



ITS Canada Annual Conference and General Meeting 2014

# Big Data *Actionable Intelligence and Beyond*

Julie Allison

INIT Innovations in Transportation



# Big Data - Introduction

## What do passengers want?

- **On-time Departure and Arrival**
- **Accurate and accessible information**
- Short travel times
- Knowledgable and friendly staff
- Cleanliness
- Security

# Big Data - Introduction

## What do transit agencies want?

- Increase in passenger ridership
- Reduce costs



# Big Data

## Where does it come from?

- Fixed route scheduling software
- CAD/AVL Statistical data
- Automatic Passenger Counting data



# View Scheduled vs. Real-time





Ilo	Trip	Vehicle	Block	Date	Sched. time	Stop	Stop Ilo	Sched. arr	Actual arr	Sched. dep	A
1	604001_	160	604021	01.10.2009	17:11:48	Unionville GO Station	685	17:11:48	16:10:20	17:11:48	
2	604001_	160	604021	01.10.2009	17:11:48	Enterprise Road	763	17:12:48	17:11:52	17:12:48	
3	604001_	160	604021	01.10.2009	17:11:48	Warden Avenue	672	17:14:48	17:14:35	17:14:48	
4	604001_	160	604021	01.10.2009	17:11:48	Town Centre Blvd.	688	17:17:48	17:18:39	17:17:48	
5	604001_	160	604021	01.10.2009	17:11:48	Woodbine Avenue	669	17:22:48	17:23:41	17:22:48	
6	604001_	160	604021	01.10.2009	17:11:48	Allstate Parkway	692	17:25:48	17:28:09	17:25:48	
7	604001_	160	604021	01.10.2009	17:11:48	East Beaver Creek	693	17:29:48	17:29:59	17:29:48	
8	604001_	160	604021	01.10.2009	17:11:48	Leslie Street	249	17:31:48	17:33:05	17:31:48	
9	604001_	160	604021	01.10.2009	17:11:48	West Beaver Creek	366	17:32:48	17:34:09	17:32:48	
10	604001_	160	604021	01.10.2009	17:11:48	Valleymede Drive	846	17:33:48	17:36:06	17:33:48	

# View Sched + Actuals + Boardings

Browser passenger 9/29/2009 Vehicle 216

Type	Stop	Actual dep	Sched. dep	Boardings	Alightings	Load	Sched. distance	Passenger Mileage	Total PM	Graphic
➡	Route blue, Block 601045	22:21:27	22:22:00	96	96	0	0	923	0	Pattern: 601002
Ⓢ	Finch Station	22:21:27	22:22:00	59	3	56	0	0	0	
Ⓢ	Steeles Avenue	22:26:11	22:26:00	3	0	59	2,067	116	116	
Ⓢ	Clark Avenue	22:28:44	22:28:00	1	6	54	3,007	56	172	
Ⓢ	Centre Street	22:30:30	22:31:00	0	2	52	4,046	57	228	
Ⓢ	Royal Orchard Blvd.	22:32:07	22:32:00	1	4	49	4,777	39	266	
Ⓢ	Richmond Hill Centre	22:40:19	22:36:00	24	13	60	7,257	122	387	
🚗	Bantry-Scott	22:44:28	22:39:00	0	0	60	8,528	77	464	
Ⓢ	16th-Carrville	22:46:06	22:40:00	2	10	52	9,304	47	510	
Ⓢ	Weldrick Road	22:48:10	22:42:00	1	8	45	10,108	42	552	
Ⓢ	Major MacKenzie Drive	22:50:03	22:44:00	1	7	39	11,264	53	604	
Ⓢ	Crosby Avenue	22:52:44	22:46:00	1	3	37	12,333	42	646	
Ⓢ	Elgin Mills Road	22:55:34	22:48:00	1	4	34	13,433	41	686	
Ⓢ	Bernard Avenue	22:56:42	22:49:00	0	11	23	13,939	18	704	
Ⓢ	19th-Gamble	22:59:07	22:52:00	1	3	21	15,517	37	740	
🚗	Jefferson Sideroad	23:00:58	22:54:00	0	0	21	17,020	32	771	
Ⓢ	King Road	23:04:25	22:57:00	0	8	13	19,660	56	827	
Ⓢ	Bloomington Road	23:07:28	23:00:00	0	2	11	21,647	26	853	
Ⓢ	Henderson Drive	23:10:28	23:03:00	0	3	8	24,094	27	880	
🚗	Golf Links Drive	23:11:59	23:05:00	0	0	8	24,825	6	885	
Ⓢ	Wellington Street	23:13:57	23:07:00	0	2	6	25,862	9	894	
Ⓢ	Orchard Heights	23:15:34	23:08:00	0	1	5	26,864	7	900	
Ⓢ	#9826 At Savage Rd	23:18:03	23:09:00	1	1	5	28,857	10	910	
Ⓢ	Mulock Drive	23:19:41	23:10:00	0	2	3	30,035	6	916	
🚗	Eagle Street	23:21:24	23:11:00	0	0	3	31,088	4	919	
Ⓢ	Newmarket GO Terminal	23:30:28	23:14:00	0	3	0	32,596	5	923	

# Big Data - Analyzing & Optimizing

## Allows you to:

- Detailed analysis of operations
- Flexible reporting and analyses options by simple change of parameters
- Direct feedback of results to Planning

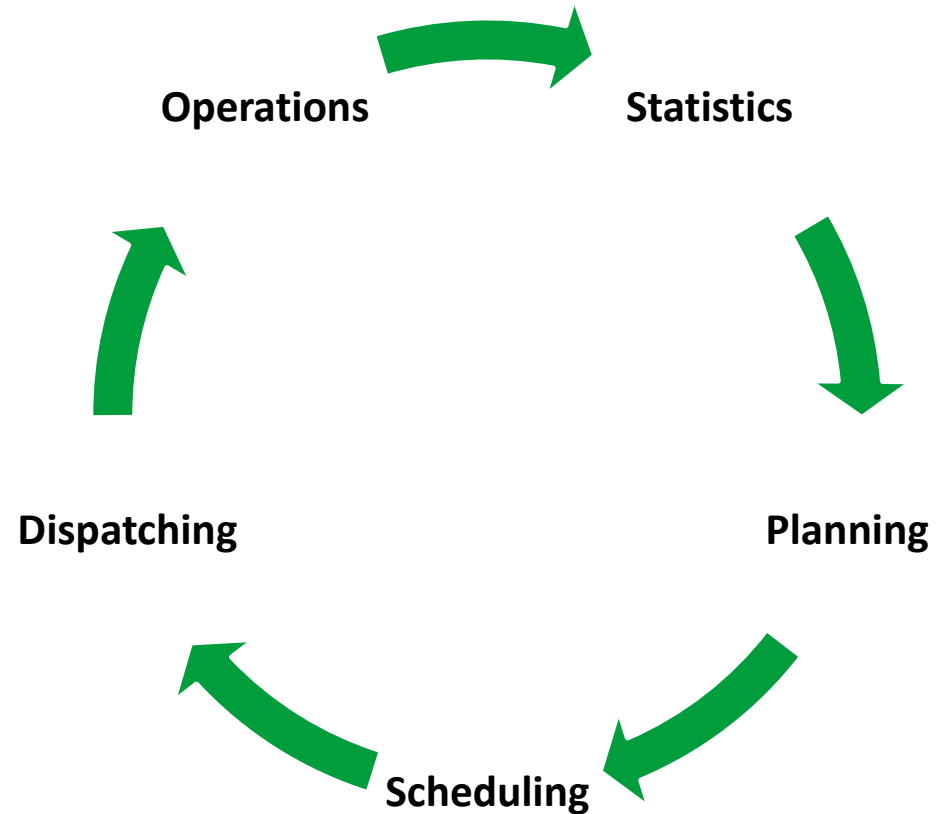


# Using Data to Improve Operations

- Create more realistic timetables
- Assign the right bus type for the passenger load
- Modify headways (slightly) to reduce number of vehicles -> save money
- Integration with business intelligence systems



# Business Intelligence



# Nottingham City Transport



- Number of buses operated: 330
- Number of drivers: 830
- Percentage of accessible buses: 100%
- Number of routes operated: 67
- Automatic Vehicle Location and Control System (AVLC)
- Real Time Passenger Information
- Passenger trips per year: 51.6 million (2011/12)

# NCT Route 45 - Tabular Timetable

MOBILE-PLAN - Timetable - 2

File Versions Fundamental data GIS Planning Publishing Interfaces System View Window ?

Lines / filters Colors

Basic journey patterns Journey patterns Time demand types Service journeys

Lines/Linegroups

- 45
  - Direction1
  - Direction2

Filter

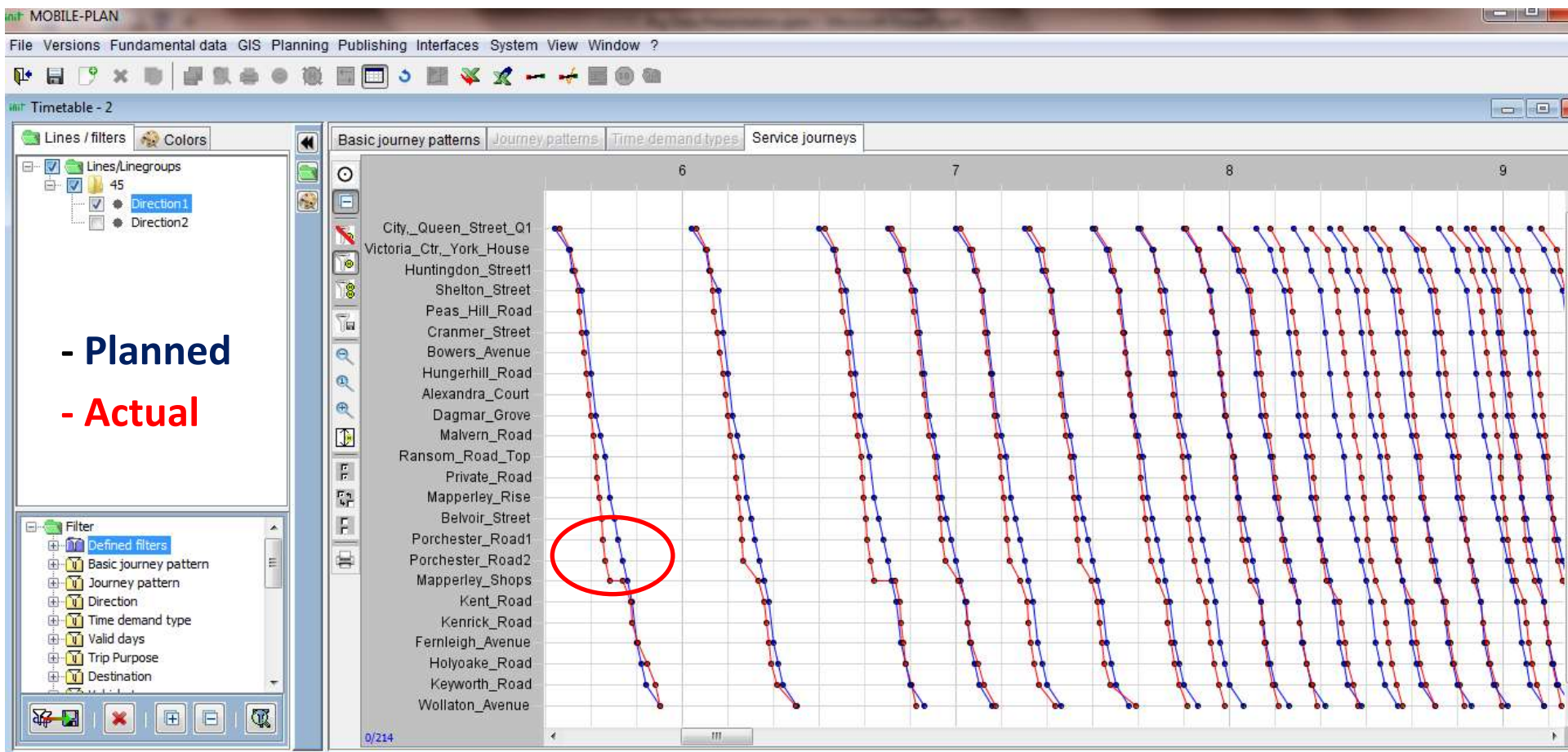
- Defined filters
- Basic journey pattern
- Journey pattern
- Direction
- Time demand type
- Valid days
- Trip Purpose
- Destination
- Vehicle type
- Organisational Units
- Optional block

No./Short Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	1
Direction	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	MS-
Trip Purpose	1	MS-Imp.	MS-Imp.	1	1	MS-Imp.	1	MS-Imp.	MS-Imp.	1	1	MS-Imp.	1	MS-Imp.	1	MS-Imp.	MS-
Vehicle type	BUS	Excel	Excel	BUS	BUS	Excel	BUS	Excel	Excel	BUS	BUS	Excel	BUS	Excel	BUS	Excel	E
Optional block	1045:3	1045:3	5045:3	5045:3	1045:3	1045:3	2045:3	2045:3	5045:3	5045:3	7045:3	7045:3	1045:3	1045:3	2045:3	2045:3	40
Meter	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6580	6
Km/h	17,165	18,000	18,082	17,165	17,165	19,740	17,165	17,190	19,149	17,165	17,165	16,907	17,165	19,690	17,165	21,534	19
1 2612/City_Queen_Street_Queen_Street	5:32	5:33:07	6:03:08	6:02	6:30	6:31:11	6:45	6:45:50	7:01:07	7:00	7:15	7:16:06	7:30	7:30:38	7:40	7:40:38	7:50
1440/Peas_Hill_Road	5:35	5:35:27	6:05:25	6:05	6:33	6:33:28	6:48	6:48:34	7:03:34	7:03	7:18	7:18:53	7:33	7:33:32	7:43	7:43:17	7:53
1441/Peas_Hill_Road	5:36	5:36:31	6:06:14	6:06	6:34	6:34:06	6:49	6:49:33	7:04:33	7:04	7:19	7:19:40	7:34	7:34:39	7:44	7:44:03	7:54
1442/Cranmer_Street	5:38	5:37:04	6:06:45	6:08	6:36	6:34:53	6:51	6:50:13	7:05:33	7:06	7:21	7:20:39	7:36	7:35:40	7:46	7:44:55	7:55
1443/Bowers_Avenue	5:38	5:37:22	6:07:03	6:08	6:36	6:35:15	6:51	6:50:51	7:05:51	7:06	7:21	7:20:58	7:36	7:35:59	7:46	7:45:22	7:56
1444/Hungerhill_Road	5:39	5:38	6:07:44	6:09	6:37	6:36:02	6:52	6:51:39	7:06:32	7:07	7:22	7:21:41	7:37	7:36:44	7:47	7:46:13	7:57
1445/Alexandra_Courtyard	5:39	5:38:26	6:08:05	6:10	6:38	6:37:00	6:52	6:52:09	7:07	7:07	7:22	7:22:05	7:37	7:37:11	7:47	7:46:41	7:57
1446/Dagmar_Grove	5:40	5:38:54	6:08:45	6:11	6:39	6:38:03	6:53	6:52:37	7:07:34	7:08	7:23	7:22:35	7:38	7:37:38	7:48	7:47:09	7:58
1447/Malvern_Road	5:40	5:39:24	6:09:29	6:11	6:39	6:38:03	6:53	6:53:06	7:08:04	7:08	7:23	7:23:04	7:38	7:38:11	7:48	7:47:45	7:58
1448/Ransom_Road_Top	5:41	5:39:55	6:09:58	6:11	6:39	6:38:03	6:54	6:53:34	7:08:33	7:09	7:24	7:23:34	7:39	7:38:46	7:49	7:48:17	7:59
1449/Private_Road	5:42	5:40:28	6:10:28	6:12	6:40	6:38:33	6:55	6:54:04	7:09:06	7:10	7:25	7:24:07	7:40	7:39:24	7:50	7:48:57	7:59
1450/Mapperley_Rise	5:43	5:41:09	6:11:37	6:13	6:41	6:39:13	6:56	6:55:21	7:09:45	7:11	7:26	7:25:08	7:41	7:40:10	7:51	7:49:48	8:00
1451/Belvoir_Street	5:43	5:41:19	6:11:51	6:13	6:41	6:39:23	6:56	6:55:37	7:09:56	7:11	7:26	7:25:25	7:41	7:40:29	7:51	7:50:04	8:01
1452/Porchester_Road	5:44	5:41:50	6:12:18	6:14	6:42	6:39:50	6:57	6:56:06	7:10:27	7:12	7:27	7:25:53	7:42	7:41:03	7:52	7:50:36	8:02
1453/Robinson_Road	5:45	5:42:22	6:12:45	6:15	6:43	6:40:18	6:58	6:56:44	7:10:57	7:13	7:28	7:26:23	7:43	7:41:36	7:53	7:51:05	8:03
1454/Robinson_Road	5:46	5:42:36	6:12:59	6:16	6:44	6:40:35	6:59	6:56:58	7:11:13	7:14	7:29	7:26:39	7:44	7:42:04	7:54	7:51:32	8:04
1455/Robinson_Road	5:47	5:43:06	6:13:27	6:17	6:45	6:41:16	7:00	6:57:44	7:11:52	7:15	7:30	7:27:14	7:45	7:42:51	7:55	7:52:19	8:05
1456/Robinson_Road	5:48	5:44:02	6:16:44	6:18	6:46	6:42:10	7:01	7:00:38	7:14:12	7:16	7:31	7:29:38	7:46	7:44:27	7:56	7:53:25	8:06
1457/Robinson_Road	5:48	5:47:02	6:16:44	6:18	6:46	6:46:35	7:01	7:00:38	7:14:12	7:16	7:31	7:29:38	7:46	7:44:27	7:56	7:53:25	8:06

Planned

Actual

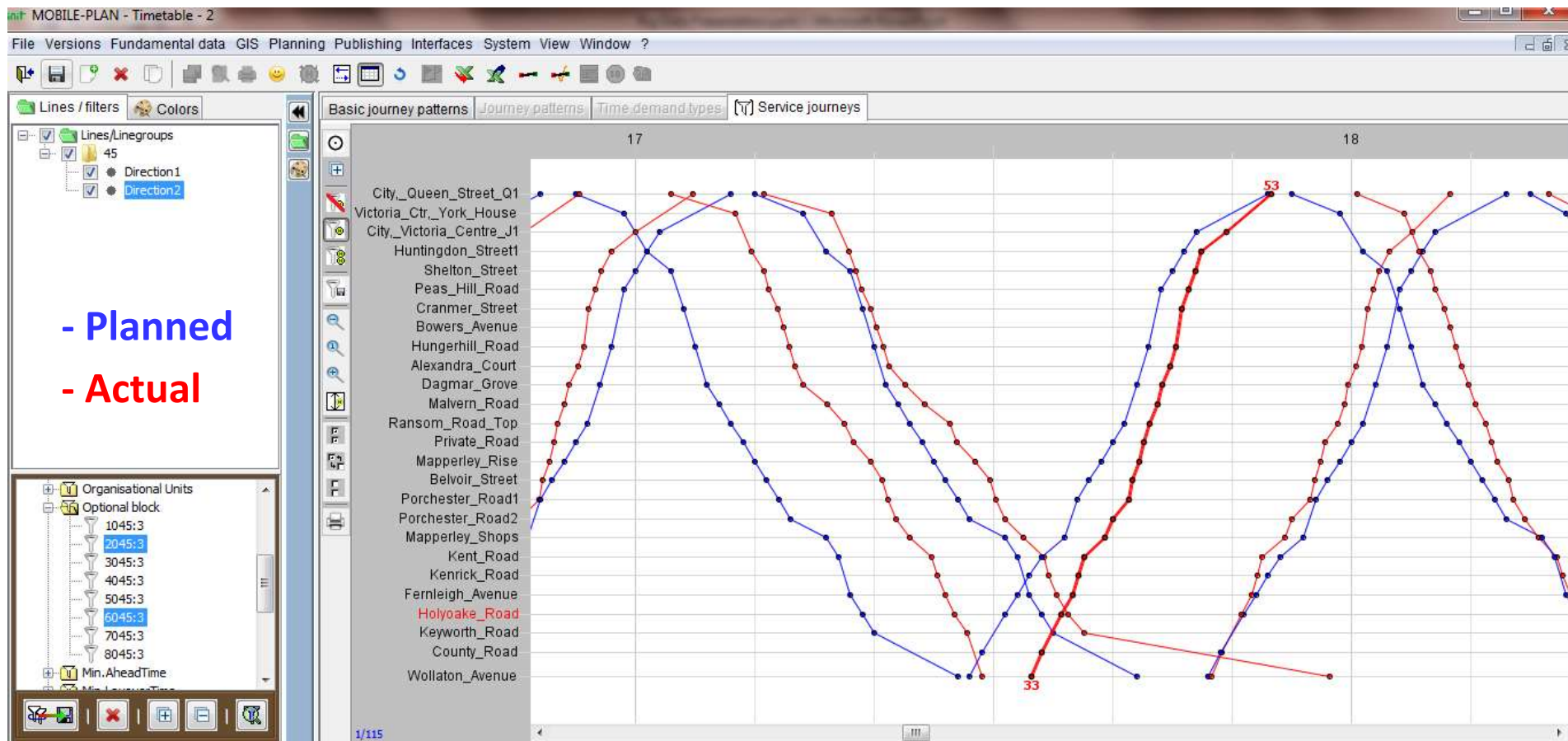
# NCT Route 45 - Graphical Timetable





# NCT Route 45 – Graphical View

- Planned  
- Actual



# NCT Route 45 - Block Editor

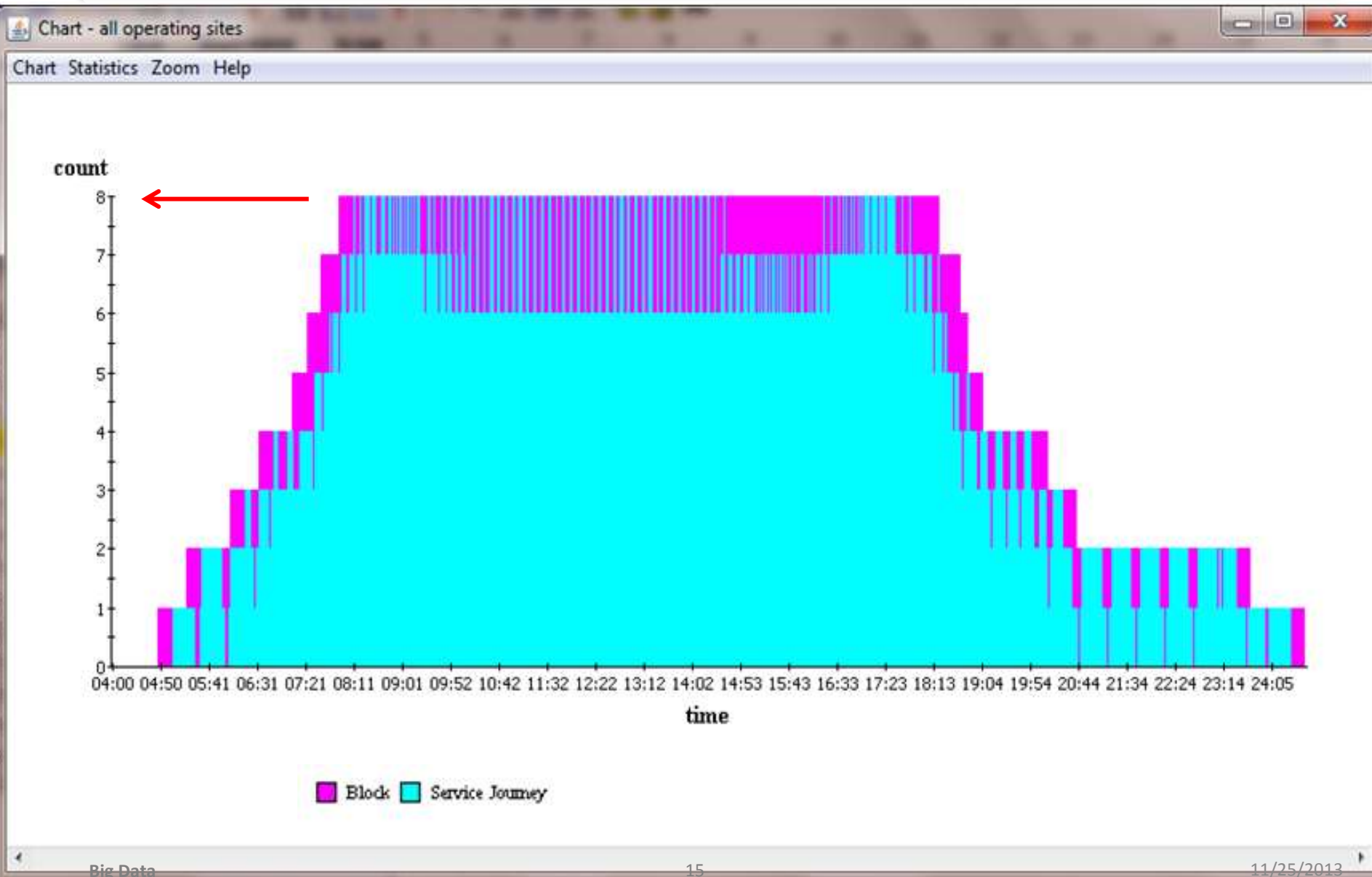
- 8 Planned Blocks (Blue)
- 9 Actual Blocks (Red)

MOBILE-PLAN - Block editor

File Edit Versions Fundamental data GIS Planning Publishing Interfaces System View Window ?

Route	Dir.	ValidDays	Departure	Arrival	from name	to name	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1045:3[1]	BUS	04:48	20:43	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
2	2045:3[1]	BUS	06:03	24:40	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
3	3045:3[1]	BUS	07:56	18:19	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
4	4045:3[1]	BUS	07:08	23:43	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
5	5045:3[1]	BUS	05:18	20:13	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
6	6045:3[1]	BUS	07:24	18:42	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
7	7045:3[1]	BUS	06:33	18:49	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
8	8045:3[1]	BUS	07:38	19:05	Parliament Str	Parliamen	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
9	1045:3[2]	Excel	04:49:13	20:41:29	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
10	2045:3[2]	Excel	06:03:51	18:13:08	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
11	2045:3[3]	Excel	17:33:18	24:35:42	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
12	3045:3[2]	Excel	07:56:13	18:12:19	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
13	4045:3[2]	Excel	07:08:15	23:42:34	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
14	5045:3[2]	Excel	05:18:30	20:07:31	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
15	6045:3[2]	Excel	07:24:36	18:36:44	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
16	7045:3[2]	Excel	06:34:21	18:40:24	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street
17	8045:3[2]	Excel	07:38:19	19:00:59	Break at PSG	Break at P	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street	Wollahn Avenue	Civ. Queen Street

# Planned Blocks





# Actual Blocks



# Big Data Results

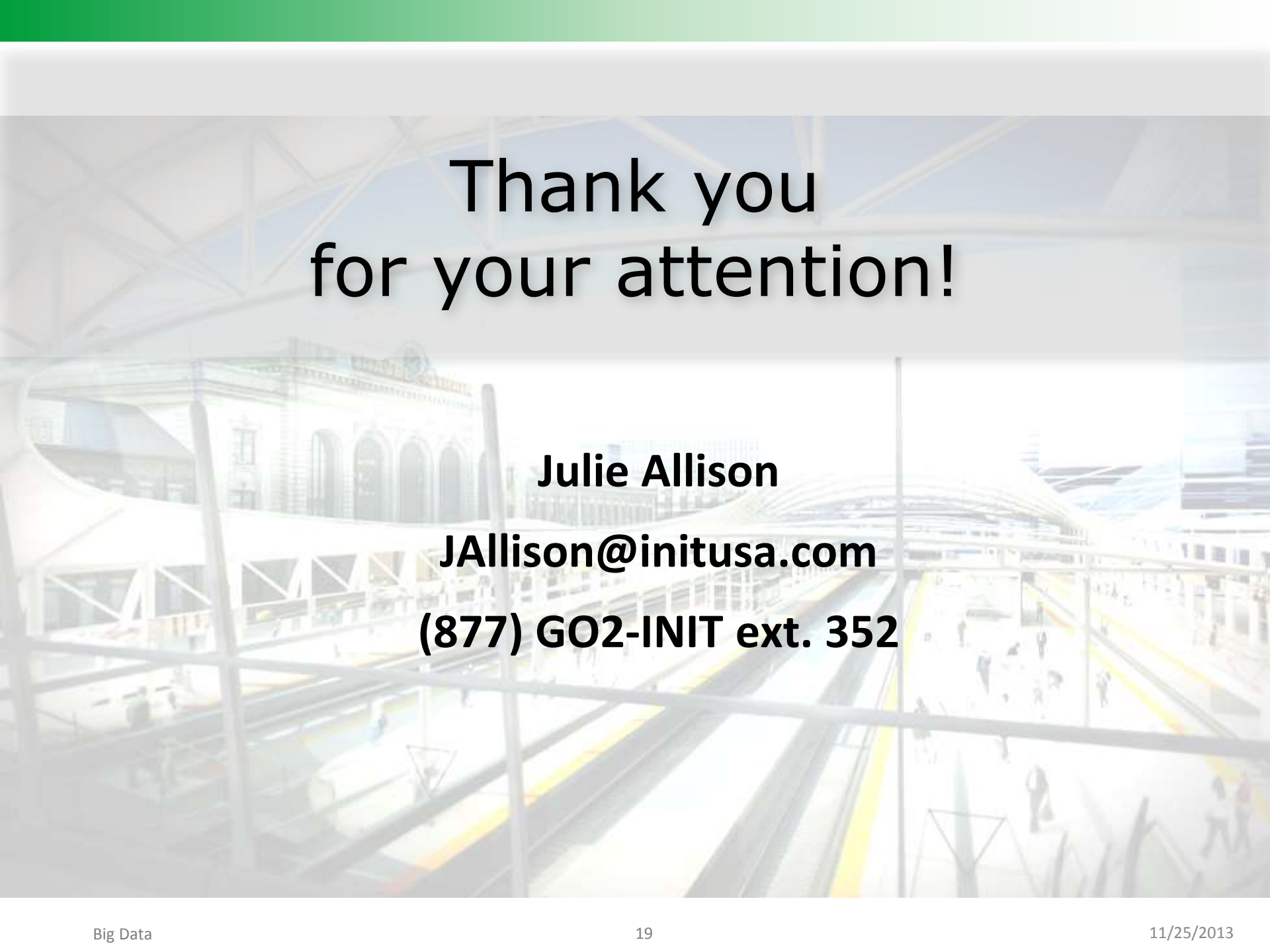
- Improves On-Time Performance
  - Minimizes service costs
  - Improves Service Efficiency
  - Provides data to real-time applications
- = Increased Customer Satisfaction
- = Transit Agency Meets Goals



# Big Data Results

- Awarded the UK Bus Operator of the Year (2012)
- UK Large Bus Operator of the Year (Route One Awards)
- 95% customer satisfaction score - highest in the UK (independent Passenger Focus Research, 2013)
- Recognized importance of consistent and accurate information to all users.





# Thank you for your attention!

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