Rubbermaid®
Commercial Products

HYGEN™

CLEAN WATER SYSTEM

2011 Time and Motion Study

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1 Introduction

The American Institute for Cleaning Sciences (AICS) is pleased to submit this report detailing the results of a time and motion study using the Rubbermaid Hygen™ Clean Water System (CWS) developed by Rubbermaid Commercial Products (RCP). The research was conducted in buildings at Adobe Systems Inc., located in San Jose, CA, and the University of Maryland Department of Residential Facilities (UMD), located in College Park, Maryland.

AICS is the leading authority in the commercial cleaning industry. It is the architect of the comprehensive Cleaning Industry Management Standard Green Building (CIMS-GB) and acts as the registrar for the ISSA certification program. We are focused exclusively on facility maintenance and the cleaning industry. Our involvement with hundreds of industry firms expands our expertise and knowledge to bring you the most comprehensive information and business solutions available. AICS is an unbiased, independent organization that does not accept product sponsors.

2 Scope of the Study

This study concentrates on both in-house and outsourced cleaning operations. Floor surfaces were selected in both facilities using different area types. The Adobe building floor surface was a long, unobstructed hallway. The UMD facility site selected a utility room in the housing department that was rectangular with few obstructions in the room. Both facilities are cleaned during the day. Day Cleaning is becoming a common system in the industry to conserve energy and provide more cost-efficient services.

3 Purpose

The purpose of this white paper is to compare the production and performance capabilities of RCP's Cleaning Water System to their conventional floor mopping equipment. This research used systematic observation, process and product layout, and stopwatch research methodology. The improvement of the work process was documented by observing non-productive work time and the workers' procedures and techniques.

4 Current State of Mopping

Over 90% of traditional floor mopping conducted in the U.S. market utilizes a single compartment bucket. The water soils rapidly after the first or second dip into the bucket. Soil and potential contaminants are then redistributed to the floor and/or grout lines after the first 1000 sq. ft. of mopping. AICS has observed workers performing this task and has determined that dips or re-wettings of a mop, occur 2-4 times when mopping a 1,000 sq. ft. area. The mop size, textile type, floor type, wringer pressure, air exchange rates and humidity level cause this to vary. Workers then judge the water by the color and make random solution changes. This procedure increases water and chemical consumption per worker. Travel time to the custodial closets is necessary per worker as the need for clean water increases, adding to the task time.

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In addition to mopping with soiled water, a traditional string mop may cause vinyl baseboard soil and can redistribute soil into vertical grout lines. When framing a floor, the worker runs the mop against the baseboard in rooms or hallways. The higher profile of a string mop can move soil up against a baseboard to 2-3 inches high. This may lower appearance scores, cause odor and increase the cost of cleaning due to project work needed to bring baseboards up to standards. A traditional string mop can clean an average of 400-500 sq. ft. per dip. The worker will flip the mop over every 200-250 sq. ft. Building conditions may cause this to vary.

A single-sided flat mop is designed to hold enough moisture to damp mop 100-150 sq. ft., which is the average size of a patient room. When these mops migrated into other cleaning segments, the soil load and moisture capacity per mop were not adequate.

Traditional single-sided microfiber flat mops are a European innovation. The primary segment for these mops was healthcare. The concept is to isolate contaminants to a patient room by changing a mop for each room. A single-sided flat mop is designed to hold enough moisture to damp mop 100-150 sq. ft., which is the average size of a patient room. When these mops migrated into other cleaning segments, the soil load and moisture capacity per mop were not adequate. This caused streaking and worker frustration due to the need for additional mops or increased travel time.

5 Time Study Method

A time study attempts to determine out the amount of work that a trained cleaning worker completes in a given period of time. The workers must do the work according to a defined method, under average conditions, and at a pace which will produce a competitive production rate. All phases and working conditions are carefully considered for the time study to be practical.

5.1 History of Time Studies

AICS uses a methodology founded on Scientific Management principles practiced by Frederick Winslow Taylor. The key element in Taylor's technology of work, to which he gave the name "scientific management," was the time-and-motion study. This was, and is, a technique for determining how fast a job can reasonably be performed, and for identifying, and eliminating, inefficient and time-wasting practices.

Practical times account for real world conditions and a consistent set of variables that can be defined by managers or supervisors in the building.

5.2 Practical versus Theoretical Time Studies

The cleaning industry recognizes two types of time studies conducted by manufacturers, service companies and third party-firms. AICS used practical cleaning time practices for the RCP time and motion study.

(1) Theoretical Cleaning Times

Theoretical times are calculated based on the cleaning width of a mop head and the forward walking pace of the cleaning worker. The average walking speed of a cleaning worker may be 1-2 miles per hour (mph). This number is then multiplied by 5280 (feet in a mile) and then divided by 12 inches. The final calculation is sq. ft. per hour that the tool will yield. Theoretical numbers typically do not represent real world production rates.

(2) Practical Cleaning Times

Practical times account for real world conditions and a consistent set of variables that can be defined by managers or supervisors in the building. These variables may include area type, soil conditions, tools, substrates, building type, weather conditions, travel time, setup time, equipment and worker skill levels. Many operations managers make an attempt to "guesstimate" these times. For accurate job costing and budgeting, it is considered a best practice for managers to conduct a time study of common tasks such as restroom cleaning, vacuuming, pulling trash and floor mopping.

6 Time Study Protocol

Although the conditions of each test site were slightly different, both Adobe and UMD used the same protocol for the study.

(a) Each facility was contacted by AICS. Two workers were asked to participate in the study at each location, one male and one female.

(b) The substrate for the study was 12x12 vinyl composition tile (VCT). The floor finish at each location was undefined.

(c) The humidity level was measured at each location. Adobe was 45-50% and UMD was 25-30%. *Note: Mopping the floor multiple times increased the humidity in the test areas. Higher humidity levels also increased the floor dry times at the Adobe site. Both studies were conducted in March of 2011.*

(d) 1000 sq. ft. areas were measured using a Disto 330 Laser measuring device and then the distances were reconfirmed using a commercial walk wheel.

(e) Start and stop points for the workers were marked with blue masking tape as indicators.

(f) Each worker traveled from the time study area to the nearest closet to fill the bucket with water and neutral floor cleaning chemical using a dilution control system. Both bucket types were filled to the 4-gallon level line. Travel time and filling time were documented for each worker.

(g) Each worker received 5 minutes of training on the new Clean Water System with the double-sided flat mop.

(h) The bucket was placed in the middle of the 1000 sq. ft. area for consistent travel time to rewet the mop.

(i) Workers were instructed to “frame the floor” and then mop at their usual pace using four- to five-foot cleaning strokes. The industry defines this as systematic overlapping passes, or a figure-eight mopping pattern.

(j) Workers first used a RCP 4 gallon single compartment bucket, a 60” fiberglass fixed mop handle and a RCP medium size looped end blended mop with tail band.

(k) Floors were dried using commercial fans between time studies.

(l) Each worker was allowed 5-10 minutes to rest between drying cycles.

(m) Workers then were instructed to use the CWS with a double-sided flat mop. The adjustable handle had a range of 48-72". The handle was adjusted to the height of each worker. The top of the handle was raised or lowered to just below the worker's chin.

(n) Cleaning time was recorded for each worker at the end of the 1000 sq. ft. area using a stop watch, clip board and time sheet.

(o) Time related to changing solution that included traveling to and from the janitor's closet, emptying and refilling the bucket was recorded for each worker.

(p) Work process and worker technique was videotaped.

(q) After all data was collected, the work process and data were thoroughly reviewed. AICS then determined which parts of the task are non-productive activities or may cause labor inefficiencies.

The Rubbermaid HYGEN™ Clean Water System is designed to improve the traditional characteristics of floor cleaning tools.

7 Test Product Features

The Rubbermaid HYGEN™ Clean Water System is designed to improve the traditional characteristics of floor cleaning tools. The features are as follows:

(a) Dual chamber bucket

(b) Back flushable filtration system in rear compartment of the bucket to recycle water

(c) Internal agitation scrubbers to remove debris from flat mop fibers – self-laundering mechanism

(d) Smooth bore twin roller wringer design

(e) 4 adjustable wringer settings for desired moisture levels

(f) Adjustable light-weight aluminum mop handle

(g) Double-sided micro fiber flat mop

(h) 360° swivel frame that makes it easy to attach and detach the mop

(i) High impact injected molded construction – longer product life cycle

8 Time Study Findings – Productivity

8.1 Production Time Improvement

Industry time studies are measured in minutes per thousand sq. ft. for different bucket configurations, types of mops and mop sizes. These times are then translated into sq. ft. per hour.

The ISSA 540 Cleaning Times table below demonstrates average times for floor mopping. *540 Cleaning Times* documents the production rate of a dual bucket and flat mop at 9,693 sq.ft. per hour. AICS found this rate overstated and was not able to replicate the production time using a flat mop in a practical or theoretical time study. AICS uses an average mopping production rate of 5000 sq.ft. per hour for workloading projects and as a baseline production rate.

The double-sided micro fiber flat mop design increased the coverage and productivity of the mop when cleaning. This allowed workers to flip the mop every 200-250 sq. ft. so each mop cleaned up to 500 sq. ft. per dip. This coverage is comparable to that of a medium sized string mop.

ISSA 540 Cleaning Times-Floors	Sq.Ft.	Minutes	Sq.Ft.Hr.
Damp Mop with 12 oz. Mop Head using Single Bucket & Wringer	1,000	16.80	3,571
Damp Mop with 12 oz. Mop Head using Double Bucket & Wringer	1,000	15.60	3,846
Damp Mop with 16 oz. Mop Head using Single Bucket & Wringer	1,000	14.40	4,167
Damp Mop with 16 oz. Mop Head using Double Bucket & Wringer	1,000	13.20	4,545
Damp Mop with 24 oz. Mop Head using Single Bucket & Wringer	1,000	12.00	5,000
Damp Mop with 24 oz. Mop Head using Double Bucket & Wringer	1,000	10.80	5,556
Damp Mop with 32 oz. Mop Head using Single Bucket & Wringer	1,000	9.60	6,250
Damp Mop with 32 oz. Mop Head using Double Bucket & Wringer	1,000	8.40	7,143
Damp Mop with 18” Micro Flat, Break Mop Holder, Using Double-Sided Bucket and Open-Base Wringer	1,000	6.18	9,693

The production rates of the new CWS were 10-20% higher than those of an RCP single compartment bucket and medium string mop. The production rates of the CWS were 6,900-8,000 sq. ft. per hour in an unobstructed area. The production rates of a RCP traditional string mop system were 5,800-7,200 sq. ft. per hour in the same area.

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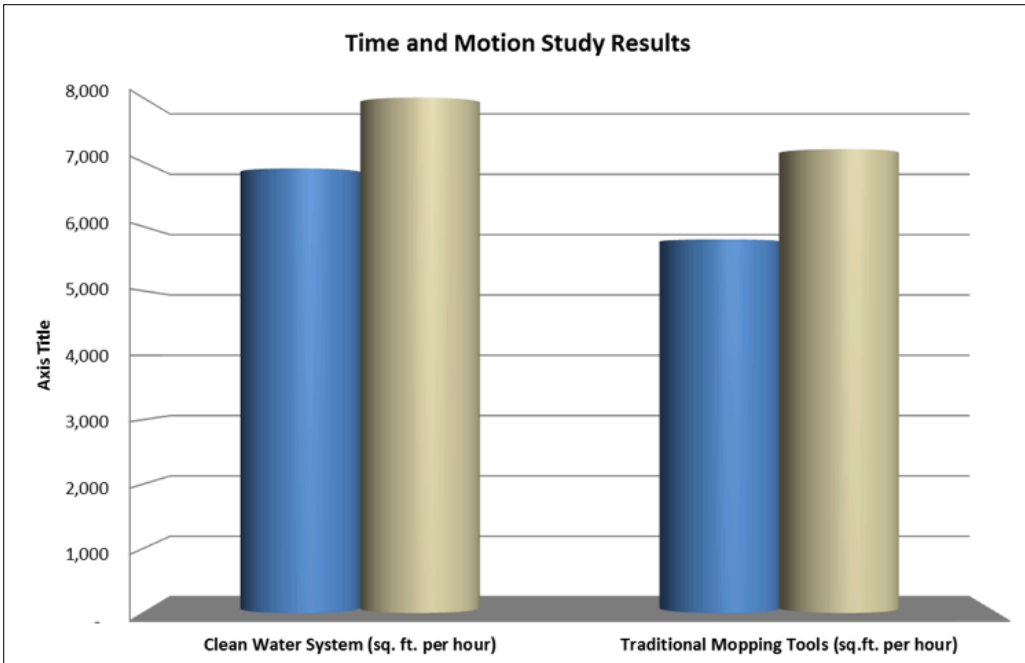

	Clean Water System (sq. ft. per hour)	Traditional Mopping Tools (sq.ft. per hour)
UMD (utility room)	6,900	5,800
Adobe (hallway)	8,000	7,200

8.2 Eliminating Non-Productive Work Time

The time required to fill and empty the bucket and travel was documented in both locations. The average time is 4 minutes per trip to dump, rinse, fill and travel back to the work area. This is non-productive work time and although we measured 4 minutes to complete the task, many operations managers say that removing the worker from the area could account for 10 minutes or more of non-productive work time.

The CWS with integrated water filter keeps custodians in their work area and eliminates travel and fill time. This does not appear to be much time, but when we account for the number of workers and filling events, it can add up to thousands of dollars in lost labor hours per year.

The chart below is an example of 5 workers with an hourly wage of $10 per hour and 20% benefits. Each worker is changing solution 4 times per shift using 4 minutes of fill and travel time (1 minute travel to the water source+ 1 minute back to the mopping site +2 minutes fill time). Annual savings is $4,160 per year in one building.

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Travel Time

How many minutes does it take to get to the water source?	1
How many minutes does it take to empty and refill a bucket?	2
Enter the number of solution changes per worker per shift?	4

Annual Travel Cost Savings

$4,160

Annual Travel Hours Saved

347

9 Observations

AICS observations are as follows:

(a) The CWS with double-sided microfiber flat mop cleaned 400-500 sq. ft. per dip at the #3 roller setting. This is the same coverage as that of a medium sized string mop with tail band. This is significantly increased coverage over a single-sided flat mop with an average coverage of 100-150 sq. ft.

(b) The CWS recycling system has a 4:1 water conservation ratio compared to an RCP single compartment 4 gallon bucket (if the worker currently changes water 3 times per shift). This reduced water consumption and chemical use by 75%. The more frequent the water changes, the greater the water/chemical and labor savings.

(c) The integrated filtration system converted soiled water into clean water and transferred it back into the clean water compartment in less than 3 minutes. This occurred while the worker was mopping.

(d) The double-sided microfiber mop left a consistent appearance on the floor. There was none of the streaking or inconsistent appearance that can occur with a traditional string mop.

(e) The square corners of the micro fiber mop reached closer to the floor's edge and maneuvered corners better than a string mop. The CWS mop's low–profile design prevented soil from spreading up on baseboards.

(f) The higher profile of the CWS bucket and twin roller wringer prevented the worker from bending and stooping compared to traditional side or down press wringers.

(g) The dry time of the double sided microfiber is equal to the dry time of a traditional string mop. The humidity levels and air exchange rates in the building may cause this to vary.

(h) Hallways have a slightly higher production rate than open areas or rooms. The walls create a structural boundary that reduces overlapping time. It keeps the worker in a "framed" area.

(i) The height of the majority of female workers on the job site ranged from 4'9"-5'7". The top of a fixed 60" standard mop handle lifted the worker's elbow above her head. This caused discomfort and the potential for fatigue.

(j) An adjustable aluminum mop handle is more ergonomic. It allows the worker to adjust the handle to a comfortable operating position.

(k) Workers required training on how to frame a floor.

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The Rubbermaid Hygen™ Clean Water System has numerable benefits that deliver meaningful value to the end users. It will change the way the industry cleans floors.

10 Conclusions

The Rubbermaid Hygen™ Clean Water System has numerable benefits that deliver meaningful value to the end users. It will change the way the industry cleans floors. The sustainability features conserve water, reduce chemical usage and create a cleaner surface. The elimination of non-productive time and labor efficiencies will assist managers who are seeking a more cost-effective cleaning tool that can reduce hours or dollars from the bottom line.

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