

Implementation of Lean Methodology in Maintenance Operations

By

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Agenda

- Initial Lean Projects Conducted with Purdue
 - Paint Striping
 - Chip Seal
- Approach for Lean Training
- Sites & Date
- Themes (areas for improvement)
- Next Steps
- Wrap-up

Lean Paint Striping

Value Stream Mapping (VSM)



VSM revealed many similarities along with a few differences between districts

Paint Striping Project

Areas for Improvement

- Loading beads quicker
- Shoot center & edge line at same time (manifolds)
- Carry more paint on truck
 - Two approaches to more paint
 - Greenfield ~ 1,390 gallon tank
 - Crawfordsville – Load paint totes directly on truck

Paint Striping Project

Filling Bead Tank - Before



Sucking beads into tank via a hose was very time consuming

Paint Striping Project

Filling Bead Tank - After



Paint Striping Project

Spraying edge & center at once



A preliminary test at the end of 2012 paint season and years of experience both suggested that a bead manifold would be required to spray edge and center lines at the same time

Paint Striping Project

Crawfordsville Approach



Quickly progressed from 220 to 275 gallon totes



Paint Striping Project

Results

- Both the Crawfordsville and Greenfield approach have proven the viability of running 1 paint truck per district
 - Both districts were able to paint ~ 30% of lane miles doing center and edge line at same time
 - Both districts nearly finished with painting (waiting on chip & seal to finish)
- Differences remain between the districts
 - Use of extended shifts (3 day work week)
 - Use of substations

Paint Striping Project

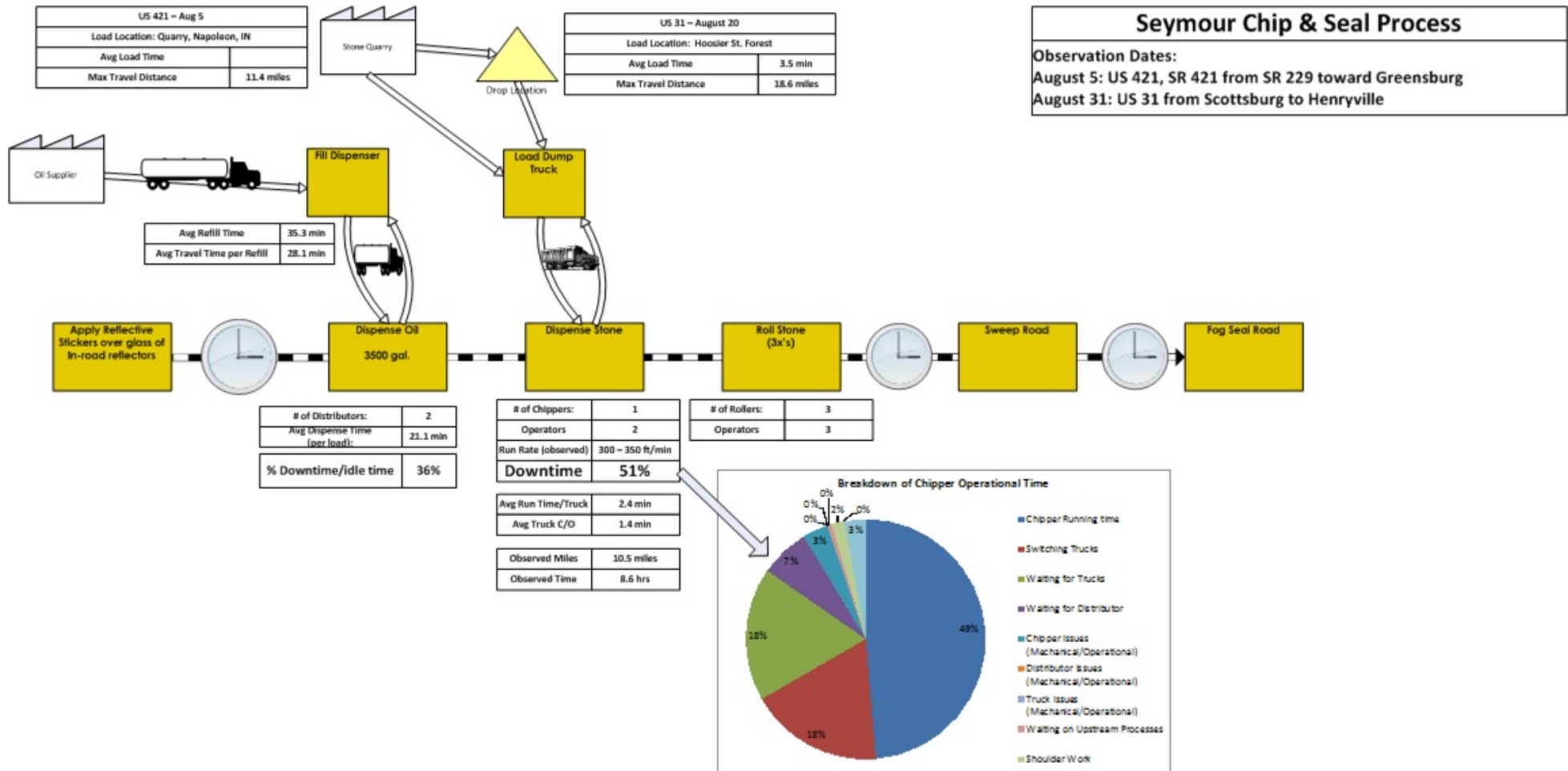
Results (page 2)

- Greenfield saw reduction in overall operations cost of ~9% (\$660K to \$600K) while price of paint rose nearly 50%
 - Would have been ~27% savings if price of paint had remained constant
 - Part of savings was based on shooting 2 lines at once, part on longer shifts

Lean Chip Seal



Mapping the Current Process

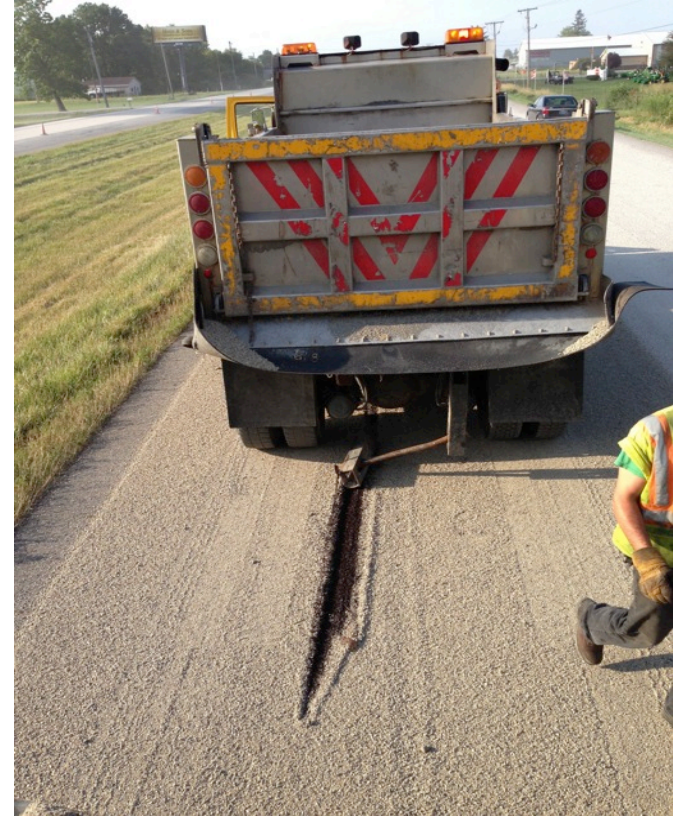


By actually drawing the process we can identify wastes and opportunities for improvement

Six Types of Downtime

1. Setup and Adjustment
2. Breakdowns
3. Idling and Minor Stoppages
4. Reduced Speed
5. Start-up
6. Quality Defects and Rework

Examples of Defects (a form of waste)



“Stuff Happens” in the field – understanding why and how often allows us to evaluate improvements

Examples of Defects & Waiting



“Stuff Happens” in the field – understanding why and how often allows us to evaluate improvements

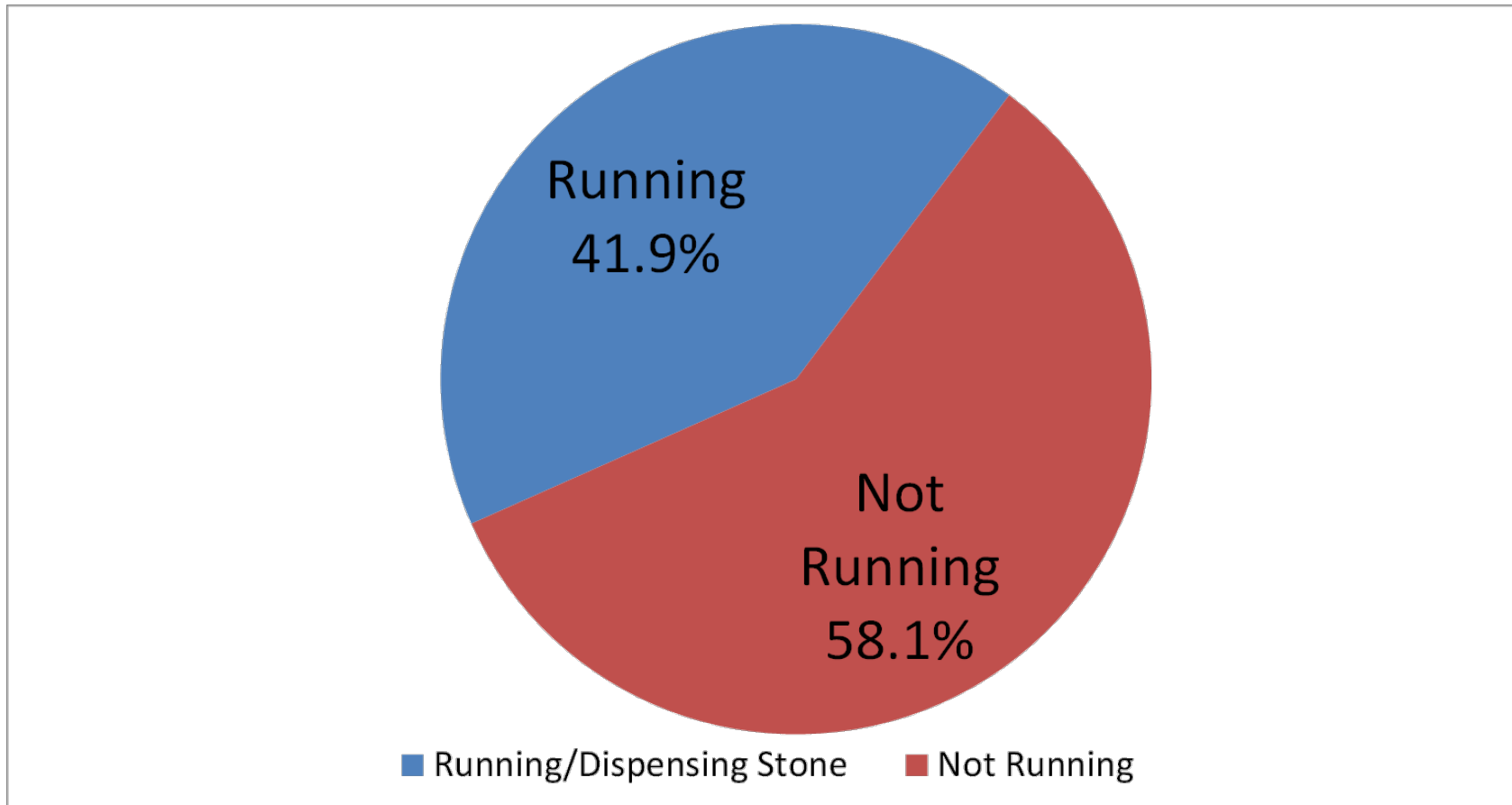
Examples of Waste



Drivers having to sign 3 copies of receipts
(Is there a way around having to weigh every truck?)

Chipper Runtime vs. Downtime

All Districts, 10 Observation Days 2013



On-site chipper observations ranged from 44% downtime up to 70% downtime

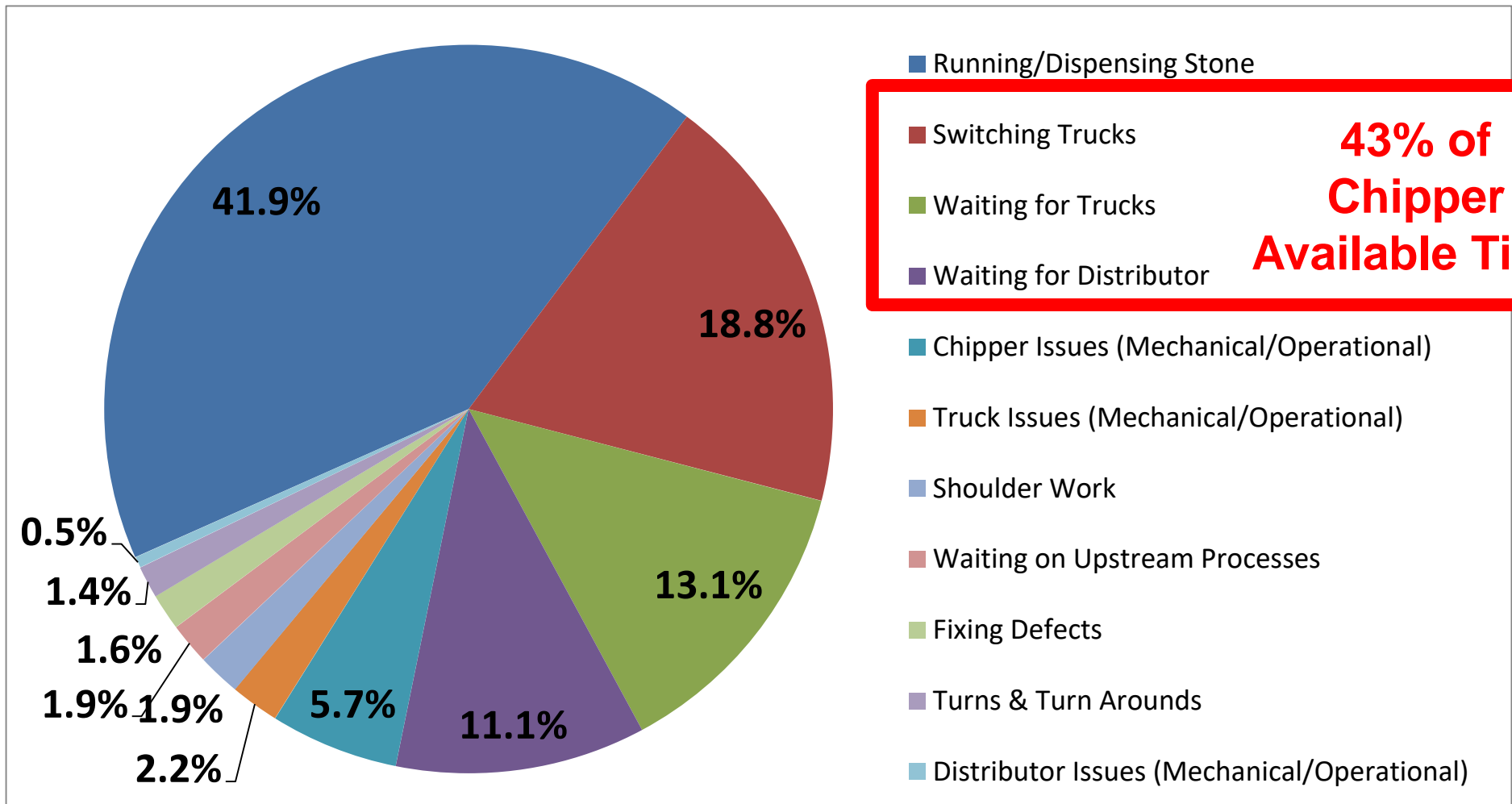
Impact of Reducing Downtime

- Task: Chip Seal 40 lane miles of SR “X”
 - Chipper planned run time = 8 hours per day
 - Chipper Run Rate = 400 feet per minute
 - 40 people on site to complete project

Chipper Downtime	Miles Per Day	Days to Complete Road	Total Labor Hours
70%	10.9	3.7	1173
60%	14.5	2.8	880
50%	18.2	2.2	704
40%	21.8	1.8	587

Chipper Runtime vs. Downtime

All Districts, 10 Observation Days



General Observations – Material Quality



Clumps in stone pile cause continual chipper clogs which negatively impacted overall quality of chip seal operation and cause more down time for equipment

Potential Areas for Improvement

- Planning, Planning, Planning
(Where to park oil tankers, trade offs for stock piles, etc.)
- Standardize trucks (bar height, diameter, etc.)
- Use higher capacity trucks with faster bed lifts
- Training for truck drivers during “off season” to let them practice connecting to chipper
- Consider trying an experiment using the same group of truck drivers across the district rather drawing from each sub district
- Review standards on oil application rate and time from oil down to chips down
- Review sourcing based on true cost (and quality) of stone

Reducing Downtime (cause 1)

■ Switching Trucks

- Reduce number of switches by using highest capacity trucks available
- Add side rails if needed so trucks can be loaded to maximum safe & legal capacity (15 ton)
- Standardize height of connector bar
- **Close road to through traffic to reduce delays in getting trucks in and out of work zone**

Reducing Downtime (cause 2)

- Waiting on Trucks
 - Acquire temporary right of way for stockpiling stone closer to point of use
 - Use a truck calculator to determine trucks needed based upon
 - Distance to stone
 - Loading from quarry or stock pile
 - Hauling capacity of trucks
 - Travel speed to stone
 - Speed of chipper
 - Width of chipped lane

Reducing Downtime (cause 3)

■ Waiting on Oil

- Use a 3rd distributor to avoid waiting on oil
- Plan multiple staging locations for tankers to reduce travel time between where filled and where sprayed

Observed Improvements

(Seymour 7/16/14)



Side boards added to increase hauling capacity of trucks

Observed Improvements

(Seymour 7/16/14)

- 0% wait time for trucks (used truck calculator)
- Average 10.6 tons per truck
(all trucks loaded with 4 buckets)
- 22% downtime waiting for distributor
(26 min out of 1 hr 58 min)
- Averaged 199' / minute while running
(excludes waiting for distributor)
- Average speed dropped from 199' / minute to
155' / minute due to waiting for distributor

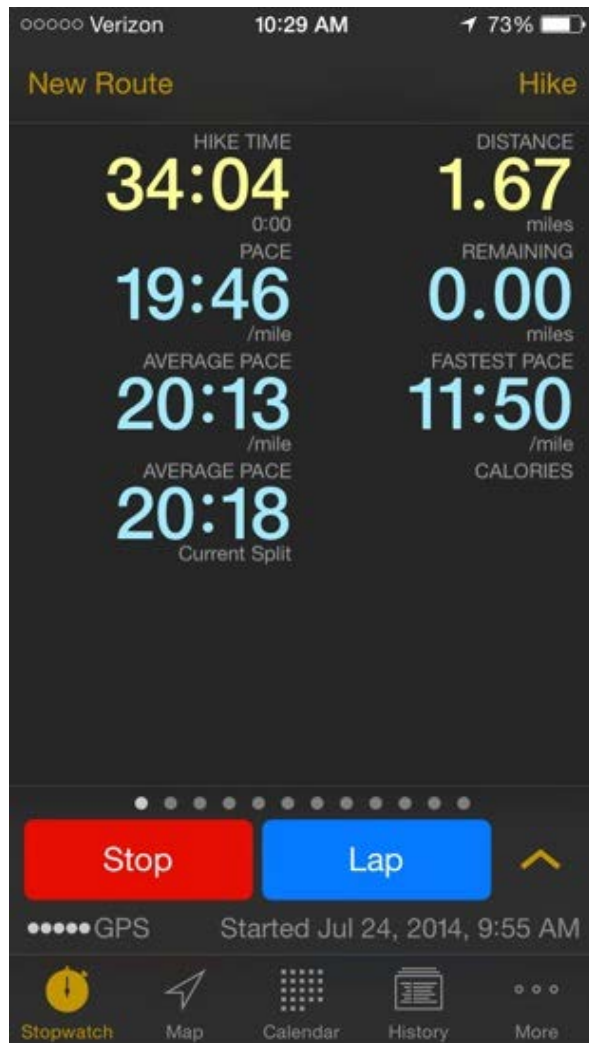
Observed Improvements

(Seymour 7/16/14)

- While running a little faster than in 2013 due to reduced wait time for stone, some of the down has been moved to waiting for oil.
 - A third distributor could significantly speed up the operation (22% downtime observed)
 - Fully loading trucks would have reduced downtime switching trucks
 - Concern expressed about going faster due to desire to keep traffic off the freshly chipped road for 1 hour

Observed Improvements

(Greenfield 7/24/14)



Screenshot from iPhone App

Averaged 260' / minute (2.94 mph) until entering city limits of Laurel (Six 90 degree turns within 1 mile)

0 wait time for stone

Averaged 13.2 tons per truck (Seymour averaged 10.6)

Reduced downtime switching trucks from 18 to 15%

0 wait time for oil (used 3 distributors)

NOTE: Work order not completed yet so accomplishment / man hour is not available

Creating a Culture of Improvement

”Culture eats Strategy
for Breakfast”

- Attributed to Peter Drucker

Approach to Lean Training

- Provide Lean / Entrepreneur training to an audience of primarily Sub District Managers
 - Systems / Process thinking
 - Process mapping
 - Identifying waste (waiting, defects, downtime, etc.)
 - Project tools (charters, stakeholder analysis, project plans, etc.)
 - Identify and begin working on improvement projects within their areas
- Research and provide recommendations on how to make Lean Initiative “stick” within INDOT

Sites & Dates

	Bloomington	Columbus	Monticello	Kokomo
Planning (half day)	4/25	4/25	4/27	4/28
Day 1	5/2	5/3	5/17	5/18
Day 2	5/15	5/16	5/25	5/26
Day 3	5/22	5/24	6/7	6/8
Day 4	5/30	5/31	6/14	6/15
Day 5	6/12	6/13	6/21	6/22
Follow up 1	7/6	7/5	7/26	7/27
Follow up 2	8/8	8/9	8/18	8/25

Focus by Workshop Day

- Planning Day - Process / Project selection
- Day 1 - Process Mapping
- Day 2 – Identifying Wastes
- Day 3 – Identifying potential improvements
- Day 4 – Project Charters, Project Planning
- Day 5 – Risk Management (avoiding unintended consequences & potential problems)
- Follow Up 1 – Tying everything together (sample exercise, Feedback from group)
- Follow Up 2 – Ideas from other DOTs, Updates & Feedback from group,

Themes from the 4 sites

- Too many / too detailed metrics & goals
 - Move to annual goals instead of monthly?
 - Possible use of spider / radar chart?
- Equipment Availability
 - High cost of “lowest bid” (Deming)
 - Not having the right equipment available
 - Increased downtime of equipment
 - Aging equipment
 - More time spent waiting for repairs
 - Bids for rental equipment vs QPA

Themes from the 4 sites

- Employee turnover & Employee training
 - High cost of turnover on operations
 - Recruiting
 - Constant training robs time from experienced employees
 - “Rookie mistakes”
 - High turnover after getting CDL

Potential Next Steps

(recommendations from groups)

■ Fall 2018

- Run workshops again for higher level INDOT staff @ Brookville Rd INDOT facility
- QA Group, Tech Services, HMDs
- Procurement, Logistics & Admins
- Communication Director for each district
- District Ops Managers
- Could be done as 2 rounds of training @ 21 people per round

Potential Next Steps

(recommendations from groups)

- Winter 2018-2019
 - “Field Level” training at same 4 locations around the state
 - Crew Leaders
 - Unit Foremen
 - Specialty Crews

Questions?

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