Background

Building construction and remodeling, manufacturing, demolition, and other projects generate large quantities of waste wood and wood-containing materials: scrap lumber, doors, windows, cabinetry, shelving, paneling, siding, shakes, shingles, wooden furniture, wooden pallets, etc. Currently, although some materials, such as serviceable cabinets, doors, windows, and shelving can be salvaged for re-sale, most of this can go into landfills. But we could dispose of these materials much more responsibly.

For example, some hardware, including screws, hinges, and metal brackets, could be stripped from the wood for re-sale and re-use. Other hardware, such as nails and other metal fasteners that are not re-usable, could be removed and recycled. Clean wood, that is, wood not contaminated by adhesives, paint, varnish, or other finish or preservation substances, could be ground up and converted into a variety of marketable products. Even some contaminated wood could be burned as “hog fuel” in power plants or other industrial systems. Only a very small amount of residue need be truly discarded.

Some organizations are exploring the concept of producing marketable products from discarded wood materials. For example, one particularly promising strategy is to chip and grind clean wood, compress it into pellets, and sell the pellets for residential pellet stoves. However, for this to become a commercially viable process, discarded wood materials must be stripped of virtually all hardware so as not to damage the wood reduction equipment and separated from contaminated wood. Removed hardware must be sorted for re-sale or recycling, and contaminated wood must be sorted for combustion or final discard.

Need

A local firm plans to implement a system to convert waste wood materials into marketable wood pellets so as to also yield salable hardware, recyclable hardware, and hog fuel as byproducts, with minimal residual waste. This customer has a yard for incoming and outgoing materials and plans to purchase grinding and pelletizing machines. A previous MIME Capstone project created the overall design for a Wood Waste Processing System (WWPS\(^1\)). Waste wood coming into the WWPS will be unloaded and sorted into salable items (e.g., good shelving), clean wood for pelletizing, hog fuel, and unusable waste.

The remaining items will be broken down in the WWPS Breakdown Subsystem (BDS) to yield clean wood for pelletizing, usable hardware, hardware for recycling, and unusable waste. The customer has asked the IE 366 class to design the BDS, a work system for a small crew of workers to break down wood waste as described above.

Customer Requirements

Following are the customer's requirements for the WWPS BDS.

1. The BDS shall accommodate a crew of up to three *large* workers.
2. All functional elements of the BDS shall be *easily* accessible to *small* workers.
3. The BDS shall provide means for workers to remove all hardware from incoming wood materials.
4. The BDS shall provide means to sort broken down materials into *suitable categories* for disposition.
5. The BDS shall be contained in a space not to exceed 20' x 10'.

\(^1\) WWPS can be pronounced “woops!”. It should not be confused with WPPSS, the Washington Public Power Supply System.
6. The BDS shall include all tools and equipment needed for *hardware removal operations* and *sorting operations*.

7. The BDS shall include an Operations Manual, *easily accessible* to workers, that contains written procedures for BDS operation.

8. The BDS shall be *safe* for workers.

9. The BDS should be *comfortable* for workers.

10. Implementation costs for the BDS shall not exceed $1,500.