

AMHS Simulation Safety Factor Analysis and its Impact to 300mm Fab Design

Authors: Chung-Soo Han, Paul Stachura, Detlev Glueer, Eric Christensen, Advanced Micro Devices, Ike Ikeda, Murata Machinery

System design for 300mm AMHS is critical to maximizing overall fab productivity with full automation capability, compared with 200mm AMHS. The simulation for unified interbay and intrabay track design is critical for determining an efficient AMHS design and even selecting an AMHS supplier. Simulation is performed based on overall tool layout in the fab and typical process operation procedures. A driving aspect of the design is the simulation safety factor because the AMHS must cover not only the production lot delivery, but also non-production lot delivery. Appropriate AMHS design can cover all delivery requirements throughout the fab life cycle time and also reduce initial capital expense and upgrade investment in the future. The following are delivery requirements that need to be considered for the simulation throughout the fab life cycle.

- Current production lot: only known delivery at the beginning of fab
- Manufacturing technology improvement: tool throughput improvement
- Design improvement: reduced device pitch size means more process steps.
- Production bubble: due to strategic and technical reason.
- Engineering lot: introduce new product, send ahead and child lots etc.
- Non-production lot: monitoring, test, rework, and scrap wafers, dummy carrier move for stocker load balance etc.
- AMHS down: bypass the downed track area increases delivery in adjacent track or bay

The analysis shows that even at the beginning of the fab the delivery requirements are about 127% ~ 165% of production lot delivery (this depends on the fab production type). The worst case at the end of fab life could be more than 250%. But there are factors to improve AMHS throughput with same AMHS system during the fab life cycle, which can reduce overall AMHS delivery burden.

- Reduced average AMHS delivery cycle time: improvement by material control and delivery scheduling system, and increasing implementation of ZFS (Zero Footprint Storage)
- Increased direct tool-to-tool delivery percentage

Even considering the AMHS throughput increase, the simulation safety factors should be around 150% ~ 230% to meet delivery requirements in the fab at the beginning and during the life cycle of the fab. Simulation results show that the AMHS throughput is increased linearly with simulation safety factor increases while the number of vehicles and track length are increased non-linearly. AMHS simulation with appropriate safety factor should be considered to support delivery requirement and to reduce initial AMHS capital spending. The study also reviews considerations required when the simulated throughput increases, such as placement of additional tools.