beneficial designs

designing beyond the norm to meet the needs of all people

Stanford University

Peter Axelson

2020-01-23

how i got to where i am

initial intentions and objectives
redirected with a new purpose
found another great place to grow
personal needs directed my designs
focused on AT and access for life

beneficial designs

designing beyond the norm to meet the needs of all people

research

design

education

areas of focus

testing of assistive technology - AT

assessment of outdoor facilities

design of assessment equipment

standards development

writing publications for AT usage

development of assistive technology

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.

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.

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.

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.

it takes a team, people…

to design, test and assess

to write, map and build

to plan, support and present

Peter Axelson

Director of R&D

Bill Blythe

it and facility manager

Stephanie Stephens

research assistant – remote from India

Maegan Elkaraki

bookkeeping and financial

Paola Vazquez

office assistant

Ria Axelson

office assistant

Sharon Vazquez

office assistant – remote

Paul Schnorbus

machinist

Stephen Pieters

wheelchair test lab leader

Sam Schnorbus

testing / assessment technician

Emery Schreckengost

testing / assessment / GIS technician

Alexa Schreckengost

office manager

Ben Hubbard

graphic artist map builder

Debbie Hester

GIS technician

Todd Ackerman

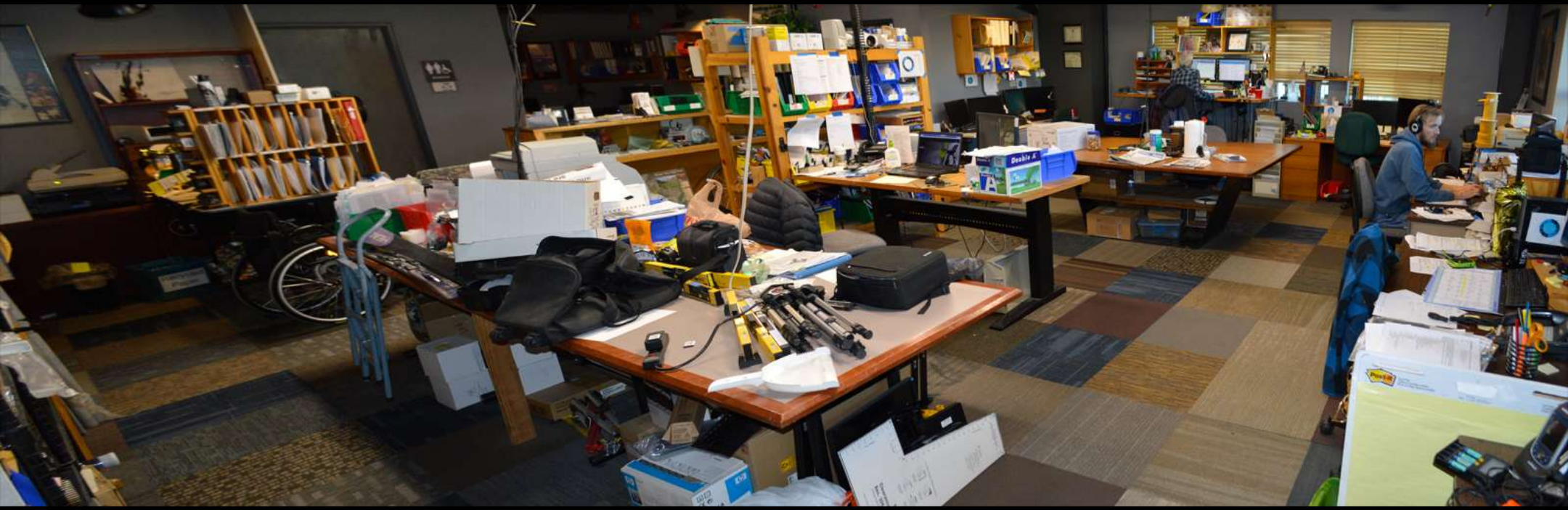
sidewalk assessment coordinator

a space with tools to work in

to design and create

to build, test and break

with material and stuff to assemble


Double A


N20K


Mobil


R2-A


N-C
N-B
GLOVES
GLOVES

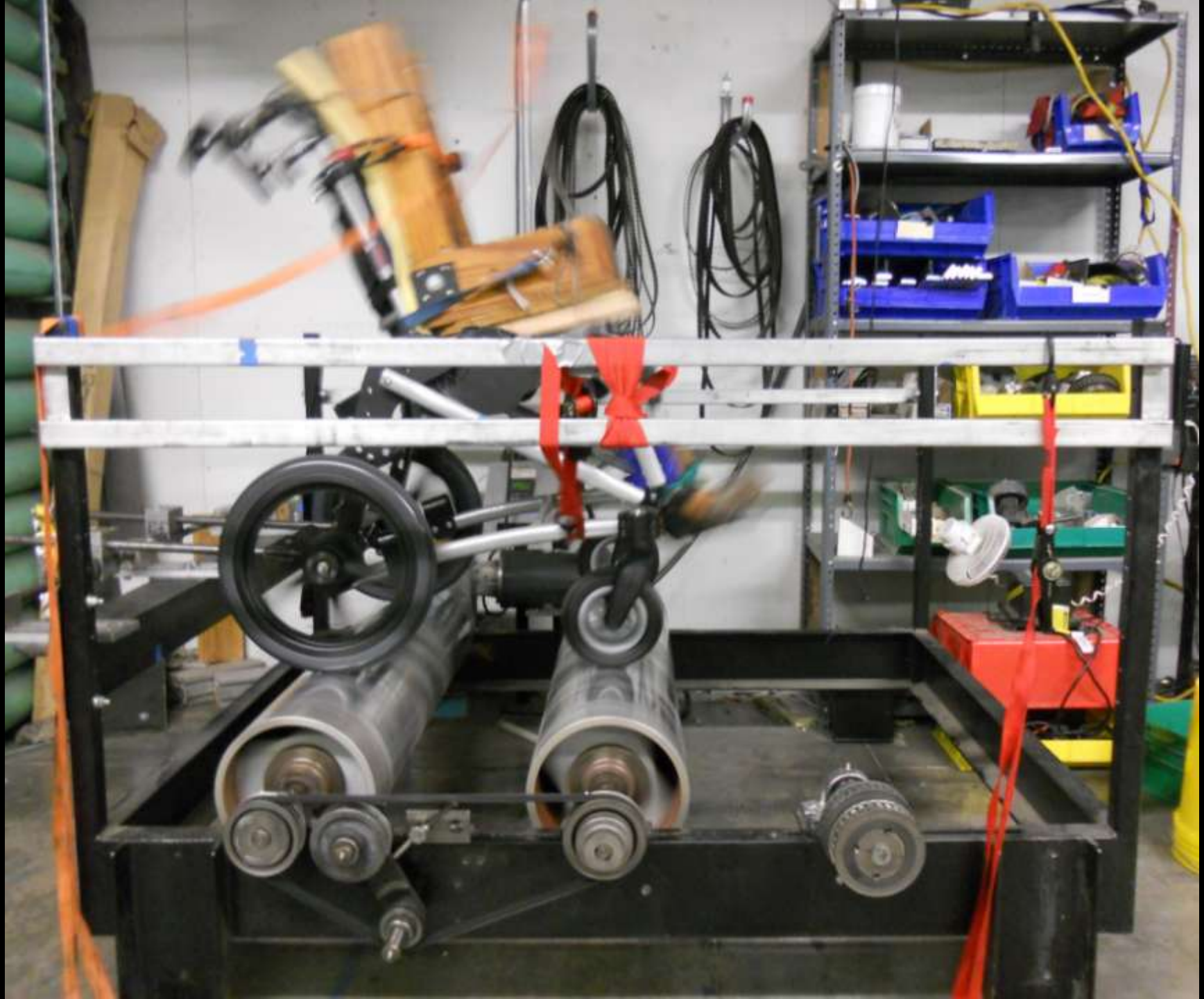

N-D
N-C

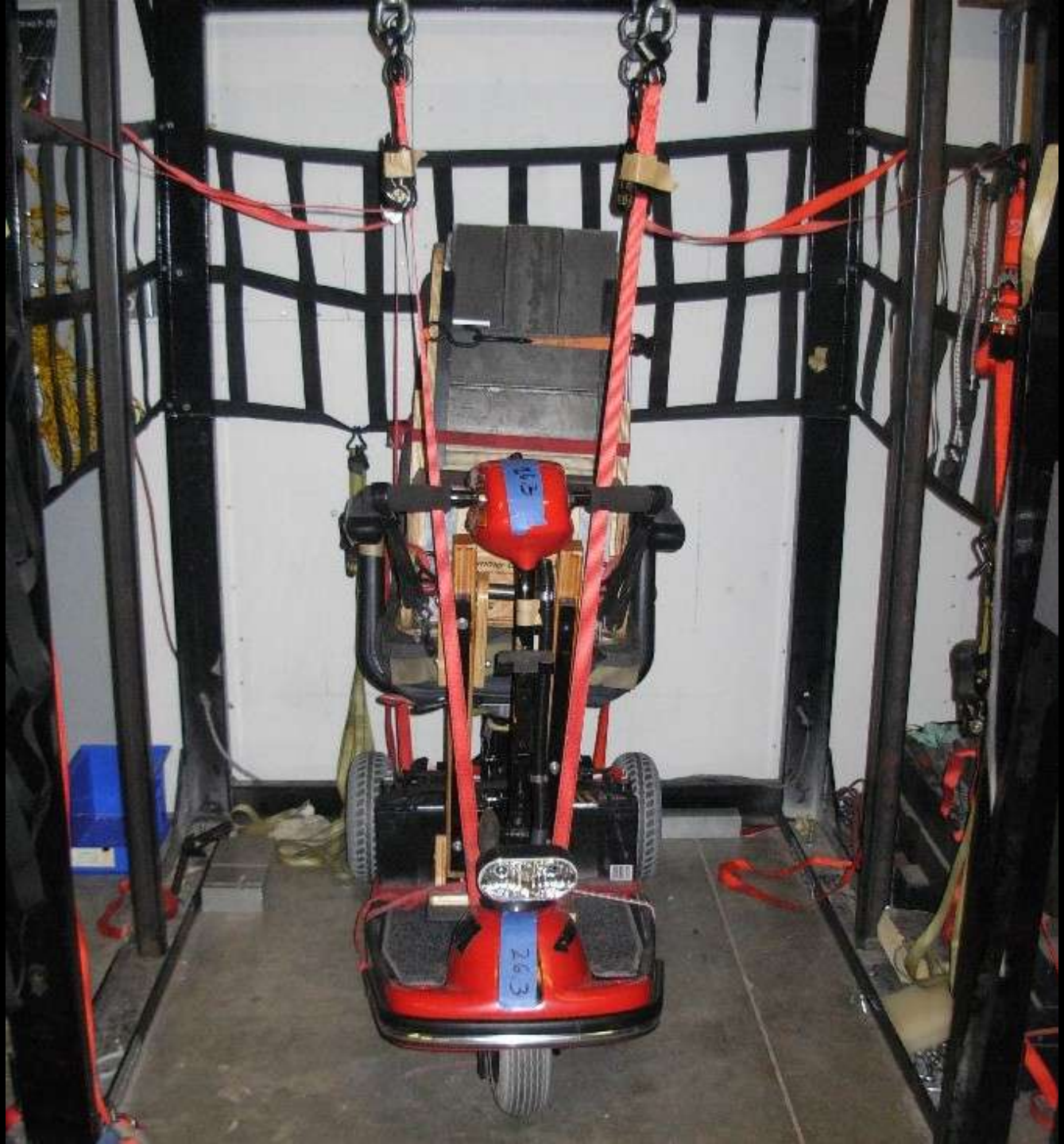
testing

- wheelchairs
- surfacing
- adaptive sports equipment
- forensics

wheelchair testing

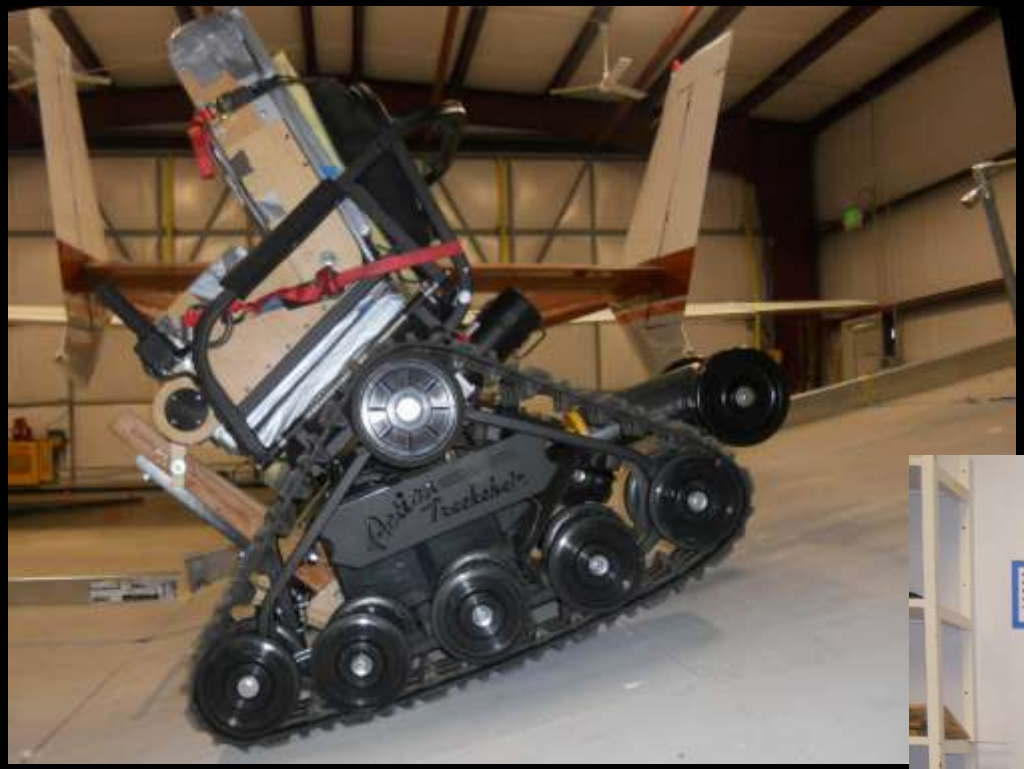
- people get hurt using them
- design and manufacturing defects
- making sure the product is safe
- determine the performance of the product
  - how fast it goes
  - how far it will go
  - how high it can climb

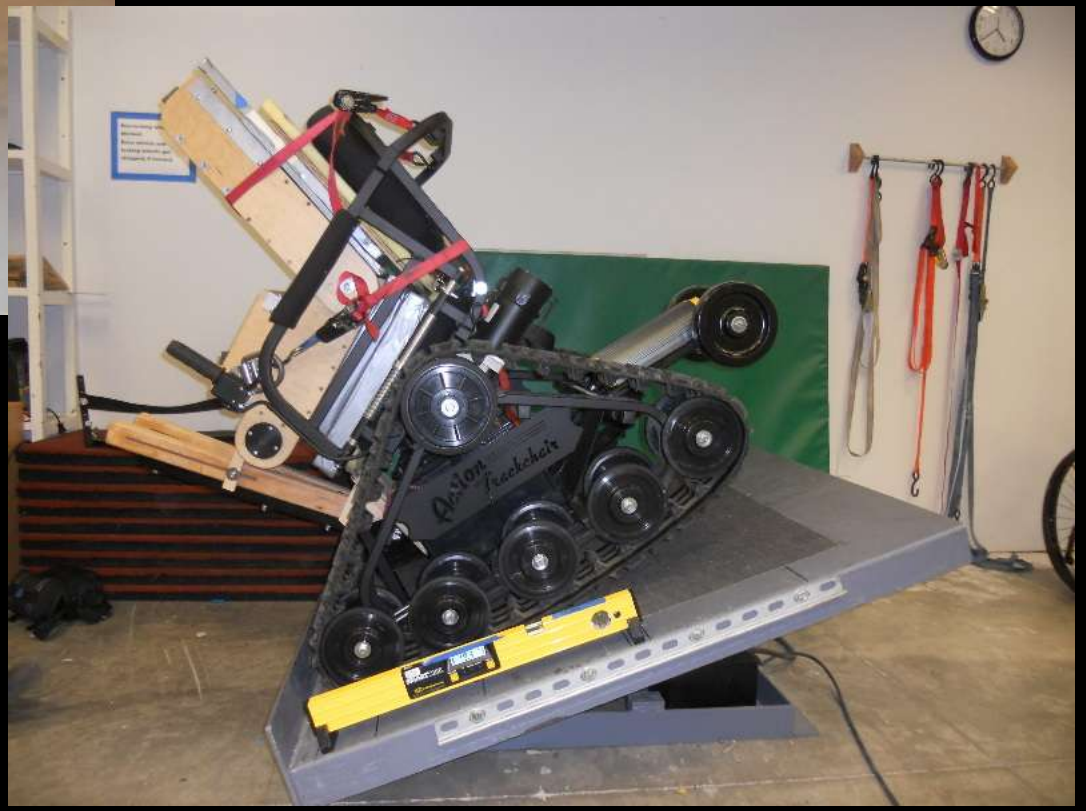





2014-2


Action Trackstander






7.5°

surface testing

- people get hurt using playgrounds
- soft but firm and stable
- making sure the product is safe
- make sure i don’t get stuck in them
    - how firm is the surface
    - how stable is the surface

Rotational Penetrometer

objective surface measurement device


BDRP100
Start Here

in/mm
ZERO
ON
ABS
USA
UNLOADED

trail with firm but unstable sandy surface

trail after installation of surface stabilizer

Rotational Penetrometer readings
Gravelpave 2

Before Application			***After*** Application		
Firmness		Stability	Firmness		Stability
0.18		0.77	0.17		0.37
0.17		0.87	0.17		0.38
0.17		0.77	0.18		0.42
0.18		0.88	0.17		0.35
0.18		0.79	0.18		0.40
0.18	Avg	0.82	0.17	Avg	0.38

seat cushion testing

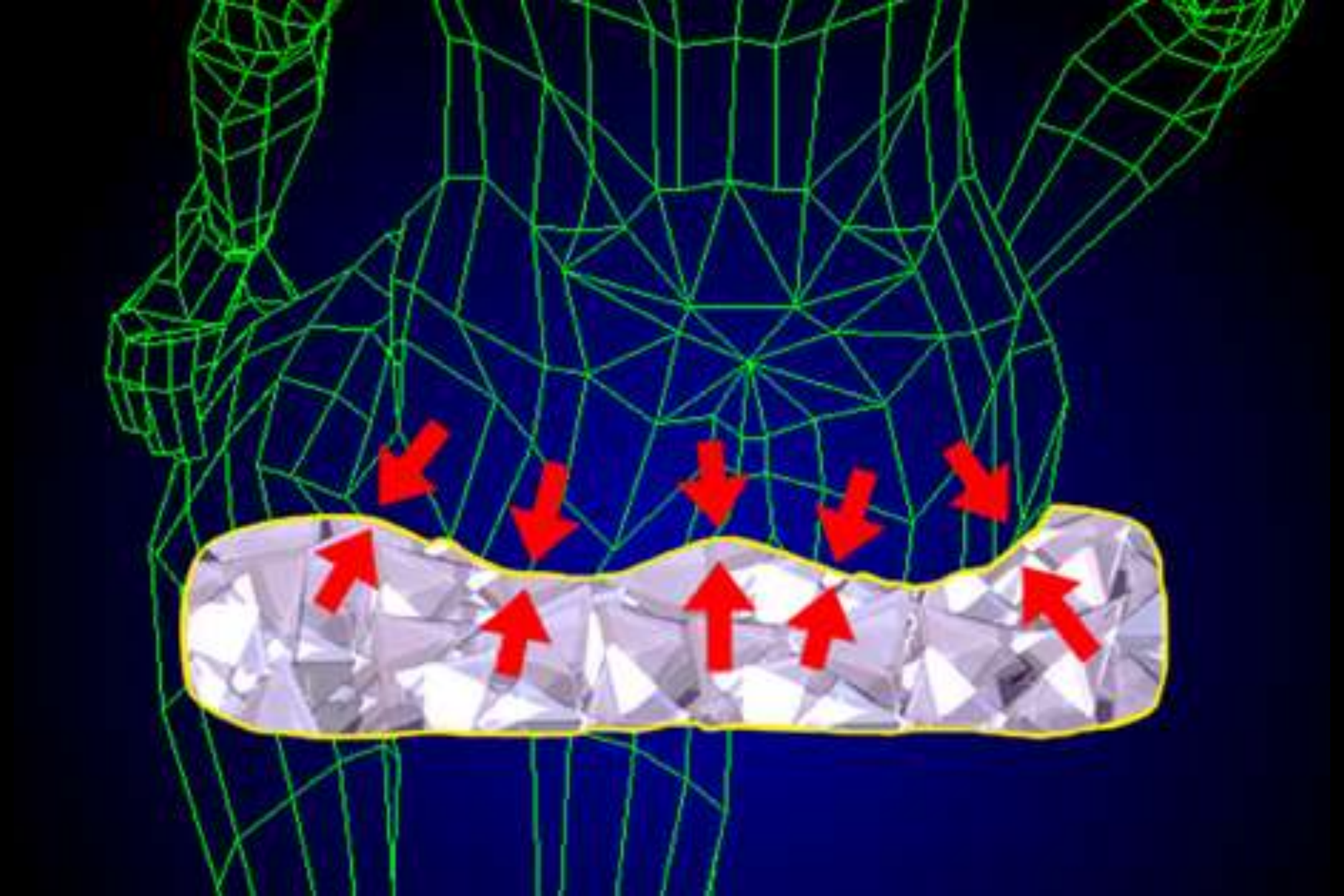
people die from pressure sores

soft but firm and stable

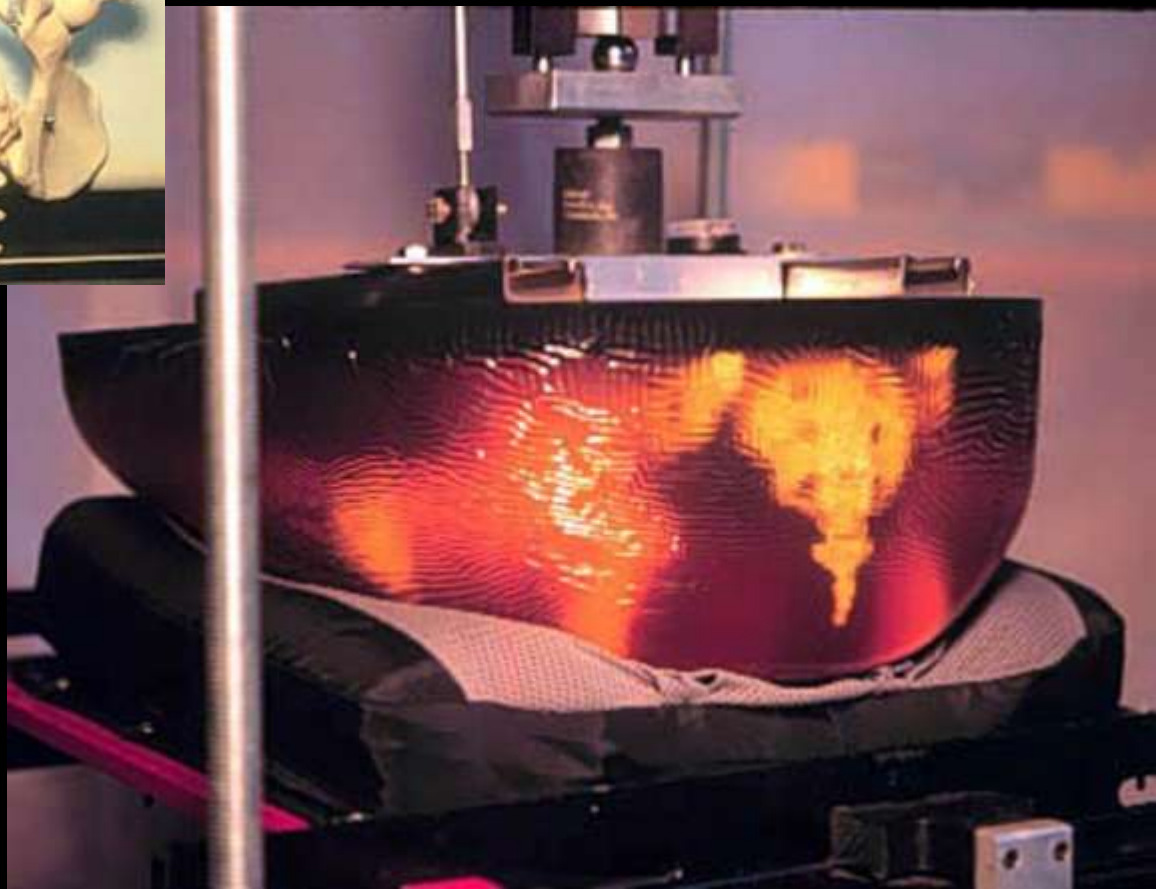
making sure the product is safe

make sure i don’t get a pressure sore

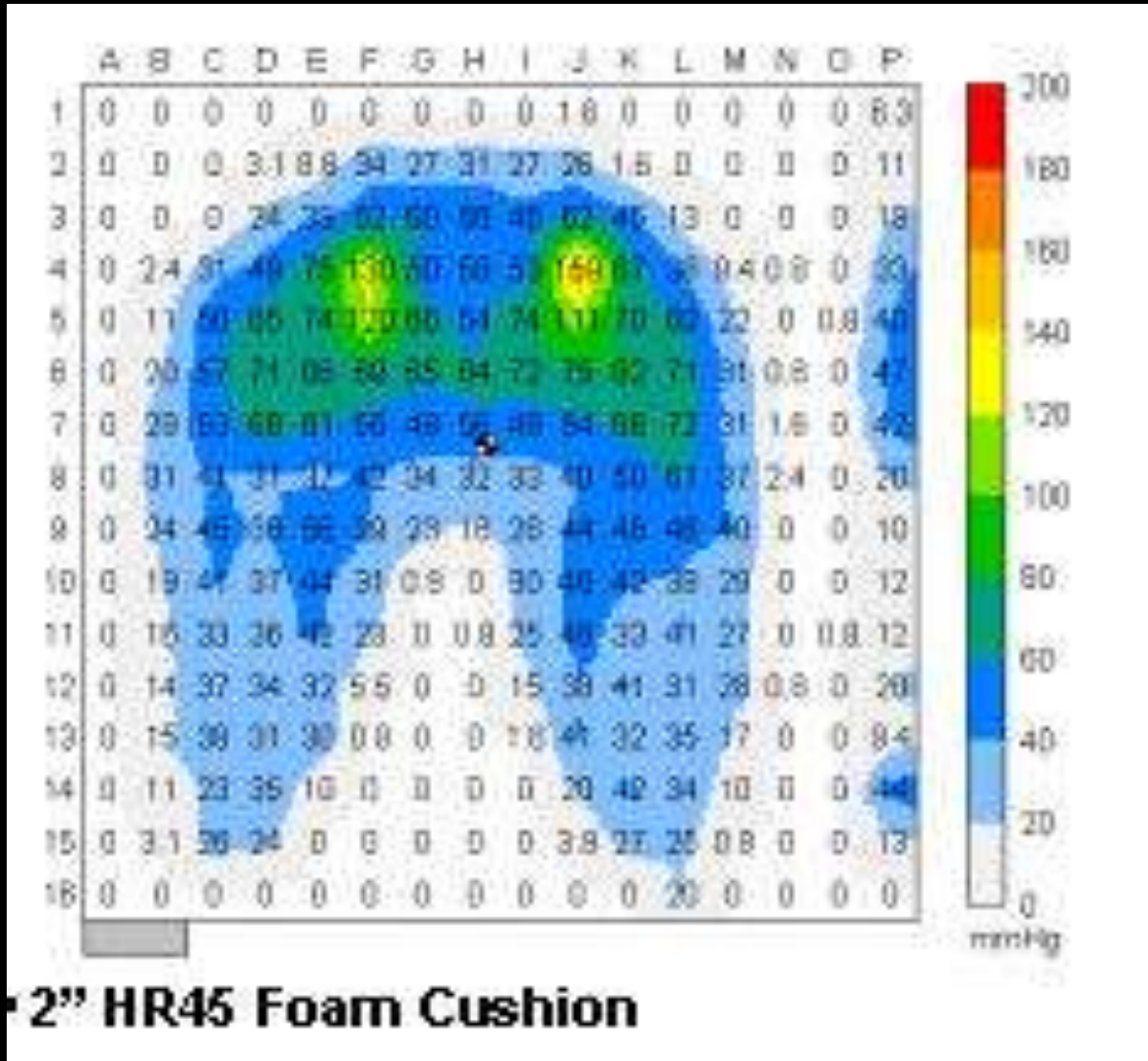
- how high are the sitting pressures
- how long can i sit on it



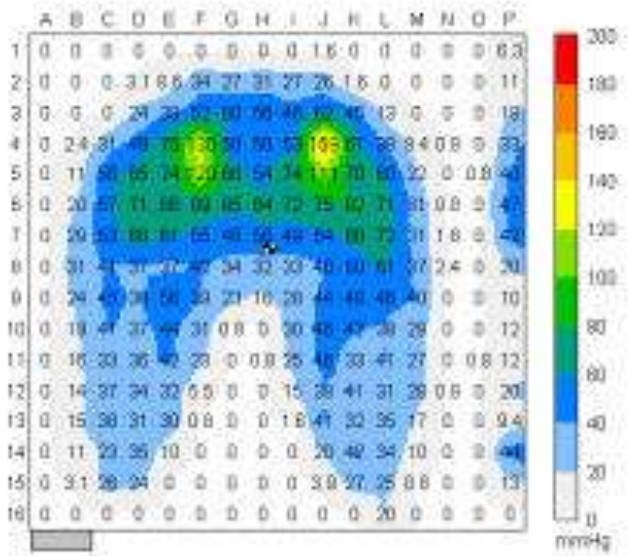
seat cushion testing



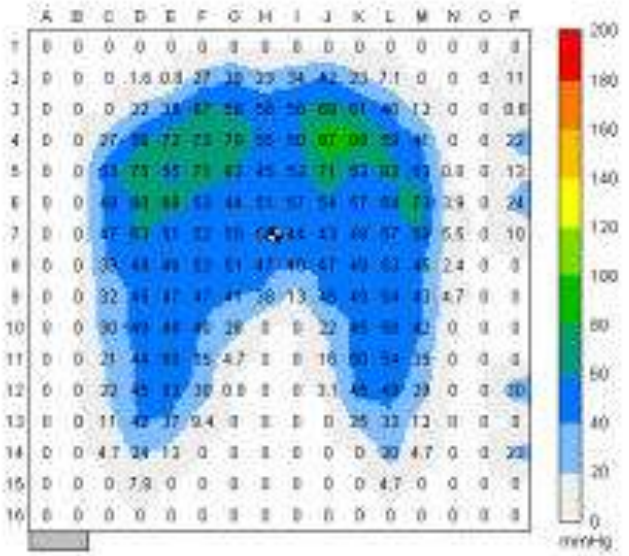
SKELI used on foam



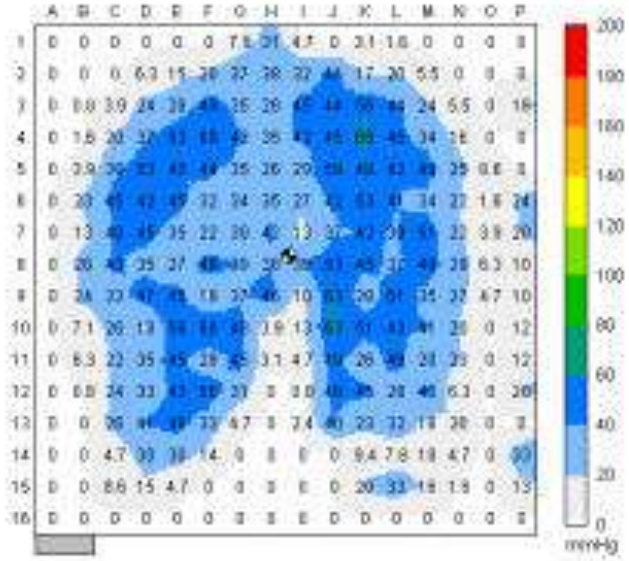
2" HR45 Foam Cushion



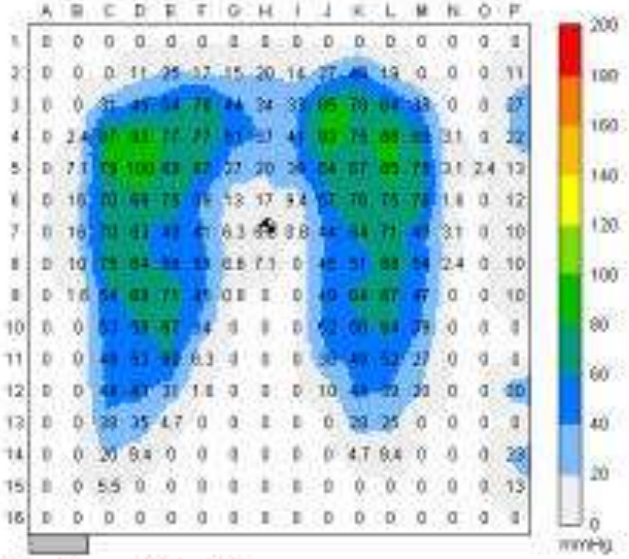
2" HR45 Foam



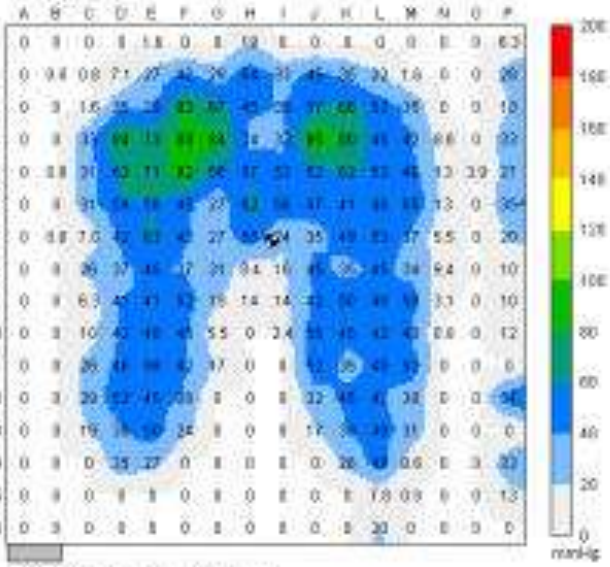
Jay 2 by Sunrise Medical



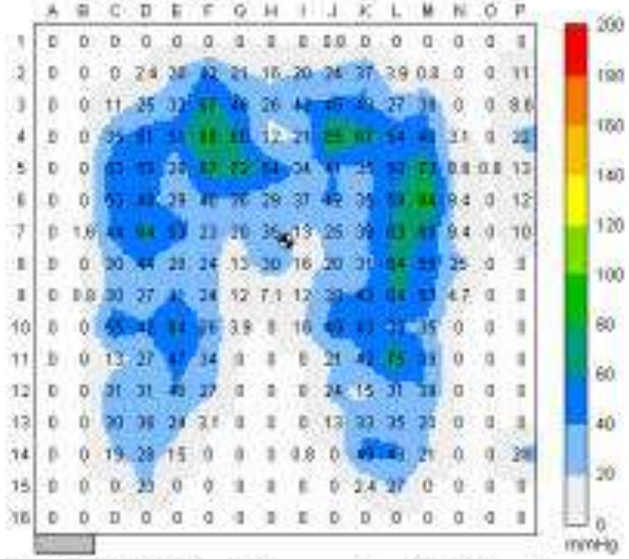
ROHO High Profile by ROHO Inc.



Contoured by Supracor



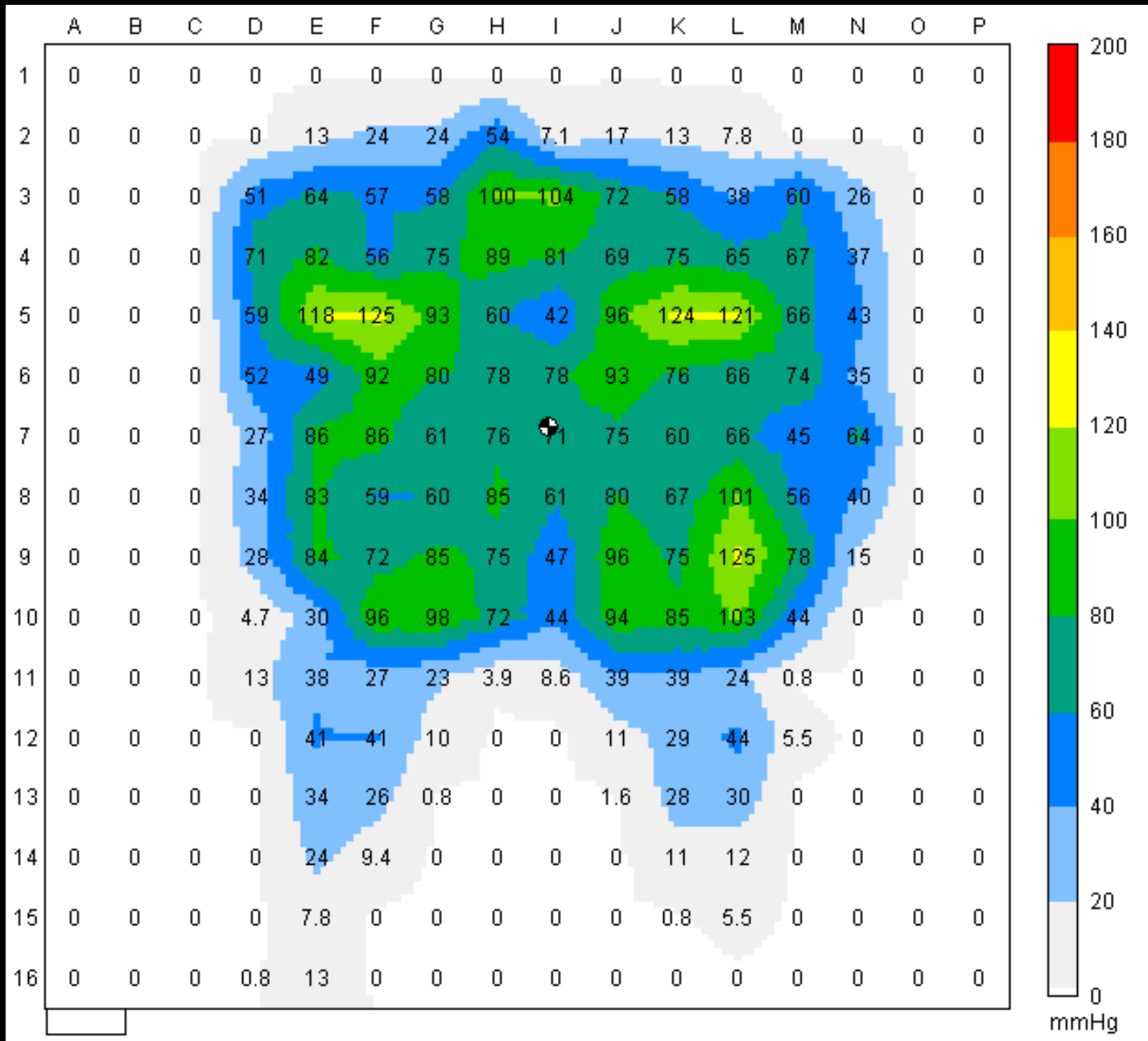
Model P by Vicair



Model P Deep Immersion by Vicair

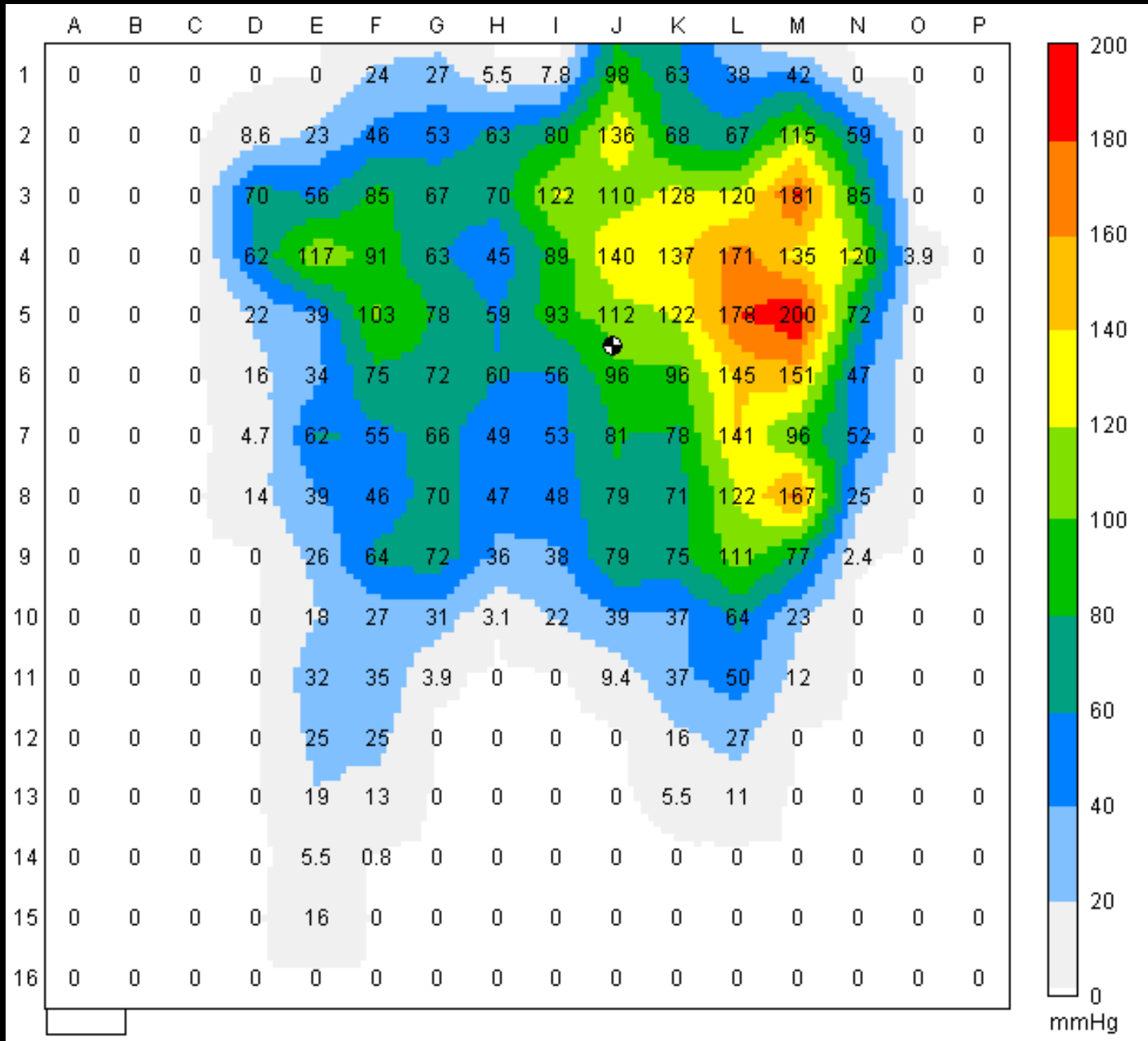
ASLI prototype became an ISO shape

pressure measurements
symmetric



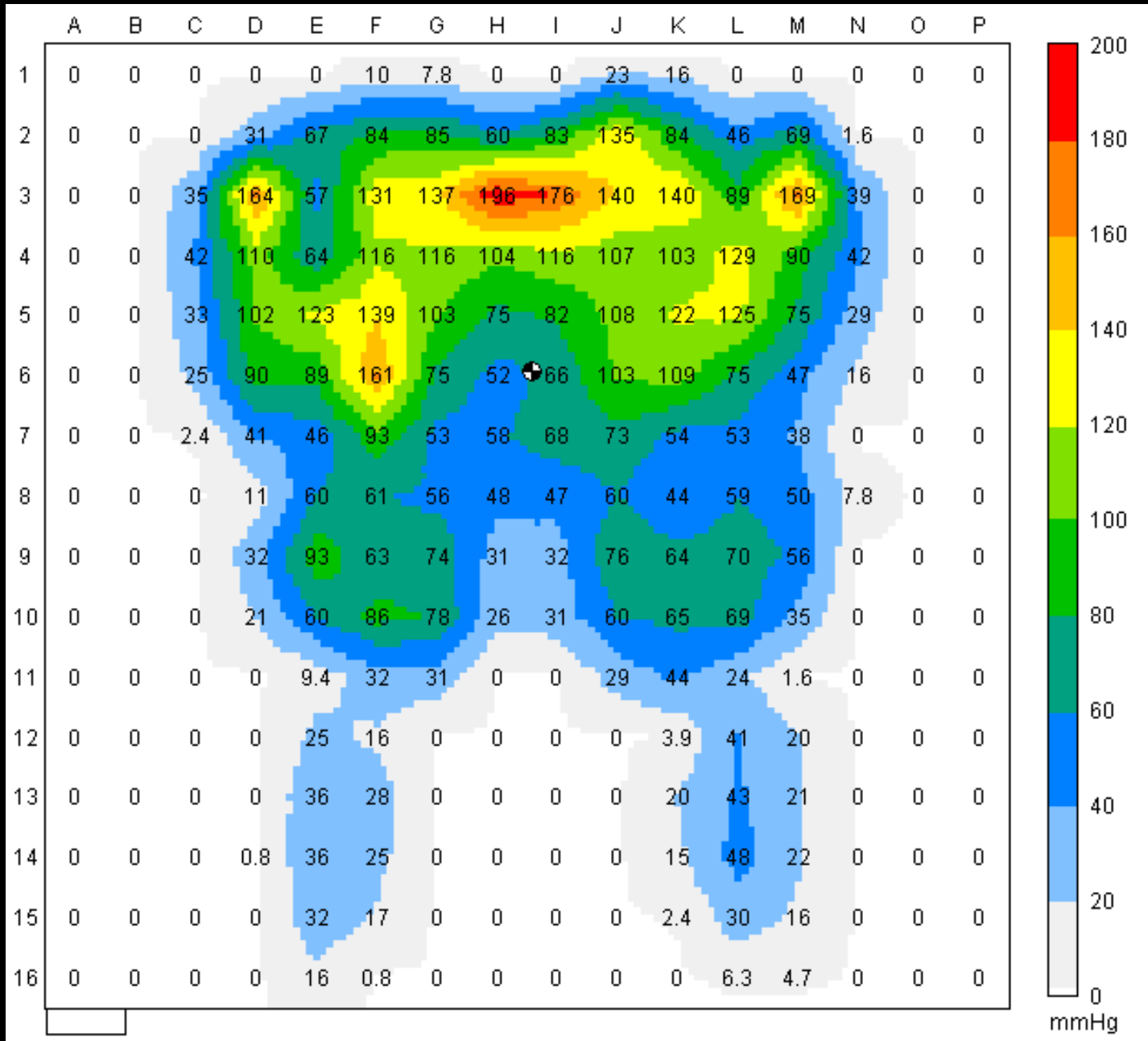
pressure measurements

10° pelvic obliquity



pressure measurements

15° posterior pelvic tilt



personal technologies

activity-specific technologies

environmental technologies

personal technologies

things that you wear

my personal wheelchair

the need
more comfort sitting

the need

a better wheel and handrim

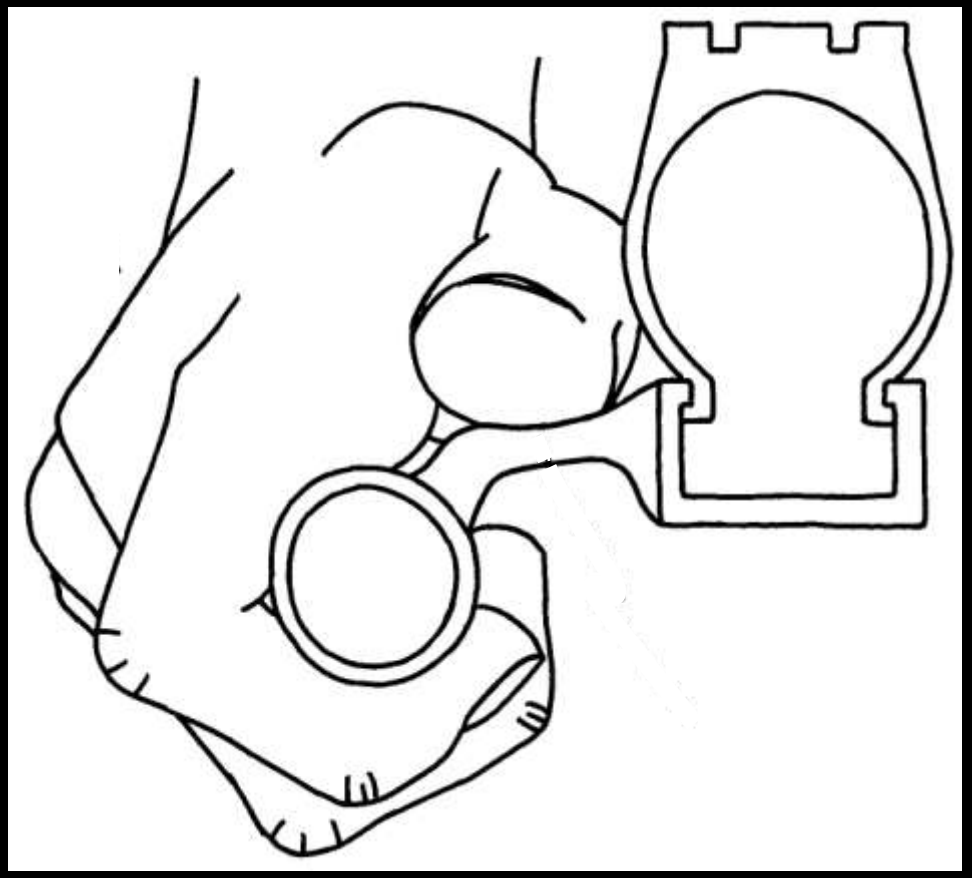
a rough surface burns the hands

difficult to grip a smooth surface

repeated motion leads to injury

the need for a better grip

solution - an ergonomic pushrim

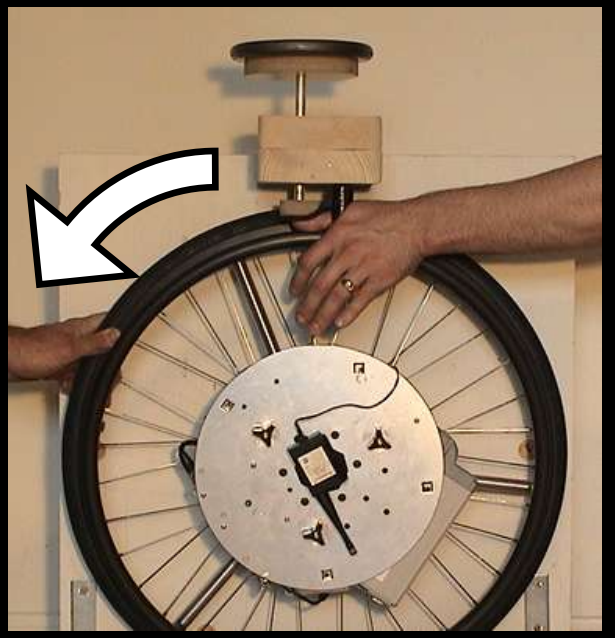


FlexRim

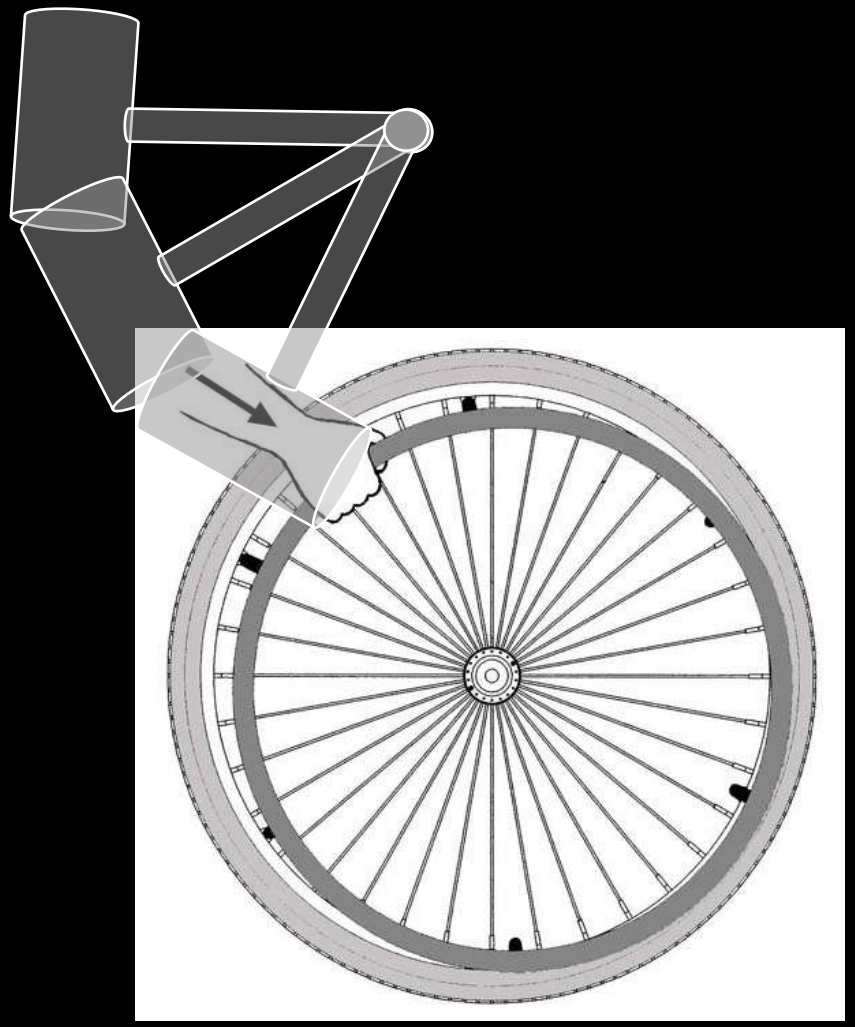
combining the discrete compliant fasteners into one

frictional improvements

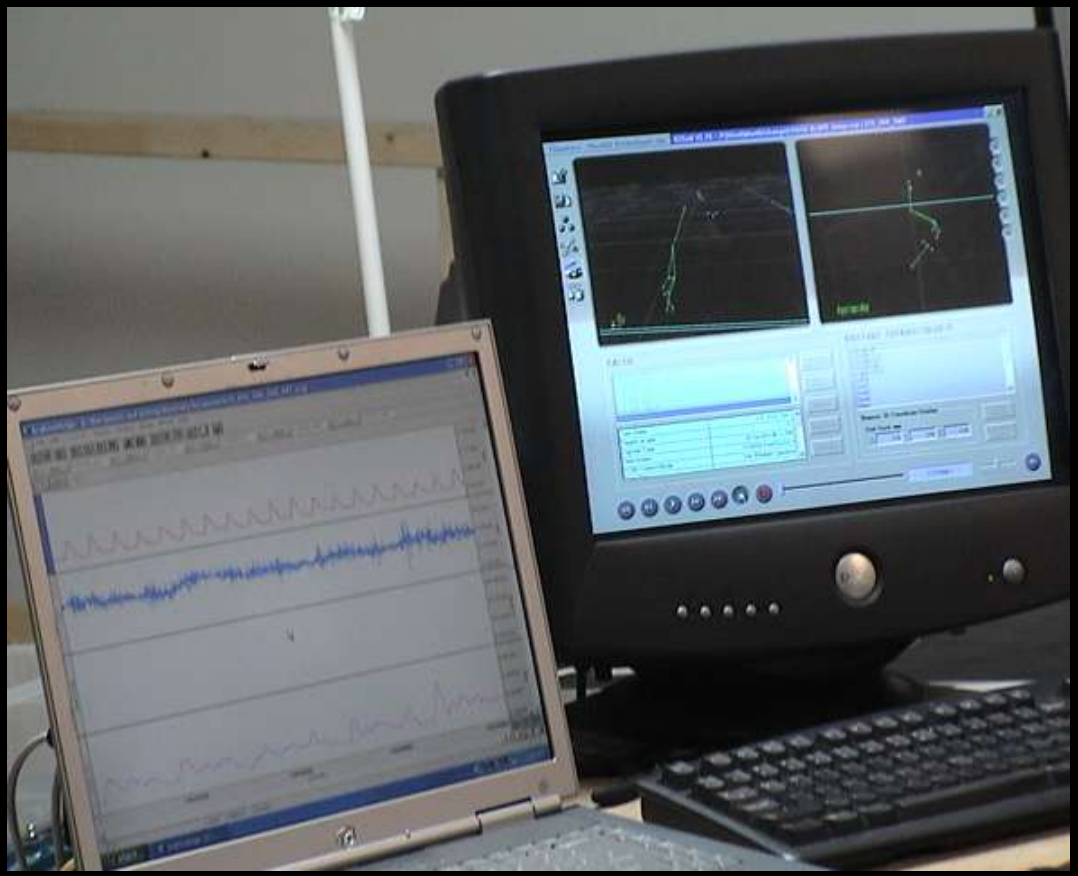
to reduce the grip force required to push

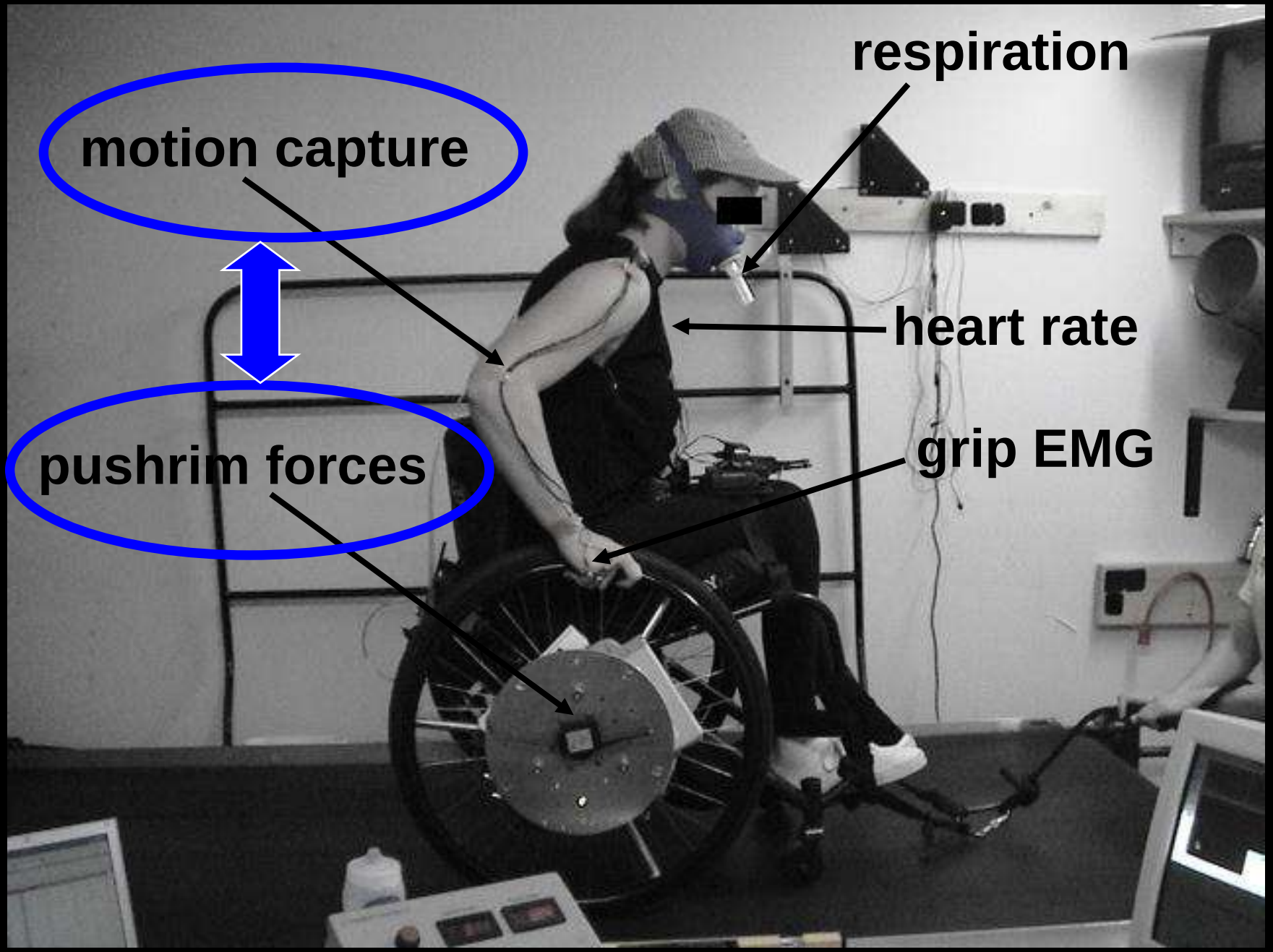


impact absorption – like running shoes

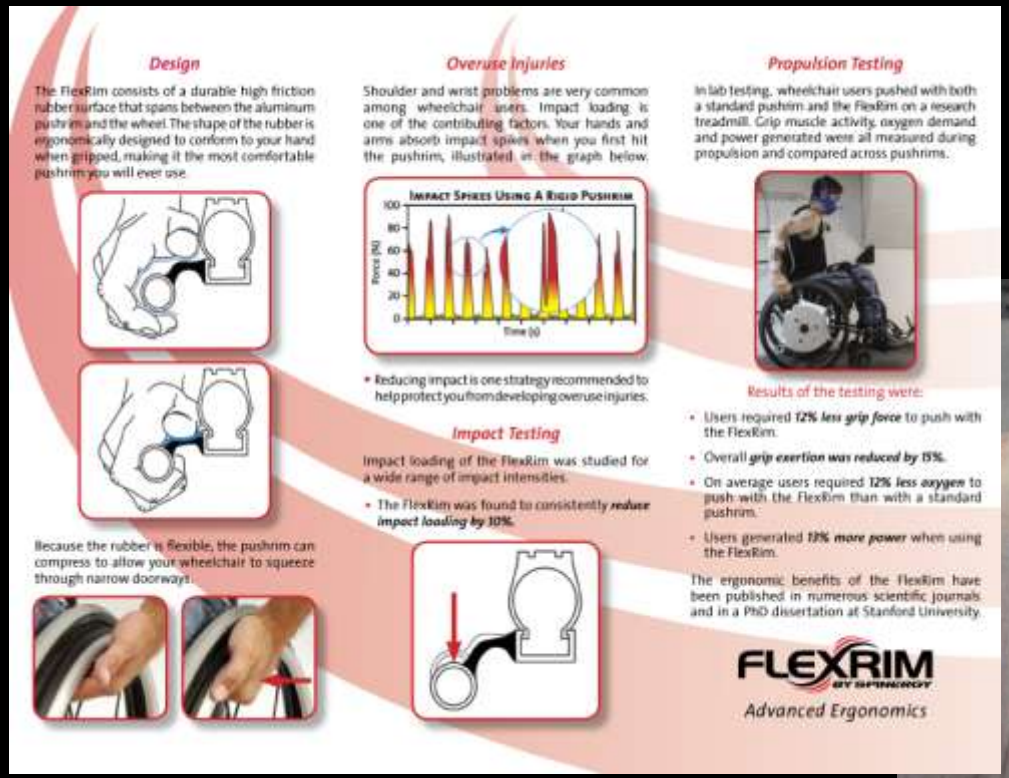


subjects are tested over a wide variety of usage environments




respiration
motion capture
heart rate
grip EMG
pushrim forces

end product – the 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 ***13% 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 SPINERGY

Advanced Ergonomics

activity-specific technologies

and the desire to recreate

the need – to get back out on the snow

the Mono Ski
now a Paralympic sport


200
205
AMERICAN EXPRESS
When you ne

dynamic seating spring assist

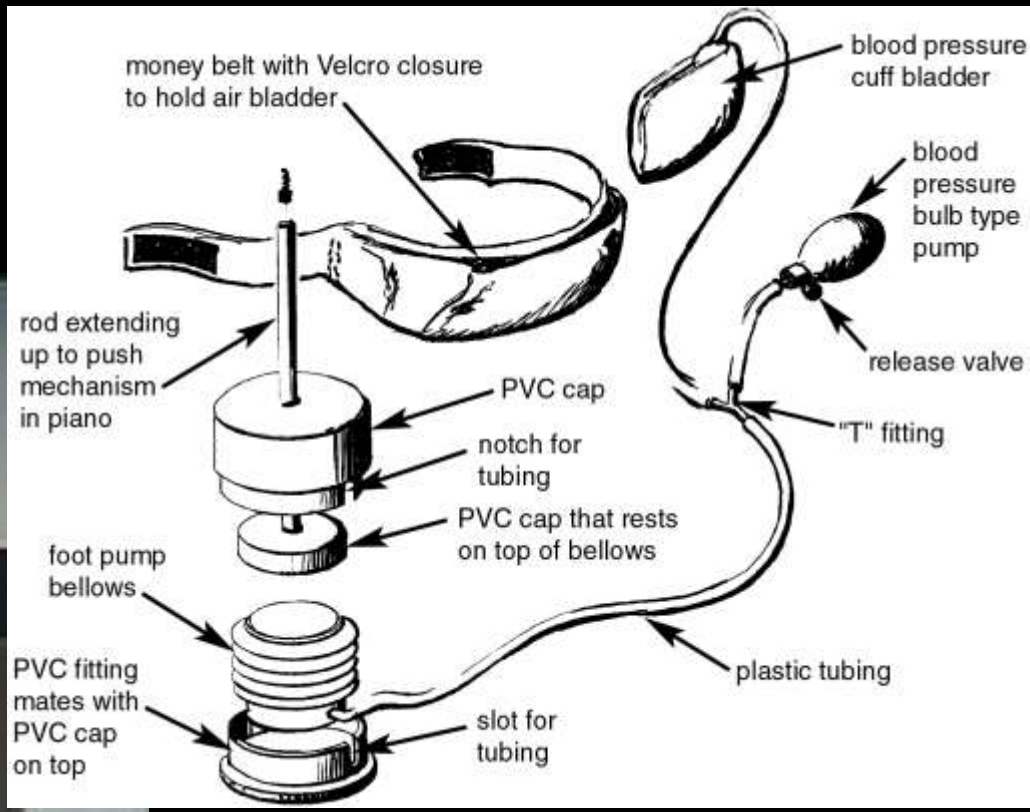
the desire – to get into the back country


4 12'98


FOX SHOX
4 12 '98

the need

using the pedal again to play the piano



the desire - to drive a manual shift vehicle

the desire – to balance and ride a bike again

the desire – to ride tandem bike with a friend

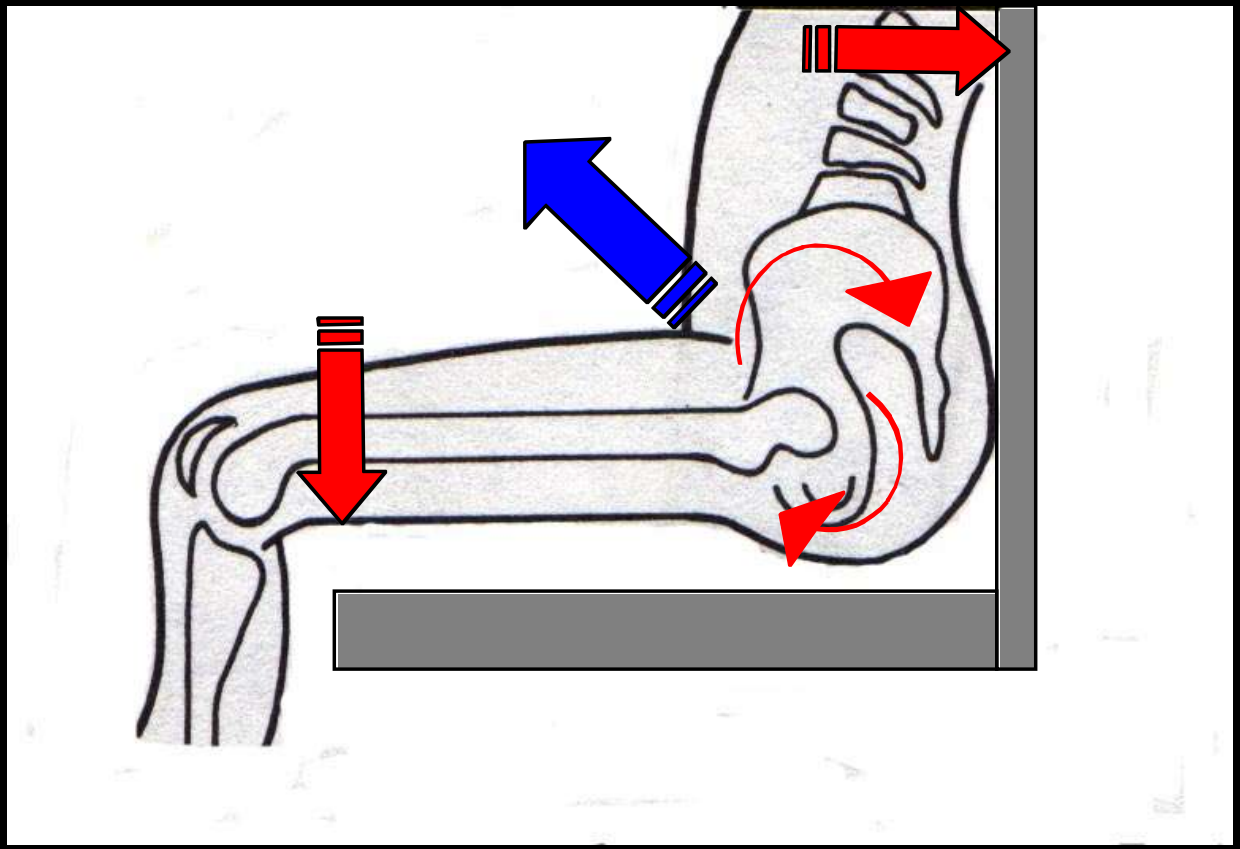
the desire – to paddle a canoe again without the required balance

lateral balance test

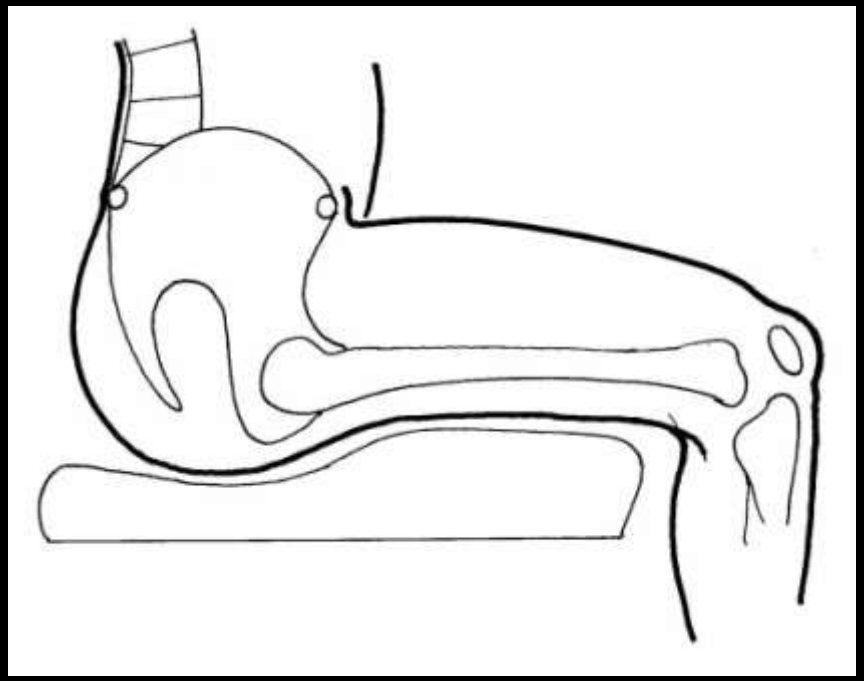
water egress testing

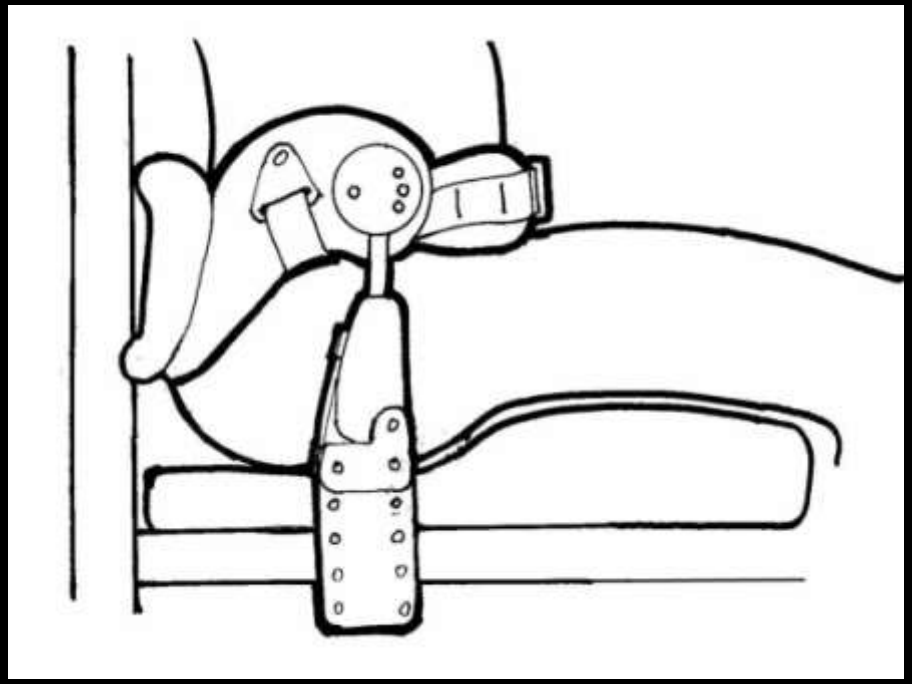
the desire –
to surf again

the problem – unwanted pelvic movement due to spasticity

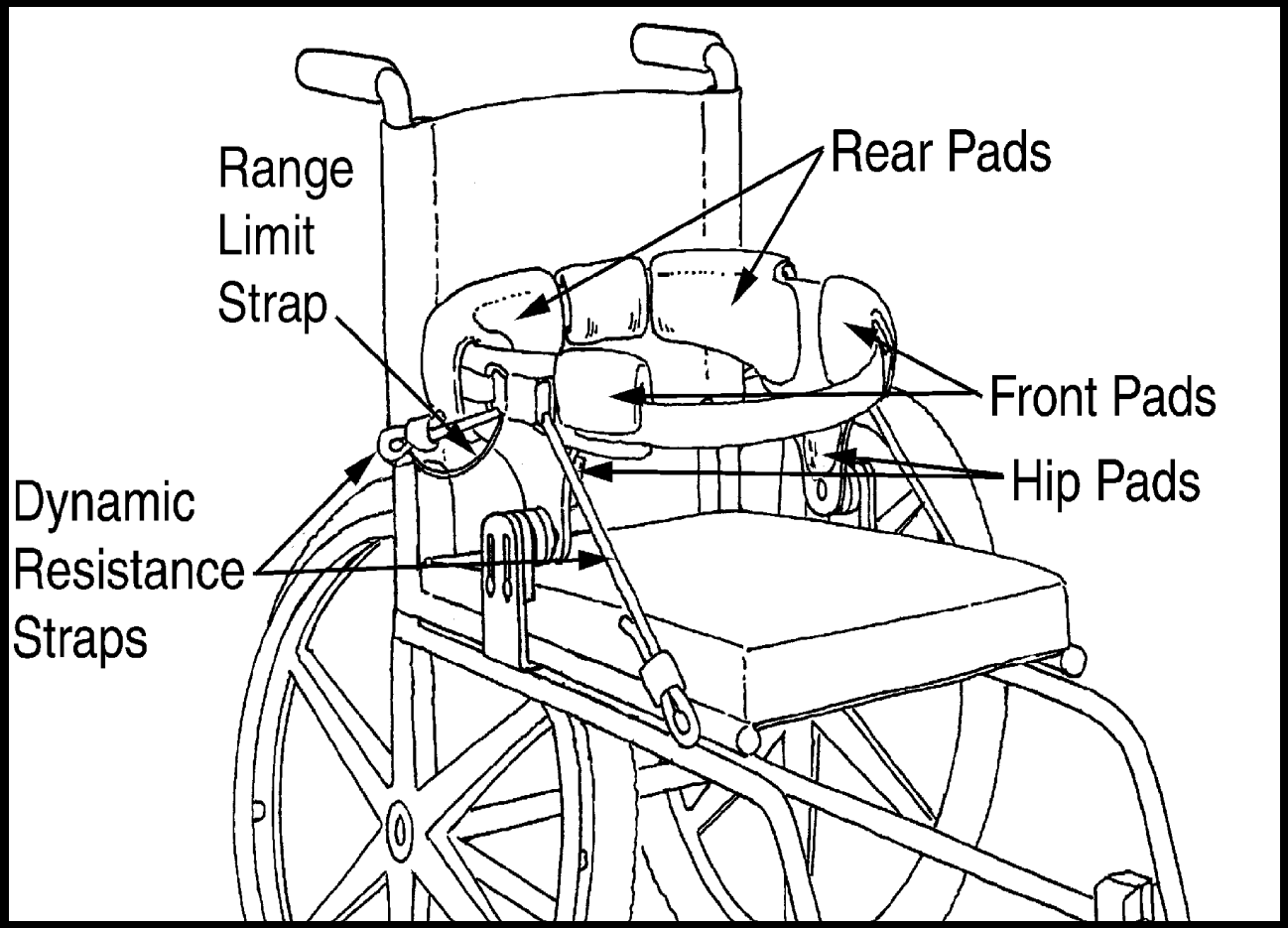


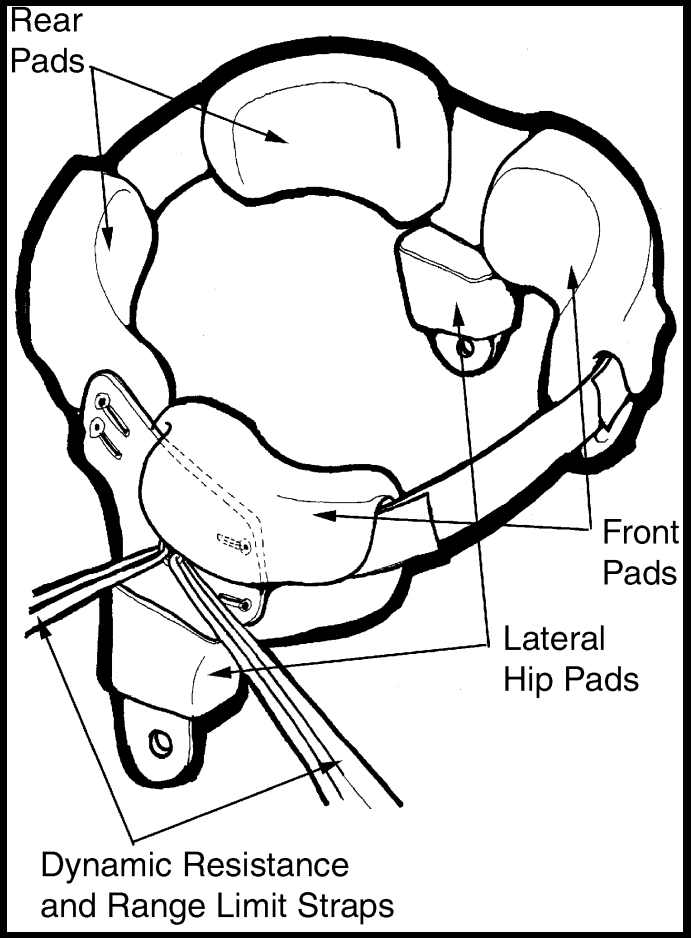
concepts developed to allow the movement but return to the desired position





early prototypes





fatigue testing of concept

the finished product

environmental technologies

things that do not move

ADA recreation trail

grade

> 8.33%	up to 30% of length
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

Universal Trail Assessment Process (UTAP)

key UTAP information

length

grade

width

surface

cross slope

features & facilities

UTAP assessment team


SMARTTOOL

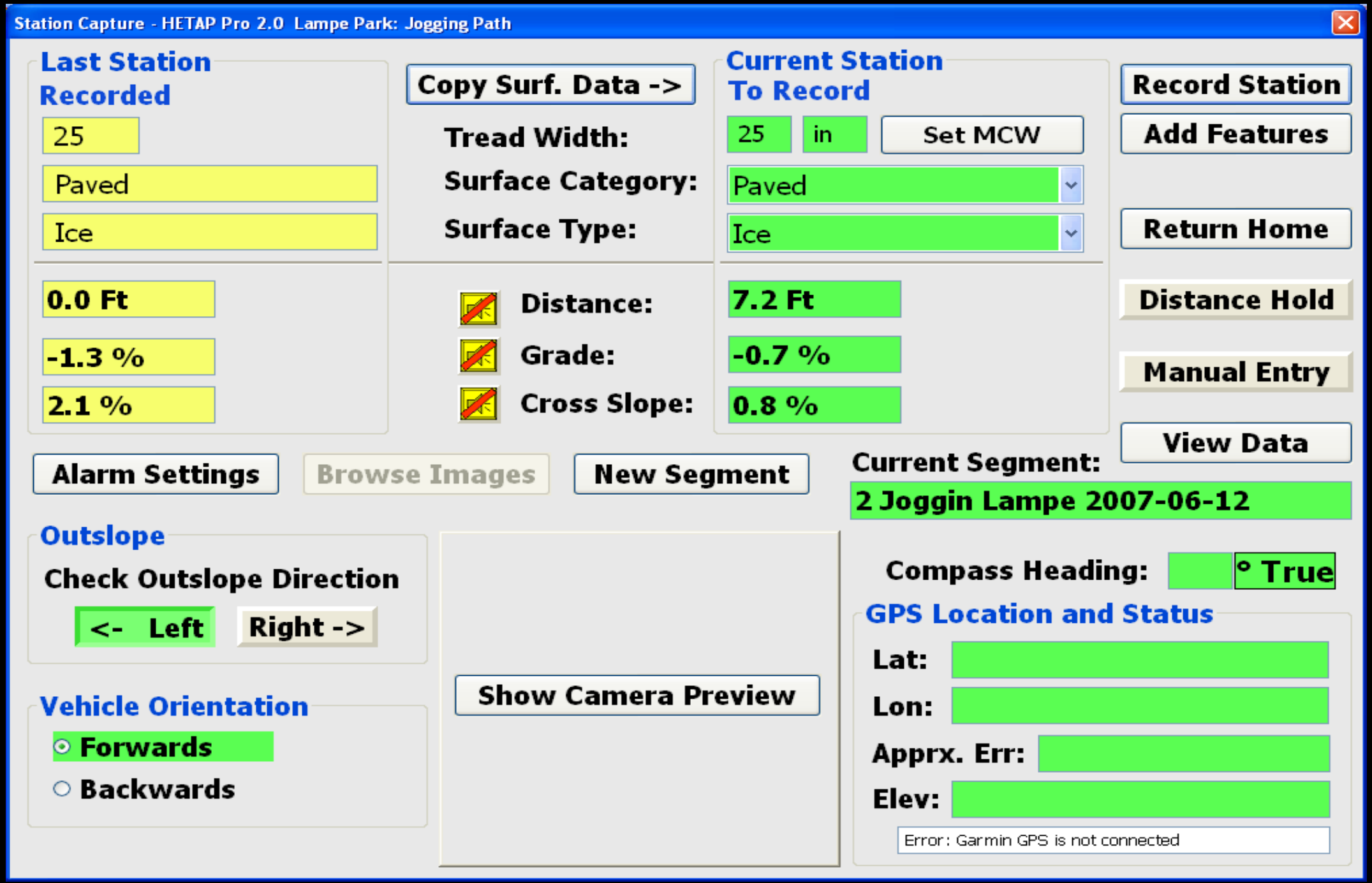
UTAP – implementation status

Over 1300 people trained to lead UTAP assessments

Over 155 trainers to teach UTAP workshops

High Efficiency Trail Assessment Process (HETAP)

HETAP wheel


Station Capture - HETAP Pro 2.0 Lampe Park: Jogging Path
Last Station Recorded
25
Paved
Ice
0.0 Ft
-1.3 %
2.1 %
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


Dune Trek
Length
Hikers
Bikes
Dogs on Leash
Equestrians
No Motorized Vehicles
Grade
Cross Slope
Tread Width
Surface

Trail Access Information (TAI)

TAI SignPosts to convey to users in a Nutrition Facts label format:

- Grade
- Cross Slope
- Tread Width
- Surface
- Obstructions

TRAIL ACCESS INFORMATION

1 SPOONER LAKE LOOP TRAIL

Spooner Lake Loop Trail

Length	2.2 (3.6 km)
Elevation Gain	199 ft (60.7 m)
Elevation Loss	349.2 ft (106.5 m)

TRAIL USE

- Hikers
- Mountain Bikes
- Dogs on Leash
- Equestrians
  North Side of Lake Only
- No Motor Vehicles

GRADE

Typical Grade	4.6%
20% of trail is	6% to 11%
929 ft (283.2 m) is	11% to 24.5%
Standard Ramp Grade	8.3%

CROSS SLOPE

Typical Cross Slope	5.4%
21% of trail is	7% to 11%
947 ft (288.6 m) is	11% to 28.1%

TREAD WIDTH

Typical Width	37 in (94.9 cm)
Minimum Width	24 in (61.0 cm)
2502 ft (762.6 m) is	24 in (61.0 cm)

SURFACE

Surface Type	Soil
1% of trail is	Hard
99% of trail is	Firm

OBSTRUCTIONS

Multiple Rocks	6-12 in (15-31 cm)

WARNING: Trail conditions may have changed since August 2017 when this trail last was assessed. Temporary trail obstructions were not recorded. Obstructions less than 2 in (5.1 cm) or outside of the tread area (36 in (91.4 cm) wide by 120 in (304.8 cm) high) were not reported.

Signage created by **Beneficial Designs Inc.** using Trail Access Information data collected by a certified trail assessment coordinator. Funded by the Nevada Recreational Trails Program and the Nevada Department of Conservation & Natural Resources.

TRAIL ACCESS INFORMATION

1 SPOONER LAKE LOOP TRAIL

Spooner Lake Loop Trail

Length	2.2 (3.6 km)
Elevation Gain	199 ft (60.7 m)
Elevation Loss	349.2 ft (106.5 m)

TRAIL USE

- Hikers
- Mountain Bikes
- Dogs on Leash
- Equestrians
  North Side of Lake Only
- No Motor Vehicles

GRADE

Typical Grade	4.6%
20% of trail is	6% to 11%
929 ft (283.2 m) is	11% to 24.5%
Standard Ramp Grade	8.3%

CROSS SLOPE

Typical Cross Slope	5.4%
21% of trail is	7% to 11%
947 ft (288.6 m) is	11% to 28.1%

TREAD WIDTH

Typical Width	37 in (94.9 cm)
Minimum Width	24 in (61.0 cm)
2502 ft (762.6 m) is	24 in (61.0 cm)

SURFACE

Surface Type	Soil
1% of trail is	Hard
99% of trail is	Firm

OBSTRUCTIONS

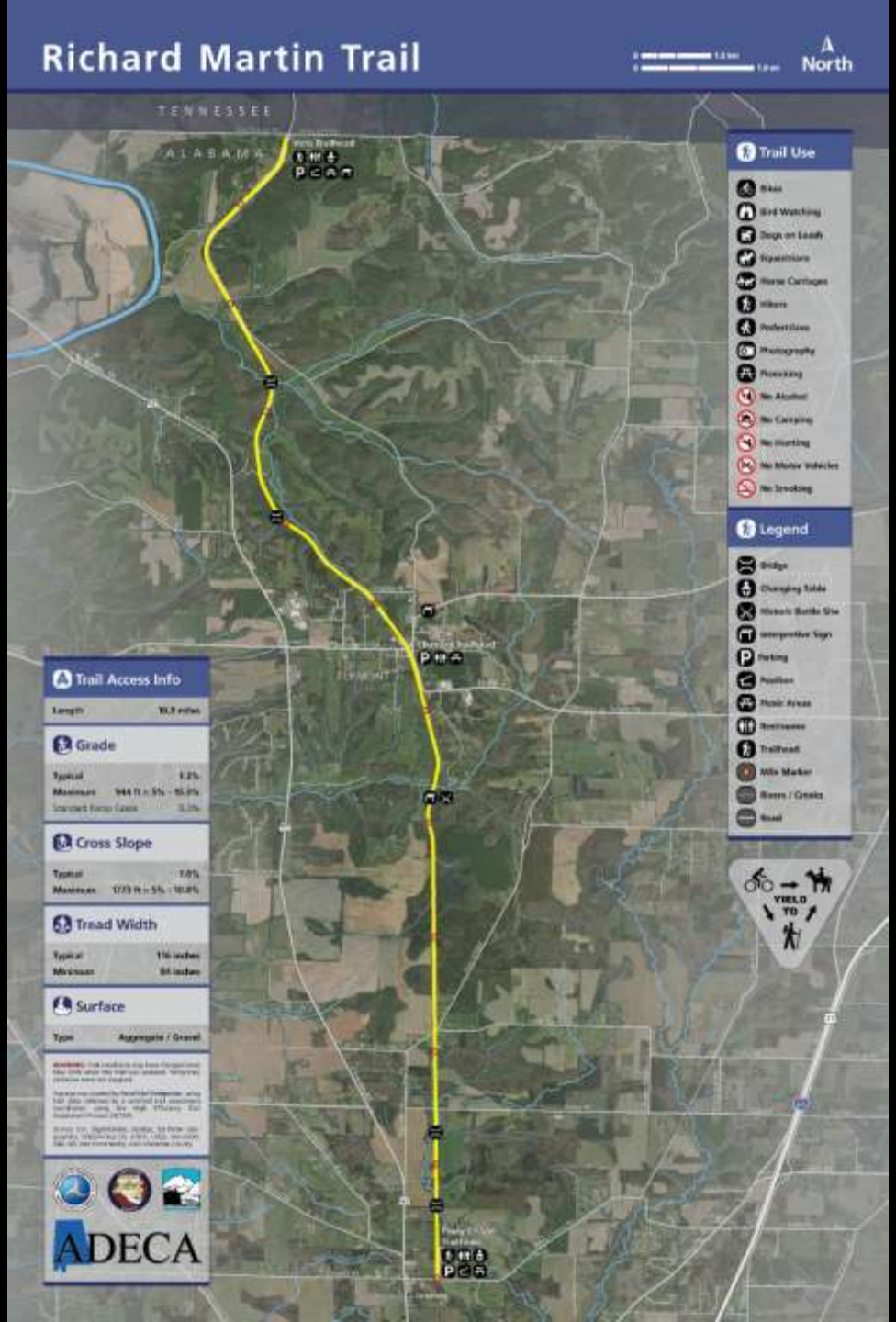
Multiple Rocks	6-12 in (15-31 cm)

WARNING: Trail conditions may have changed since August 2017 when this trail last was assessed. Temporary trail obstructions were not recorded. Obstructions less than 2 in (5.1 cm) or outside of the tread area (36 in (91.4 cm) wide by 120 in (304.8 cm) high) were not reported.

Signage created by **Beneficial Designs Inc.** using Trail Access Information data collected by a certified trail assessment coordinator. Funded by the Nevada Recreational Trails Program and the Nevada Department of Conservation & Natural Resources.

TRAIL ACCESS INFORMATION

Richard Martin Trail



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

North

0 ft — 300 ft

To Reno NV

To Mount Rose Wilderness

Mount Rose Summit Trailhead

Mount Rose Campground

Mount Rose Summit Trail

Tahoe Rim Trail

Tahoe Rim Trail

To Relay Peak and Brockway Summit

Mount Rose State Scenic Byway
NV Highway 431

Vista

To Incline Village

Tahoe Meadows Trailhead
Elevation 8730 ft

Easiest Path of Travel

Steep Grades

To Ophir Creek Trail

You Are Here

Tahoe Meadows Interpretive Trail

Funded by the Nevada Recreational Trails Program

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 (From Tahoe Meadows Trailhead to Spooner Summit Trailhead)
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 0.73 in)

Surface Firmness (in): <0.25 Hard Paved; <0.35 Firm; <0.55 Moderately Firm; >1.00 Soft Sand

Surface Stability (in): <0.25 Hard Paved; <0.35 Stable; <0.55 Moderately Stable; >1.00 Unstable Sand

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.

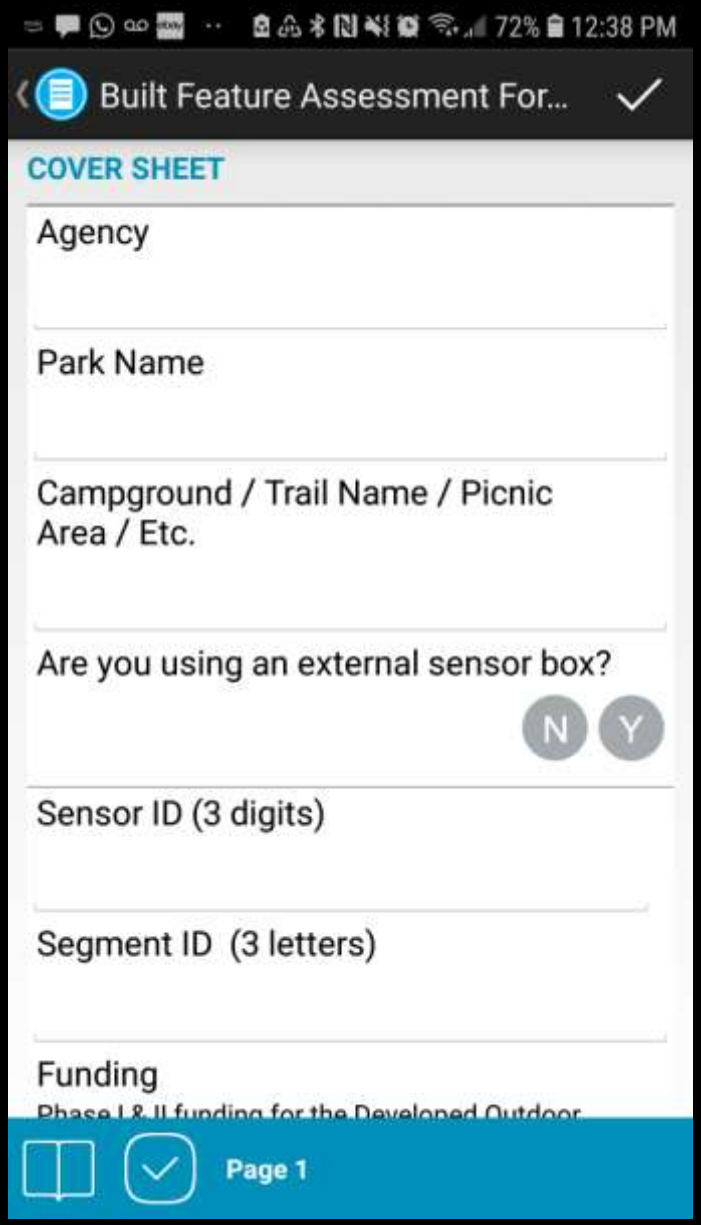
Trail Access Information

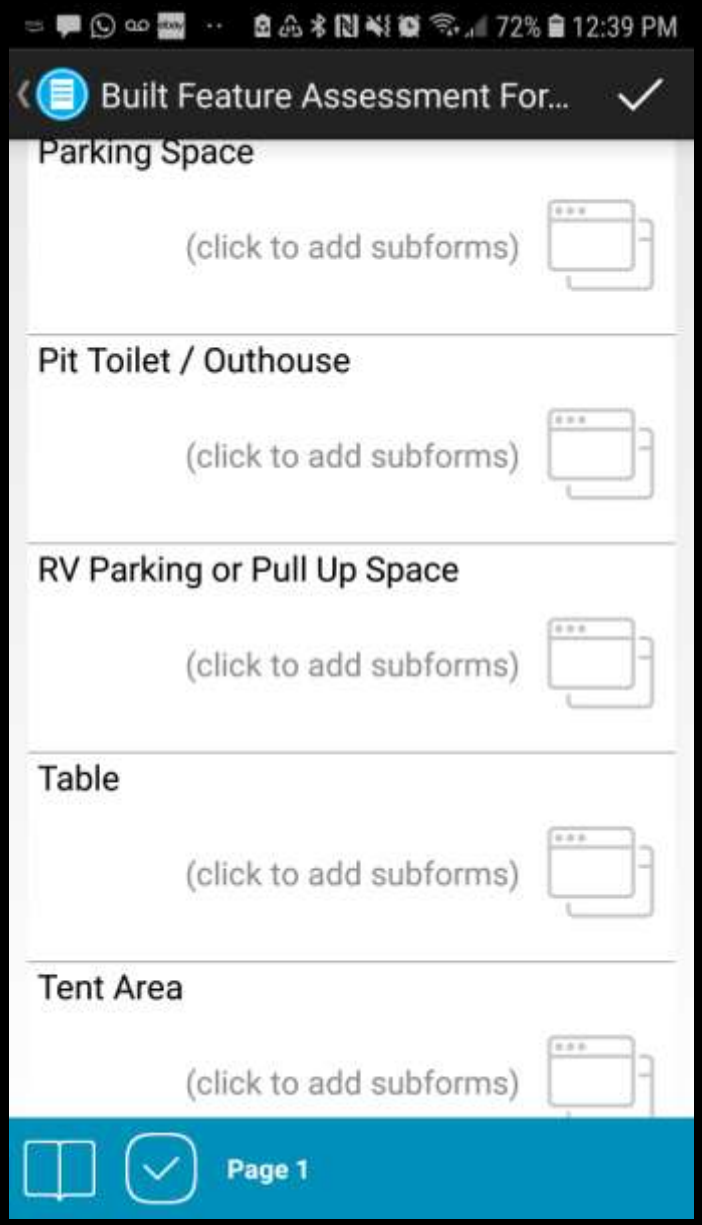
Developed Outdoor Recreation Assessment Process

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

picnic table clearance space


72% 12:38 PM
Built Feature Assessment For...
COVER SHEET
Agency
Park Name
Campground / Trail Name / Picnic Area / Etc.
Are you using an external sensor box?
N
Y
Sensor ID (3 digits)
Segment ID (3 letters)
Funding
Page 1


72% 12:39 PM
Built Feature Assessment For...
Parking Space
(click to add subforms)
Pit Toilet / Outhouse
(click to add subforms)
RV Parking or Pull Up Space
(click to add subforms)
Table
(click to add subforms)
Tent Area
(click to add subforms)
Page 1

Table

ABA/FSORAG

What type of assessment?

◯ ABA ◯ FSO

REQUIRED SPACES

Is the table Circular?

Table Diameter

Measure the height from the
to the table top

Table

Table

Measure the height from the gro
to the table top

Table surface height (min 28 in
- max 34 in)

Compliant

CLEAR SPACE

Does one full unobstructed side
clear ground space around the t
adjoin or overlap an ORAR trail

Table

Table

WHEELCHAIR CLEAR SPACE

Measure the Wheelchair clear s
length. The length may extend a
maximum of 25 inches beneath
the table.

WC Clear space length (min 48 i

Not compliant

Measure the Wheelchair clear

Table

Table

Suggested maintenance

Notes

Optional photos

MANUFACTURER INFO

Manufacturer and Model

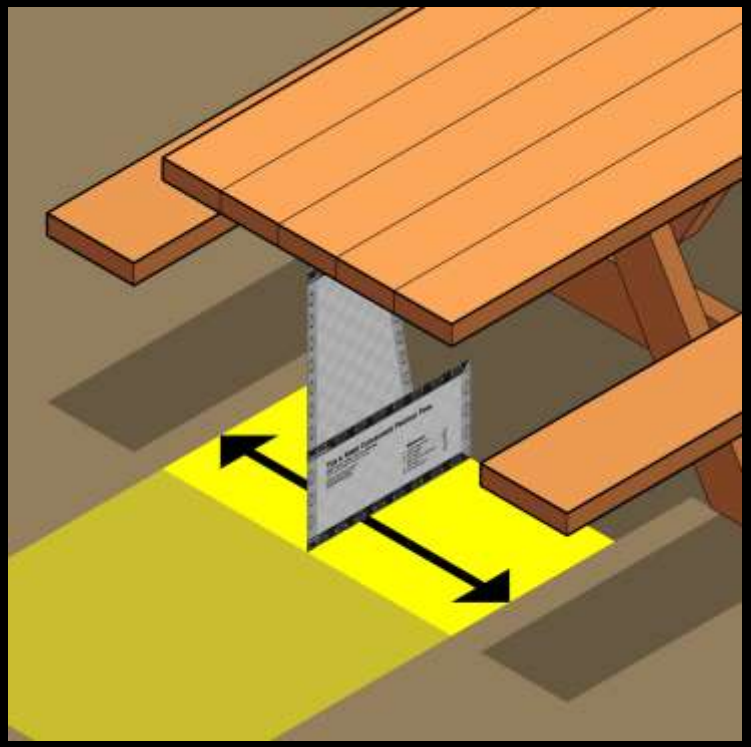
If available, enter the model and manufacturer of the feature.

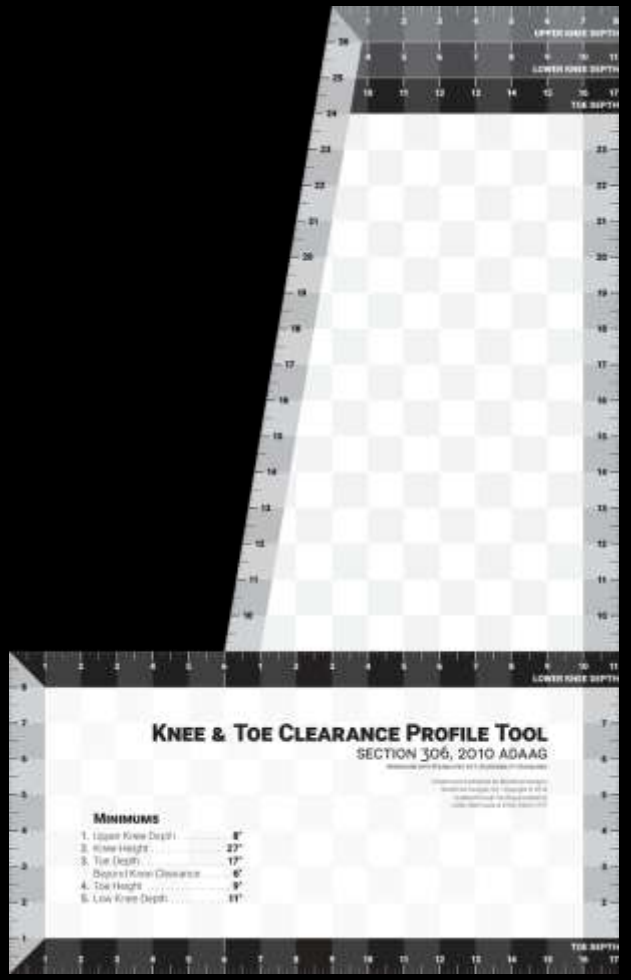
Manufacturer

Model

Knee & Toe Clearance Profile Tool

unobstructed knee & toe space





adjustable height cooking grill

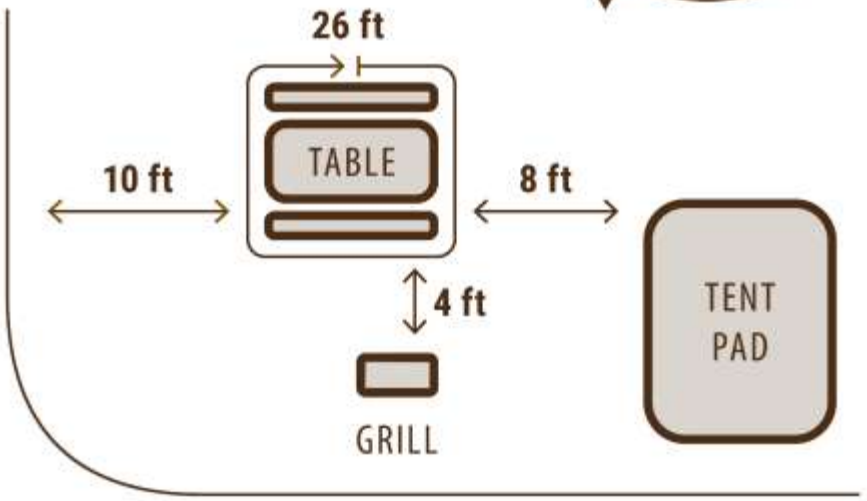
water pump with closed fist operation

water pump actuation force

water pump height measurement

campsite
access info

RESET
BEFORE YOU GO



Please return elements so that this campsite remains **accessible**

If you do not require access and mobility features, please do not use this site between **11AM and 6PM**

Site 18

Single Site

PRIORITY USAGE

If you **DO NOT** require access and mobility features, please **DO NOT** use this site between

11AM – **6PM**

Accessible Elements

Tent Pad

Size	11.5 ft x 16.0 ft
Accommodates	4 Persons

Table

Pivot Grill

Fire Ring

Hydrant

Please return elements so this campsite remains **accessible**

U.S. Department of Agriculture

CAMPSITE
ACCESS INFORMATION

Site 18

Single Site

PRIORITY USAGE

If you **DO NOT** require access and mobility features, please **DO NOT** use this site between:

11AM – **6PM**

Accessible Elements

Tent Pad

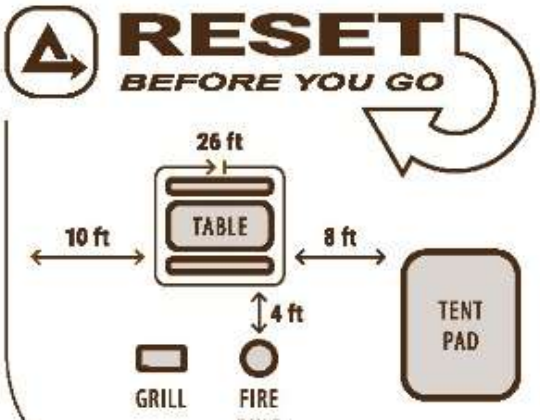
Size	11.6 ft x 16.0 ft
Accommodates	4 Persons

Table

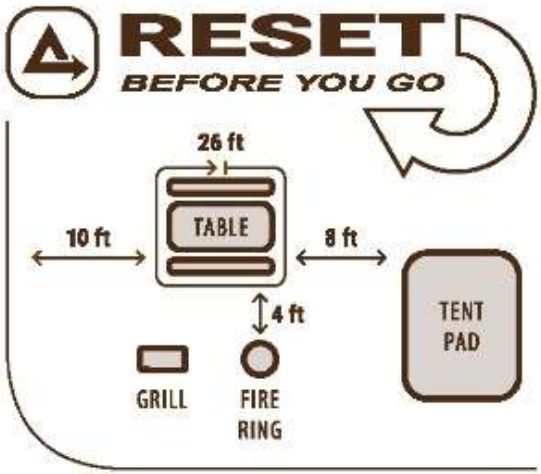
Pivot Grill

Fire Ring

Hydrant



Hydrant



Please return elements so this campsite remains **accessible**

WARNING: Campsite conditions may have changed since March 2011 when this campsite was assessed. Temporary obstructions were not recorded.

Phase I & II funding for the Developed Outdoor Recreation Assessment Process is provided by the **U.S. Department of Agriculture** through the Small Business Innovation and Research Program Grant number 2013-33610-21051

CAMPSITE ACCESS INFORMATION

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

develop standards for **trail and sidewalk design**

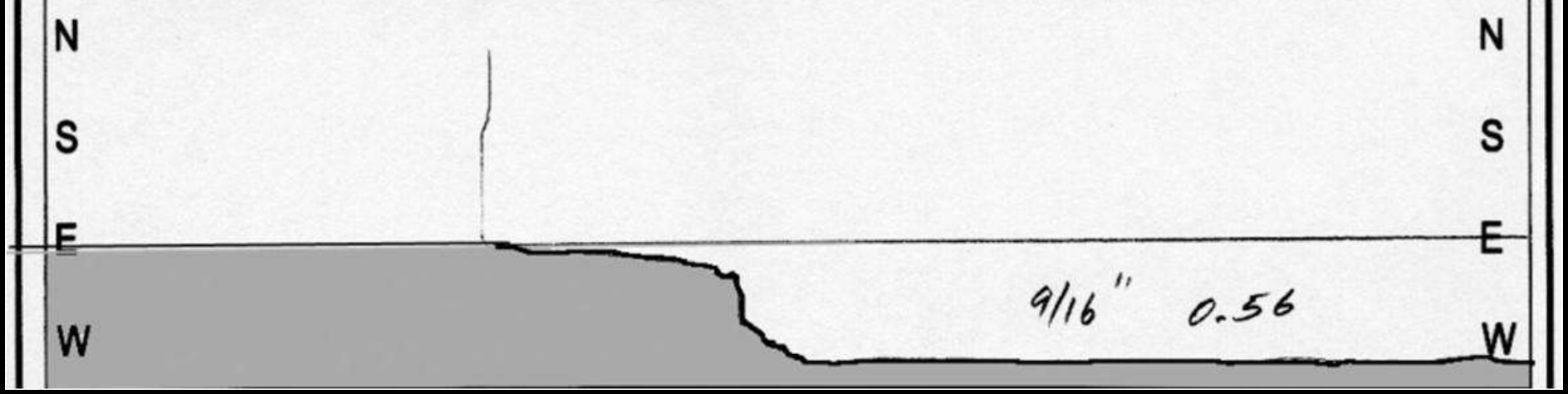
Architectural Barriers Act (ABA)
Outdoor Recreation Access Guidelines

Public Rights of Way Access Guidelines (PROWAG)

HEIGHT TRANSITIONS Project #: 216-2 Date: 4/27/09

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

*N COUNTY ROAD TO MACKLAND



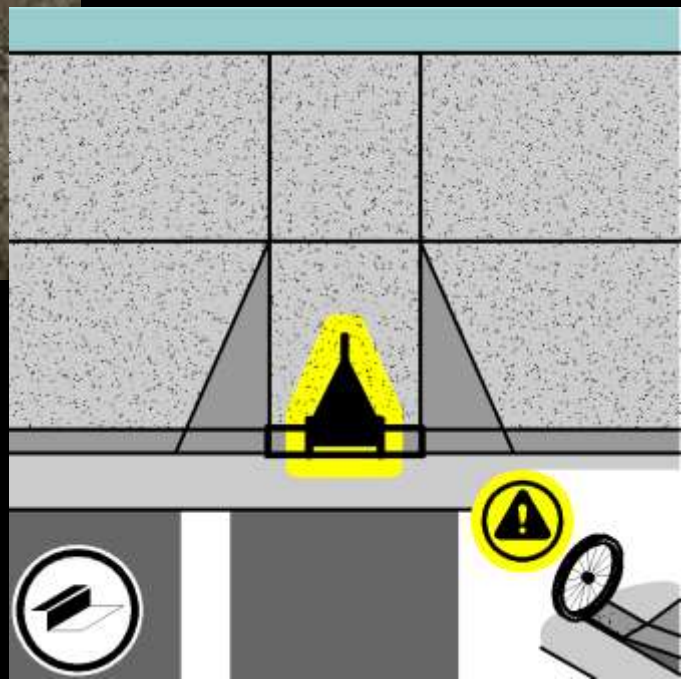
sidewalk assessment

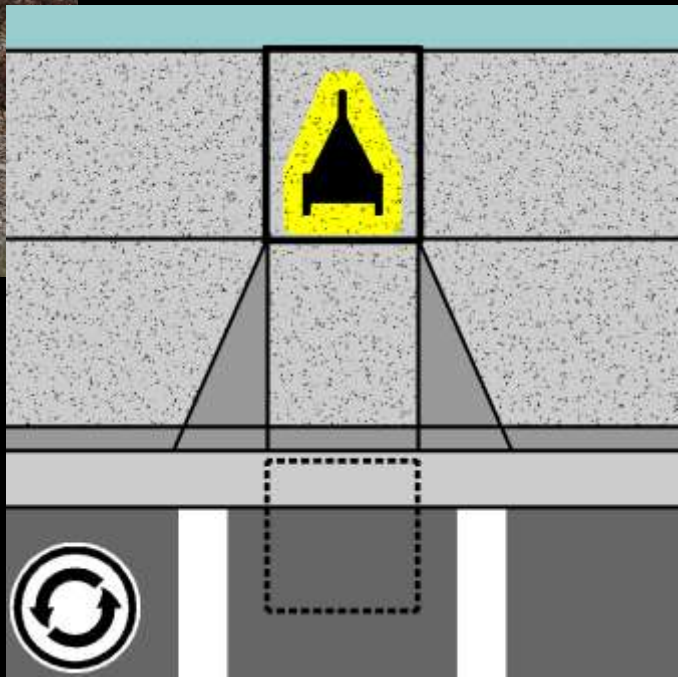
Public Rights-of-Way Assessment Process (PROWAP)


GPS receiver
Laptop prompts the user to evaluate conditions when a walkway violates the standard
1.9-megapixel webcam automatically captures sidewalk imagery
Gyro distinguishes between changes in grade and acceleration/deceleration
Sensors monitor the plane between the three wheels to measure grade and cross-slope
Detachable wheel measures areas the cart can't reach
Magnet in the rear wheel tracks distance
Detachable height tool measures trip hazards

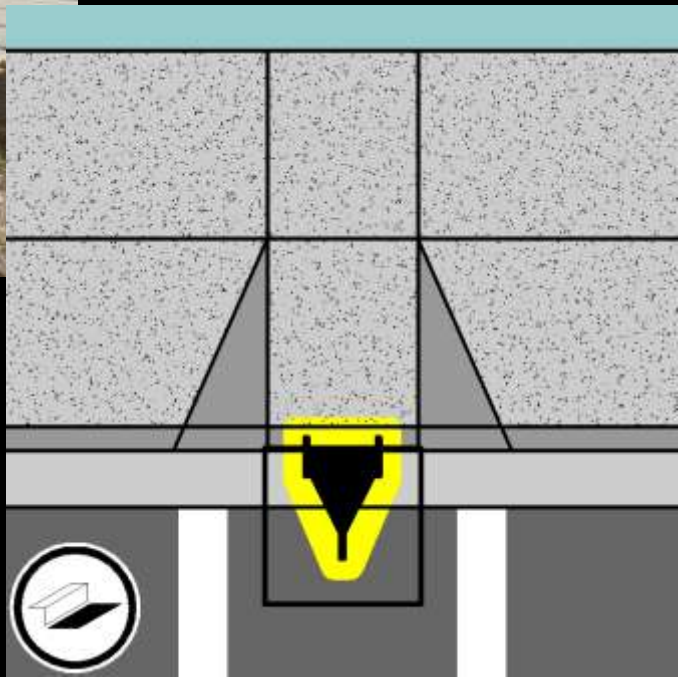
Digital Measuring Wheel (DMS)

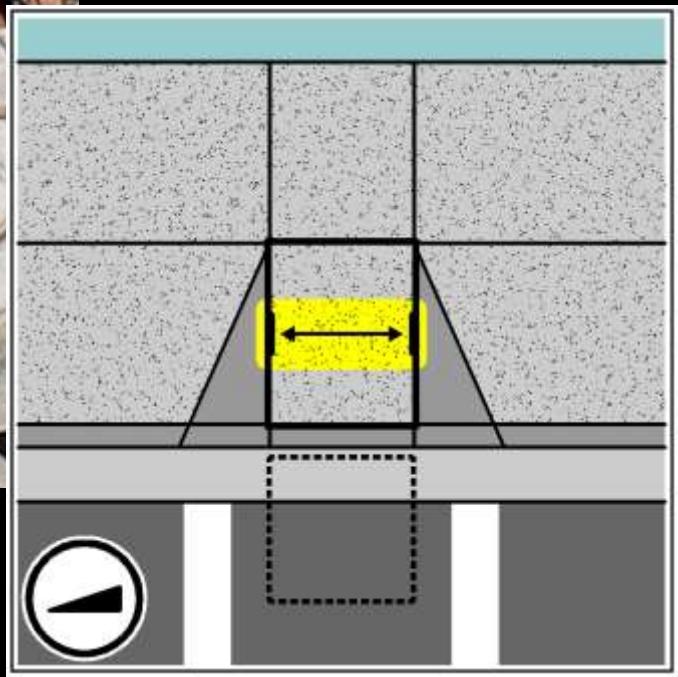
Digital Height Measuring Device

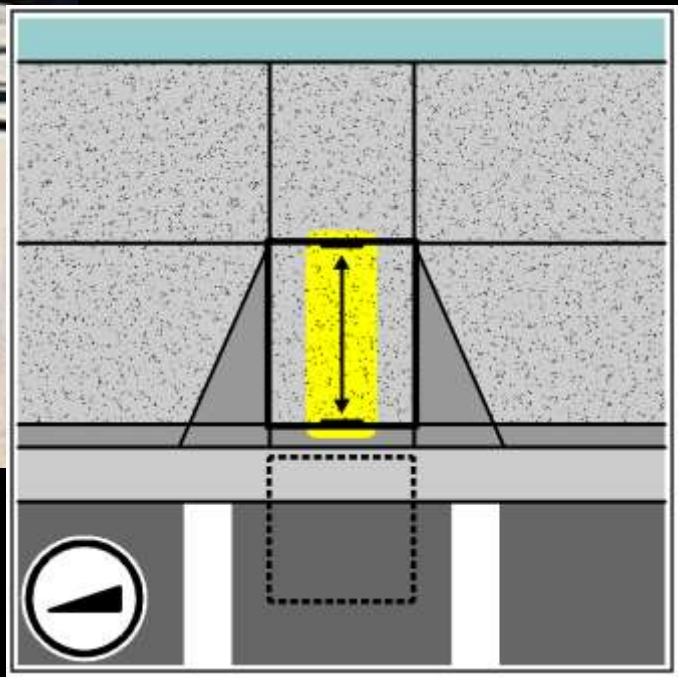





ON-STAR
AUTO REPAIR







NDOT

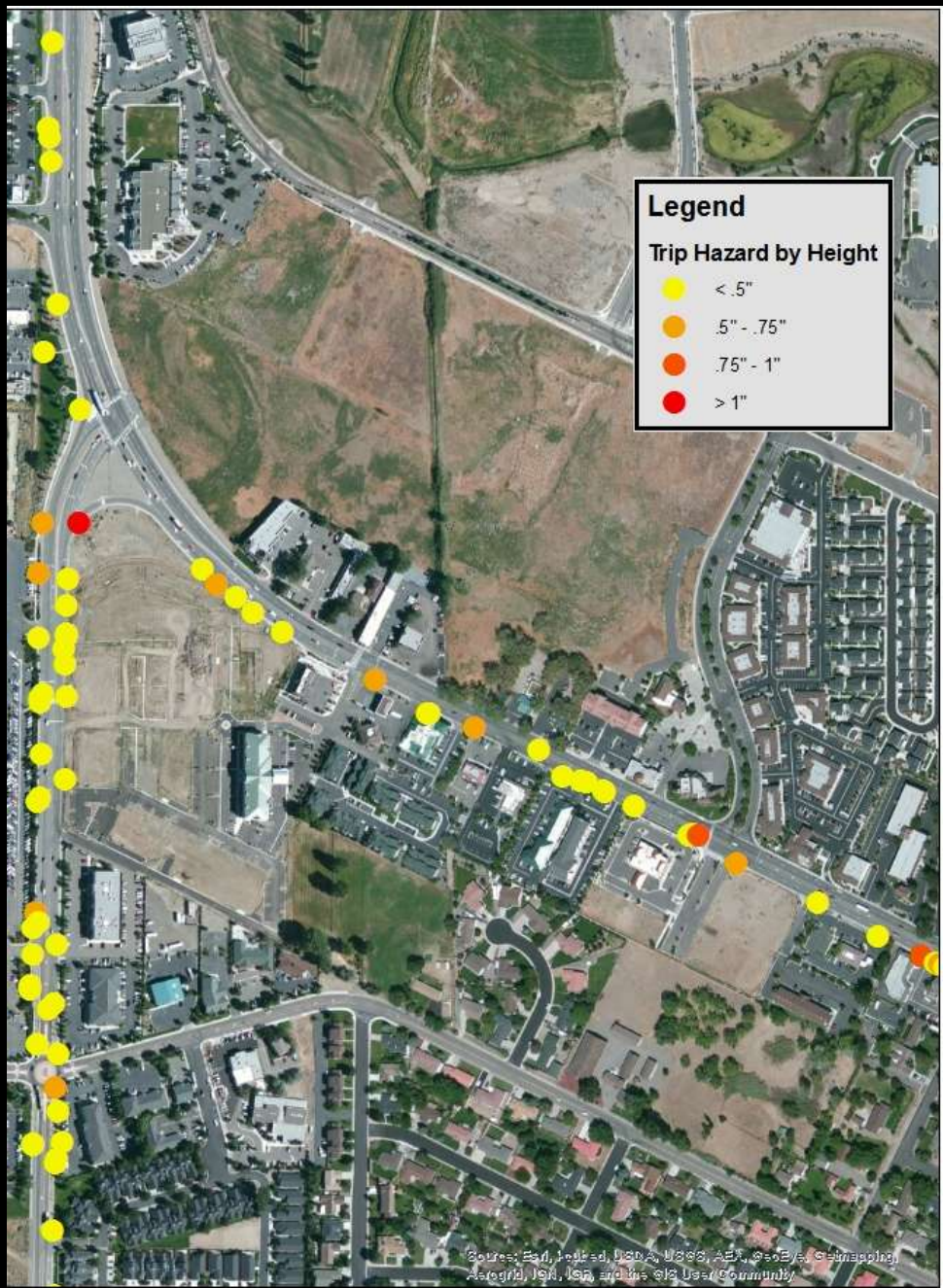
tread width

NDOT

cross-slope

NDOT

tripping hazard height



universal design standards

for products

Universal Design of Fitness Equipment (UDFE) Standards

low step-up height design


5.0 LB
10 LB
4.5 kg
20 9
35 16
50
65
80 36
95 43
110 50
125 57
140 64
155 71
170 77
185 84
200 91
215 98


LifeFitness
UT OR PRESS QUICK START
Calories
Distance
Time
Incline
Speed
Heart Rate
1 2 3
4 5 6
7 8 9
Clear 0 Enter
Manual
Fat Burn
Cardio
Zone Training
Enter Weight
Random
Hill
Personal Trainer
Fit Test
Speed Interval
Quick Start
Pause
Cool Down
WARNING
POLAR
CAUTION: RISK OF INJURY TO PERSONS - TO AVOID INJURY, STAND ON THE SIDERAILS BEFORE STARTING TREADMILL. READ INSTRUCTION MANUAL BEFORE USING.


LifeFitness
UT OR PRESS QUICK START
Calories
Distance
Time
Incline
Speed
Heart Rate
1 2 3
4 5 6
7 8 9
Clear 0 Enter
Manual
Fat Burn
Cardio
Zone Training
Enter Weight
Random
HRC
Personal Trainer
Fit Test
Speed Interval
Quick Start
Pause
Cool Down
WARNING
POLAR


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
Time Remaining
Calories/Hour
Floors Climbed
Level
Display
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 standards

for amusement park rides


DIR 24


2013. 12. 23 13:43


2013.12.23 13:17


2013.12.23 13:18


2013.12.23 13:19


2013.12.23 13:19

new area of focus on air travel

one focus area is

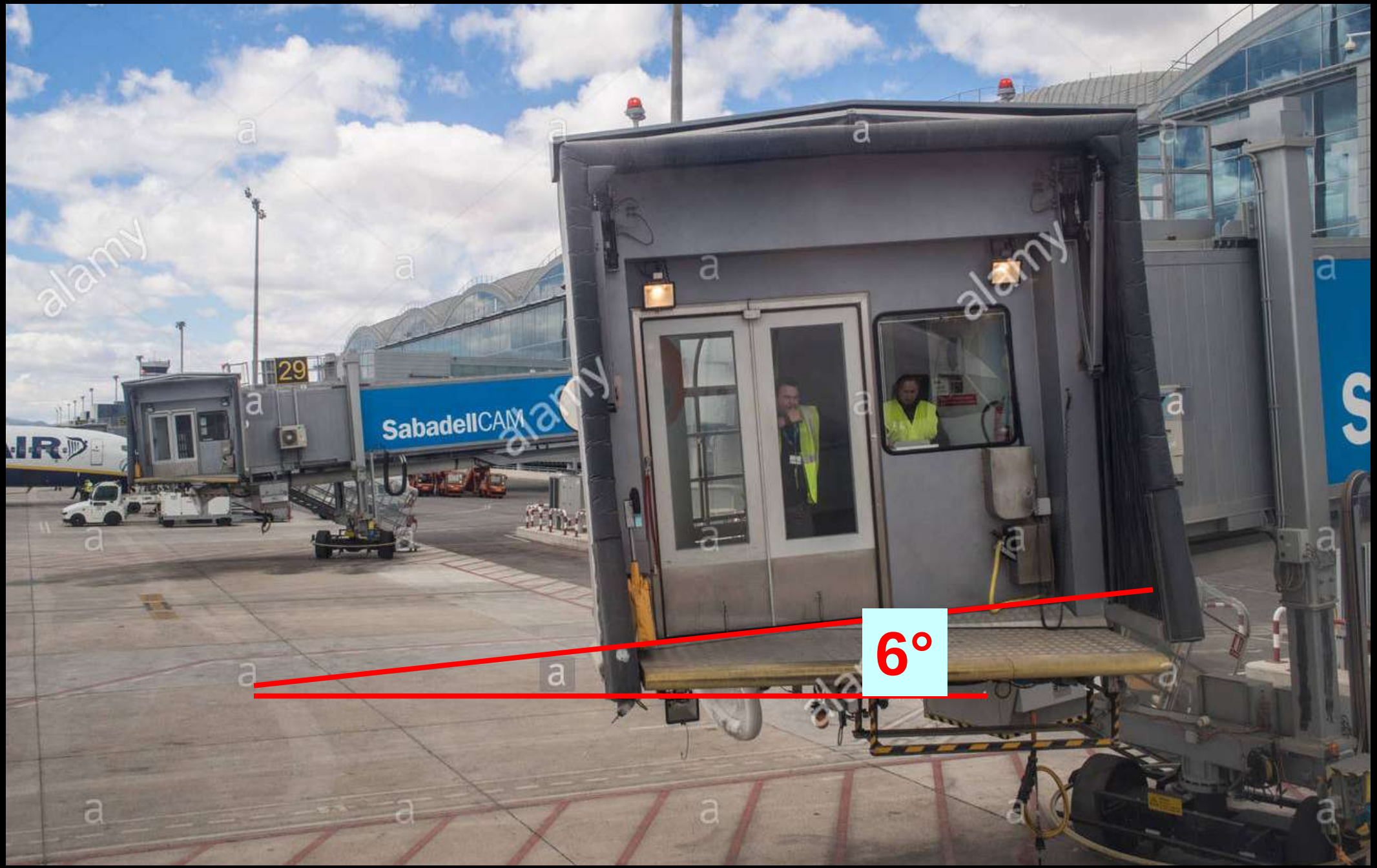
Air Travel Assistive Technologies Standards

issue

steep jetway slopes

- Typically steeper than standard ramp
- Dangerous for mobility device users
- Exempt from ADA guidelines


214
6°

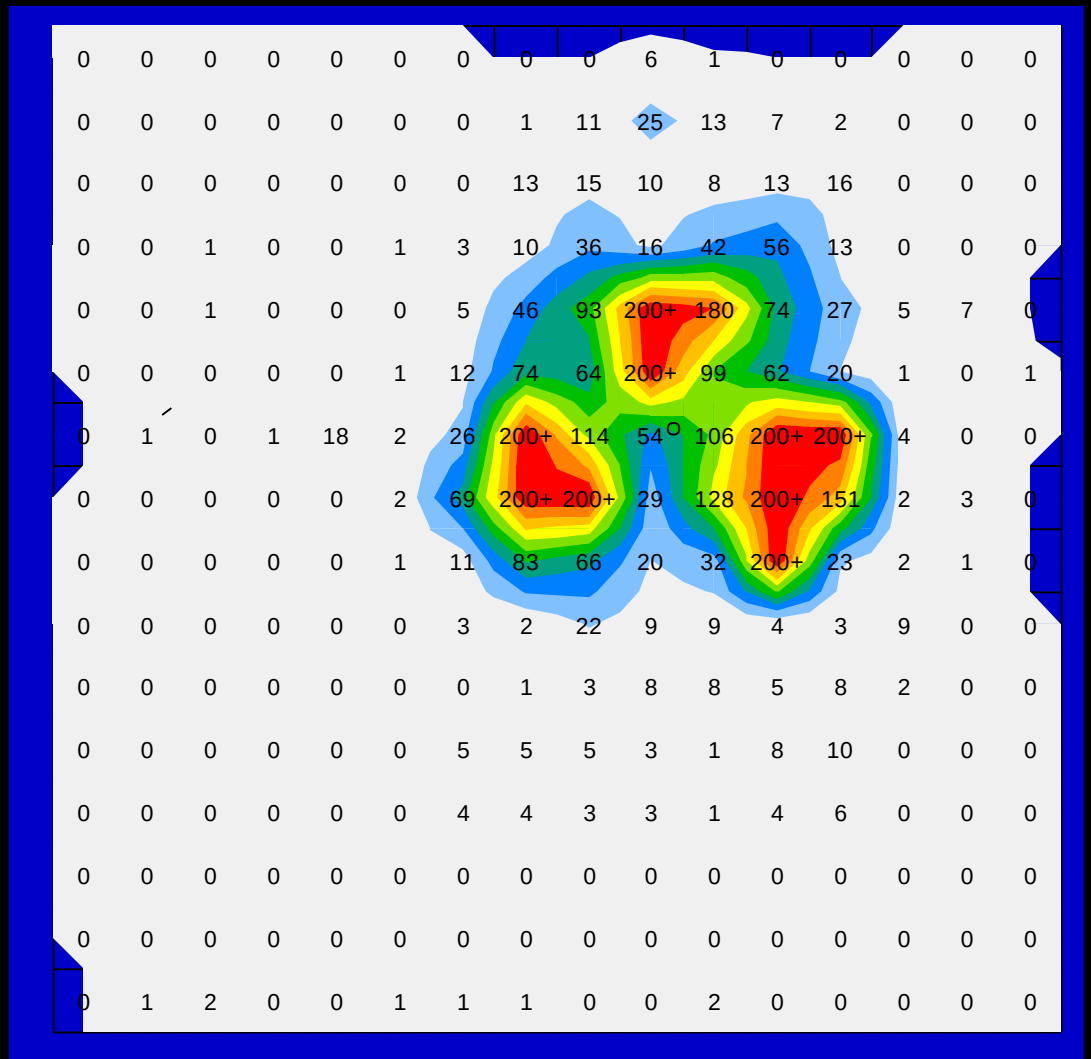

29
SabadellCAM
6°

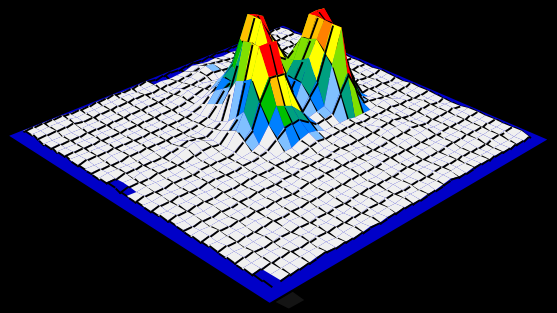
boarding devices

assessment of traditional aircraft boarding devices

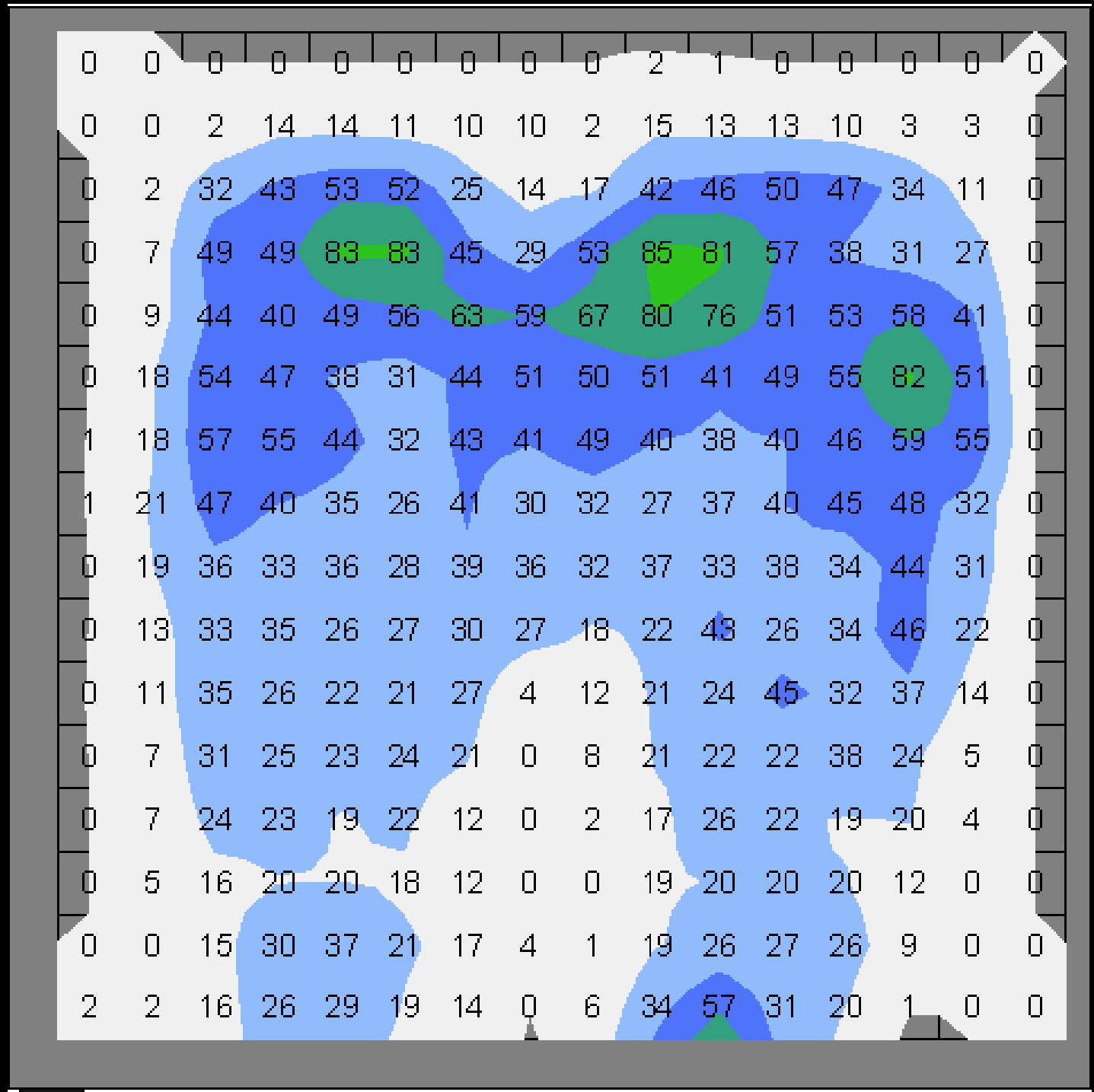
stability

sitting on an S boarding device without cushion





Minimum (mmHg)	0.00
Maximum (mmHg)	200.00
Average (mmHg)	15.64
Variance (mmHg²)	1823.88
Standard deviation (mmHg)	42.71
Coefficient of variation (%)	272.99
Horizontal center (in)	10.47
Vertical center (in)	10.20
Sensing area (in²)	289.27
Regional distribution (%)	100.00

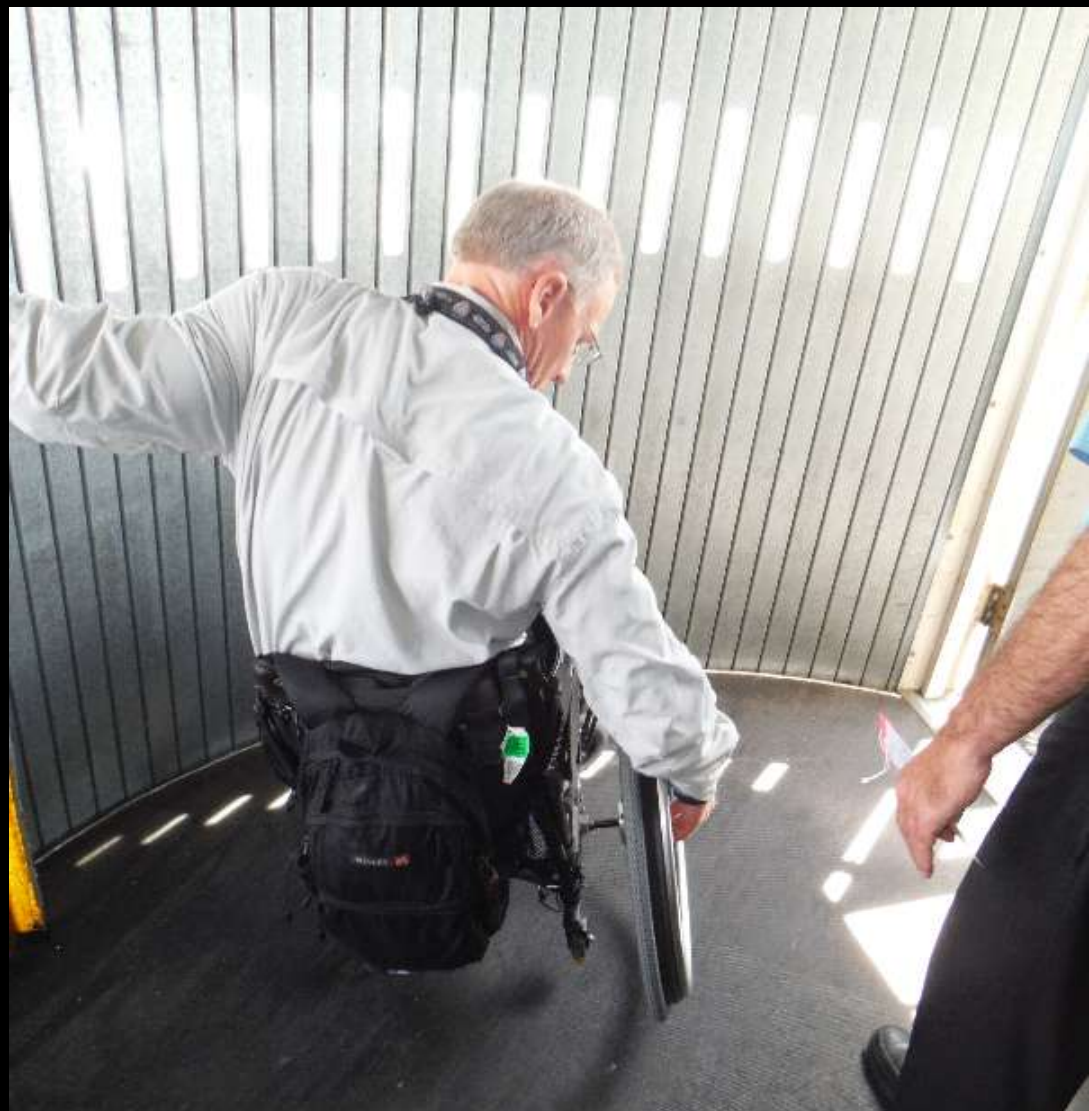

0 0 0 0 0 0 0 0 0 2 1 0 0 0 0 0
0 0 2 14 14 11 10 10 2 15 13 13 10 3 3 0
0 2 32 43 53 52 25 14 17 42 46 50 47 34 11 0
0 7 49 49 83 83 45 29 53 85 81 57 38 31 27 0
0 9 44 40 49 56 63 59 67 80 76 51 53 58 41 0
0 18 54 47 38 31 44 51 50 51 41 49 55 82 51 0
1 18 57 55 44 32 43 41 49 40 38 40 46 59 55 0
1 21 47 40 35 26 41 30 32 27 37 40 45 48 32 0
0 19 36 33 36 28 39 36 32 37 33 38 34 44 31 0
0 13 33 35 26 27 30 27 18 22 43 26 34 46 22 0
0 11 35 26 22 21 27 4 12 21 24 45 32 37 14 0
0 7 31 25 23 24 21 0 8 21 22 22 38 24 5 0
0 7 24 23 19 22 12 0 2 17 26 22 19 20 4 0
0 5 16 20 20 18 12 0 0 19 20 20 20 12 0 0
0 0 15 30 37 21 17 4 1 19 26 27 26 9 0 0
2 2 16 26 29 19 14 0 6 34 57 31 20 1 0 0

aircraft boarding using a personal aisle chair

removable
wheels

aircraft boarding using a wheelchair with narrow accessory wheels

fewer
transfers



aircraft compatible wheelchair

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

potential solution

Educate travelers without sensation to use pressure relief seating accessories when sitting in aircraft

Allow for wheelchairs to be secured in aircraft like they are in buses

Issue - **lack of accessible bathrooms**

Passengers needing a personal caregiver are not accommodated by the current size of bathrooms

Including infants and older adults and non-ambulatory passengers that must us an on board aisle wheelchair

Would only fly 2-3 hours without bathroom access

Damage to drive wheel that came off powered wheelchair

Rehabilitation Institute of Chicago/ Beneficial Designs/ PVA #3028

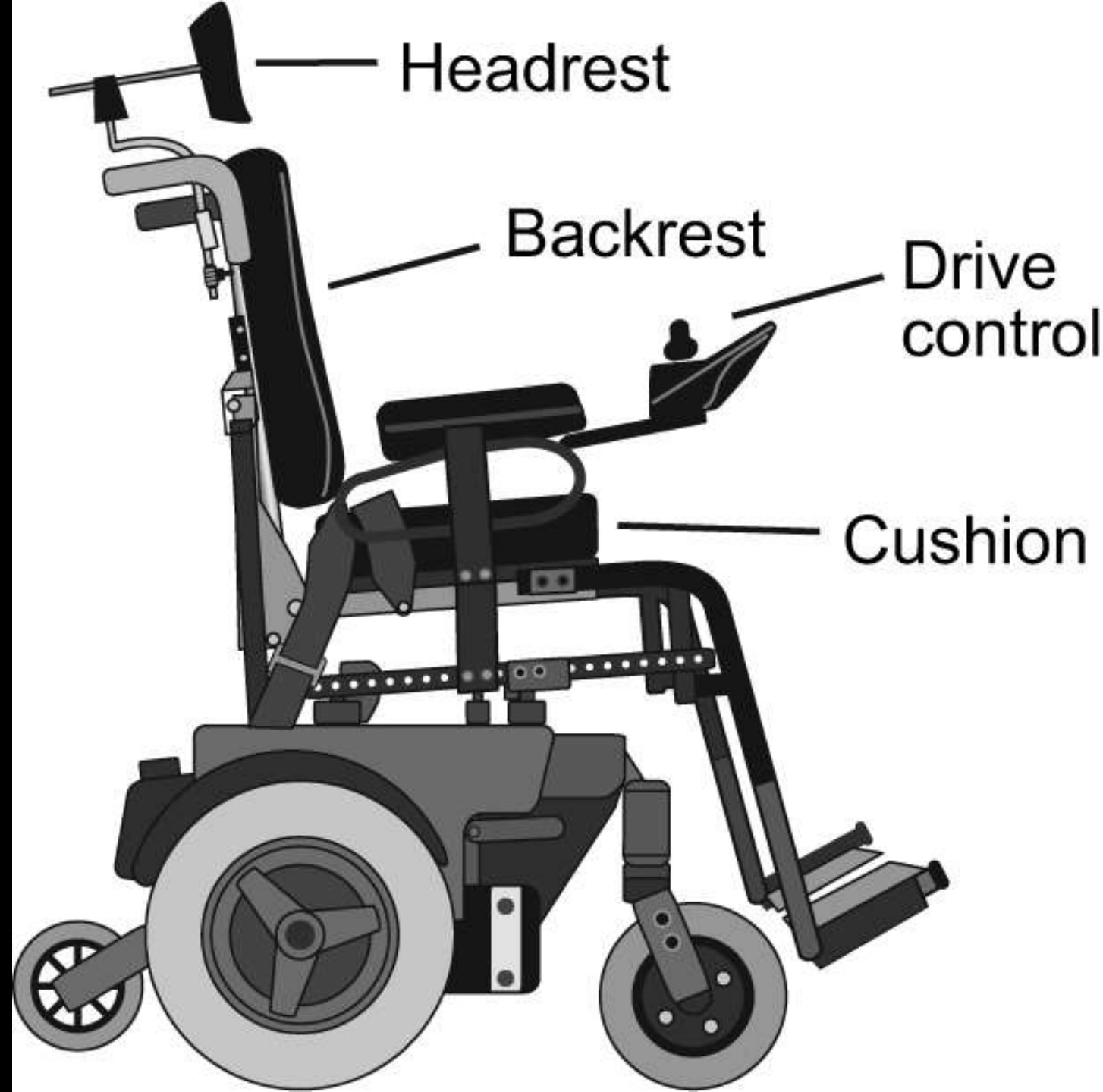
Assistive Technology for Air Travel Standards

- Airline carriers and manufacturers
- Wheelchair manufacturers
- Disability organizations
- Government agencies – DOT - FAA
- Wheelchair repair companies

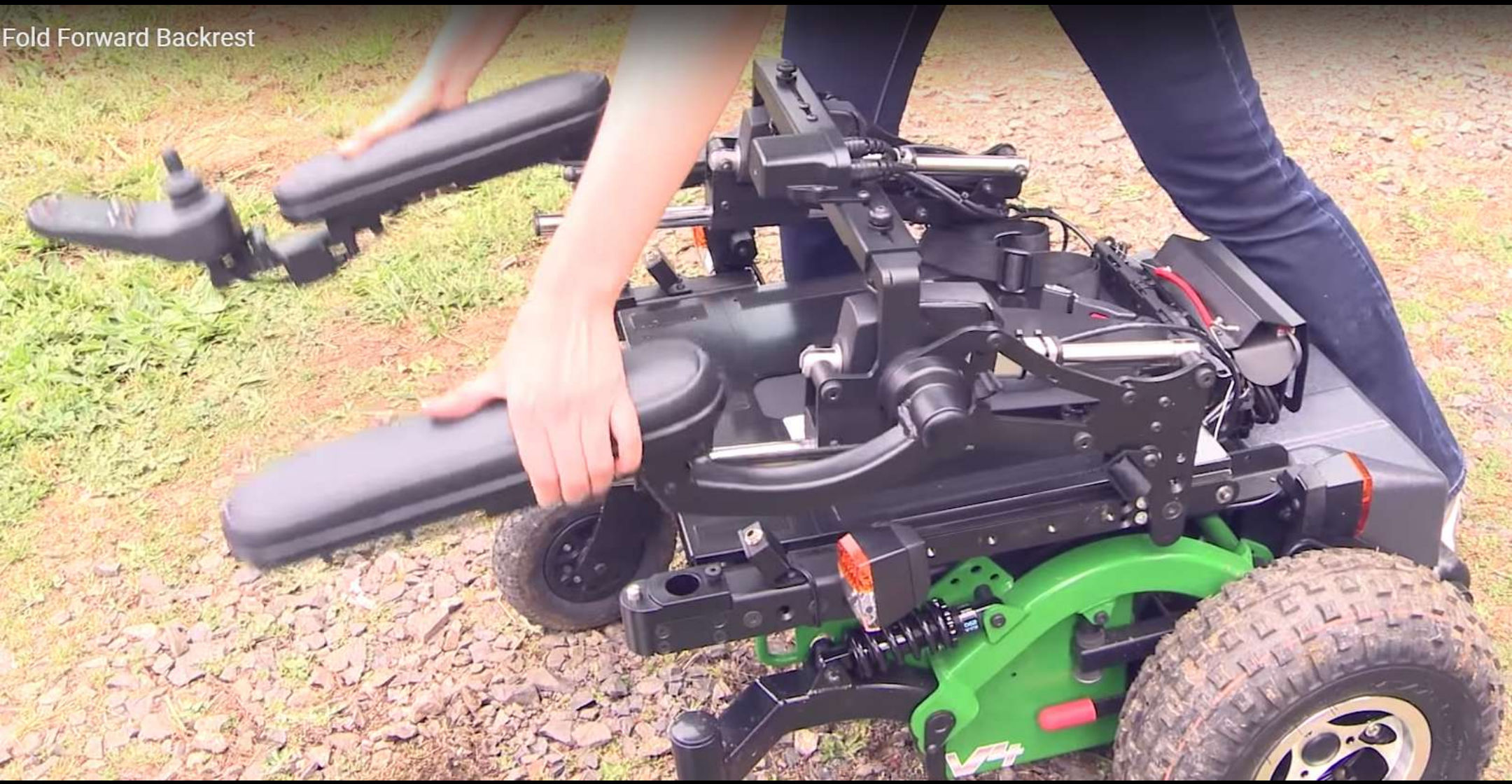
standards for PMDs designed for air transport

Create specifications for design features that will enable powered mobility devices to be able to withstand the rigors of being loaded and unloaded from aircraft

PMD with transit option


Headrest
Backrest
Drive control
Cushion


Magic Mobility Fold Forward Backrest
MORE VIDEOS


Fold Forward Backrest

PMD labeling guidelines
drive disconnect

Drive disconnect
Front of chair

Move the levers **outwards to release** the brakes. The chair can now be moved manually.

PMD Labeling Guidelines

weight

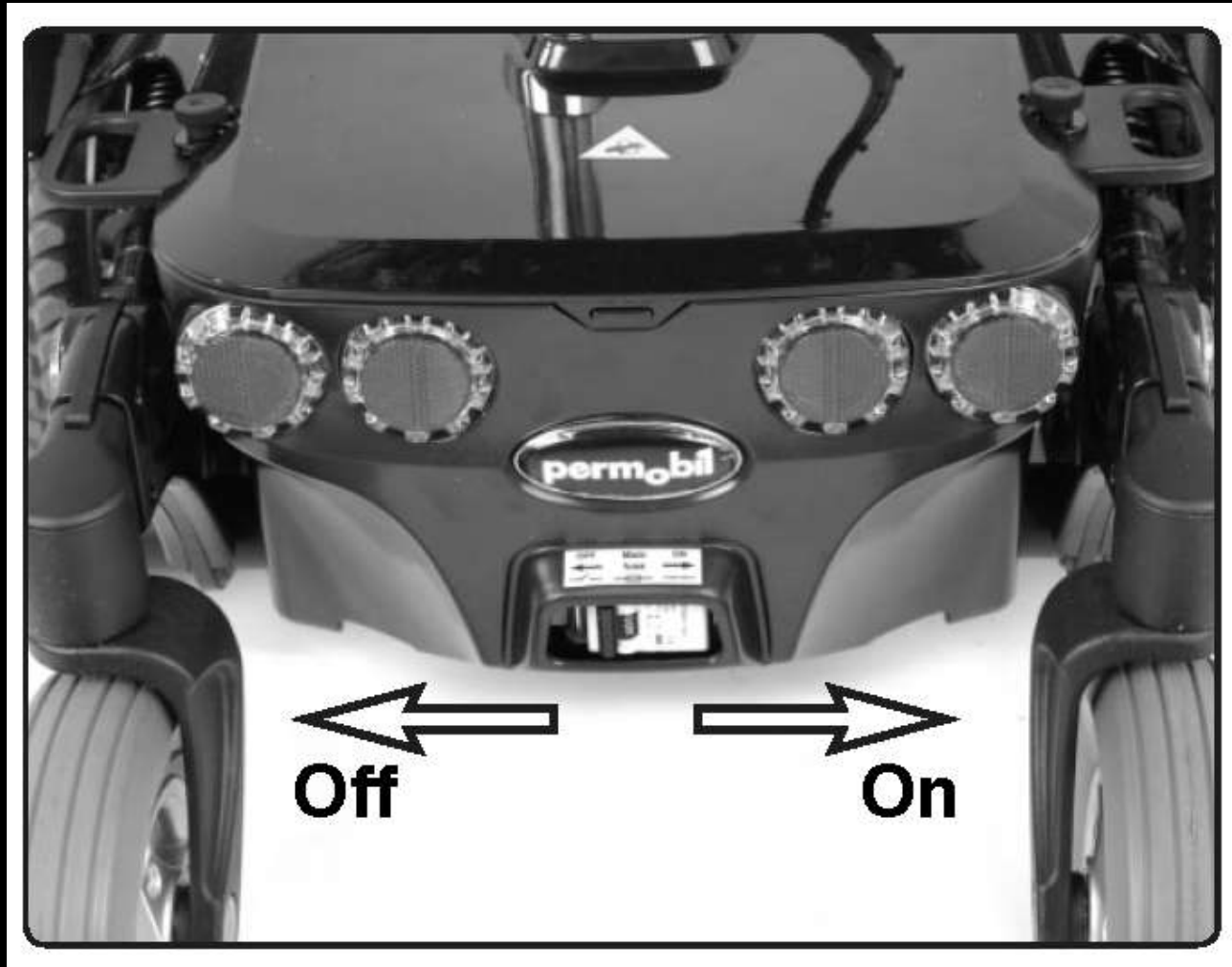
WHEELCHAIR

150 kg

330 lb

WEIGHT

PMD labeling guidelines
location of power disconnect



permobil Model: M300 Corpus HD

Air Travel Configuration

Owner Name:
Owner Phone:
Owner Email:
Chair Serial Number: 7200003

1 **Remove seat cushion** (User)
Remove seat cushion; store in aircraft overhead bin.

2 **Remove head support** (User)
Remove head support to store in aircraft overhead bin.

3 **Lower back support to fit Into aircraft** (User)
Remove the back support cushion. It is fixed in place by means of velcro on the rear of the cushion.
Remove the upper section of the back support by carefully pulling it straight up.
Using the control panel, tilt the back support forward.
Store back support in aircraft overhead bin.

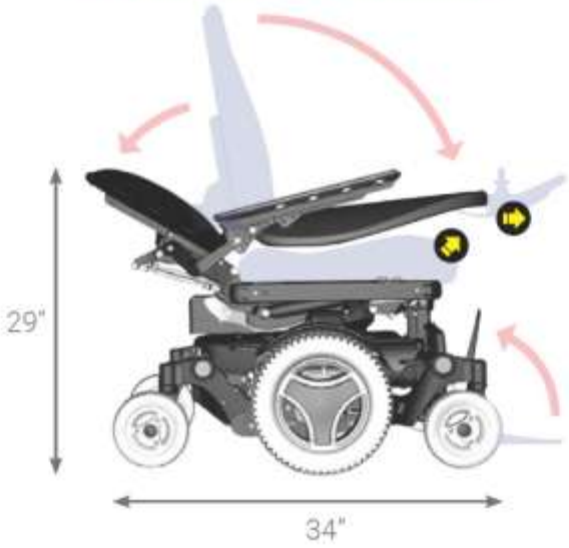
4 **Remove joystick** (User)
Remove joystick controller; store in aircraft overhead bin.

5 **Isolate battery power**
Switch breaker to off to fully disconnect power.

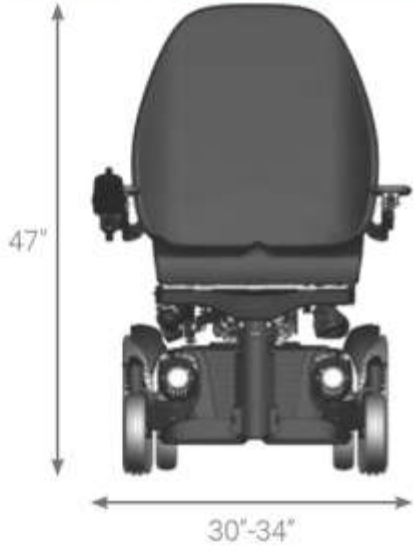
6 **Raise foot supports**
Move foot supports to upright position.

7 **Disengage drive system**
If the joystick controller is not removed, first shut off power using the control panel.
Rotate the lever on each motor to disengage the motors and release the brakes, enabling the chair to be manually pushed.

Travel Configuration



Driving Configuration



Unoccupied Product Weight

150 kg (330 lb)

WARNING: This product should be lifted using a mechanical lift to avoid injury.

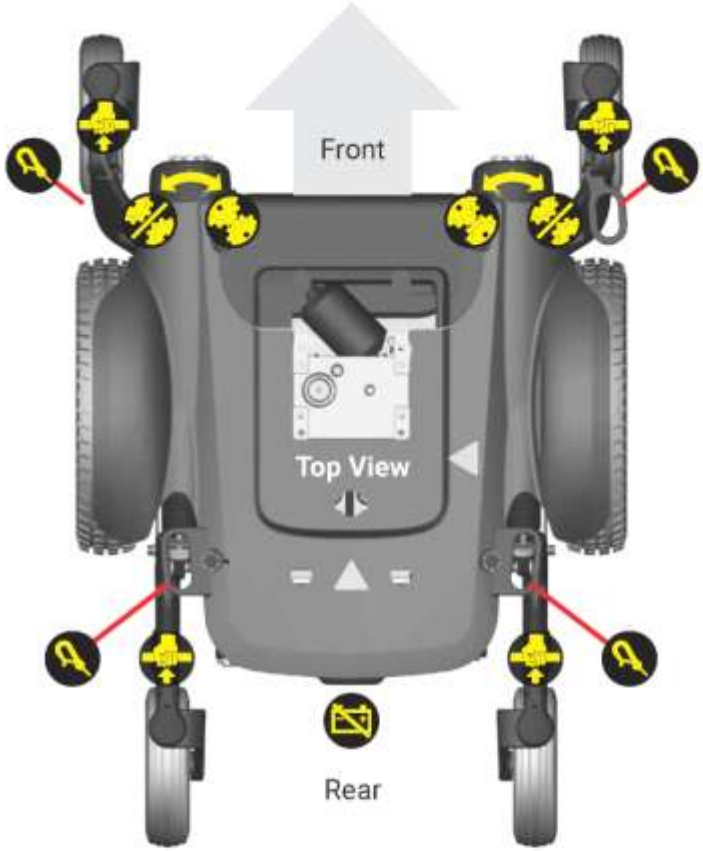
Weight of Additional Components (if greater than 10 kg)

_____ **kg** (_____ lb)

Battery Information

WARNING: Only sealed lead acid group 34 batteries may be installed on this product.

This wheelchair was manufactured with **2 lead acid sealed gel cell non-spillable batteries** conforming to DOT CFR 173.159 (d), IATA Packing Instructions 806, and IATA Provision A67



Isolate Battery Power

The circuit breaker is located in the rear beneath the tail lights. It also acts as a battery isolator and is controlled via the lever located inside the hole at the bottom of the rear battey cover.
Switch breaker to off to disconnect power from the battery.

Disengage Drive System

A manual brake release is located on each drive wheel that can be released to make it possible to move the chair manually. The brake release levers are located at the front of the wheelchair.
Move levers outwards to disengage motors which releases the brakes.

Manual Lift Points

WARNING! This product should be lifted using a mechanical lift to avoid injury. Unnoccupied product weight is 450 lbs / 205 kg.

The Permobil M300 Corpus HD unoccupied weight is 450 lbs. Manual lifting requires multiple lifters. Use designated lift points!

Manual lift points are located on all four caster arms.
When lifting chair with a device, use securement points.

Chair Securement

When fastening the chair, re-engage the drive system to lock the chair. Use fastening straps attached to the designated transport eye locations at the front and rear of the chair.
Attach fastening straps to RESNA WC19 securement locations.

The make and model of wheelchair selected to draft this prototype of an Air Travel Configuration card was selected based on the product having a built-in electrical isolation switch to isolate the batteries. The data was obtained from a user manual that was available online. Some values are estimated and do not necessarily represent the actual data for this product. The manufacturer of this product has not reviewed or approved this information.

beneficial designs

designing beyond the norm to meet the needs of all people

www.beneficialdesigns.com

peter@beneficialdesigns.com

775.783.8822 voice

775.783.8823 fax