

PRODUCTION TARGETS

- The client identified four production targets to analyze: 75, 150, 200, and 500 units per year.
- Takt times (cycle times required to meet yearly demand) were calculated for each production target.
- Takt times became the base for simulating the facility, to determine the number of employees, machines, etc. to achieve these targets.

ANALYZING THE DATA

- Production steps and process data were provided by the client.
- Due to the long production time for one bicycle frame, the process could not be observed with a time study. Estimations from the client served as the process times for simulation.
- Process times provided by the client were “best case” scenarios, where there were little to no delays in the process.
- 20% allowance was added to the data to account for PF&D – Personal, Fatigue, and Unavoidable Delays.
- Due to lack of historical production data, the process times were chosen to be described by a uniform distribution. The minimum possible time was assumed to be a “perfect” operation with no allowance, and the maximum would be a “worst case” operation with the full 20% allowance.

CELILO CYCLES FACTORY EXPANSION

Developing takt times, simulating production, and generating layouts for local upstart wooden bicycle manufacturer Celilo Cycles.

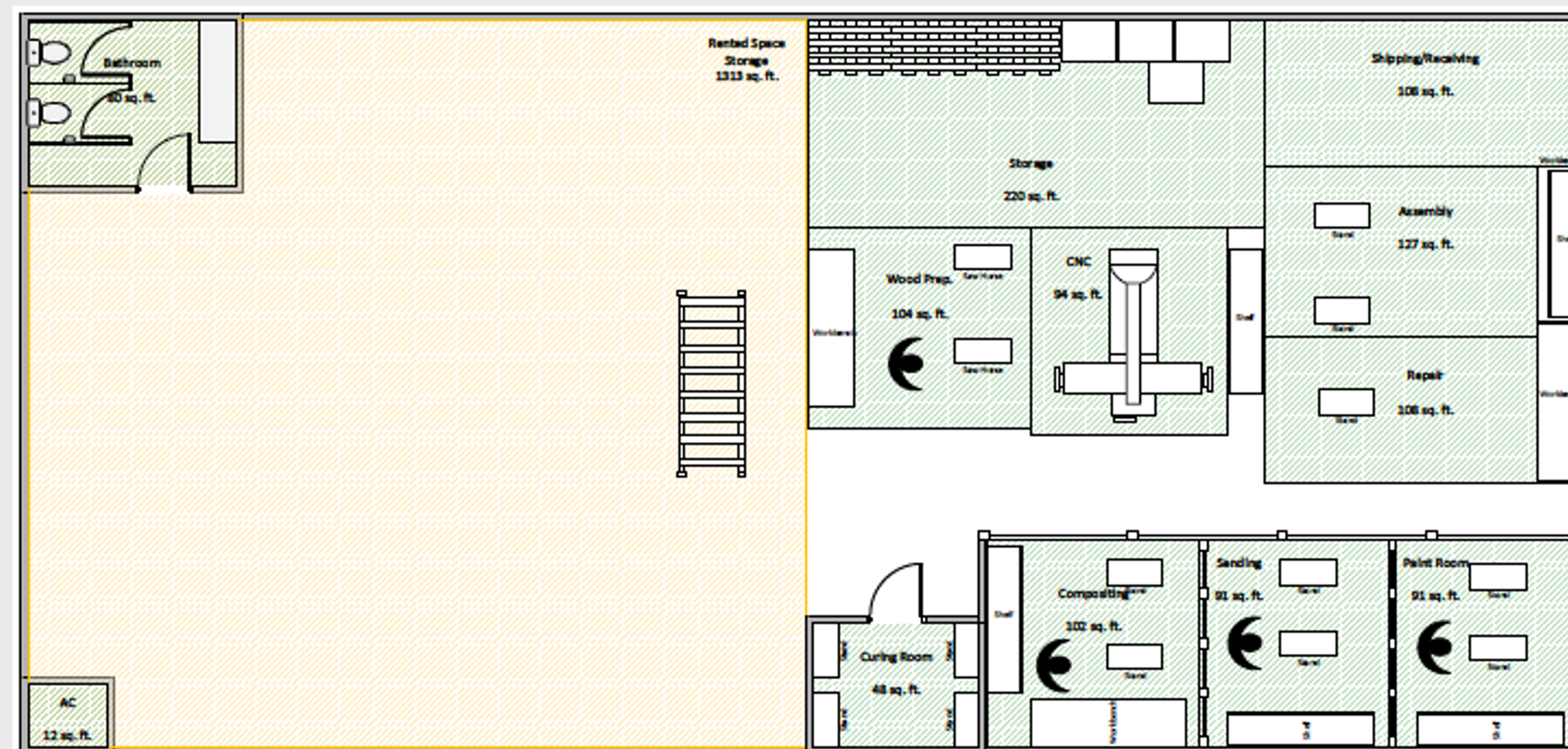


Figure 1: Layout generated for 150 units per year.

LAYOUT GENERATION

To construct the layout, we used a method called as Systematic Layout Planning (SLP). This method helps us in determining the proximity of each workstation. We can then generate the layout based on the closeness of each workstation that we identified in the previous step.

SAFETY RECOMMENDATIONS

- Wearing suitable clothes, such as long-sleeved shirts or long pants, is advised. Wear a lab coat if at all feasible.
- Wear goggles at all times to protect your eyes from sharp objects.
- Familiarize yourself with the emergency route in the event of an emergency
- Never eat or drink inside the factory
- Adhering to Covid safety measures.

SIMULATION

- Simulation was created in Arena simulation software.
- Each operation of the bicycle frame production process was analyzed to determine its total time, the step in which it needed to occur, and the resources it required.
- The resources for these steps were identified as: production operators, CNC machines, bicycle mount, work bench, sanding kit, and circular saw.
- Takt times represented an “arrival rate” of new orders to the system. If the system could produce a given number of units per year, the final output would match the takt time (or be close to it).
- Simulations were run for 261 days, for 7.5 hours per day to simulate a whole year of eight-hour workdays. Each simulation ran for 5 replications to account for variability in process times.
- When a simulation could produce the yearly production target, the number of resources were recorded, as well as their average utilization.

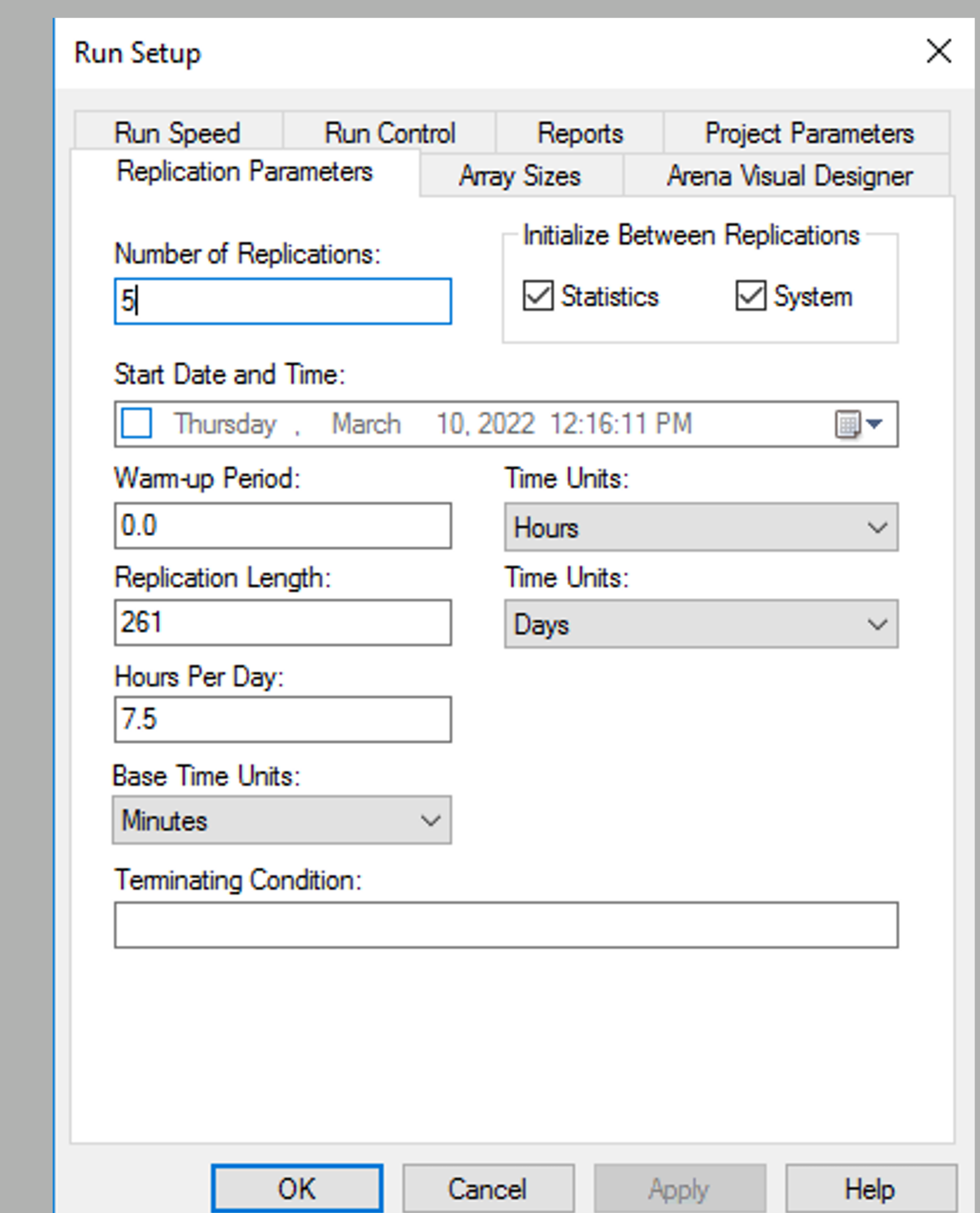


Figure 2: Simulation run parameters for Celilo Cycles simulations.