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GreenLandings® Program
Excess Taxi Times in Atlanta

Contents

1. Forward

This analysis measures the taxi time difference at Atlanta between when the GreenLandings® queue management tool was on and sending RTAs to Delta pilots versus when GreenLandings® was off. Additionally, there was a noted difference when Delta introduced the Target Landing Window process.

2. Executive Summary

It has been noted over the past several weeks that the "gap" between gate accuracy and runway accuracy in the GreenLandings® ETAs has increased. The magnitude of this increase has been between about 10% to 20%.

A detailed study of taxi times in Atlanta has shown that this gap between runway and gate accuracy was in fact due to increased taxi times, and in particular, an increase in taxi times greater than 17 minutes.

The mechanism of this increase in taxi times has been identified as a change in the pattern of arriving traffic. ATH has identified two significant changes:

1. An increased number of aircraft arriving ahead of schedule and waiting for a gate, and,
2. Increased randomness of traffic with respect to schedule.

The data correlates these changes to three separate events:

1) Moving the target arrival time from -1 to -6 minutes ahead of schedule,
2) Introduction of an aircraft centric Target Landing Window, and
3) Further moving the optimum arrival time from -6 to -10 minutes before schedule

The impact of these changes has been an increased number of gate conflicts as measured by gate changes within the last 20 minutes of flight, increased number of taxi time outliers (taxi greater than 17 minutes), increased taxi times, increased average fleet speed, and decreased A0 performance. ***The preferred solution would be to resume GreenLandings® optimization to smooth out traffic randomness, and to change the target landing time to some value closer to scheduled landing time.***

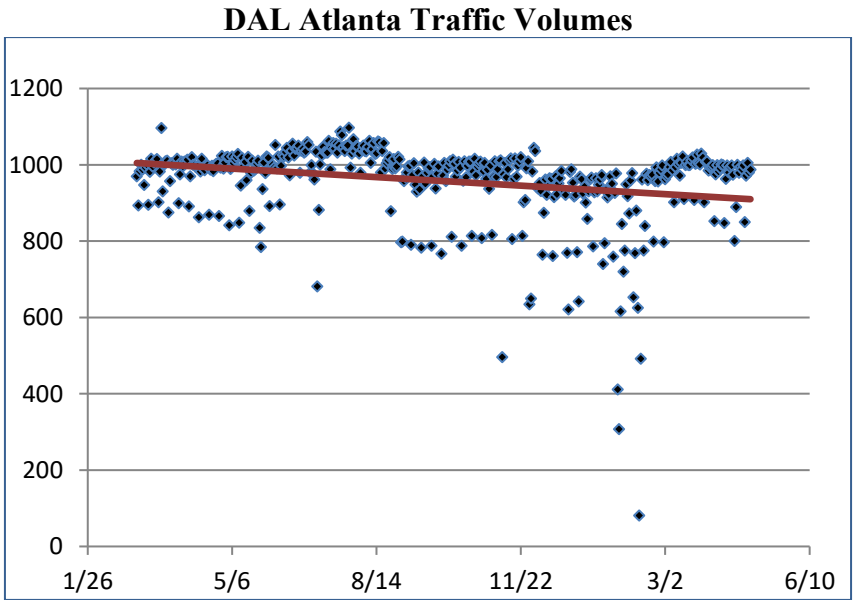
The analytical tools used in this report could in fact derive the best target time to reduce taxi time, improve A0, and reduce fleet speed. The GreenLandings® optimization engine could use this exact number as a goal.

3. Method

Taxi times were measured using Delta Airlines "In" times minus "On" times. The data used was ACARS "OOOI" data. This data is routinely collected for all Delta flights.

4. Traffic volumes

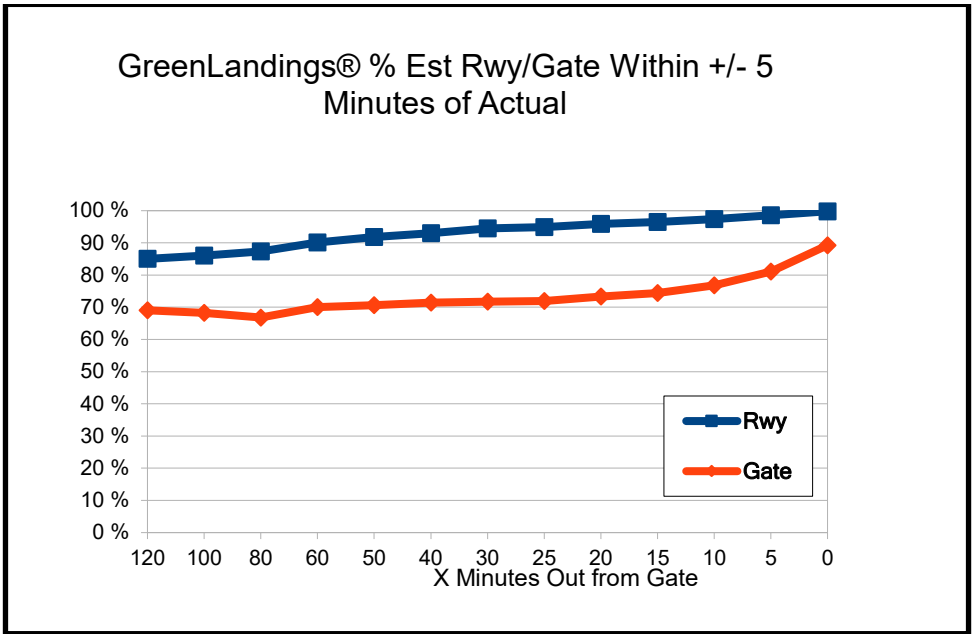
First, we looked at overall traffic volumes, to see if there had been an increase in demand. As you can see from the chart below, traffic volume does not appear to have been a factor.



5. ETA Accuracy "Gap"

Routine ETA accuracy reporting began showing a drop off in the gate "in" time accuracy in Atlanta in the early part of 2014. This came to be known at the "gap". This gap has increased from about 10% to about 20%.

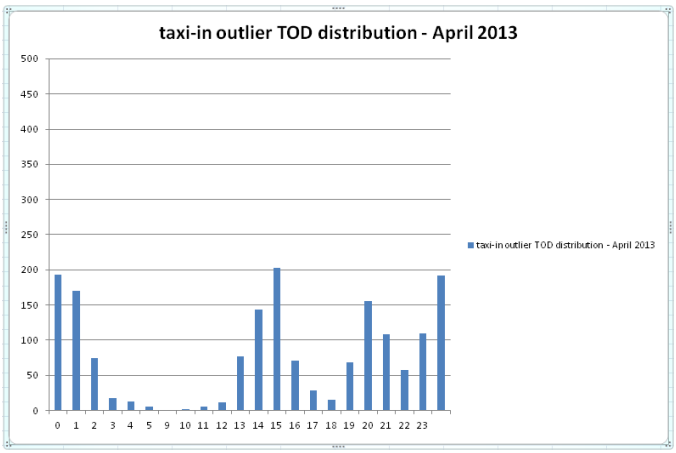
Below is the ETA accuracy report for the most recent time period in ATL.

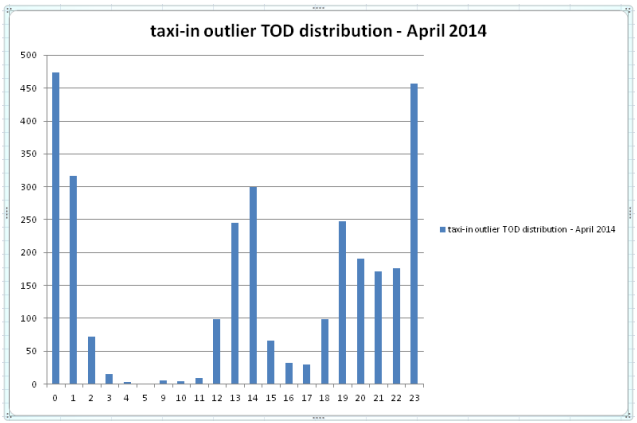


6. Taxi Outliers

An investigation of the mechanism of the changes leading to the gap, showed a marked increase in the number of taxi outliers. An outlier is defined as a taxi value greater than 17 minutes. These values are normally filtered out of the taxi tables because they are thought to be anomalies and mostly due to data errors.

The charts below show the number of outliers observed in Apr 2014 versus approximately the same period in 2013. As you can see, there is a marked increase in outliers in 2014.





7. Cause of Outliers

Further analysis was done to understand the mechanism of the increase in taxi in outliers.
We began by looking at the relationship between excess taxi time, and proximity to scheduled "on" time.

a. Proximity to Schedule

The proximity to schedule was studied to determine if there was a systematic change to how flights were landing as compared to schedule. The charts below show a clear increase in the "randomness" in the schedule variance when observed by time of day.

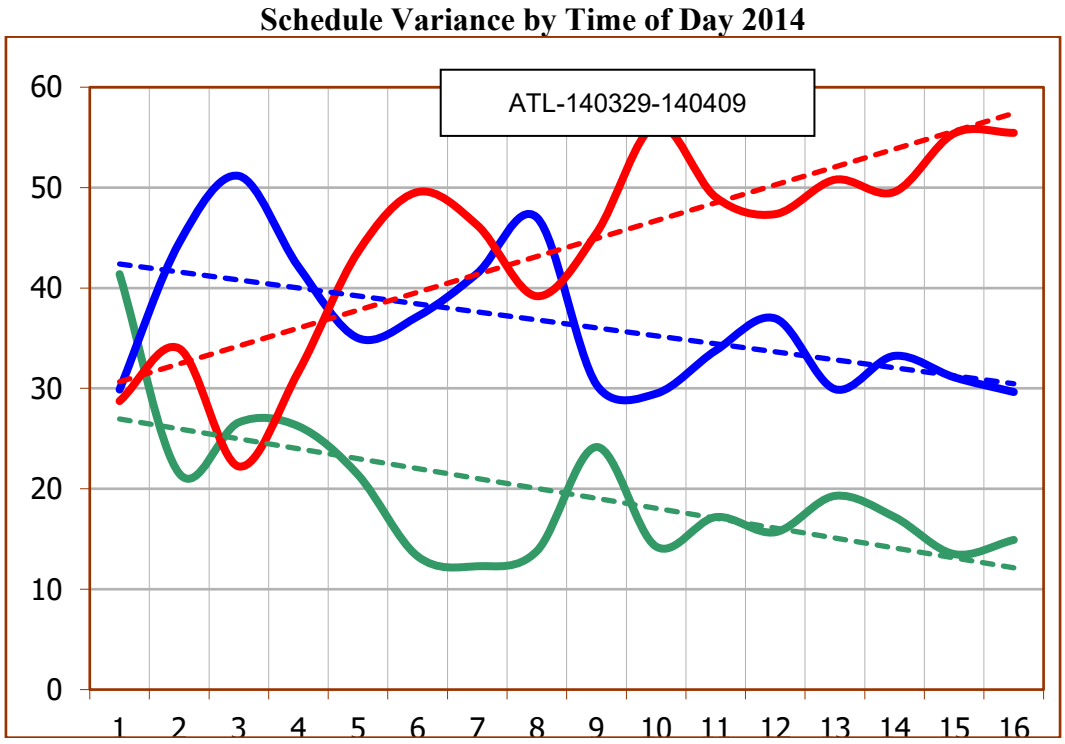
In this chart the blue line indicates arrival within the Target Landing Window (TLW), the green line indicates early with regard to the TLW, and the red line indicates late.

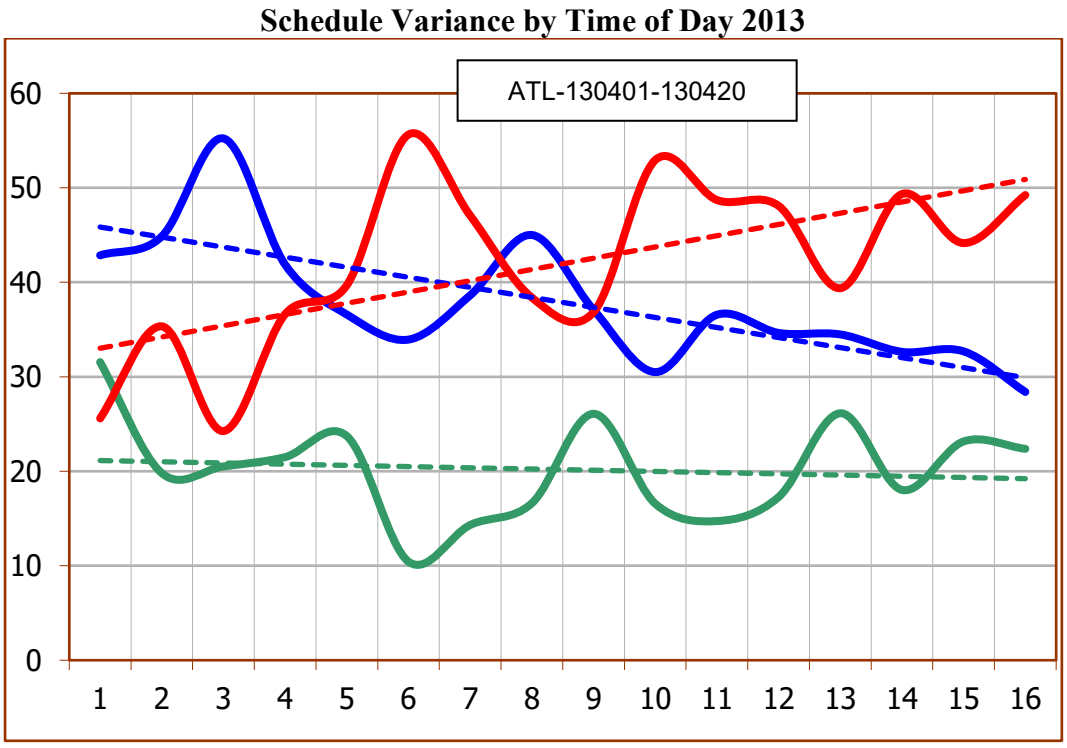
First, please look at the chart from 2014. Note that the slope of the red line is strongly positive. This indicates that more flights are getting late as the day goes on. The green line slope is strongly negative, indicating that fewer flights are early as the day goes on.

Next, please look at the 2013 chart. This was a period when GreenLandings®™ was on and using RTA messaging. Note that the slope of the red line is less positive than it was in 2014. This shows that, although flights do continue to get late during the day, fewer of them do so.

Please also notice the slope of the green line is close to zero. This means that the number of flights that get early is more or less constant throughout the day. This is not only important from the point of view of flight time, but it also reduces the kind of "bunching" that can lead to ramp congestion in the later part of the day.

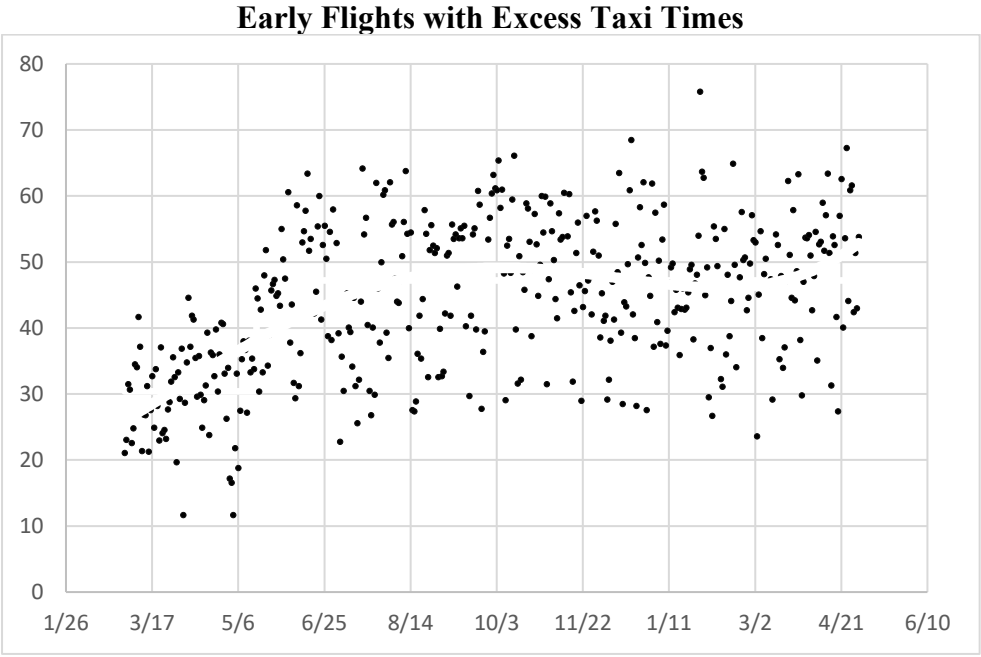
Red is late with respect to the target landing window, Blue is within the window, and Green is early.





b. Schedule versus Excess Taxi Time

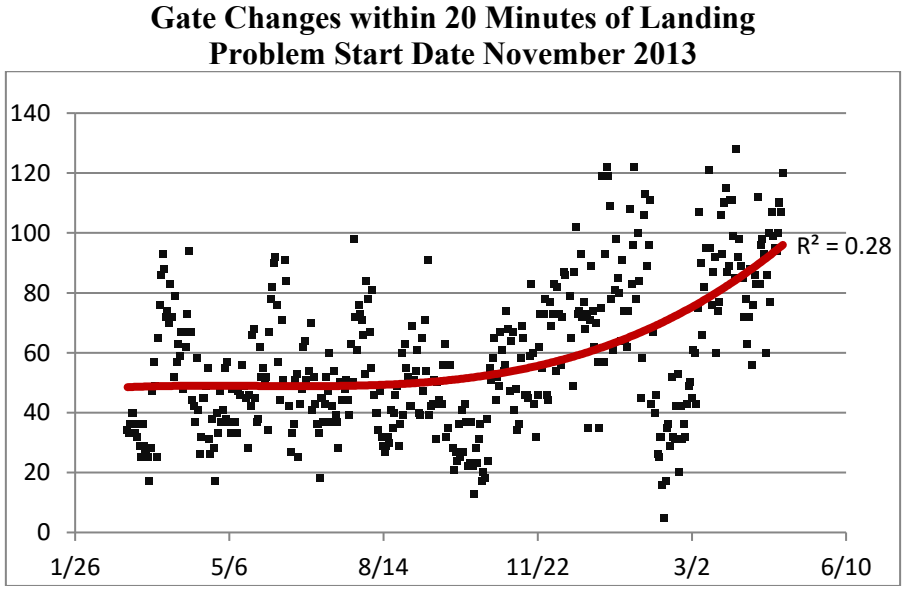
The chart below shows flights that arrived ahead of schedule and had excess taxi times. Note the very clear increase that occurs in the summer of 2013.



c. Gate Conflicts

We then looked at "gate conflicts". By "gate conflict" we mean a flight arriving before its gates is available.

We reasoned that a good measure of "gate conflicts" is the frequency and timing of gate changes. The chart below shows gate changes that occur within 20 minutes of landing. You can see from this chart that there has been a clear increase in the number of gate changes in the last 20 minutes of flight.



d. Average Fleet Speed Change

Fleet speed was measured using the AwSim™ metrics tool, FAA surveillance, and flight plan data. No GreenLandings®™ data was used.

These metrics were computed for all DAL flights, for each aircraft type, for the data periods of April 2013 (On) and Mar/April 2014 (Off).

The average cruise velocity increased in 2014 as compared to 2013. This increase was about 6 kts for ATL.

This speed increase was most significant among MD88 and A320 aircraft.

e. Policy Changes

Below are some of the policy changes that are thought to impact ATL taxi times. Note that ATH does not know exactly when these policy changes would have been operationally implemented. However, the data clearly shows the impact.

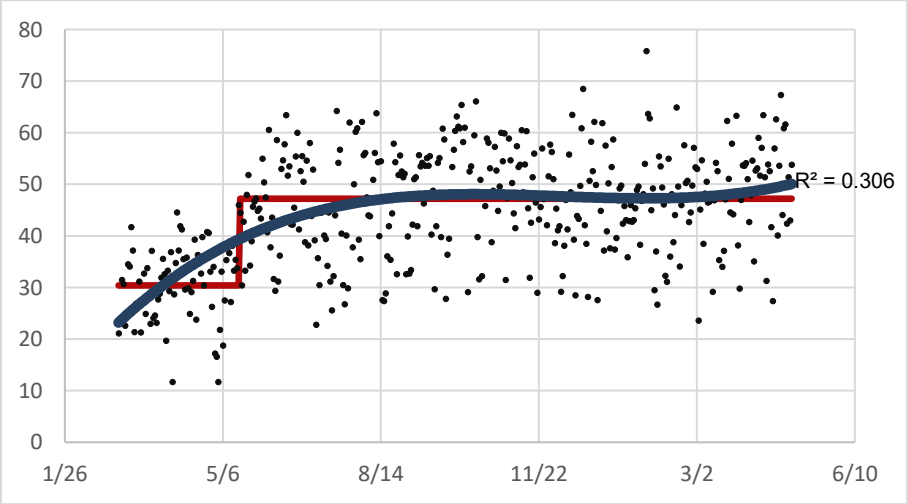
A detailed listing of policy changes from an GreenLandings® perspective is available in the change log.

- June 28, 2013 - Target landing time was changed from -1 to -6 minutes ahead of schedule,
- Introduction of the Target Landing Window initiative, and
- December 12, 2013 - Target landing time was changed to -10 minutes to be consistent with the Target Landing Window initiative.

8. Timing of Excess Taxi Times

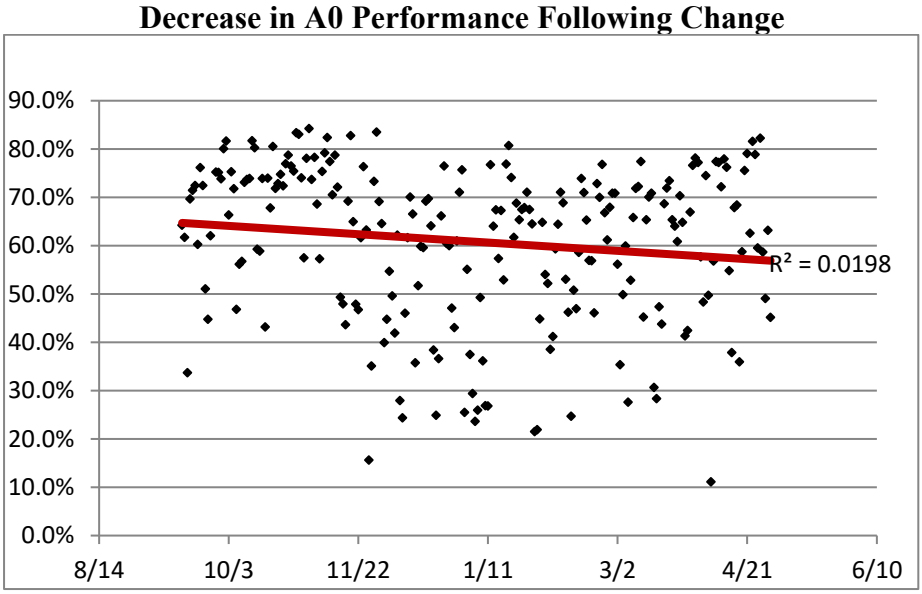
Fitting a 3-point least squares polynomial to this data clearly shows us the date at which this problem began. The chart below shows the start date as about 16 May 2013 +/- 5 days.

Early Flights with Excess Taxi Times
Problem Start Date 16 May 2013



9. Impact on A0

Lastly, we looked at what impact this problem is having on schedule performance in ATL. The chart below shows a small decrease in the on-time arrival (A0) performance.



10. Conclusion

This study confirmed that the gap in accuracy between the runway ETA and the gate ETA does exist and has increased from about 10% to about 20%.

This has been shown to be due to increased taxi times, and in particular, an increase in taxi times greater than 17 minutes.

The mechanism of this increase in taxi times has been identified as a change in the pattern of arriving traffic. ATH has identified two significant changes:

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The analytical tools used in this report could in fact derive the best target time to reduce taxi time, improve A0, and reduce fleet speed. The GreenLandings® optimization engine could use this exact number as a goal.

It should also be noted that a similar increase in late gate changes were seen in MSP and DTW beginning about the end of 2013. A detailed study of these or other DAL airports has not yet been done.