



ISWP Standards Working Group

March 14, 2018 Meeting Recap

The ISWP Standards Working Group met by conference call on Wednesday, March 14, 2018 from 12:00 p.m. to 1:30 p.m. U.S. Eastern Time. This document provides a recap. Link to call recording: <https://iswp.adobeconnect.com/pho8dqj8v9e4/>.

Next call: Wednesday, June 13, 2018, 12:00 p.m. U.S. Eastern Time.

Discussion

1. Standards Working Group Chair: Jon Pearlman is interim chair, but the goal is to have the WG chaired and run by the community. **Standards WG members** are requested to submit nominations for Standards WG chair to Jon Pearlman.
2. ISWP Funding: ISWP is on bridge funding through August 31, 2018 based on the initial USAID grant. ISWP is fortunate to have the continued support of organization donations in addition to USAID. ISWP also received a five-year grant from NIDLIRR (National Institute on Disability, Independent Living and Rehabilitation Research) to support caster testing and rolling resistance equipment building and testing at Pitt.
3. May 2018 ISO Meeting: Jon Pearlman and Anand Mhatre will attend an ISO seminar, May 5-10, 2018 in Nairobi, Kenya, to present the ISWP product testing standards; a draft was submitted in advance of the meeting.
4. USAID/ISWP Stakeholders' Meeting, Bangalore, January 2018: ISWP co-hosted a stakeholders' meeting with USAID on January 15-18, 2018 in Bangalore, India. Sixty participants representing a cross-section of stakeholders attended, including representatives from Standards WG member companies LDS, Shonaquip and Free Wheelchair Mission. The meeting goal was to support USAID's agenda in the area of wheelchair service and provision by identifying three priority areas and three priority action items for the sector in the next five years aligned with WHO GATE's four P's: Policy, Product, Provision and Personnel. The final meeting report will be issued in April;

Jon Pearlman will forward. Jon highlighted recommendations for the Product area:

- a. Create global product profiles and validated product quality standards based on evidence of need and wheelchair performance in the community through a representative standards body which is inclusive of users, service providers, government and manufacturer. Goal is to assist governments in purchasing products that meet the needs of wheelchair users in their country. (*Will support WHO in this project*).
 - b. Run a global campaign on appropriate wheelchair provision targeting individuals (wheelchair users), service providers, donors and policy makers.
 - c. Improve global wheelchair markets to reduce costs, increase quality and increase supply chain efficiency.
 - d. Support user centered innovation.
5. *Free Wheelchair Mission Whole Chair Testing Equipment*: Testing equipment was moved to a new Free Wheelchair Mission building in January and powered in February. The Free Wheelchair Mission (FWM) team is learning how to keep the conveyor belt centered in the middle of the equipment. The belt is moving as a result of the chair going over obstacles.

FWM also is running tests with accelerometers and string gauges to determine correlation with a goal to use accelerometers only. Don Schoendorfer would appreciate assistance with frequency domain analyses. **Matt McCambridge** to check on possible resources at MIT. Jon Pearlman mentioned Anand Mhatre is using a similar approach for caster analysis and might be able to assist.

Once additional ISWP funding is secured, Jon Pearlman would like to arrange an in-person Standards WG meeting to discuss the validation process for durability and testing in the lab versus field data and reach consensus on a methodology.

6. Rolling Resistance – LeTourneau and Pitt:

- a. Norm Reese reported LeTourneau students have worked on zeroing the load cell to ensure the caster is directly in the middle and on top of the drum. During the remaining six weeks of class, they are working on the wheel tester, testing the big wheels, where most of the wheelchair weight should be but varies depending on whether the user self-propels or is pushed. They also are working on cart testing.

Norm presented rolling resistance coefficients grouped by surface -- packed dirt, smooth floor, carpet, and concrete at 25 degrees and 70 degrees -- and pneumatic and non-pneumatic tires. Link to Norm's presentation: [link](#).

Matt McCambridge emphasized the need to test on real terrain, as well. Steve Sprigle, Georgia Tech, has done research on wheelchair propulsion using a powered cart and measuring drag at the axle location. Difficulties were expressed in finding a way to get smooth, consistent results in the data from real terrain. One option is to look at inclined or coast down testing methods.

The LeTourneau rolling resistance project was submitted to the RESNA student competition.

- b. The University of Pittsburgh is using NIDLIRR grant funding to build a second rolling resistance machine. Jon Pearlman and Joe Ott presented equipment drawings: [link](#). The equipment includes a variable frequency drive and encoder to obtain feedback from the drum, as well as an in-line gear box, making for a compact design. The bottom half of the equipment is similar to the LeTourneau machine; the top half can be customized.

Matt McCambridge offered to assist with a design review. This was conducted through a series of emails. The proposed action was to have LeTourneau try to implement the new design.

Joe Ott to send Standards WG members an invitation to a weekly meeting (Tuesday at 10:30 am - 11:30 am U.S. Eastern Time) when the Pitt staff reviews the project status.

7. *Caster Testing*: Jon presented field data from Anand's dissertation. Norman Reese contributed data comparing the number of acceleration points in different levels of g's to the ISO double drum, with the goal of matching field data with test equipment. Anand tuned the Chakra tester to match the acceleration exposures in Norm's data both in large and small casters using two different sized obstacles.

Corrosion testing protocol simulates one year of outdoor corrosion, which is 100 hours in the salt fog tester. ISWP tested abrasion matching using shock exposure, corrosion and tire wear. Anand looked at field data on the number of years the tire has been in service, number of casters and friction. He then tested different grits of sandpaper on the chakra tester to do accelerated life testing. Tested 8 models with salt fog, corrosion and tire wear under 4 conditions: shock; corrosion + shock; abrasion + shock; corrosion + abrasion + shock with 2 samples per condition. Key findings: a) Wear and corrosion have an impact on durability; and b) environmental factors (adding corrosion and wear) to a caster exposed to shock and one exposed to shock, corrosion and wear results in reduced durability on 25% of models tested. ISO currently does not have tire wear testing or corrosion testing, so this is a broader outcome and should be considered when doing durability testing. When comparing failure mode with just shock with failure mode with corrosion and friction, 75% moved from a lower risk failure mode to higher risk. Failure risk was based on caster checklist which Anand developed. Anand drafted a new ISO standard to for this testing that will be presented at the ISO meeting in May.

Also, majority (73%) of casters which failed in the field also failed in lab testing.

Matt McCambridge to check with MIT on availability of sensor data from Indonesia to evaluate, as well.

In light of the NIDLIRR grant funding, there is an opportunity to test debris and understand field conditions on failure data we receive to ensure that lab testing is as similar to field testing as possible. A network of U.S. providers and national health system in UK are contributing caster field data, tying injuries to caster failures. Goal is to have a larger set of data to be conclusive on failure modes.

8. *Future Testing Priorities:* Goal is to identify what else to test and deliver to sector to guide wheelchair design and selection and leverage investments in tests to produce comparisons of products which can be valuable. WG members provided suggestions:
 - a. Survey on caster testing for a larger range of products. (*Jon*)
 - b. Corrosion testing considering different surface coatings (different kinds of paint; anodized versus powder coated) and expected longevity of each type of coating. (*Jon*)
 - c. Is there a better bearing? Should we be using bushings, instead? Not only find out what's wrong but also what can be done to correct. There is a trade-off between giving someone a steel and aluminum wheelchair. Is there something in the middle to extend the corrosion resistance of a wheelchair? (*Don*)
 - d. What can we do to make casters last longer? The nuts and bolts of how to make a better chair. (*Don*)
 - e. Data to help supporters understand it is not just the cost of producing/distributing the chair but also the cost to the end user. How to make a better chair without costs going through the ceiling. (*Don*)
 - f. Validating anecdotal information on technical solutions which manufacturers have collected over time. Examples: Enormous variation based on subtle changes in manufacturing. Sensitivity of manufacturing

quality control. Corrosion is key; there are some standards, but they are ad hoc. The standard method of applying powder coat is not the gold standard. Bearing corrosion and packing bearings also have a lot of ad hoc solutions but aren't tested. (*Matt*)

- g. Environmental factors impacting fabric wear. (*Eric*)
- h. Comparison of lab testing to what occurs in the field. How to collect field data easily and accurately. (*Eric*)

Standards WG members are invited to provide additional suggestions, which will be discussed on the next call.

Participants

- Bonnie Gonzalez, Free Wheelchair Mission
- Dave Mahilo
- ✓ Daniel Martin, Shonaquip
- ✓ Matt McCambridge
- Mark Sullivan, Convaid
- ✓ Norman Reese, LeTourneau University
- ✓ Chris Rushman, Motivation
- ✓ Don Schoendorfer, Free Wheelchair Mission
- Scott Walters, Mobility Worldwide
- Karl-Erik Westman, Handicap International
- ✓ Eric Wunderlich, LDS Charities
- Ben Gebrosky, University of Pittsburgh
- ✓ Mendel Marcus, University of Pittsburgh
- Anand Mhatre, University of Pittsburgh
- ✓ Joe Ott, University of Pittsburgh
- ✓ Jonathan Pearlman, University of Pittsburgh
- ✓ Nancy Augustine, University of Pittsburgh

Prepared by: Joe Ott, University of Pittsburgh