



INFORMS Transactions on Education

Publication details, including instructions for authors and subscription information:
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To cite this article:

Amit Pazgal, Gilles Reinhardt (2014) Case—Take Me Out Of The Ball Game. INFORMS Transactions on Education 14(3):139-139.
<http://dx.doi.org/10.1287/ited.2014.0126cs>

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Case

Take Me Out Of The Ball Game

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When the Chicago Cubs™ finish playing an afternoon baseball game at Wrigley Field, their home stadium, tens of thousands of fans start heading for the neighboring train station, the “Addison Red Line el stop,” and often experience very long delays before boarding their train home.

Assume that 40,000 are in attendance at Wrigley on a given afternoon and that three quarters of them, 30,000, will board a CTA train at Addison once they leave the game. Further assume that fans start heading for the el at 4 P.M. (at the end of the 7th inning stretch) at a rate of 100 per minute for one hour. At 5 P.M. (the end of the game), people head for the el at an increased rate of 175 per minute. The rest of the fans enjoy the local establishments and leisurely start to head home at 6 P.M. (at a rate of 135 people per minute). To get on a train, fans walk into the station, go through the turnstiles, and climb up the stairs to the platform. Trains pick up passengers at an average rate of 120 per minute since they carry approximately 1,200 people each and run every 10 minutes. With no additional attendants, all regular working turnstiles process 60 people per minute. Each additional attendant increases this rate by 40 people per minute. Suppose the Chicago Transit Authority

(CTA) staffs the turnstiles with two additional attendants from 5 P.M. onward. Assume that only baseball fans board at Addison from 4 P.M. onward and that no fan is deterred by the long queues.

1. At what time will the last fan have boarded a train home?

2. Estimate the overall average waiting time, and the average waiting time of fans that left at 4 P.M., 5 P.M., and after visiting neighboring establishments.

3. You have been hired as a consultant to the CTA and tasked with recommending process improvements.

(a) If staffing one more turnstile costs \$ X per hour, increasing the train capacity by 20 people/min costs \$ Y per minute, and fans have a waiting cost of \$ Z per minute, which system structure is best for (i) the CTA, (ii) the fans, and (iii) both?

(b) Can you suggest “small cost” incentives that could lower the costs to the CTA and the fans?