

**Beneficial Design
Designing Beyond the Norm to Meet the Needs of All People**

Stanford University

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Opening

Beneficial Design

**Designing Beyond the Norm to Meet the Needs
of All People**

**Research
Design
Education**

Stanford University
7 February 2012
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.

Bill Blythe & Jeremy Vican

Seanna Kringen & Carla Shepard

Barton Cline & Dana Helwig

Harvie Keith & Nathan Tolbert

Stephen Pieters

Ben Hubbard & Sharon Vazquez

Wheelchair drum tester

Wheelchair drum tester

Wheelchair drum tester

Wheelchair drop tester

Wheelchair drop tester

Wheelchair scales

Wheelchair tip testing dummy

Wheelchair incline tester

Shop tools

Shop tools

Shop tools

Shop tools

Shop tools

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

Balance Dimension

Physical

Intellectual

Spiritual

Peter and Ria at [location]

White water rafting

Getting ready for zip line

Getting ready for zip line

Peter zip lining

Peter and Ria at the zip line

Peter exercise modeling

Peter exercise modeling

Painting

Sociological Dimension

Dependence

Independence

Interdependence

Dependence example

Interdependence example

Independence example

Personal Technologies
Activity-Specific Technologies
Environmental Technologies

Environmental Technologies

Things that do not move

Activity-Specific Technologies

Arroya Sit Ski

Peter competing on his Mono Ski

Mono Ski

Peter competing on his Mono Ski

Mono Ski and Bi Ski

Bi Ski on ski lift

Getting off of a ski lift

Mono Ski rough model

Dynamic Seating Spring Assist

Cross Country Ski

Peter using Cross Country Ski

Peter using Cross Country Ski

Pax Back

Available from BES Rehab Ltd.

Aircraft Aisle Chair

Piano Pedal Pusher

Manual Vehicle Hand Controls

Dynamic Seating

Dynamic Seating

Peter on top of [location]

Peter in the waterfall

Hand Bike

Contoured Seating

SKELI with Pelvis Model

SKELI from Rear

Pressure Diagram

SKELI Used on Foam

Seat Cushion Testing

Beneficial Designs has played a key part in the ongoing effort to develop Wheelchair Seating Standards within the ISO. The Skeletal Imbedded Loading Indenter (SKELI) was developed to provide an anatomically based loading indenter for the standard.

Pressure Seating Graphs

ASLI Prototype
ISO Part 2 Shape

**ASLI Prototype V 1.0
with Surrogate Pelvis/Femur Symmetric
loading**

**ASLI Prototype
10° Pelvic Obliquity**

**ASLI Prototype
15° Posterior Pelvic Tilt**

ASLI Prototype

Symmetric loading 10° Rotation

**ASLI Prototype V 2.0
with Gel Soft Tissue
10° Pelvic Obliquity and
15° Posterior Pelvic Tilt**

**Pressure Measurements
Symmetric**

**Pressure Measurements
10° Pelvic
Obliquity**

**Pressure Measurements
15° Posterior Pelvic Tilt**

**Pressure Measurements
10° Pelvic Obliquity 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

Dancing

Hip Grip Components

Modular Hardware

**Pivot Bracket
Current Design**

**HipGrip
Test
Fixture**

HipGrip

The HipGrip is a postural seating device designed to help control pelvic position and provide stability while in a wheelchair while allowing range of motion and movement in anterior and posterior pelvic tilt.

Available from Bodypoint

Functional Forward Reach

Functional Reach Downward

**FlexRim – Combining the discrete compliant
fasteners into one**

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

The subtle details of the final profile were refined

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**

**Subjects are tested over a wide variety of usage
environments**

Test diagram

**Baseline study – FlexRim adapted for
propulsiometer**

FlexRim

GripRim

Benefits of a Universal Design Canoe Seat for Paddler Function

Alida Lindsley, Seanna Kringen,
Peter W. Axelson, Patricia E. Longmuir
Beneficial Designs, Inc., Minden, NV

Greg Lais, Beth Vandehaar,
Michael Passo
Wilderness Inquiry, Minneapolis, MN

Canoe seating

Adaptive Canoe Seating

Available from Chosen Valley Canoe Accessories

Universal Canoe Seating System Components
Bench Seat with Sidewall Brackets

Universal Canoe Seating System Components
Pelvic and Low Back Support

Universal Canoe Seating System Components
Upper Back and Lateral Thoracic Support

Canoe Seating Tester

Canoe Seating

Canoe Seating

Methods – Endurance

MedGraphics VO2000 portable metabolic system
Resting, self-selected paddling, and self-selected
pace + 20%

Methods – Strength

Dynamic power from Concept2 rowing ergometer
Maximal isometric paddle pull

Lateral Balance Test

Water Egress Testing

Wave Ski

Tools and Technology for Accessible Trails

Universal Trail Assessment Process

Universal Trail Assessment Process (UTAP)

Objective measurement system for trails
Proven accuracy and reliability
Simple, inexpensive tools
All trail data in one assessment
(mapping, interpretation, access, etc.)

Tools used during the UTAP measurements

Key UTAP Information

Length Grade

Width Surface

Cross Features &
slope Facilities

UTAP Assessment Team

UTAP – Implementation Status

Over 1200 people trained to lead UTAP
assessments
Over 155 trainers to teach UTAP workshops

Station Data Entry Screen

Feature Data Entry Screen

**High Efficiency Trail Assessment Process
(HETAP)**

USDA SBIR Phase II

HETAP – Rollawheel

HETAP – Rollawheel in use

HETAP System with Quad

Stations Screen

Feature Screen

Playground

Playground Surface Testing

Boardwalk Surface Testing

Surface Testing

ASTM F 1951–99

American Society for Testing and Materials (ASTM)

Standard specification for determination of accessibility of surface systems under and around playground equipment

Rotational Penetrometer

Objective surface measurement device

Draft Standard for firmness with stability measurement under development

Gravelpave2 Before Installation

Gravelpave2

Gravelpave2

Gravelpave2 After Installation

Rotational Penetrometer Readings-Gravelpave 2

<i>Before Application</i>		<i>After Application</i>	
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

Trail Rutting and Braiding

New Boardwalk Substructure

Side View

¼ Mile Long

Barrier at Riverview Park

Third Inverted Bollard Design

Electronic Gate Barrier

Pedestrian and Motorized Vehicle Trail Traffic Counter

Trail Access Information Sheet

Nevada Recreation Trails (NV NRT)

TAI on Narrow Trail/Logo

Riverview Park/Mexican Ditch Trail System

Riverview Park/Mexican Ditch Trail System Panel Map

South Fork State Recreation Area Panel Map

Eisenhower Park Panel Map

McAllistar Park Panel Map

www.traiexplorer.org

Search Results

Develop standards for trail design

Designing Sidewalks and Trails for Access Part I and Part II

Access Board Negotiated Rulemaking Committee

Feedback on US Forest Service 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

Wheelchair Using Curb Ramp

Walker being used on Crosswalk

Stroller on Sidewalk

Public Rights of Way Assessment Process (PROWAP)

PROWAP

PROWAP

PROWAP

PROWAP Data form

PROWAP

PROWAP Data form

Pedestrian Zones in the Public Right-of-Way

Wheeled Instrument Sensor Package (WISP)

Three wheeled data collection cart

Rear Wheel Distance Encoder with resolution of 0.1 feet

Digital Measuring Wheel

Wireless Range of 60 meters

On-Device Field Collection Prompts

Measurement resolution of 0.1 Inches (1 mm)

Digital Height Measuring Device

Same Range and similar Automatic population of Data

Measure vertical distances from Zero to 44 inches

Measurement resolution of .01 inches (0.1 mm)

PROWAP Data Screen

PROWAP Data Tree

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

HETAP Cart

Data Export Formats Supported

SQL data structure

Excel Spreadsheet

Rich Text Format (CSV)

Directly into a Geodatabase

PROWAP Stroll Data

PROWAP Stroll Data

The Manual Wheelchair Training Guide

**1.2
Set Up
and
Adjustment**

1.4	Learning Your Limits	Wheelchair Standards
		Volume 1: Requirements & test methods for wheelchairs
1.8	Propelling Your Wheelchair	Volume 2: Additional requirements for wheelchairs with electrical systems
1.9	Wheelies	Volume 1: Wheelchairs
1.9	Wheelies – Popping a Wheelie	Nomenclature, terms & definitions
2.2	Thresholds and Obstacles	Static stability
2.5	Ramps	Overall dimensions
2.7	Curb Cuts	Seating dimensions
2.8	Curbs	Static, impact & fatigue strength
	Forward	Test dummies
	Popping a partial wheelie	Coefficient of friction
2.8	Curbs	Information disclosure
	Getting a push from an assistant	Resistance to ignition
2.8	Curbs	Stand-up type w/c's
	Getting a push from an assistant	Set up procedures
2.8	Curbs	Volume 2: Wheelchairs with Electrical Systems
	Getting a push from an assistant	Dynamic stability
2.11	Escalators	Effectiveness of brakes
3.2	Evacuation Procedures	Energy consumption
4.4	Hiking	Speed, acceleration, retardation
Appendix B	Accessories	Climatic tests
		Obstacle-climbing ability
		Power & controls
		Electromagnetic compatibility
		Wheelchair Stability Testing
		Drum Tester
		A Guide to Wheelchair Selection

Wheelchair Width

Wheelchair Seat Height and Tilt

Wheelchair Seat Angles

Wheelchair Seat Angles

Wheelchair Wheel Setting

**Designing Sidewalks and Trails for Access Part
2**

The Population is Aging

Characteristics of Pedestrians

Change of Grade

Detectable Warnings

Zone System

**Protruding Objects
and Vertical Clearance**

Solutions for Narrow Sidewalks

Change in Cross Slope

Gaps, Grates and Openings

**Universal Design of Fitness Equipment (UDFE)
Standards**

Accessible “mainstream” fitness equipment – user friendly

Health benefits for everyone

Social benefits for everyone

Comply with the Americans with Disabilities Act (ADA)

Fitness Equipment

Low Step-up Height Design

Grip Bars

Color Contrast

Weight Pin Gripability

Control Panel Contrast Clear

Control Panel Contrast Color Blind

Control Panel Contrast Clear

Control Panel Contrast Color Blind

Development of Uniform Standards for Cognitive Technologies

Goal

Increase Access to Technology
for People with Cognitive Impairments

Cognitive Research Symbol

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