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SIMULATION OF THEME PARK RIDE DESIGN AND OPERATIONS

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ABSTRACT

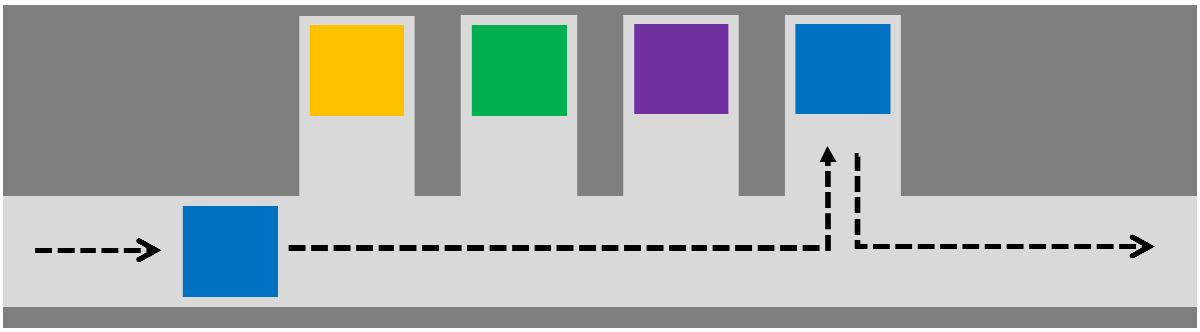
Simulation was used to help design engineers better understand the operating dynamics of a unique, not-yet-built theme park ride to gain insight into whether or not the ride is likely to function as designed while keeping within safety parameters. The analysis also assessed different methods of configuring ride operations to maintain maximum rider throughput and avoid interruptions to the rider experience resulting from delays in the load/unload station. Factors assessed through this analysis included time limits for rider load/unload, timing of ride switches, inbound/outbound velocity and acceleration of ride vehicles, locations of vehicle buffers, and station dispatch sequencing. Simio simulation software was used to build the model. Due to confidentiality requirements, ride details and the client organizations cannot be named.

1 INTRODUCTION

Strongside Technologies was contracted to help a company test and refine their designs for a ride attraction in development for a major theme park. Due to the complex vehicle control systems and synchronized vehicle movement with little room for error, simulation was selected as a method to bring the ride designs to life and provide engineers with confidence about whether or not their ride is likely to perform as designed. Simulation videos, screen snapshots, and a detailed positional analysis were all used to provide the engineering team with the evidence they needed to move the project forward.

2 OVERVIEW OF THE RIDE SYSTEM

The main components of the ride system are as follows: autonomous ride vehicles, the ride track, the station track, 4 load/unload bays, and 4 switches to move the ride vehicles from the station track to the loading bay. Guiding this system is a consistent pulse with ride vehicles both entering and exiting the station at a constant rate. When a ride vehicle has been loaded with passengers and leaves the loading bay, the next incoming ride vehicle will approach the outbound vehicle and move into the newly available loading bay. A schematic screenshot of the station area is shown below.

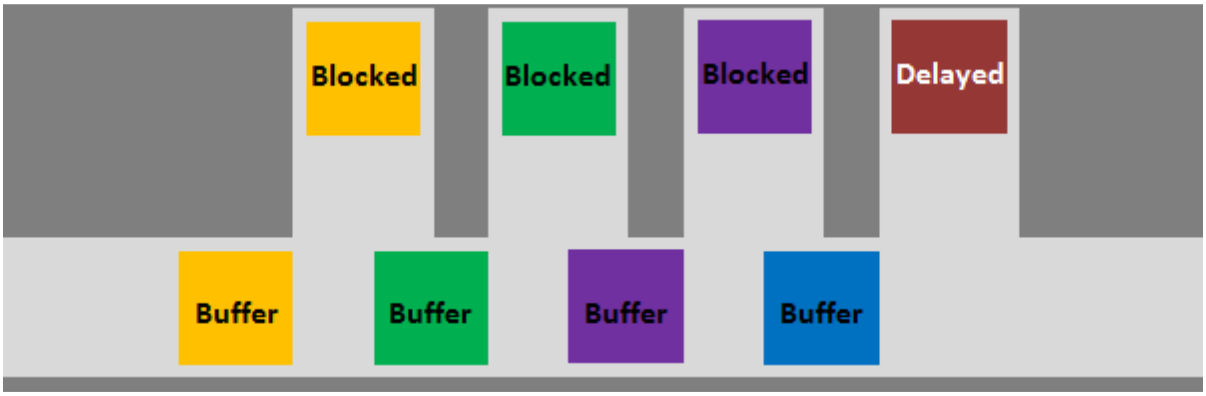


3 MODELING OF THE INITIAL STATION DESIGN

The starting point for this analysis was to build a baseline simulation of the ride station based on the initial design parameters to determine whether or not the system would be likely to operate safely and as designed. Using the pulse rate of X seconds along with the estimated load/unload times, vehicle performance, and switch timing, we modeled only the station section of the ride with vehicles being disposed upon exit from the station. The analysis showed that under baseline conditions, there would likely be vehicle collisions in the station area so changes would be necessary. Using the simulation, we were able to identify a combination of loading times, switch speed, and vehicle acceleration that would alleviate the synchronization problems in the station.

4 EXPANDING TO THE FULL RIDE SYSTEM AND STRESS TESTING

After a round of changes to the station design, the simulation was expanded to include the entire ride system. This model operates as a closed system with ride vehicles exiting the station, proceeding through the ride track, and eventually returning to the station. At this point we needed to consider the additional complexity of ride vehicle synchronization in order to maintaining the consistent X-second cycle in and out of the station. At this time we also assessed the impact of delays in the load/unload station. Due to the precise timing required and lack of buffer space for incoming vehicles, any station delays could easily result in the ride becoming backed up and guests having their ride experience interrupted. Multiple scenarios were assessed to better understand how many guests would likely be impacted if delays of up to two minutes occurred in the station. A vehicle buffering strategy was developed to reduce the number of ride vehicles impacted by these station delays. Unfortunately, this solution came at the cost of lower ride throughput since outbound vehicles that would otherwise be ready for dispatch were being blocked by the buffered vehicles. Because of this, a more flexible solution was investigated.



5 FLEXIBLE RIDE OPERATIONS

The next phase of the work was to investigate the possibility of using alternate station dispatch sequences to take advantage of fast loaders and mitigate potential station delays. Instead of ride vehicles being dispatched in the same repeating sequence, we assessed whether or not the ride would continue to operate as designed if this sequence was altered (i.e. vehicles dispatched in the reverse sequence and an alternating sequence). After making some adjustments to station parameters, we were happy see all the test sequences working as well or better than the original scenarios. This phase of work is ongoing, but initial results have been promising...