

WSDOT's Next Dynamic Pricing Algorithm – Integrating Dynamic Pricing into Existing Traffic Management Systems

July 14, 2015

Summary

- WSDOT's background with dynamic pricing
- Lessons learned and challenges identified
- Proposed solution
- Overview of the new system

Quick summary of tolling in WA

Tolling is part of Washington's history

- 14 bridges financed with bonds and paid for with tolls from 1930s through the 1980s

Good To Go! is the state's electronic toll payment system

- No slowing down, no stopping

Good To Go! accounts work on any toll facility in the state

- Tacoma Narrows Bridge
- SR 167 HOT lanes
- SR 520 Bridge



SR 167 HOT Lanes Pilot Project

- **10-mile HOT Lane System**
- **Operations began in May 2008**
- **Converted both directions of an existing and underutilized carpool lane**
- **Toll vendor was hired:**
 - Designed and installed an in-lane AVI solution
 - Designed and built a dynamic pricing algorithm
- **WSDOT configures and operates the pricing algorithm**
 - Standalone system within the Seattle-area traffic management center



Pricing System Lessons Learned

The 167 Dynamic Rate Algorithm and User Interface system would have benefited from:

- Supporting greater flexibility after experiencing initial operations
- Involving more operations staff during development
- Better understanding of operator needs

Pricing System Lessons Learned

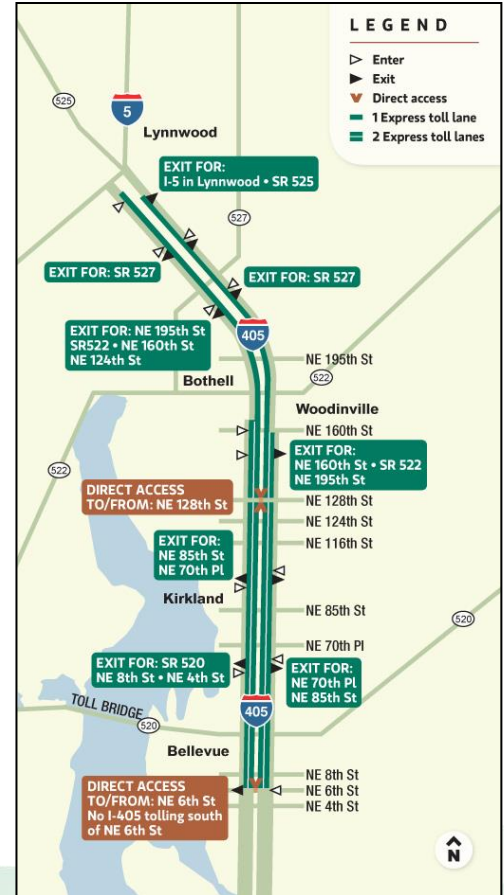


Next Step: I-405 Express Toll Lanes

17 miles of converted carpool lane, plus added capacity to operate two express toll lanes in each direction for half of the facility

Pricing based on three destination fare zones, customers identified when they enter and charged based on where they exit

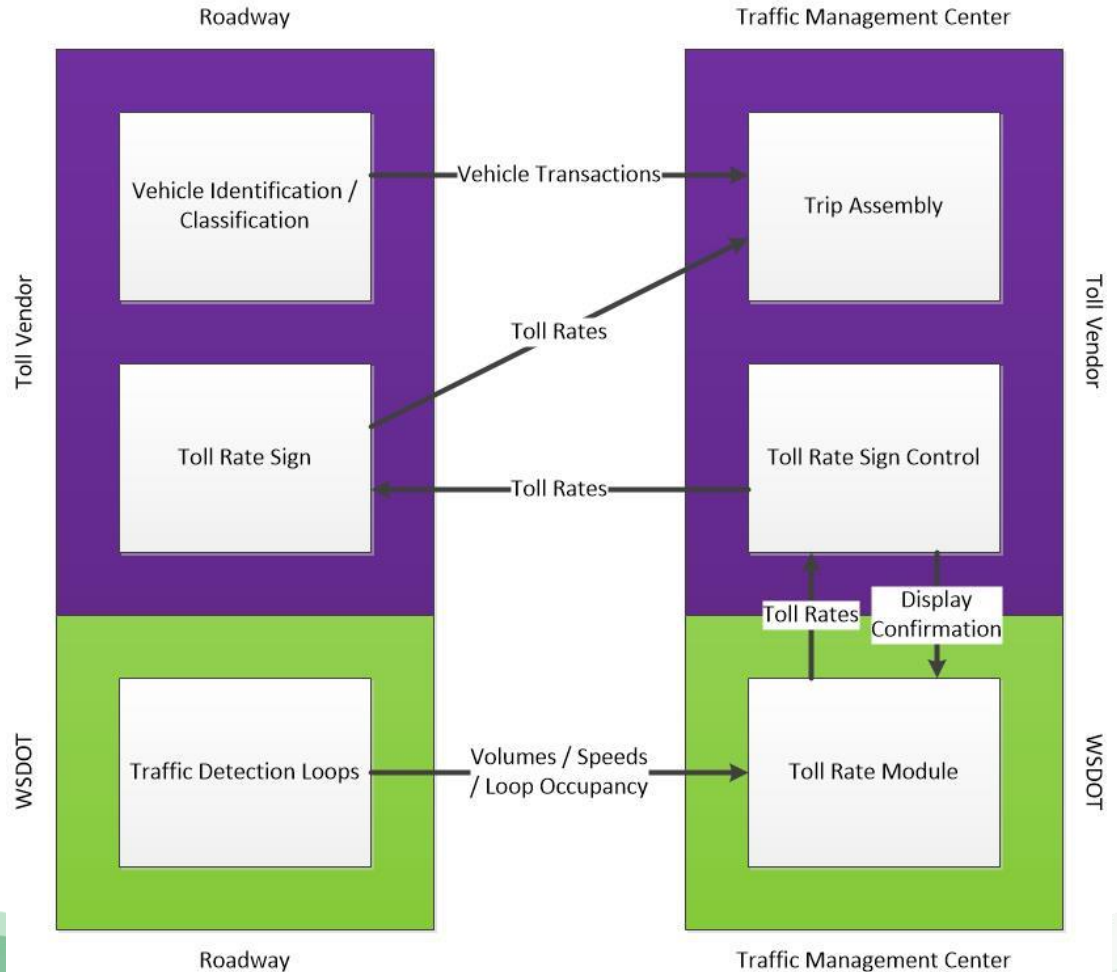
Prices are displayed on electronic message signs in advance of entrances so customers make informed choice



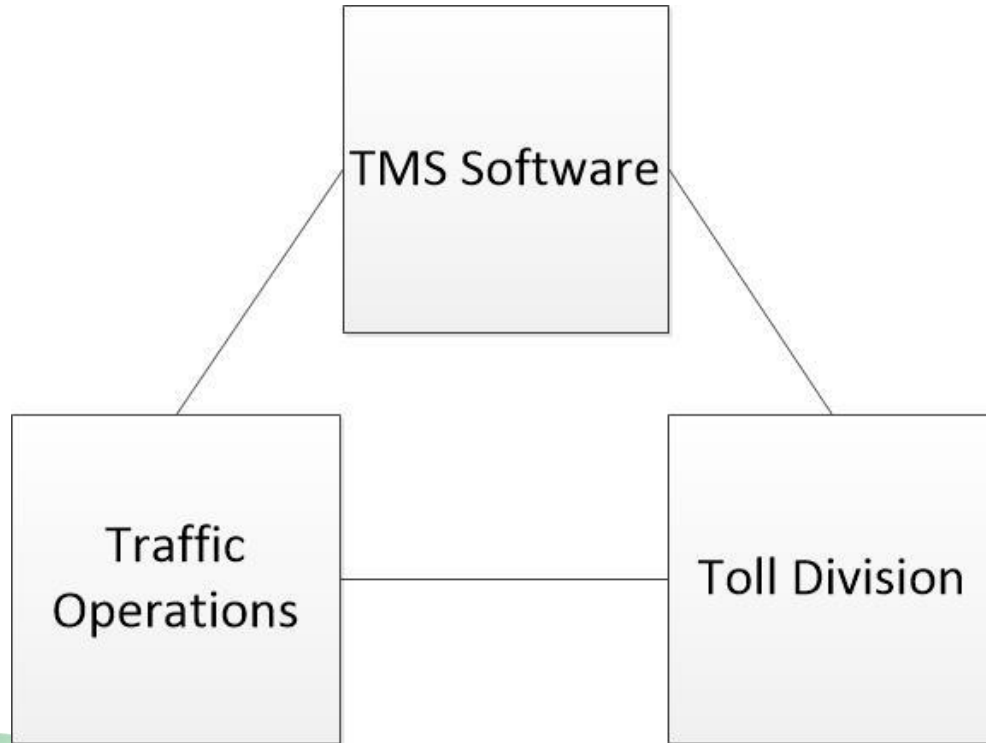
Challenge for Future Dynamic Pricing Systems

How does WSDOT improve on the work completed on SR 167 and maintain revenue collections accountability?

Solution: Leverage Expertise and Ownership



Strong Teaming

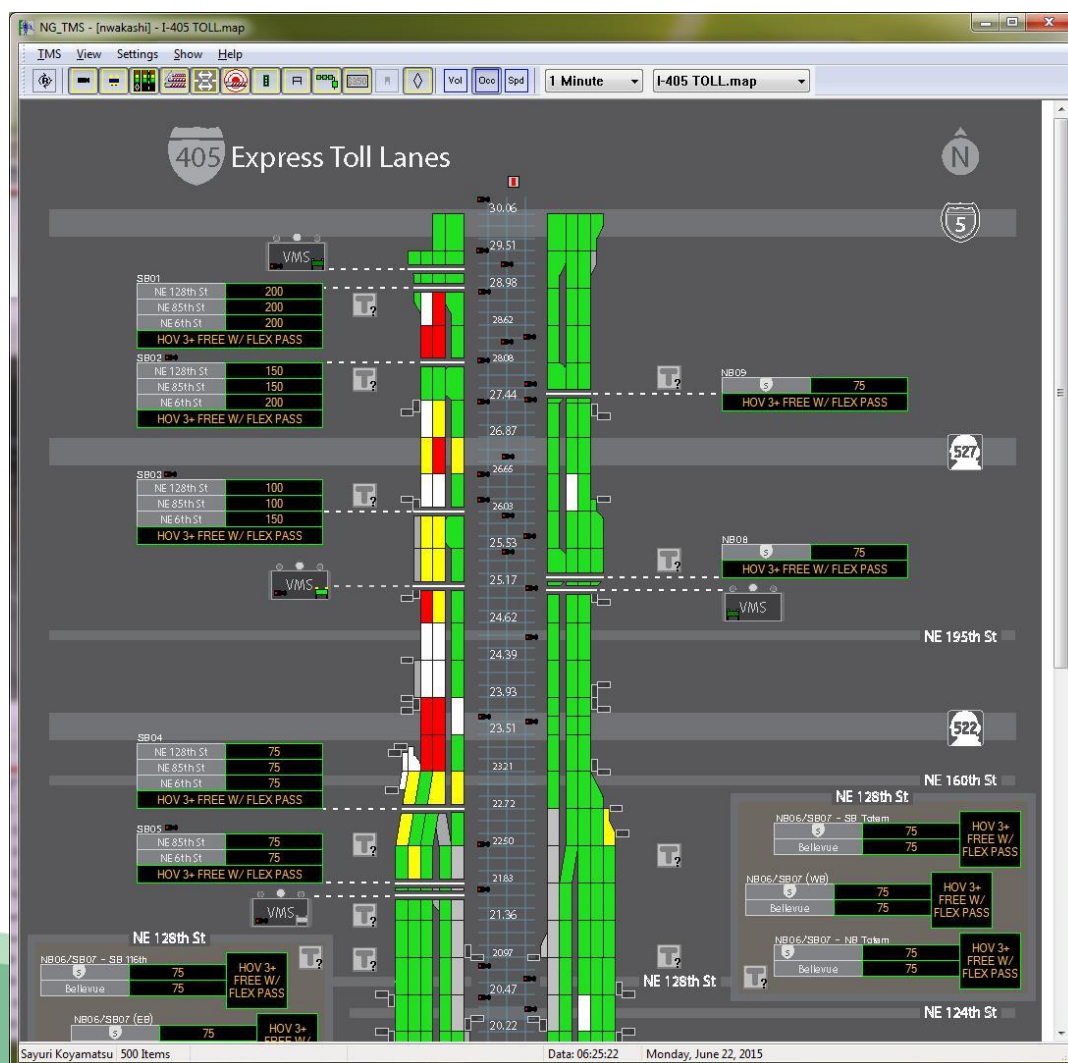


Design Process

For this work we followed the standard systems engineering process, including:

- Concept of Operations
- System Requirements
- Software Development Plan
- Interface Control document between traffic management system and lane system vendor, including automatic file transfer testing
- User Manual
- Initial software release
- Initial functional testing
- Running algorithm with live data from SR 167
- Final software development, release production software
- Configure and set up algorithm for I-405 launch

User Interface





How are toll rates calculated for specific electronic message signs?

Each toll rate sign message panel is associated to a specific trip

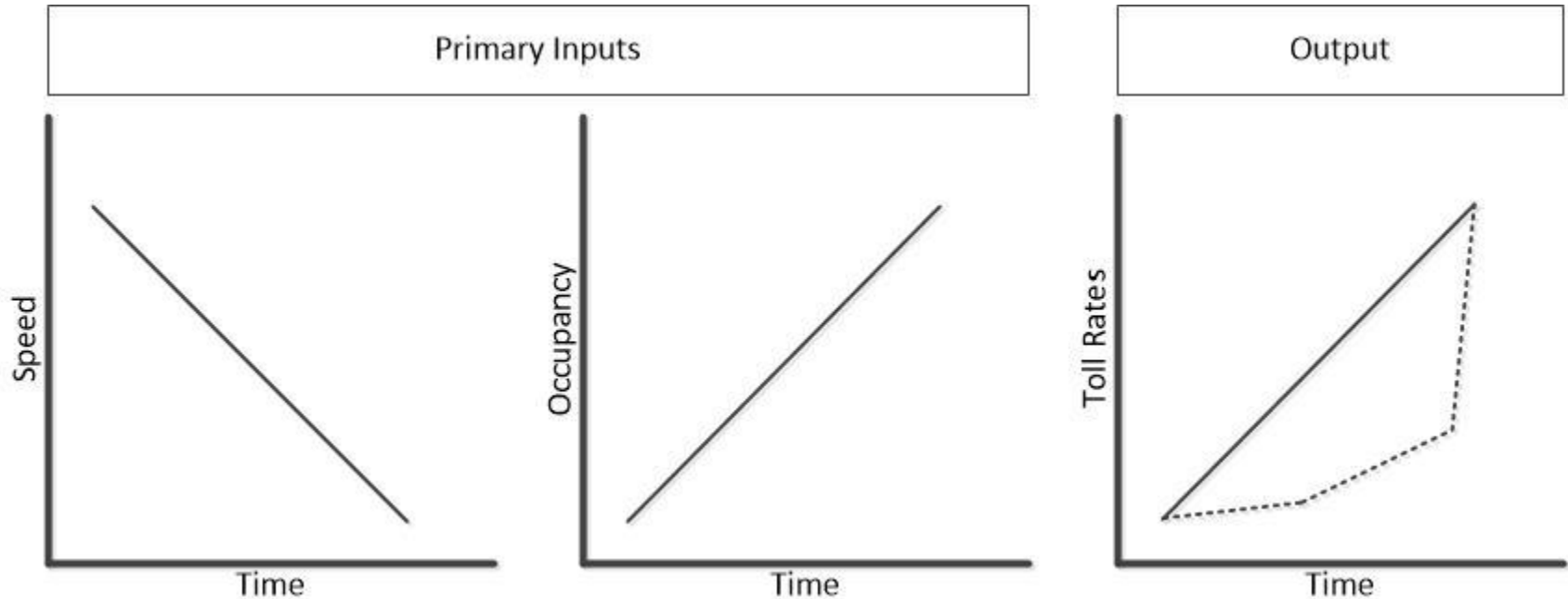
Each trip has its own set of parameters that can be tuned independently

Example: Customers entering from the mainline lanes in downtown Bellevue see the same destinations as customers entering from the NE 6th direct access; the displayed toll rates to the same destinations from these different accesses will be independently calculated.

The image shows a digital electronic message sign for Express Toll Lanes. The sign is divided into several sections. At the top, it says "EXPRESS TOLL LANES" in large, bold, black letters. To the right of this text is a "Good To Go!" logo with the WSDOT logo below it. Below the main heading, there are three rows of information, each with a destination on the left and a toll rate in a black box on the right. The first row shows "NE 124th St" with a toll rate of "\$0.75". The second row shows "Jct" followed by a shield icon with the number "522" and a toll rate of "\$1.00". The third row shows "Jct" followed by a blue and red Interstate 5 shield icon and a toll rate of "\$1.25". At the bottom of the sign, there is a large black box with white text that reads "HOV 3+ FREE W/FLEX PASS".

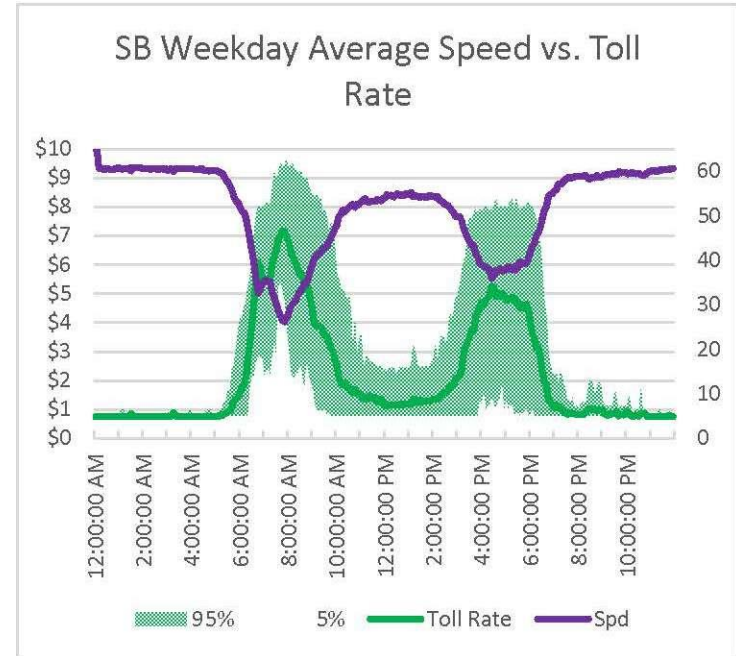
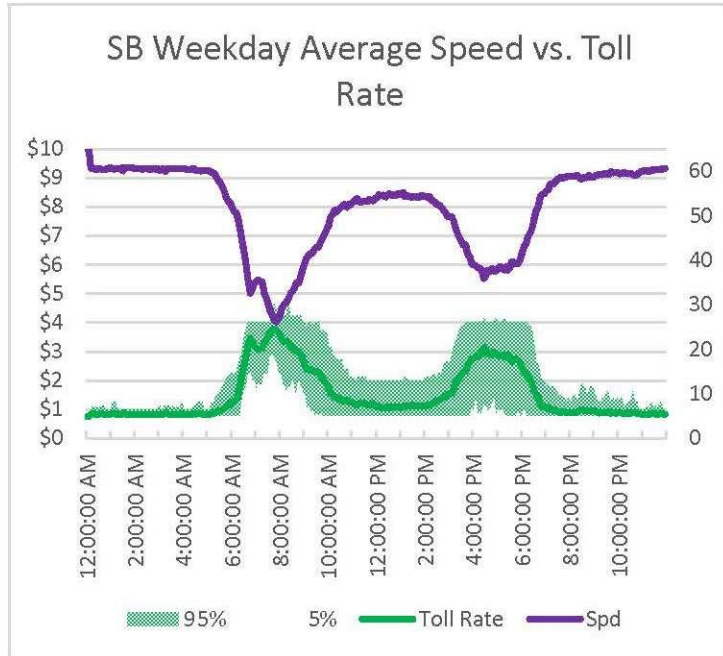
EXPRESS TOLL LANES	
NE 124th St	\$0.75
Jct 	\$1.00
Jct 	\$1.25
HOV 3+ FREE W/FLEX PASS	

How does the algorithm take traffic loop data and generate a toll rate?



What tuning flexibility is available?

(Two tuning approaches, based on same input data)



Does the algorithm rely on just data from the Express Toll Lanes?

The algorithm can include data from both ETL and general lanes

The WSDOT algorithm is configurable as to which data is included.

Data from the general lanes was included in the algorithm when SR 167 HOT lanes was first launched. While refining the algorithm in the first few months of operations, engineers removed the general lanes data to better smooth calculated toll rates.


Engineers are evaluating whether or not to include data from the general lanes in the algorithm for I-405 and will monitor this closely after toll commencement.

What happens if there is an incident in the Express Toll Lanes?

Established procedures for addressing incidents


In the case of a blocking incident, the Express Toll Lanes can be closed. Customers will only be charged for their trip up to the closed section of Express Toll Lanes.



In the event of an incident that has blocked the adjacent general lanes, WSP may detour drivers into the Express Toll Lanes and around the scene. Drivers will not be charged if detoured into the ETL.

EXPRESS TOLL LANES 

NE 128th St	CLOSED
NE 85th St	CLOSED
NE 6th St	CLOSED

EXPRESS TOLL LANES CLOSED

EXPRESS TOLL LANES 

NE 124th St	OPEN
Jct 	OPEN
Jct 	OPEN

OPEN TO ALL



How often does the toll rate update? And what are the toll increments?

Toll rates will update every 5 minutes



WSDOT will post toll rates for I-405 every 5 minutes. This has proven to be frequent enough to effectively manage traffic and not confuse drivers.

Toll rates will be calculated in increments of \$0.25

Based on experience with SR 167 HOT lanes, this has proven to be quick and easy for drivers to understand.

EXPRESS TOLL LANES		Good To Go!
NE 124th St	\$0.75	
Jct 	\$1.00	
Jct 	\$1.25	
HOV 3+ FREE W/FLEX PASS		

EXPRESS TOLL LANES		Good To Go!
NE 128th St	\$1.25	
NE 85th St	\$1.50	
NE 6th St	\$1.75	
HOV 3+ FREE W/FLEX PASS		

EXPRESS TOLL LANES		Good To Go!
NE 124th St	\$2.00	
Jct 	\$2.25	
Jct 	\$2.75	
HOV 3+ FREE W/FLEX PASS		

What are the policies for updating and monitoring the parameters?

Traffic operations and toll operations will work closely

Procedures will be established for ongoing operations and monitoring. The Express Toll lanes on I-405 is a partnership between the WSDOT Toll Division and Northwest Region Traffic Operations.

Parameter updates will be frequent at first

We expect the algorithm parameters for the Express Toll lanes on I-405 will likely be refined after toll commencement; changes will be less frequent as the system reaches a steady state.

Final Steps: Testing and Go-Live Readiness



Neil Enns

@DaneCreekPhoto

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New blog post: deciphering the @wsdot I-405 toll test signs. wp.me/p1JkX6-pv cc: @NEWSGUYSULLY

8:36 AM · 16 Jun 2015



WSDOT Good To Go! @GoodToGoWSDOT · Jun 16

@DaneCreekPhoto @NEWSGUYSULLY @wsdot Nice job, we're impressed! You're 90 percent there. Hint: One of the numbers is a bit higher.



Neil Enns @DaneCreekPhoto · Jun 16

@GoodToGoWSDOT @NEWSGUYSULLY @wsdot You're right. Given traffic today, I bet L is 3, not 1.



WSDOT Good To Go! @GoodToGoWSDOT · Jun 16

@DaneCreekPhoto @NEWSGUYSULLY @wsdot Getting warmer! Yes, we were traveling at peak when HOV lane traffic was higher. #intest



Neil Enns @DaneCreekPhoto · Jun 16

@GoodToGoWSDOT You could save me a lot of effort non 0, 2, 5, and 7 digits are :)



WSDOT Good To Go! @GoodToGoWSDOT · Jun 16

@DaneCreekPhoto You were very close - L is a 4. Again, kudos, ever have other questions about the testing feel free to ask :)



Neil Enns @DaneCreekPhoto · Jun 16

@GoodToGoWSDOT :) I just want the lanes open so I can use them!

“☺ I just want the lanes to open so I can use them!”

For more information

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