

Prototype Testing:

Engineering Metric Being Tested: Collection Container Accessibility

Purpose:

This protocol will have the purpose of analyzing the ease of removing and replacing the urine collection container. Because urine is managed by the household on a regular basis, it is important that the design of the toilet system be easy and intuitive to remove and replace for the residents of the household.

Goals:

The goal of the design is to make the process of removing and replacing the urine jug have a net time of equal to or less than the current SOIL Ekolakay toilet.

Conclusions:

The average time to remove and replace the urine jug was 10.1 seconds. Because there is not a measurement for this process for the current SOIL model, we cannot say whether the diverter we designed increased or decreased this time. It could be noted, however, that the newly designed diverter did not affect the removal time because lifting the seat caused the diverter to be completely out of the way. Replacing the container may have caused the diverter to affect the time though. It did take some precision to align the diverter and urine jug openings. But because the total average time to get the jug in and out of the toilet was only 10.1 seconds, we can assume that if the time was increased, it would not be a significant issue because the time is still very short. This test may be run again with the addition of the cookie cutter insert. It is hypothesized that the cookie cutter insert may reduce the time to replace the urine jug because it easily identifies the location of the placement of the urine jug.

Materials:

- Complete toilet prototype with waste containers
- Calibrated stopwatch

Procedure:

1. Place waste containers in appropriate locations within toilet (as denoted by cookie cutter)
2. Prepare to remove the urine jug.
3. Start the stopwatch and begin removing (detaching) the urine jug.
4. Stop the stopwatch once the urine jug has been successfully removed from the system.
5. Prepare to replace the urine jug.
6. Start the stopwatch and begin replacing (reattaching) the urine jug.
7. Stop the stopwatch once the urine jug has been successfully replaced to the system.
8. Repeat steps 2-7 two more times to ensure data is collected in triplicate.

Results:

Trial	Urine Jug Removal and Replace Time (s)
1	16.75
2	11.10
3	10.38
4	9.15
5	9.60
6	9.65
7	8.66
8	9.16
9	7.73
10	8.72

Average Time for Removing and Replacing: 10.1 seconds

Analysis:

This testing was performed by continually removing and replacing a full urine jug (full of fresh water). A full jug was used to simulate the time caused by the resistant force of a full urine jug. One thing to note was that after continually repeating the same motions, the time decreased as the tester became more familiar with the placement and weight of the jug. Something else that was noted as the testing progressed was that the newly designed urine diverter did not affect the time for jug removal. The diverter was completely out of the way when the seat was lifted. The time for replacement, however, may have been affected though because it took a couple moments to align the spout of the diverter with the top opening of the jug. Having the cookie cutter insert may reduce the overall collection container time.