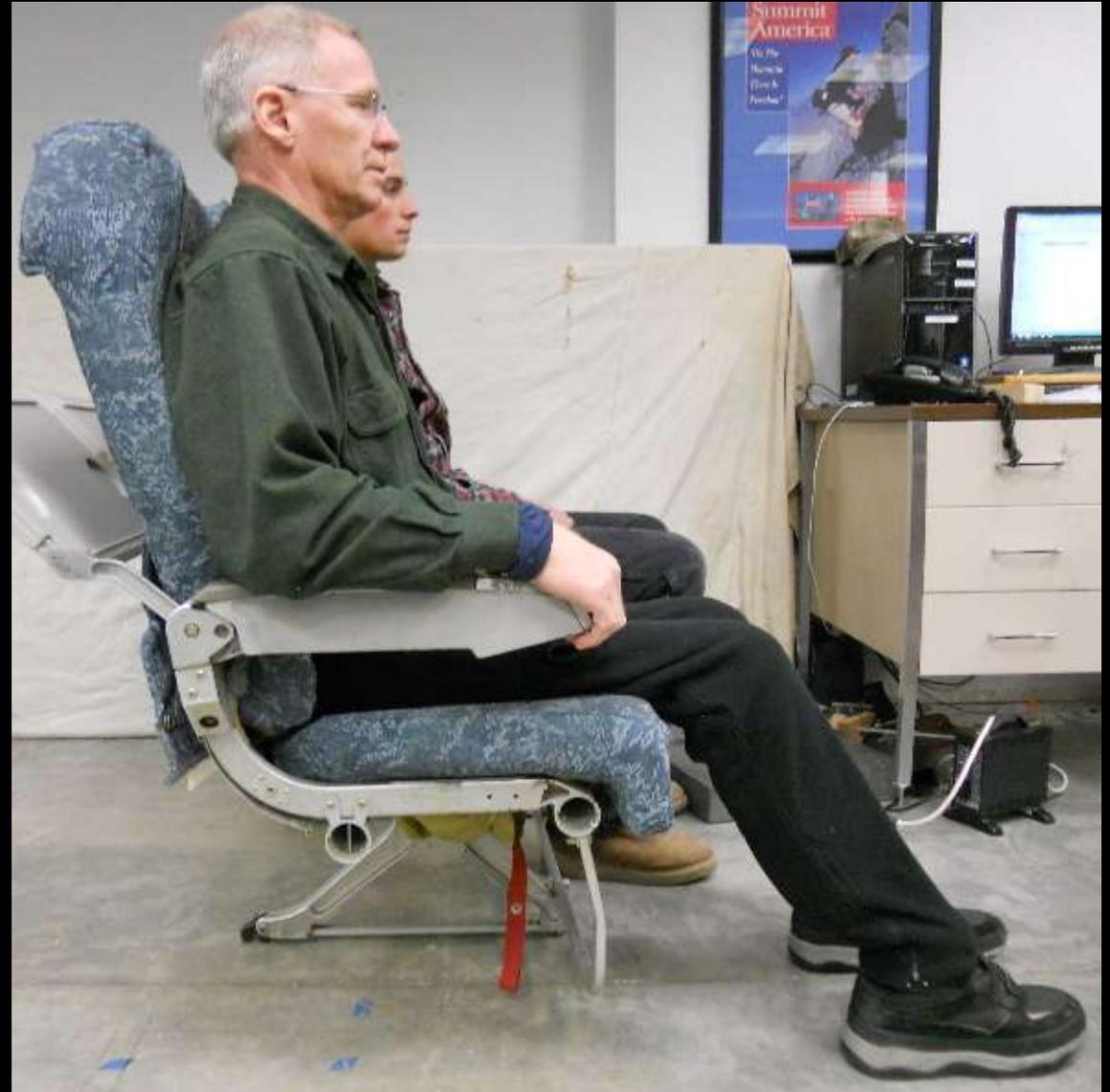


Aircraft Seating Using a Personal Aisle Chair

Fold and store
wheelchair on
board aircraft

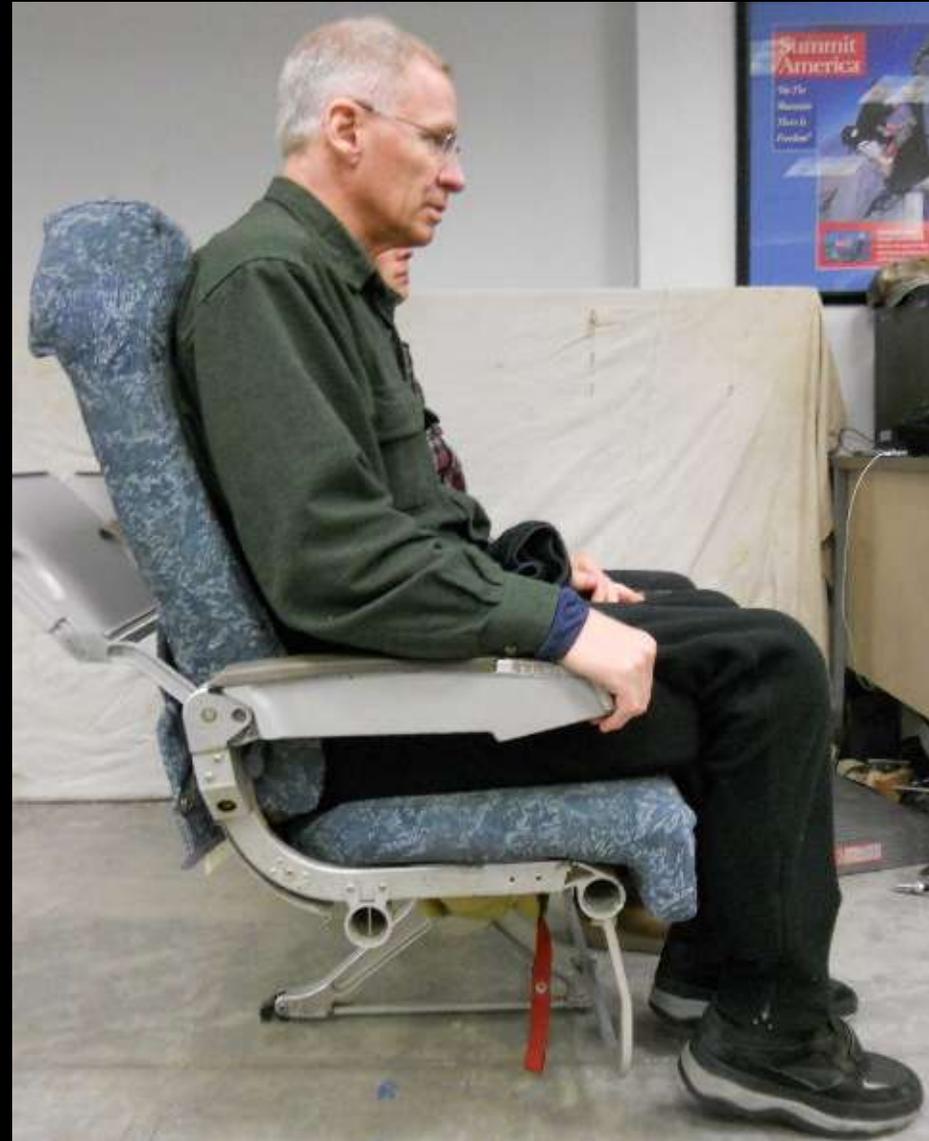


Aircraft seating without pressure relief Cushion



**Aircraft seating
with
pressure relief
cushion from
wheelchair**

**legs hanging
shoulders forward
neck extended
arm not supported**



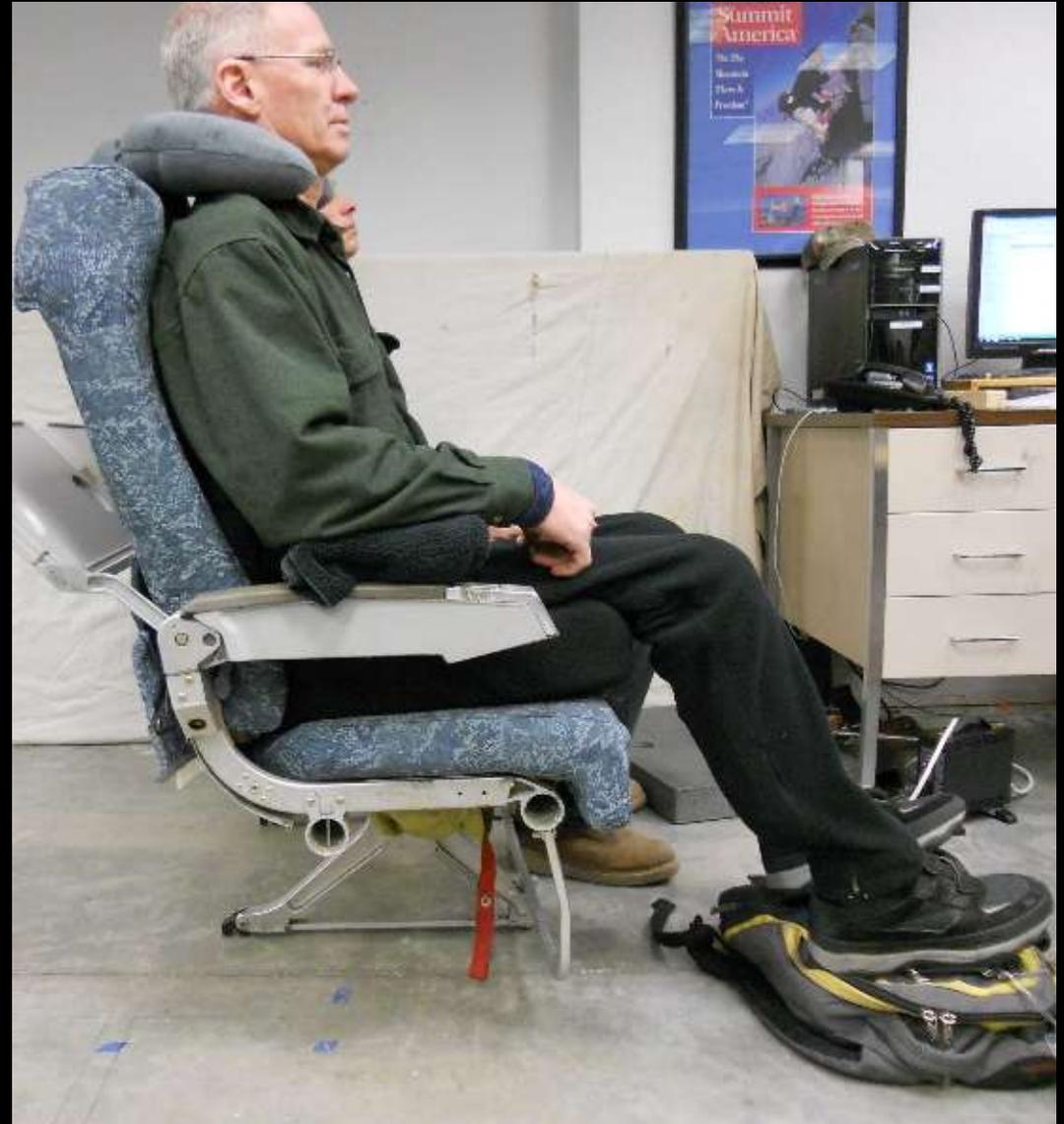
Aircraft seating with pressure relief cushion and “accessories”

foot support
lumbar and spine
support
neck/head support
arm support

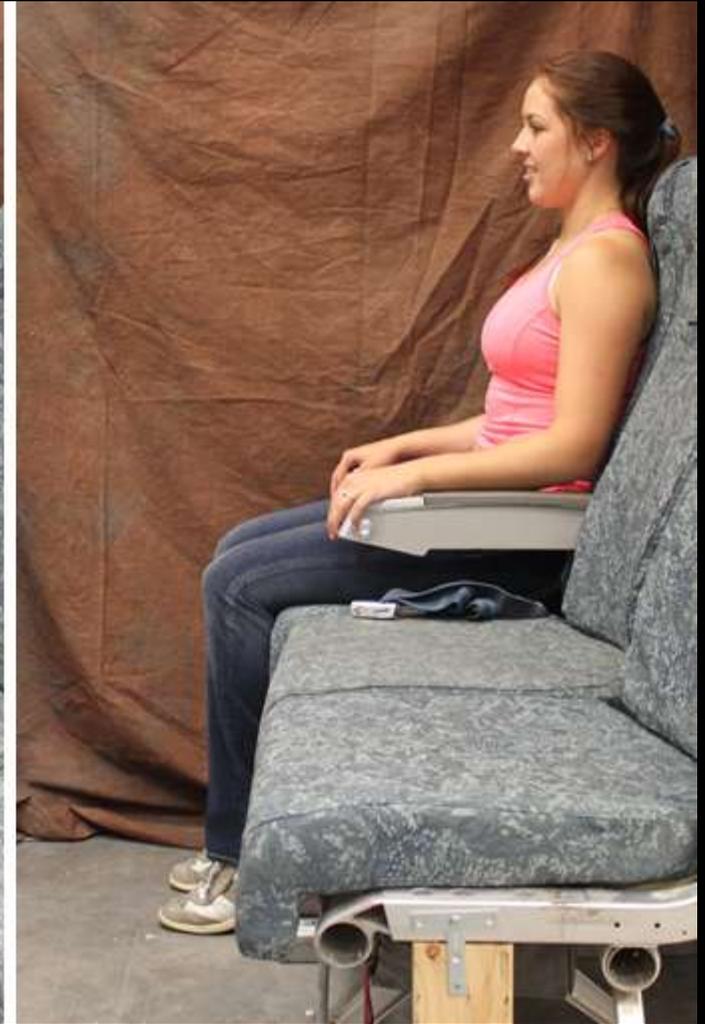


**Aircraft seating
with
pressure relief
cushion and
“accessories”**

**feet supported
lumbar and spine
supported
neck/head support
arm supported**



Seat height on Aircraft seating



**Seat
cushion
raises
the feet
further**

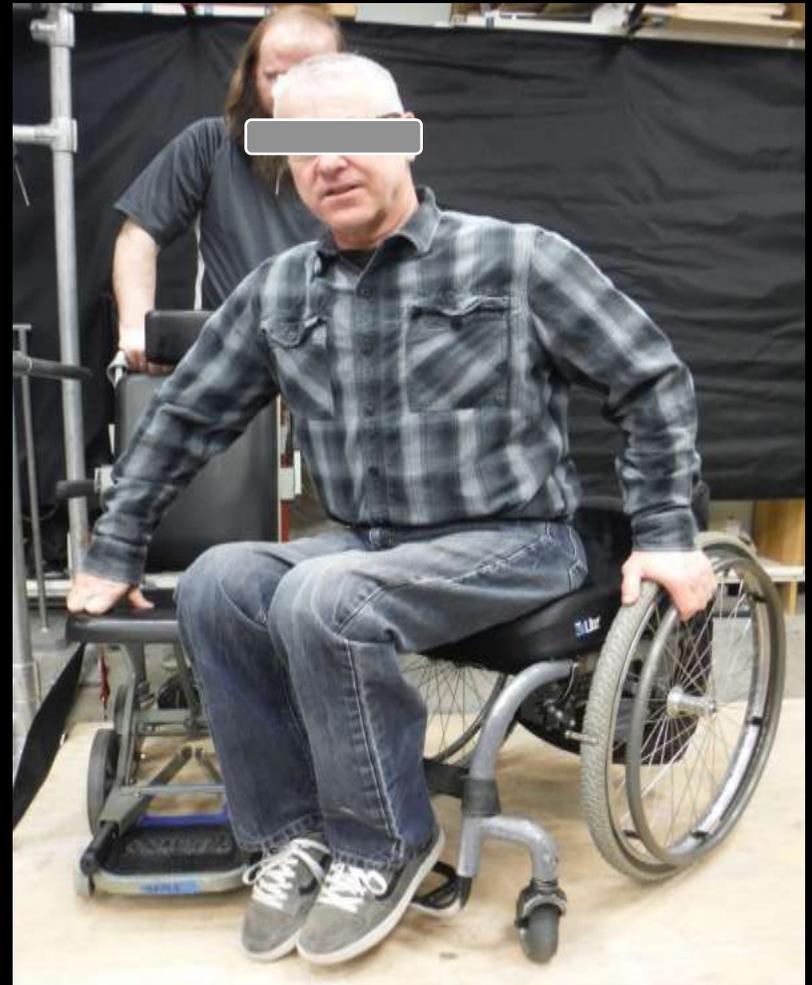


Aircraft seating with foot support



Assessment of Transfers to Aircraft Boarding Devices

Columbia
Facing uphill
Hand/foot placement



Assessment of Aircraft Boarding Devices Observation

Lack of hip flexion with
Fixed back angle
Foot support issues



Assessment of Aircraft Boarding Devices Observation

Lateral stability issues



Assessment of Traditional Aircraft Boarding Devices— Stability

Chest support straps



Assessment of Aircraft Boarding Devices - Measurement

Trunk support strap
Location issues



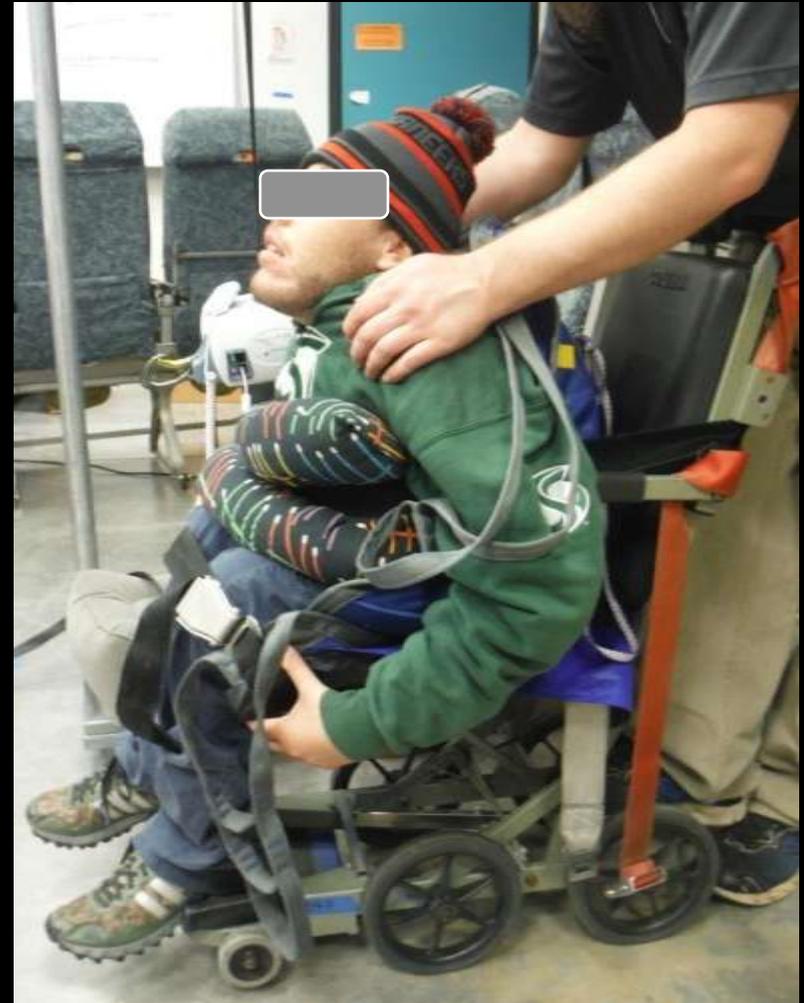
Assessment of Aircraft Boarding Devices Observation

Arm supports provide
lateral stability
Foot support issues



Assessment of Aircraft Boarding Devices Observation

Anterior chest support
needed

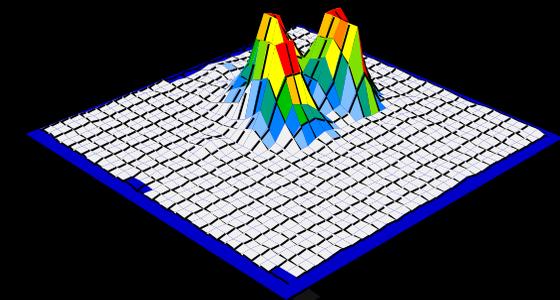
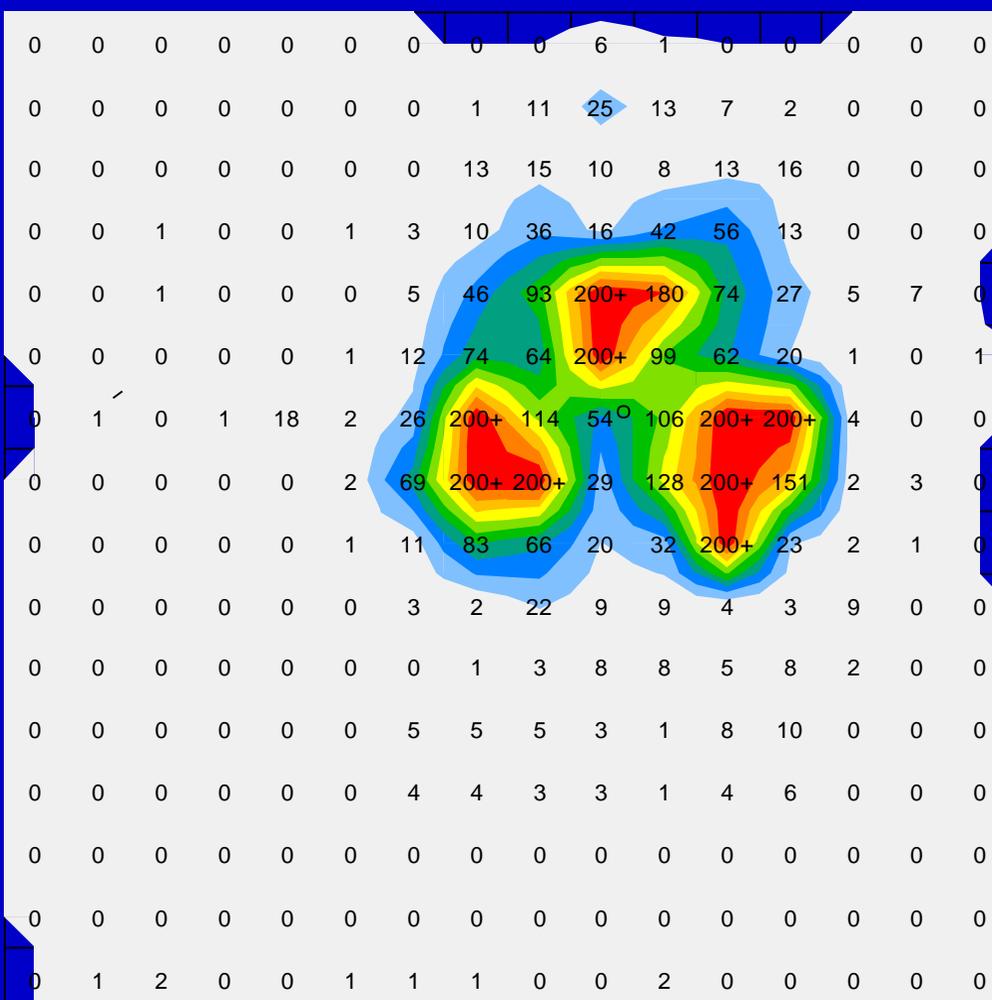


Assessment of Aircraft Boarding Devices - Observation

Trunk support straps

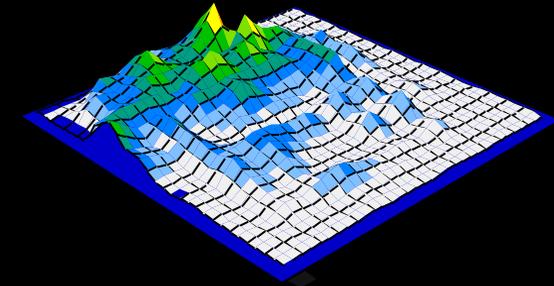
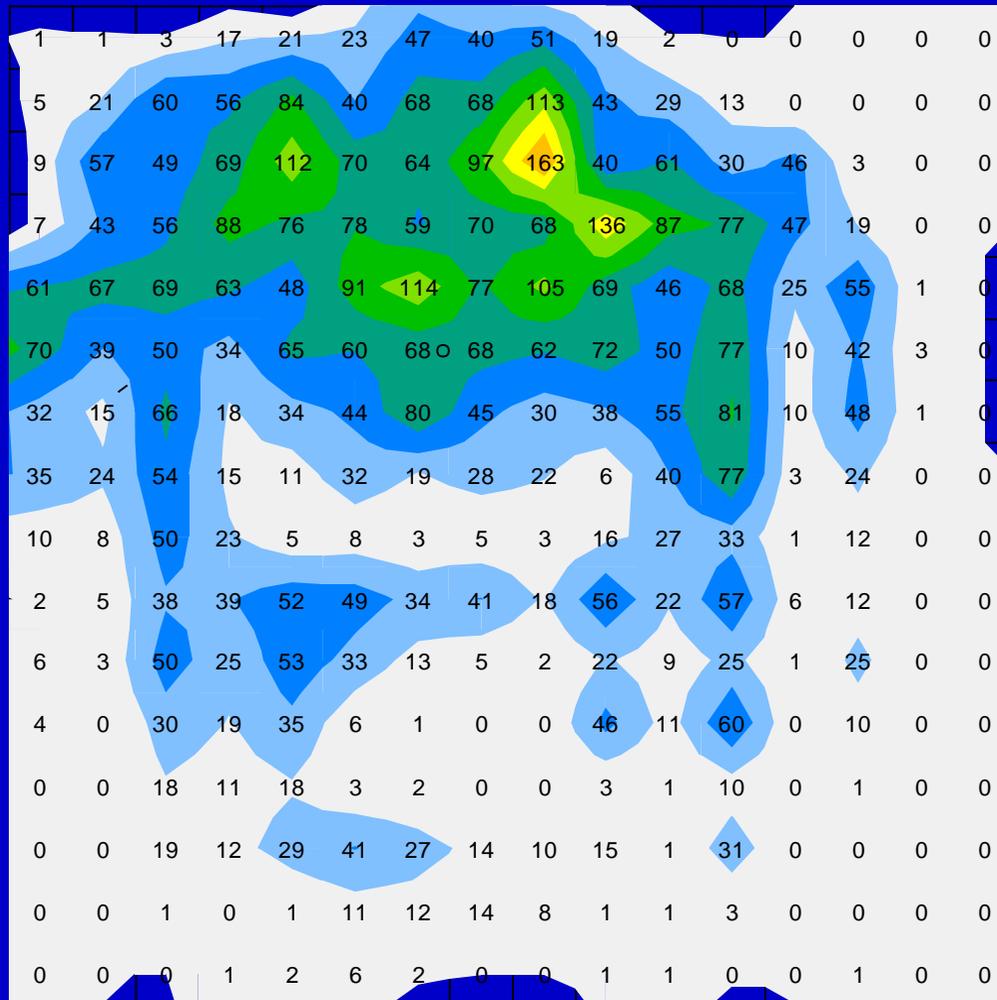


Sitting on Staxi boarding device without cushion



Minimum (mmHg)	0.00
Maximum (mmHg)	200.00
Average (mmHg)	15.64
Variance (mmHg ²)	1823.88
Standard deviation (mmHg)	42.71
Coefficient of variation (%)	272.99
Horizontal center (in)	10.47
Vertical center (in)	10.20
Sensing area (in ²)	289.27
Regional distribution (%)	100.00

Sitting on Staxi boarding device with Roho Cushion



Minimum (mmHg)	0.00
Maximum (mmHg)	163.34
Average (mmHg)	26.50
Variance (mmHg ²)	908.25
Standard deviation (mmHg)	30.14
Coefficient of variation (%)	113.70
Horizontal center (in)	7.33
Vertical center (in)	11.13
Sensing area (in ²)	289.27
Regional distribution (%)	100.00

Assessment of Transfer to Aircraft Seating

Hand / foot placement



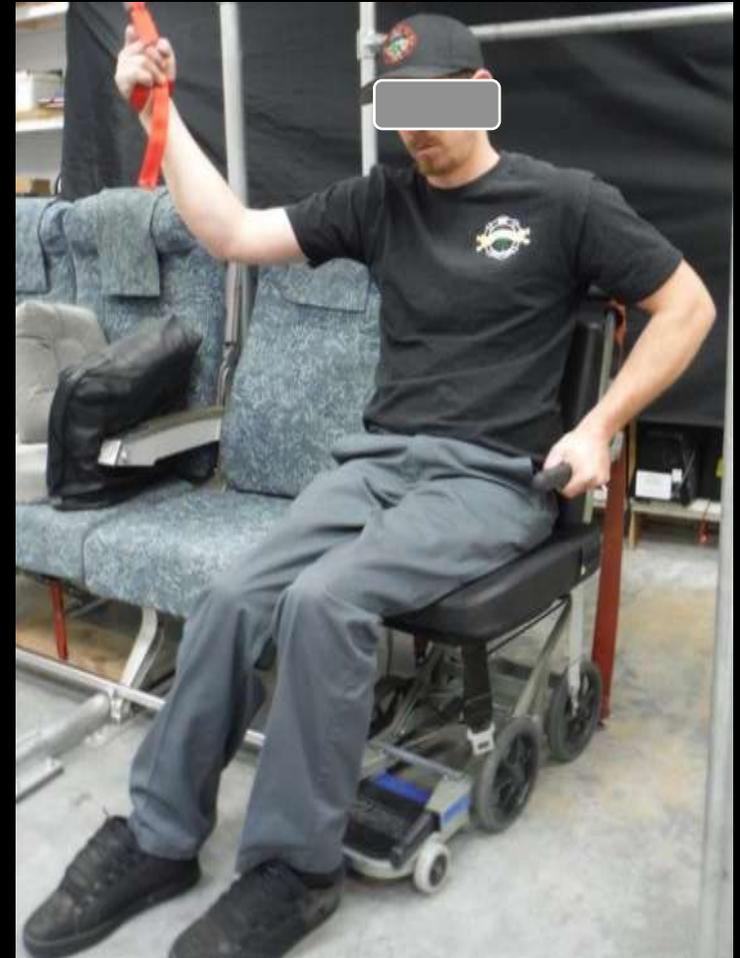
Assessment of Transfers from Aircraft Seating

Hand / foot placement



Transfer Assist Technology

Overhead Strap



Transfer Assist Technology

Overhead Strap



Transfer Assist Technology

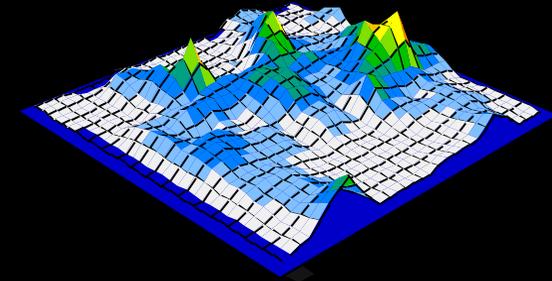
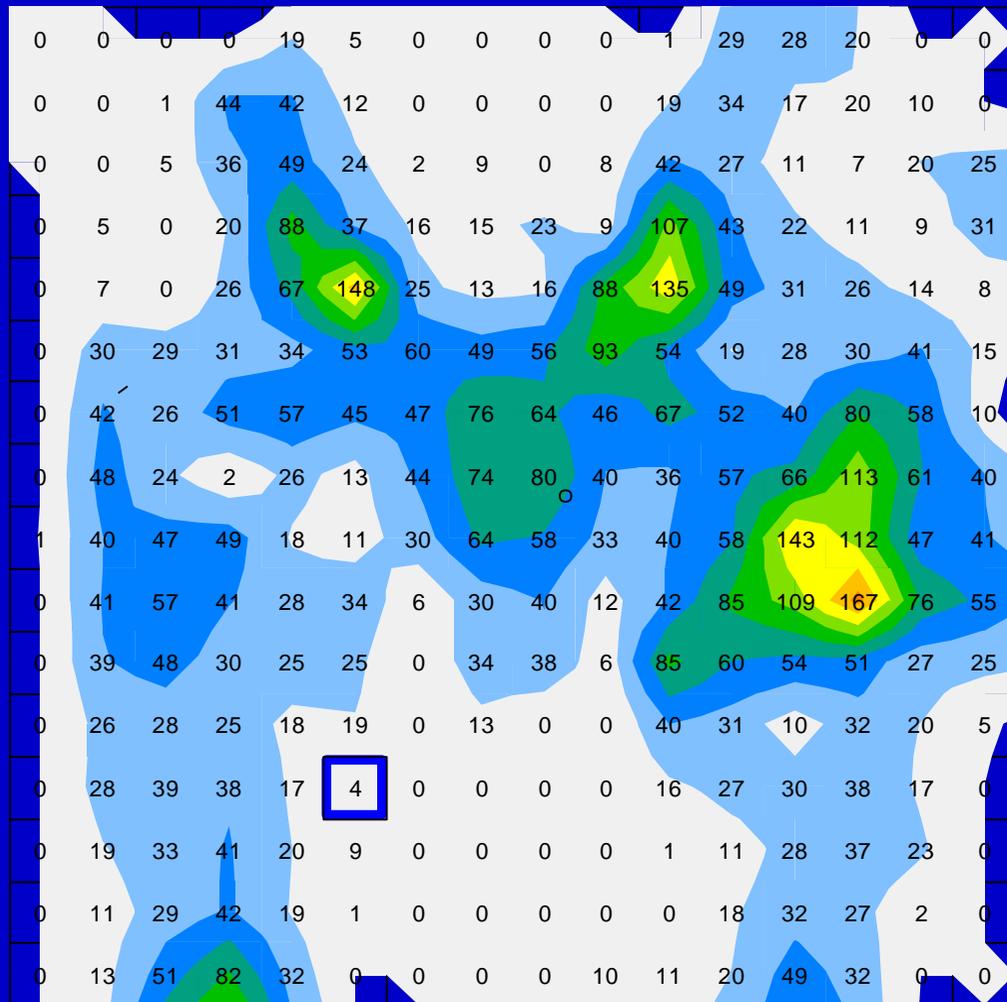
Overhead Lift track
Safety for
passengers
attendant providers



Assessment of Aircraft Seating

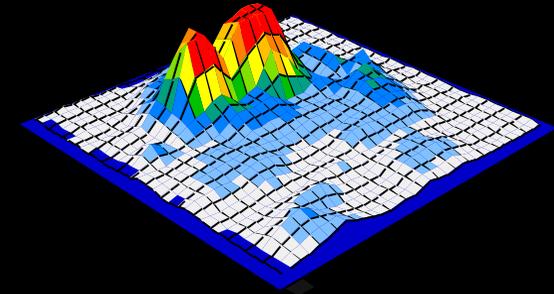
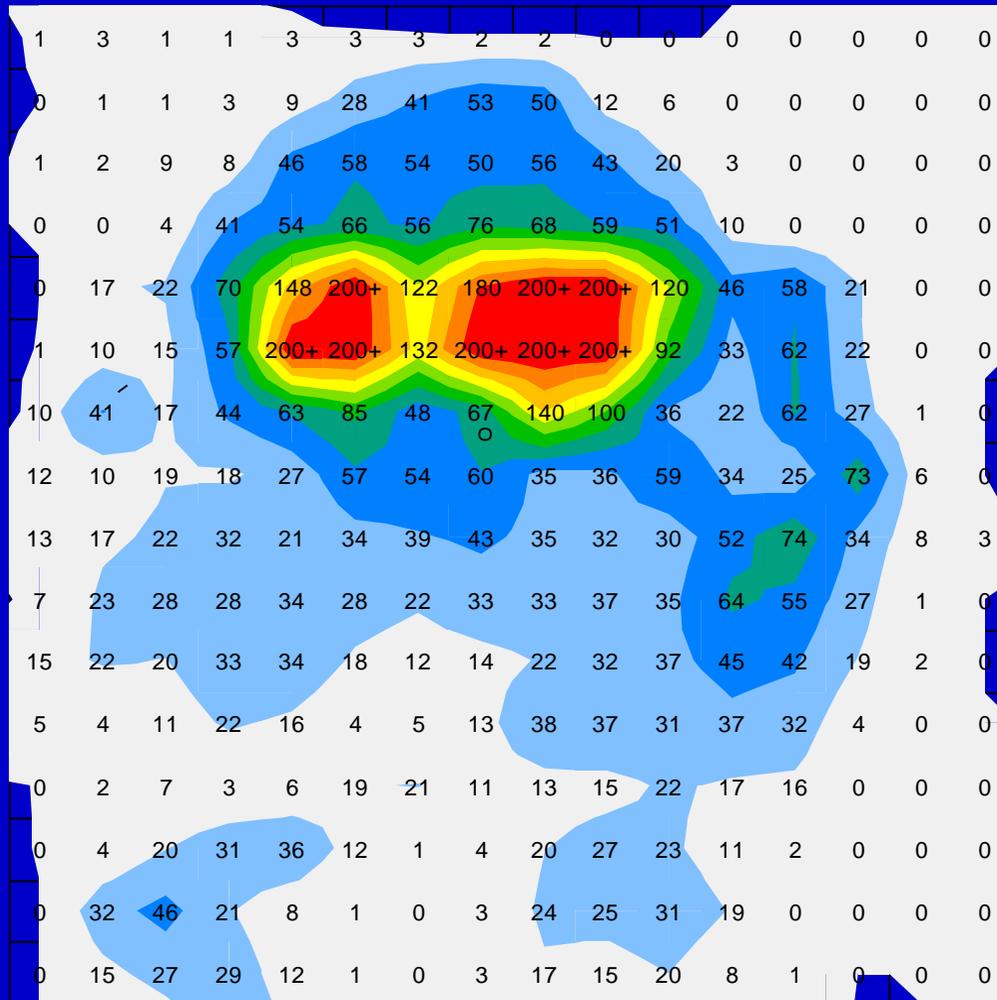


Sitting in personal wheelchair with Roho Cushion



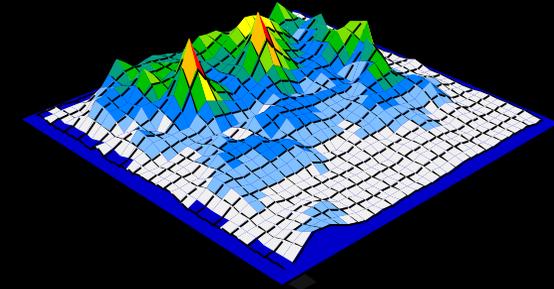
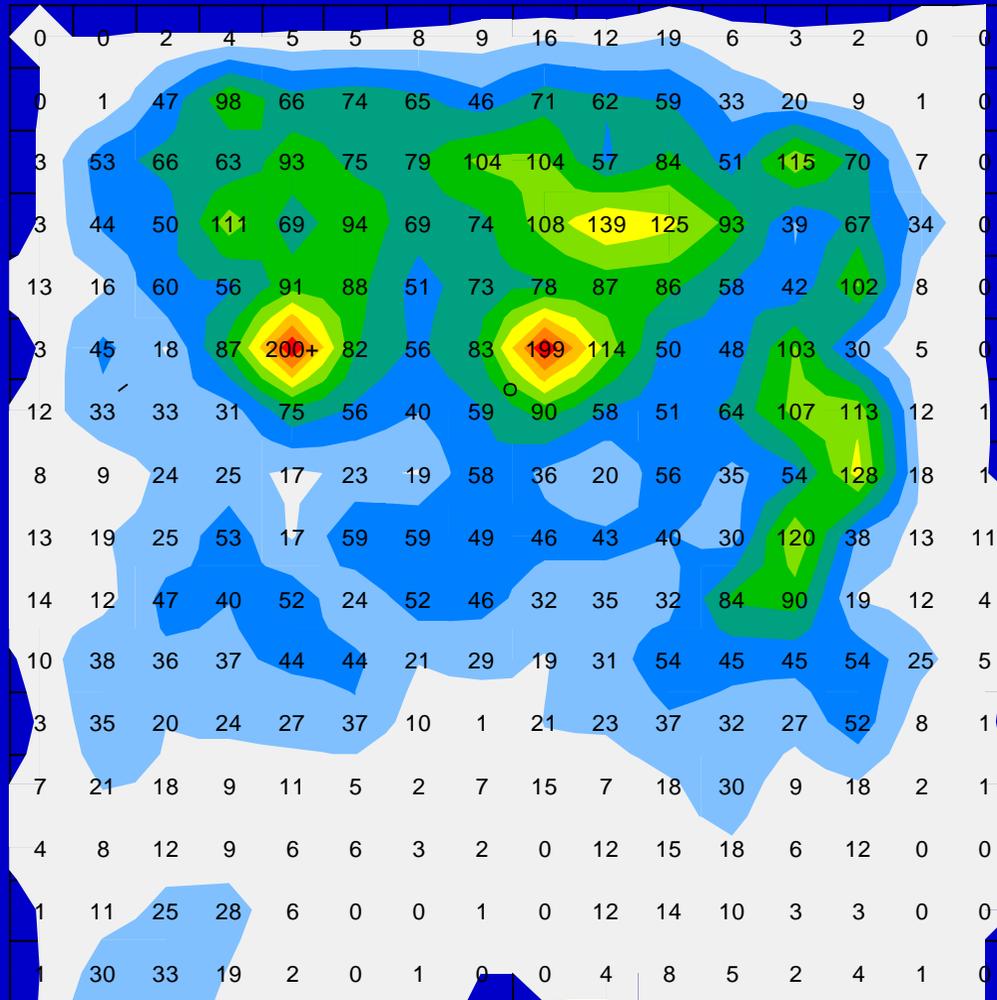
Minimum (mmHg)	3.58
Maximum (mmHg)	3.58
Average (mmHg)	3.58
Variance (mmHg ²)	0.00
Standard deviation (mmHg)	0.00
Coefficient of variation (%)	0.00
Horizontal center (in)	5.85
Vertical center (in)	3.72
Sensing area (in ²)	1.13
Regional distribution (%)	0.05

Sitting on aircraft seat without cushion



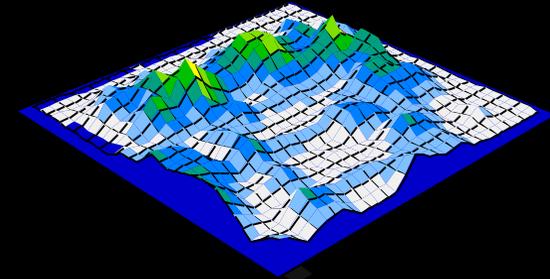
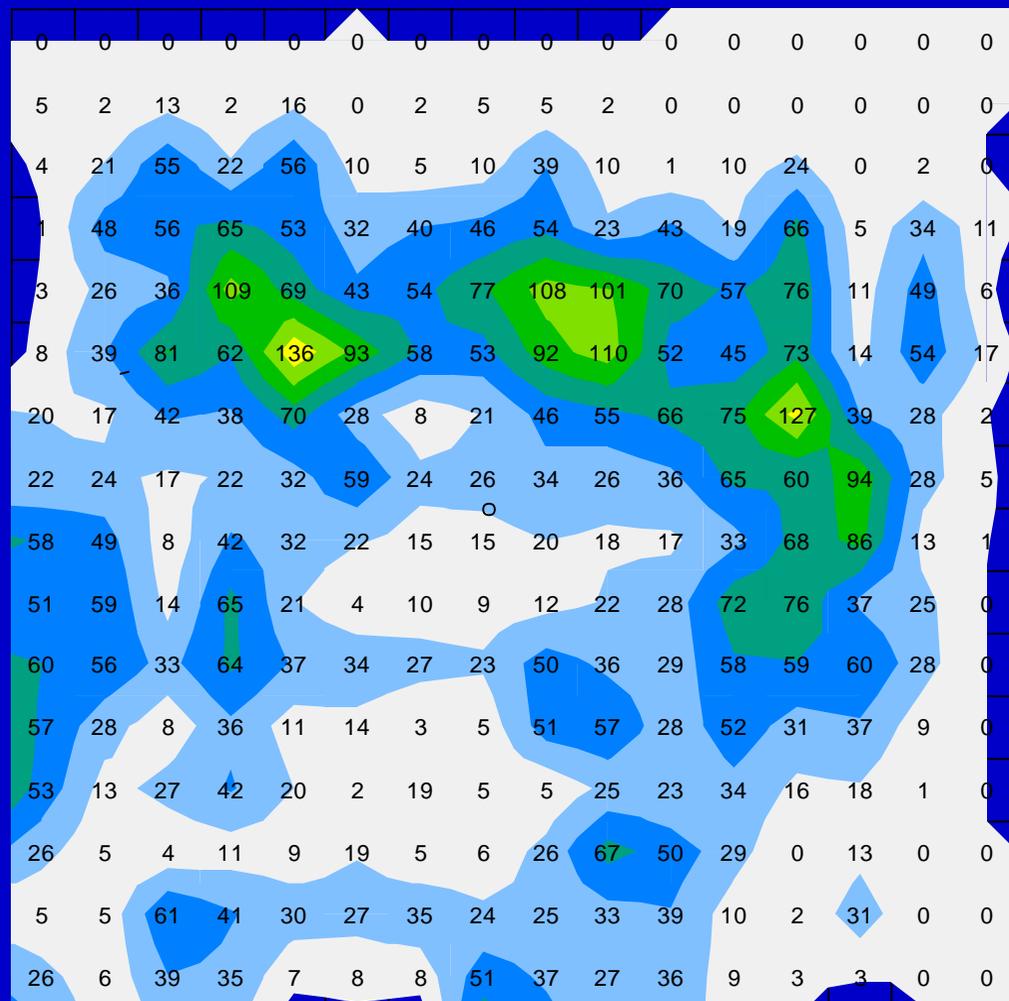
Minimum (mmHg)	0.00
Maximum (mmHg)	200.00
Average (mmHg)	29.05
Variance (mmHg ²)	1718.65
Standard deviation (mmHg)	41.46
Coefficient of variation (%)	142.71
Horizontal center (in)	8.06
Vertical center (in)	9.72
Sensing area (in ²)	289.27
Regional distribution (%)	100.00

Sitting on aircraft seat with contoured Cushion



Minimum (mmHg)	0.00
Maximum (mmHg)	200.00
Average (mmHg)	34.87
Variance (mmHg ²)	1260.99
Standard deviation (mmHg)	35.51
Coefficient of variation (%)	101.83
Horizontal center (in)	8.45
Vertical center (in)	10.44
Sensing area (in ²)	289.27
Regional distribution (%)	100.00

Sitting on aircraft seat with Roho cushion



Minimum (mmHg)	0.00
Maximum (mmHg)	135.55
Average (mmHg)	28.76
Variance (mmHg ²)	724.99
Standard deviation (mmHg)	26.93
Coefficient of variation (%)	93.63
Horizontal center (in)	8.09
Vertical center (in)	8.48
Sensing area (in ²)	289.27
Regional distribution (%)	100.00

Optimization of Aircraft Seating

Foot rest
Seat cushion



Transfer Assist Technology

Overhead Gantry Boarding Device



Transfer Assist Technology

Overhead Gantry Boarding Device



Transfer Assist Technology

Moves laterally over aircraft seating



Transfer Assist Technology

No manual lifting required to place passenger in seat



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This project is funded by the Paralyzed Veterans of America (PVA) Research Foundation Grand award #3208 – Airline Travel: Assistive Technology for Non-Ambulatory Passengers

Standards for Powered WC designed for Air Transport

Goal is to create specifications for design features that enable powered wheelchairs to be able to withstand the rigors of being loaded and unloaded from aircraft



Loading wheelchair into aircraft



Weight of Wheelchair Label

WHEELCHAIR

82 kg

180 lb

WEIGHT

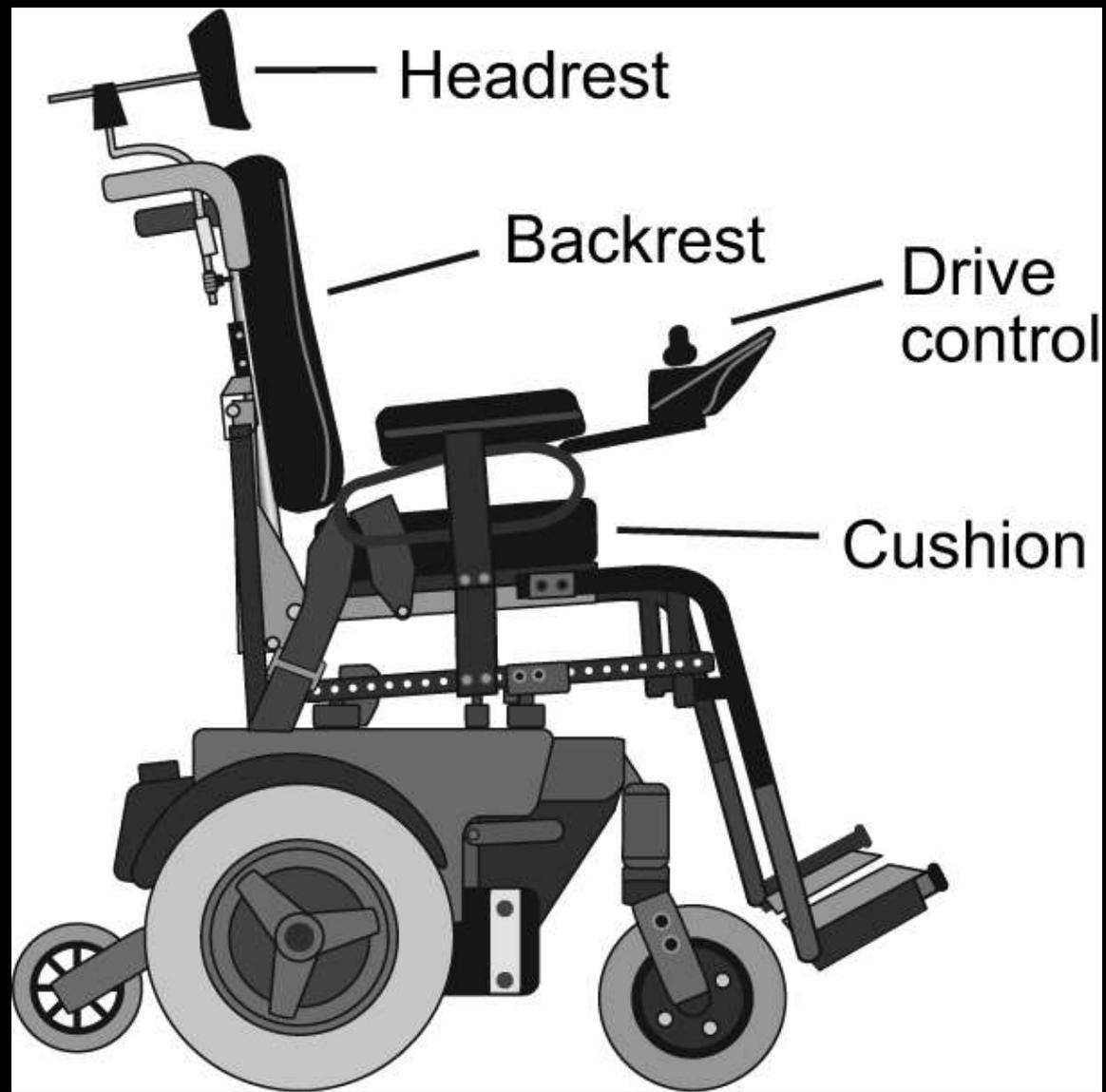


Identification of Power Disconnects



Identification of Freewheel Disengagement





**Protect
input
control
device**



**Fully
protect
input
control
device**



Elastic strap to hold WC folded



**Typical
location
of
webbing
with
elastic
and side
release
buckle**





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