Using Fixed Route Transit to Improve Paratransit Service Quality
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Introduction
- Paratransit is a flexible route public transit system for the elderly and handicapped
- Paratransit systems follow a shared-ride model, leading to long wait times
- Coordinating Paratransit with bus schedules could reduce overall service time

Methods
- Ride requests were scheduled using greedy scheduling algorithm with local search algorithm Generalized Task Swap in addition[1]
- Generated schedule was tested using statistical simulator, written in Python
- Bus schedules randomized using CDFs of Port Authority historical data
- Total Ride Duration was used as the main performance metric

Results
- 15 simulations were run per headway parameter
- 14% of the requests for one day were identified as candidates for using the bus based on the distance from the pickup location

Results from Entire set of requests vs Candidate subset

<table>
<thead>
<tr>
<th>Headway</th>
<th>Min</th>
<th>Max</th>
<th>Average</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>00:00:56</td>
<td>01:17:49</td>
<td>00:13:31</td>
<td></td>
</tr>
<tr>
<td>5 min</td>
<td>00:00:57</td>
<td>01:36:47</td>
<td>00:14:40</td>
<td></td>
</tr>
<tr>
<td>10 min</td>
<td>00:00:57</td>
<td>01:36:46</td>
<td>00:15:04</td>
<td></td>
</tr>
<tr>
<td>15 min</td>
<td>00:00:59</td>
<td>01:36:59</td>
<td>00:15:22</td>
<td></td>
</tr>
<tr>
<td>30 min</td>
<td>00:00:57</td>
<td>01:37:15</td>
<td>00:15:57</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
- Adding fixed route transit decreases ride duration for long trips, but increases duration for short trips

Future Work
- Add minimum distance covered on bus as candidacy constraint
- Analyze system using other performance metrics such as cost or capacity
- Increase standard deviation of paratransit travel time distribution to more realistically simulate traffic conditions
- Test simulation using dynamic paratransit scheduling
- Schedule paratransit rides to a particular bus time, instead of waiting for next bus
- Test feasibility of holding the bus based on scheduled paratransit arrival at stop

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