

Improving Inventory Stocking System and Redesigning Layout for Better Work Flow in a Bicycle Repair Shop

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Problem Description

- **Lacking an organization system for:**
 - Bike parts
 - Bikes
- **Clogged bike shop layout**
 - Walkways are blocked
 - Bike parts everywhere
- **No system for taking in donated bikes**
 - Donated bikes are mixed with other bikes
 - No sense of how long a bike has been in the shop

Management Objectives

1

Reduce time searching for parts when repairing bikes by 20%.

2

Implement an overall inventory management system.

3

To have an organized and clean workplace area.

4

Create and implement a system to process donated bikes.

Final Deliverables

**Organization
Scheme:
Bins, Labels,
and Signage**

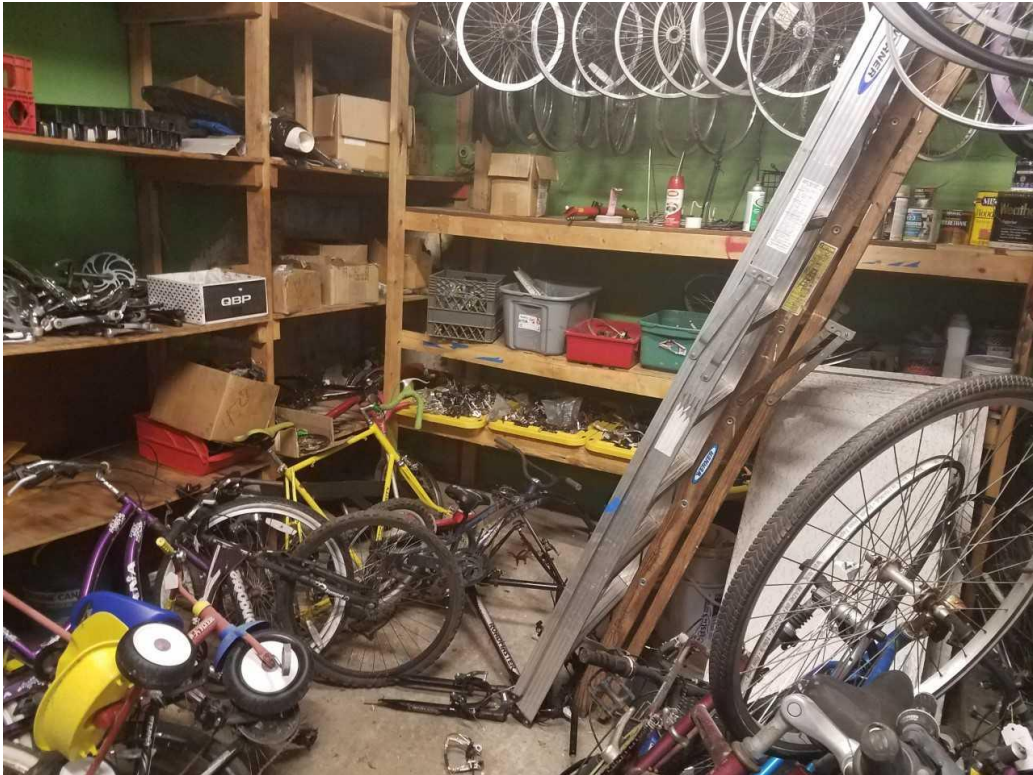
**Back of Shop
Layout**

**Donated Bikes
Tagging System**

5S Checklist

**Training procedures
for inventory
management
system**

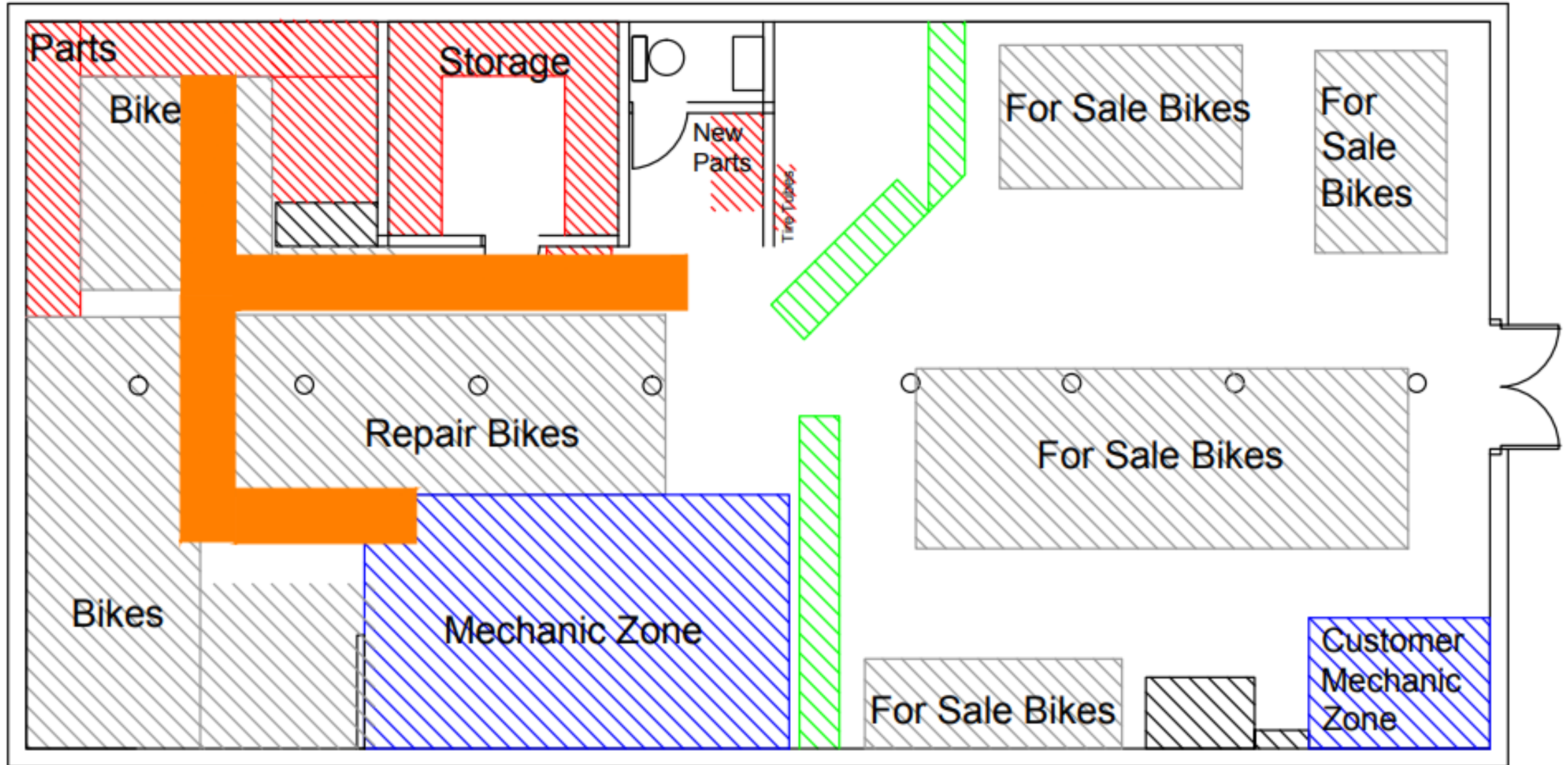
Organization Scheme: Bins, Labels, and Signage



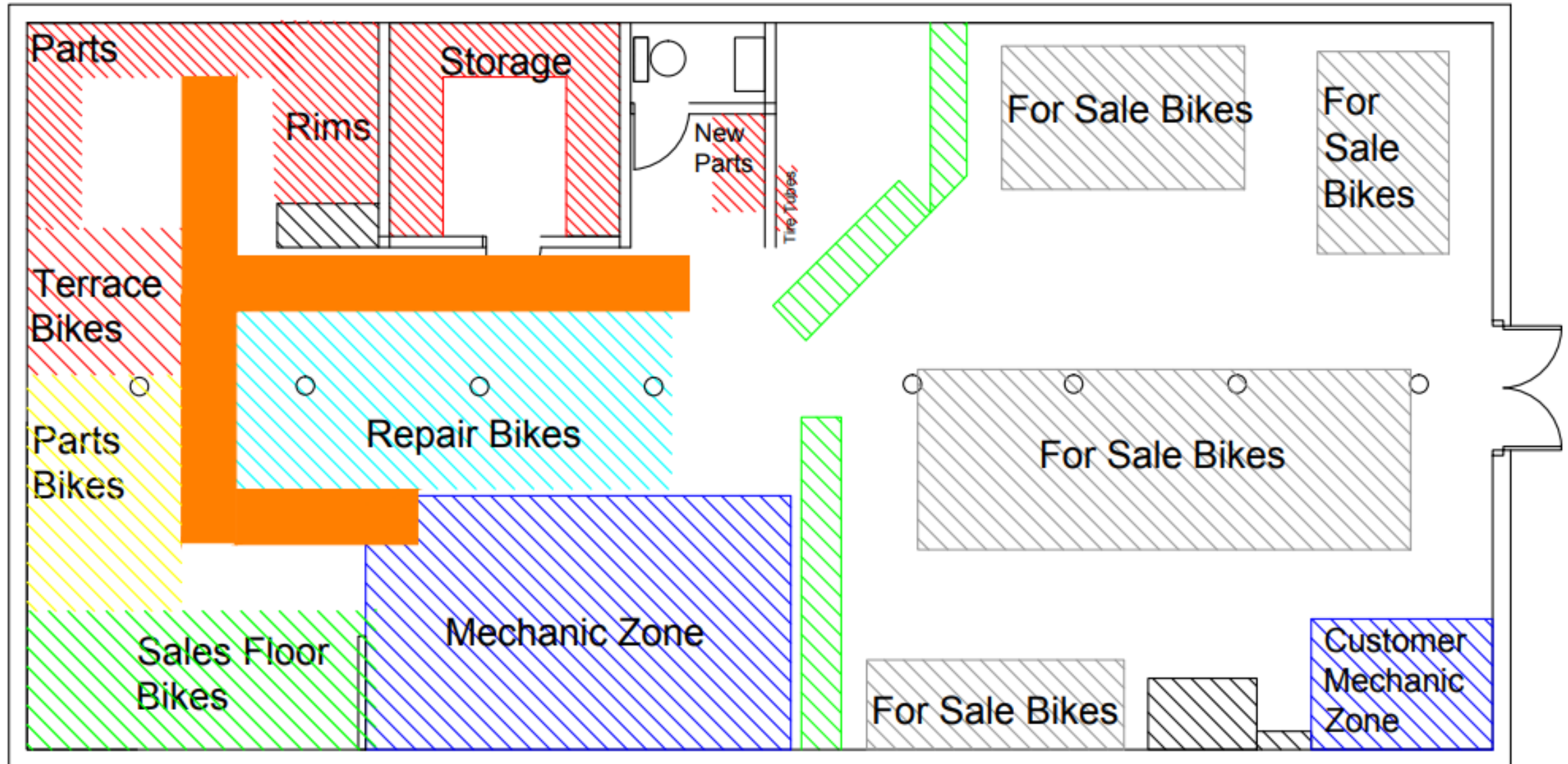
Organization Scheme: Bins, Labels, and Signage

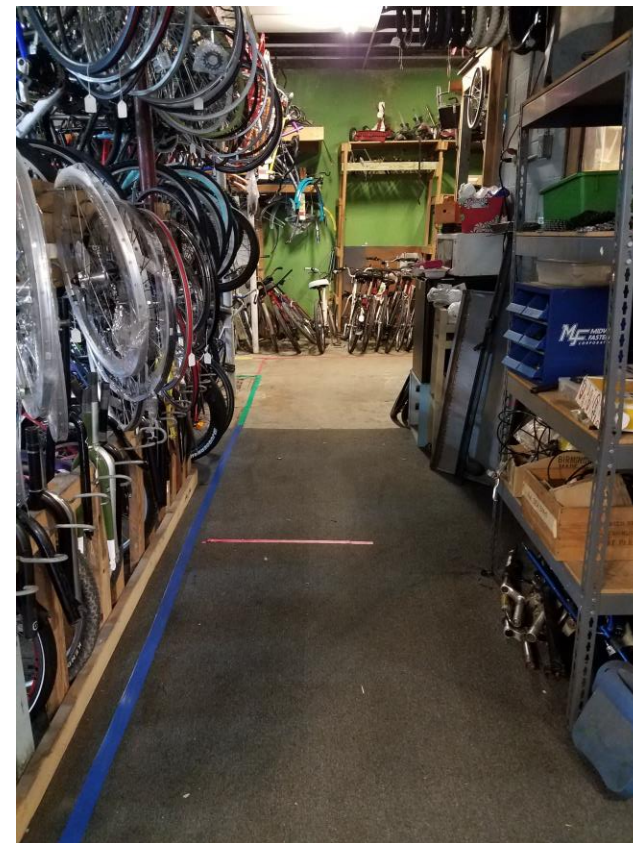


Back of Shop Layout: Before



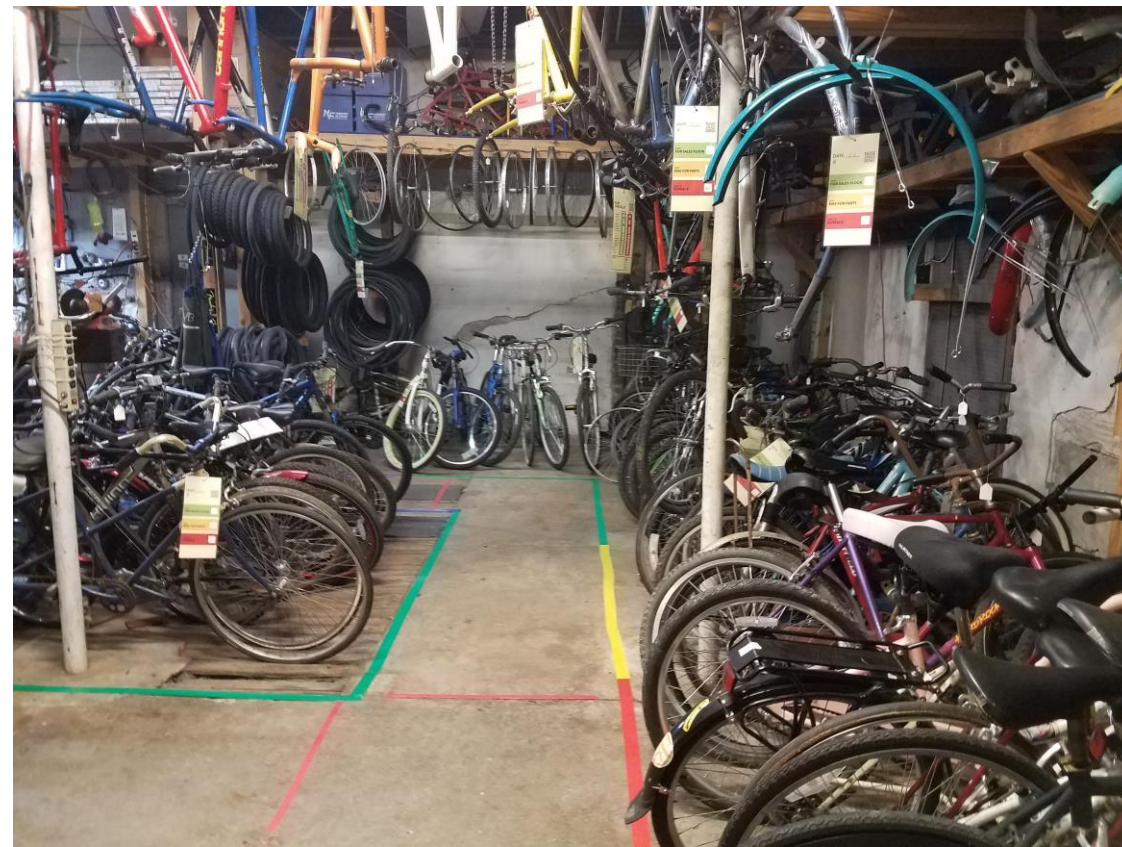
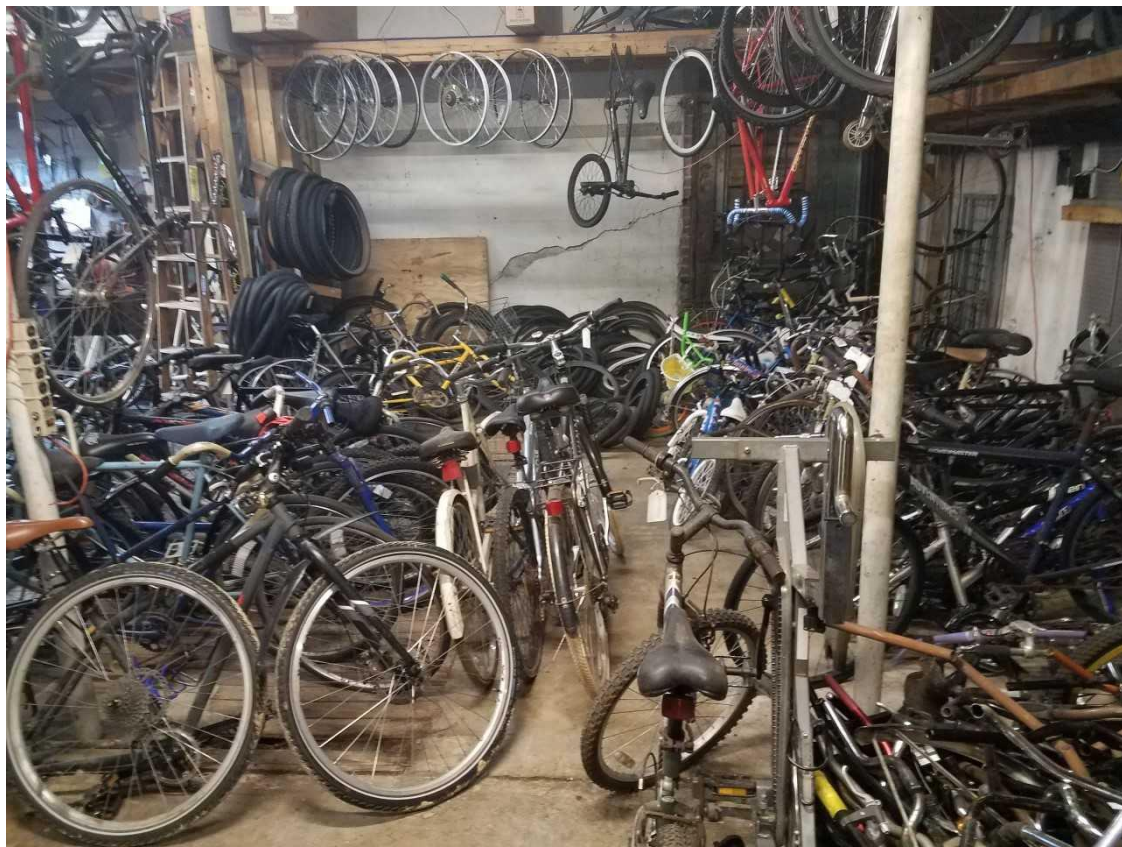
Back of Shop Layout: After





Hallway Before and After

Back of Shop Before and After



Tires Before and After



Wheel Storage Before and After



Donated Bikes Tagging System

DATE: / /

**FRONT
YARD
BIKES**

**KEEP
FOR SALES FLOOR**

☐

**KEEP
BIKE FOR PARTS**

☐

**SEND TO
TERRACE**

☐

**PART
CHECKLIST**

**FRONT
YARD
BIKES**

	FUNCTIONAL	MISSING
SHIFTERS	☐	☐
BRAKES	☐	☐
CALIPERS	☐	☐
LEVERS	☐	☐
GEARS	☐	☐
FRONT DERAILLEUR	☐	☐
REAR DERAILLEUR	☐	☐
CASSETTE/FREEWHEEL	☐	☐
SEAT	☐	☐
FRAME	☐	☐
BIKE CHAIN	☐	☐
CRANKSET	☐	☐
WHEELS	☐	☐
HANDLEBAR	☐	☐
GRIPS	☐	☐
STEM	☐	☐
PEDALS	☐	☐

NOTES

TIME
NEEDED
TO FIX

☐ 1 day

☐ 2 days

☐ 3 days

☐ 1 week

- Designed for the mechanics and managers
- Goes hand-in-hand with labelling and signage
- Tool to manage influx of donated bikes

Front of Bike Tag

- 3 Zones
 - Keep for sales floor
 - Keep bike for parts
 - Send to Terrace
- Storage Capacity Board

Back of Store Bike	Capacity	/55
Fix-Up Bike	Capacity	/35
For Parts Bike	Capacity	/10
Terrace Bike	Capacity	/10

DATE: <u> </u> / <u> </u> / <u> </u>	FRONT YARD BIKES
#	
KEEP FOR SALES FLOOR	☐
KEEP BIKE FOR PARTS	☐
SEND TO TERRACE	☐

Back of Bike Tag

- Part checklist
 - Functional
 - Missing
- List of all bike parts
- Notes section
- Time needed to fix checklist

PART CHECKLIST



	FUNCTIONAL	MISSING
SHIFTERS	☐	☐
BRAKES	☐	☐
CALIPERS	☐	☐
LEVERS	☐	☐
GEARS	☐	☐
FRONT DERAILLEUR	☐	☐
REAR DERAILLEUR	☐	☐
CASSETTE/FREEWHEEL	☐	☐
SEAT	☐	☐
FRAME	☐	☐
BIKE CHAIN	☐	☐
CRANKSET	☐	☐
WHEELS	☐	☐
HANDLEBAR	☐	☐
GRIPS	☐	☐
STEM	☐	☐
PEDALS	☐	☐

NOTES

TIME NEEDED TO FIX

☐ 1 day

☐ 2 days

☐ 3 days

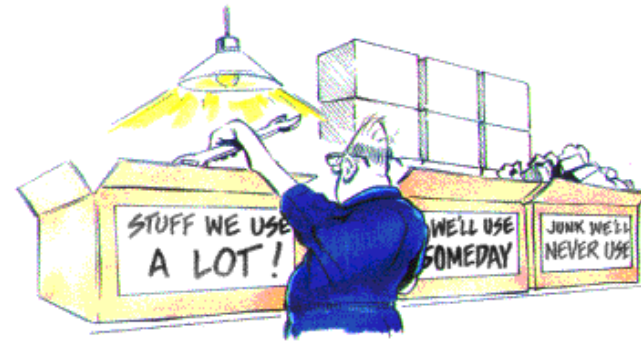
☐ 1 week

Implementation of Bike Tags

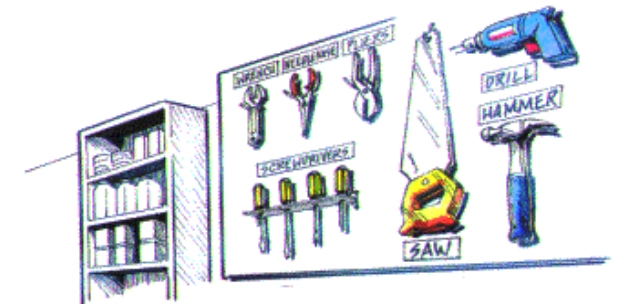


5S Checklist

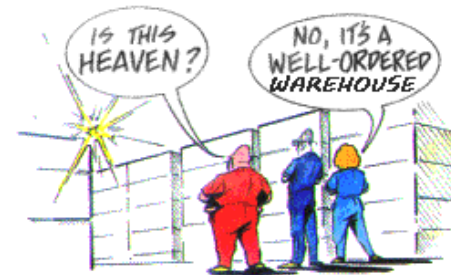
1. Sort
2. Set in Order
3. Shine
4. Standardize
5. Sustain



1. Sort



2. Set in Order

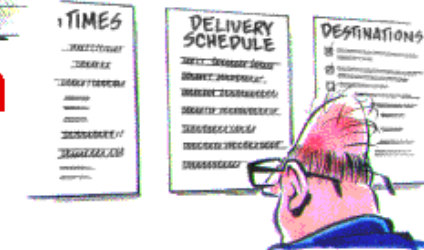


5. Sustain

5S's



3. Shine



4. Standardize

Training procedures for inventory management system

- Checklists



- Schedules



- Designate responsibilities

Front Yard Bikes at Mid-City
Inventory Management Procedures: Organizational “5S” Back of Shop Checklist

Every Monday Follow This Checklist

- ☐ Walk around the back of shop and check if there are **Any Non-Bike Parts**
If there are any non-bike parts, move them behind the register or put them within the storage closet.

Count inventory and sort for one of the categories.

Week 1	Hubs
Week 2	Handlebars
Week 3	Front & Rear <u>Derailleurs</u>
Week 4	Cranks (Square Taper and Other)
Week 5	Bottom Brackets (Square Taper and Other)
Week 6	Training Wheels, Cable Splitters, Handlebar Accessories and Miscellaneous
Week 7	Stems (1 1/8 inch thread less. Quill)
Week 8	Handlebars
Week 9	Seat Posts, Kickstands, and Seats
Week 10	Peddles & Peddle Cages
Week 11	Brakes (V Brakes, Caliper Breaks, Cantilever, <u>Centerpool</u> , Disc)
Week 12	Brake levers (Road, Mountain, Break)
Week 13	Shifters (Road, Mountain)
Week 14	Chain Rings (BMX, Standard)
Week 15	Wheel Rims
Week 16	Tires

*After 16 Weeks, Start over at Week 1

- ☐ Update the POS system inventory totals.
- ☐ Assess the donated bike capacity of the shop.
If any area is overcapacity, determine lower priority bikes to leave the shop to make room. Load the trailer with the lower priority bikes and Terrace street bikes to move them to Terrace.

Front Yard Bikes at Mid-City

Inventory Management Procedures: Processing Bike Donations

Bike Donation Procedure:

1. When a bike is donated, ask the donor to fill out the designated donation paperwork.
2. Tag the bike with the “Processing Donation Bike Tag” and categorize it by check boxing one of the three categories.

Write the date on the tag and your initials.

KEEP FOR SALES FLOOR ☐

KEEP BIKE FOR PARTS ☐

SEND TO TERRACE ☐

3. Update the capacity whiteboard accordingly.

Back of Store Bike Capacity /55

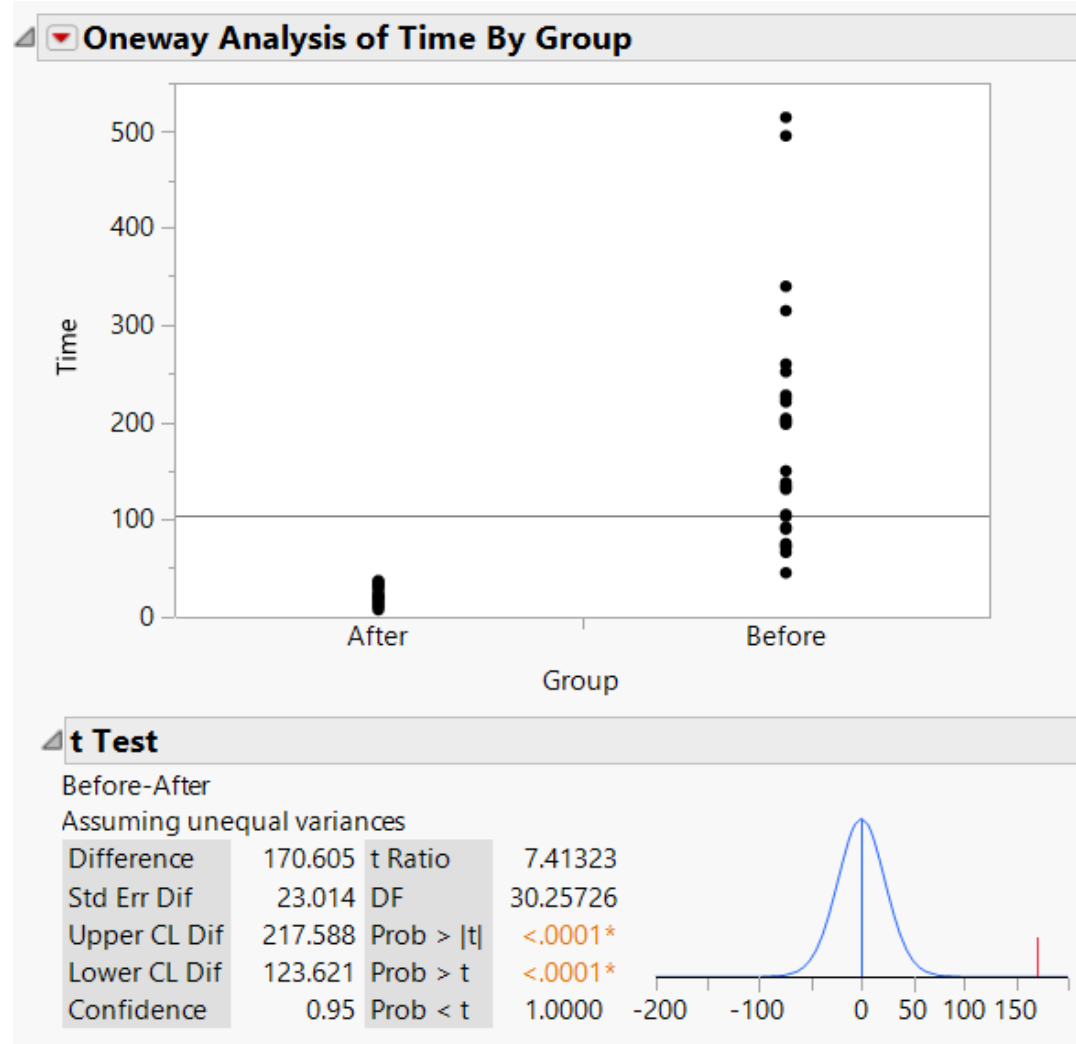
For Sale Bike Capacity /35

For Parts Bike Capacity /10

Terrace Bike Capacity /10

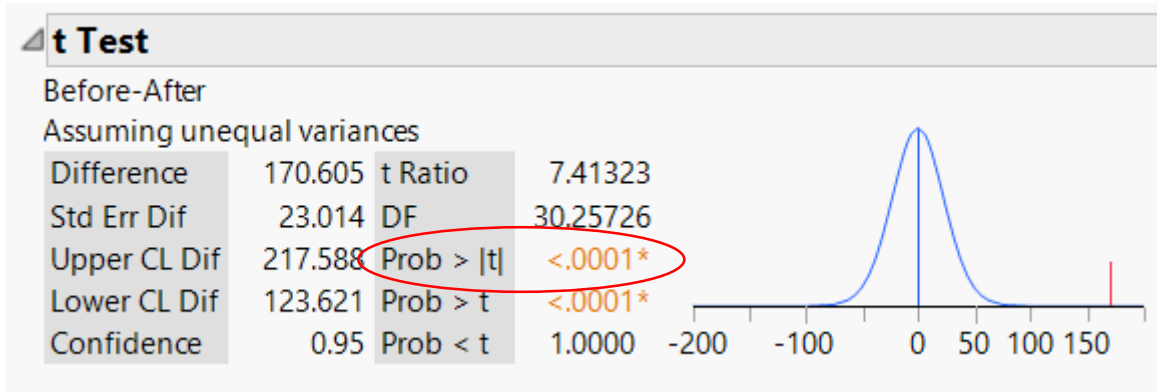
4. Update the POS system or tell the manager to.
5. Bring the bike to the color taped zone it belongs to.

Statistical Analysis (t-test)



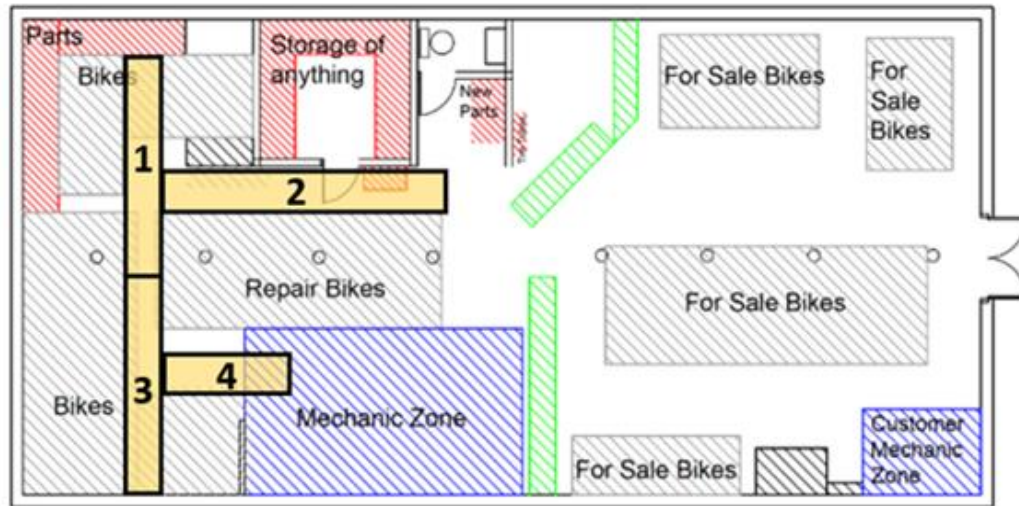
- Used JMP statistical software
- Conducted a t-test
 1. Stated the null and alternative hypotheses
 2. Set level of significance
 3. Conducted a test of means (t-test)
 4. Generated p-value
 5. Compared p-value to alpha level
 6. Developed a conclusion

Statistical Analysis (t-test)



- Used JMP statistical software
- Conducted a t-test
 - $H_0: \mu_{\text{difference}} = 0$
 - $H_1: \mu_{\text{difference}} \neq 0$
- Alpha level = 0.05
- $<.0001^* < 0.05$
- Reject the null hypothesis

Aisle Space Percentage



Section	Length (inches)	Pre-Implementation Average Width (inches)	Pre-Implementation Walkway Area (in^2)	Post Implementation Current (Minimal) Walkway Area (in^2)
[1]	120	22.875	2745	3600
[2]	250	27.38095	6845.2375	7500
[3]	135	19.64286	2651.7861	4050
[4]	100	29.7	2970	3000
Total			15212.0236	18150

Minimal Walkway Area = Length of Pathway Space × 30 inches (minimum width)

$$\text{Aisle Space Percentage} = \frac{\text{Cube Space Occupied By Aisles}}{\text{Total Cube Space}} = \frac{15,212.01}{18,150} = 83.81\%$$

- **16.2 %** of the back of the shop's pathways were occupied by bicycles

$$\text{Aisle Space Percentage} = \frac{\text{Cube Space Occupied By Aisles}}{\text{Total Cube Space}} = \frac{18,150}{18,150} = 100\%$$

Economic Analysis

Economic cost	
Bin Cost	\$98.73
Wood Working Shelving Cost	\$73.76
3rd tier wheel rack Cost	\$40.57
Tire rack material Cost	\$20.95
Laminating	\$38.56
Sub Total of Materials	\$272.57
Employee time Cost	\$220.00
Total Cost	\$452.57

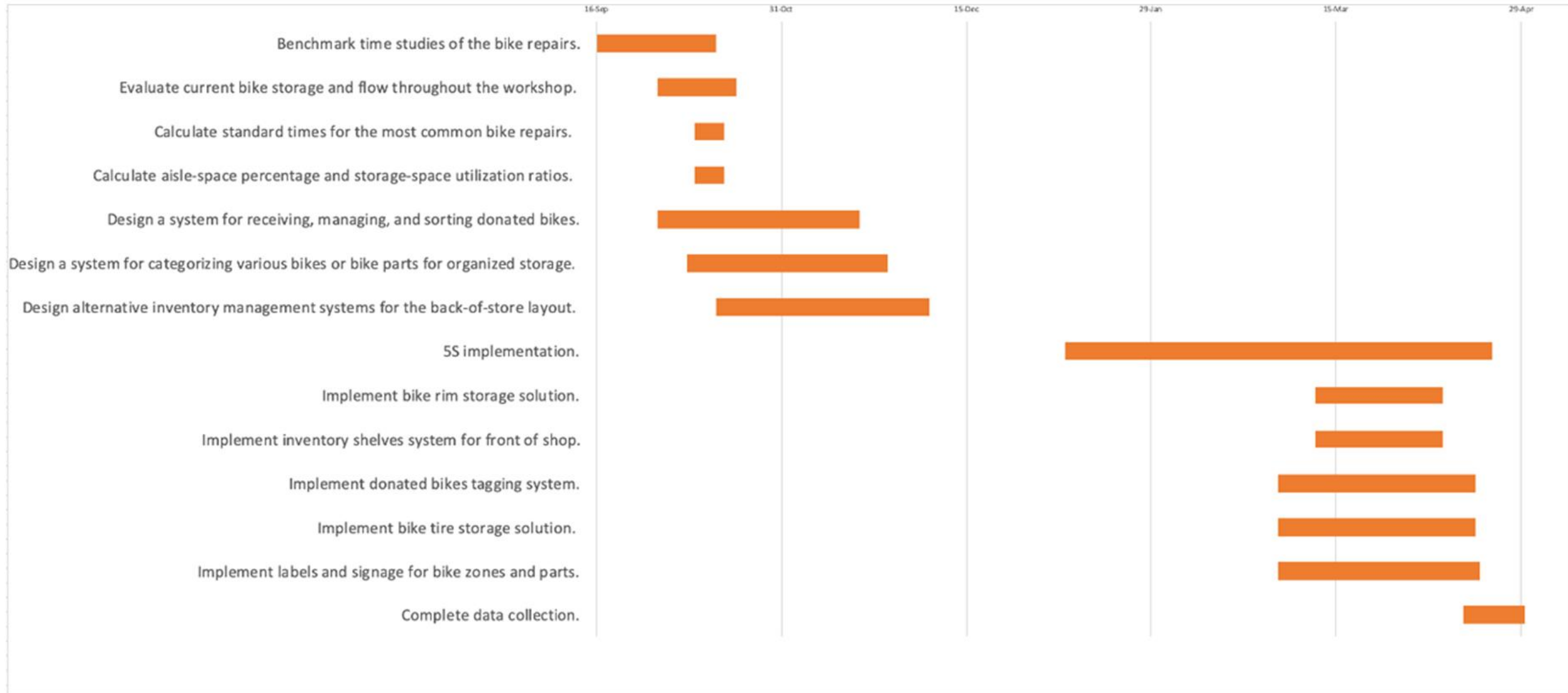
- Average Time Decrease Overall = **170 Seconds** over 2-week Period
- 170 seconds x 31 parts = **5,288 Seconds Saved Bi-Weekly**
- **2,644 Seconds Saved Weekly**
- 2,644 seconds saved weekly x 50.5 weeks (to account for holidays) = **133,522 Seconds Saved Per Year**
= **37.089 Hours Saved Per Year**

37.089 Hours Saved per Year X \$10 Salary (Mechanic) = **\$370.89 Saved Yearly**
37.089 Hours Saved per Year X \$17.5 Salary (Manager) = **\$649.06 Saved Yearly**

Average of \$509.97 Saved Yearly

$$\text{\$452.54} < \text{\$509.97}$$

Project Schedule



Final Recommendations: Objectives

- Reduce time searching for parts when repairing bikes by 20%.

"Yes, the time the mechanics and I have spent time searching for parts has been reduced" - Will Adams

- Implement an overall inventory management system.

"Yes, everything is better organized and more logically placed. The signage helps keep everything organized and easier to find things. The bike zones also help accomplish this" - Will Adams

- Maintaining an organized and clean workplace area.

"Yes, definitely from the bike zone system. It has made pathways clearer and he's a happier person all in all." - Will Adams

- Create and implement a system to process donated bikes.

"Yes, with the tagging system it ensures all employees are on the same page and have the same information on the bikes that are donated." "Less discussion had to take place to understand the situation with each bike. - Will Adams

Final Recommendations: Next Steps

- Management should follow the two sustain documents
 - Bike Donation Processing Procedure (Every time a Bike is Donated)
 - 5s Checklist (Weekly)
- Keep the system operational by maintaining at a capacity of **55 bikes**
 - Prioritize bikes to keep at the shop, re-allocate others
- Future Work: Donation Bikes Received vs Up-Cycled Bikes Built Ratio
 - FYB receives a lot more donations than what can be produced
 - Backlog of bikes

Conclusion

- The 4 management objectives achieved improves inventory awareness overall visually.
- The results yielded a safer and more efficient shop.
- Keeping the shop lean saves operational time and money.

FRONT
YARD
BIKES

Questions?