



**CHARLOTTE**  
SOLID WASTE SERVICES

Using Digital Tools to Gain Program Efficiency:

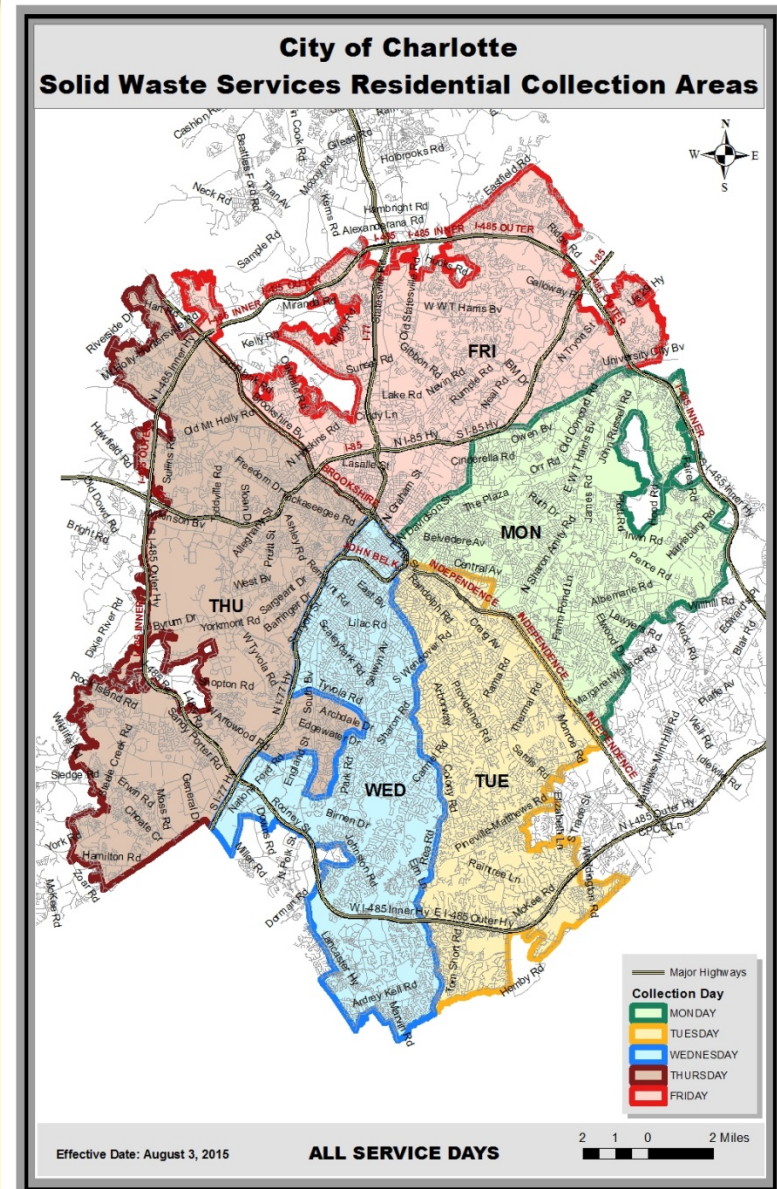
**Using technology to improving route management during worker shortage**

CRA 2023

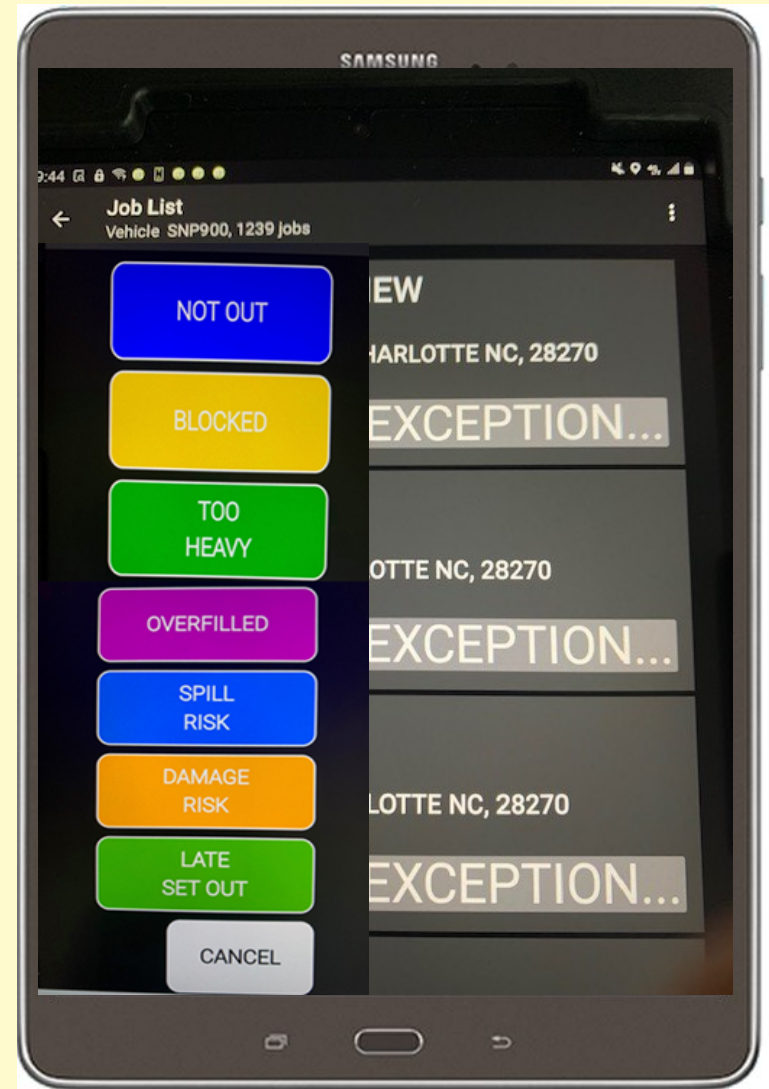


# Overview: the Organization

- >227,000 service locations
- Routing for multiple services
  - Garbage (RS)
    - 65 routes (61.6 auto; 3.4 rear loader)
  - Yard waste (RS)
  - Litter picking (RS)
  - Recycling (contracted)
    - 24 routes (22 auto; 2 rear loader)
  - Multi-family (contracted)
  - Bulky, dead animal (Optimo)



- **Route Optimization**
  - high density routing
    - (*RouteSmart Technologies*)
  - dynamic daily routing
    - (*OptimoRoute*)
- **Route Management / Dissemination / Monitoring**
  - work order / asset management
    - (*Cityworks*)
    - (*E-Roads*)
  - route deployment / on-board devices
    - (*Cityworks*)
    - (*E-Roads*)
  - Route completion
    - (*Cityworks*)
    - (*E-Roads*)



# The Challenge: Worker Shortage

## Some triggers:

- **Same day call-offs occur** – expect assignment delays
- **Planned vacation**, but no one to fill in
- **Training assignments**, have to maintain timeline

ROUTE	Truck	SEO	AttCode	REPLACEMENT
4100L	SNP916	208-LUGO,JOHNANTHON	TRAN	392-BRAHAM,MARVIN
4101G	SNP983	222-SEAGARS,CHAVIS	REG	
4102G	SNP956	217-ERVIN, LARRY	REG	
4103G	SNP971	220-VAZQUEZ, ISRAEL	REG	
4104G	SNP836	276 LILE, CHAYETTA	VAC	211-ALFORD,KENNY
4105G	SNP912	204-SPENCER, JEFFAN	REG	
4106G		234 CARTER, CHARLES	TRAN	222, 217, 205, 211
4107G	SNP975	212 GALLAWAY, CEDRIC	REG	
4108G		247 SANCHEZ, REINEL	SICK	215, 221, 218, 210
4109G	SNP909	205 SPANN, ERIC	REG	
4110G	SNP895	229 PATTERSON, MARCUS	REG	
4111G	SNP961	218-GREGORY, MARY	REG	
4112G	SNP919	230 BAILEY,JOHN	REG	
4113G	SNP970	210-GRAY, JAMIE	REG	
4114G		235 BARBOSA, RAUL	VAC	229, 212
4115G	SNP938	233 HARRIS, EDDIE	REG	
4116G	SNP922	267-MONTERIUS DYE	REG	
4117G	SNP982	232 ONEIL,DEXTER	REG	
4118G	SNP875	224 HOPKINS, TIFFANY	REG	
4119G	SNP875	225 NIXON, THOMAS	SICK	267, 233, 230, 232
4120G	SNP958	249-PEEBLES,RAYMOND	REG	

## Some implications:

- Extra time drawing maps or distributing unstaffed workload
- High variance between times
- Reduced parity for route loads
- At least 5-10 minute variance between times
- An every day issue (currently)



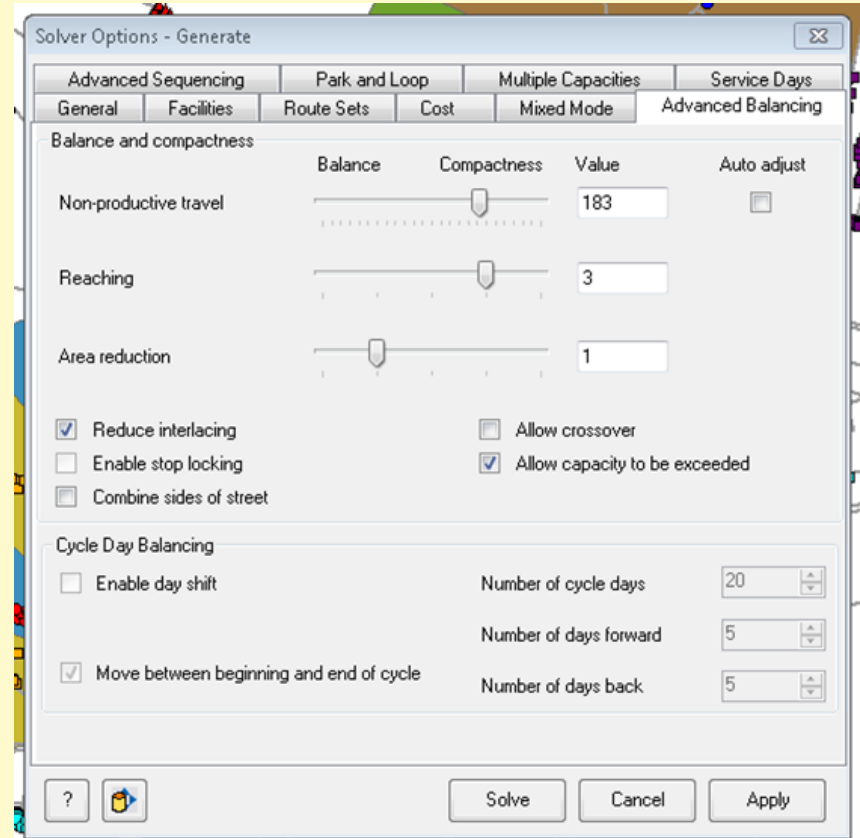
# Standing Routes

- Avg. 1-3 routes per day per area (due to time off)
- Highlighted routes have no drivers to collect route
- Assign parts of standing route to other routes
- Drivers on other routes must complete standing route before collecting regular route  
(*disincentive to idle on regular route*)

DATE 3/16/2023 Area 2	Radio Call Number	Route Number	Truck Number
516-CASEY,TORRENCE	516	4201Y	SNP912
310 319 332 344		4202Y	
344-HODGE,FRANKLIN	344	4203Y	SNP977
516 510 324 305		4204Y	
305-WILSON,ROBERT	305	4205Y	SNP866
332-CURRY,JOSHUA	332	4206Y	SNP946
510-BURRIS, SANDRA	510	4207Y	SNP992
319-MCMILLIAN, ARMANI	319	4208Y	SNP913
324-CARR, CHARLES	324	4209Y	SNP849
318-ROBINSON,JOIA	318	4210Y	SNP952
316- WILLIAM, GARFIELD	316	4211Y	SNP902
310- YOUNG, THOMAS	310	4212Y	SNP824

# The Mechanism

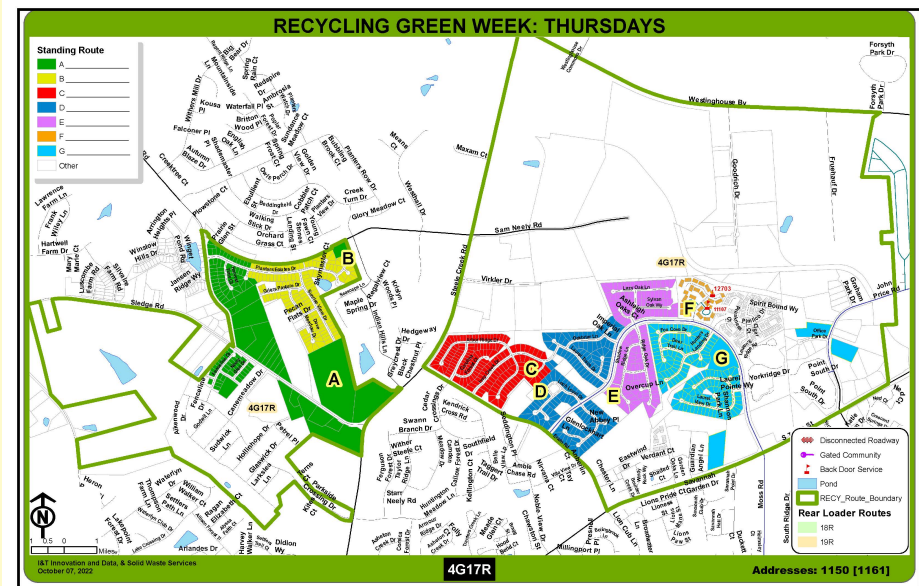
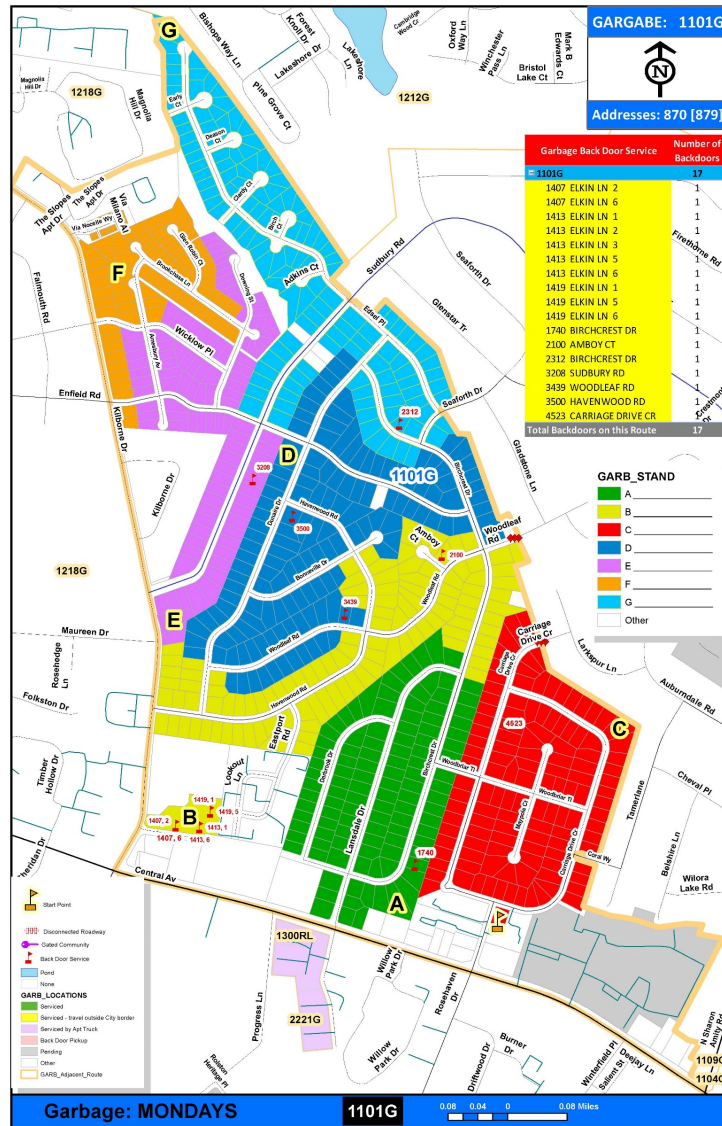
- Use existing routes as regions
- Generate un-sequenced sub-routes based on 55 minute time limits (*fine tune*)
- Sequence routes to determine the best starting point for each sub-route
- Generate new sub-route boundaries that can be used for proof of service coverages.
- Settings
  - Nonproductive Travel – more compact (180)
  - Reaching – 2 or 3
  - Area reduction – 1 or 2



# The Solution: 1101G

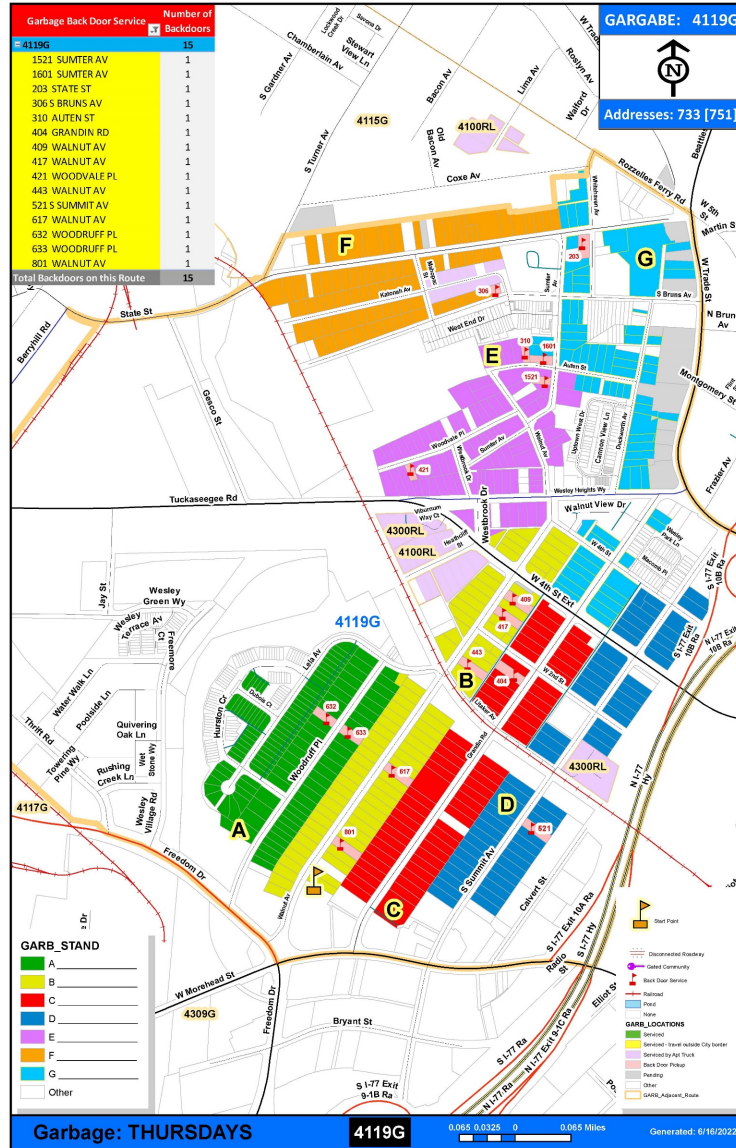
Route ID	Int	Time at Start	Time at End	Total Distance (miles)												
Start Location	End Location	Seq Stops	UnSeq Stops	Total Stops	Demand	# of Trips	Start Time	End Time	Travel Time	Service Time	Idle Time	Extra Time	Facility Time	Total Time		
# Stops					Travel Time					Total Time						
1101G1	*** First Stop ***	*** Last Stop ***	117	0	117	3,720.60	1	6:45 AM	7:26 AM	0.16	0.25	0.00	0.00	0.00	0.41	2.5
1101G2	*** First Stop ***	*** Last Stop ***	115	0	115	3,657.00	1	6:45 AM	7:27 AM	0.17	0.25	0.00	0.00	0.00	0.42	2.2
1101G3	*** First Stop ***	*** Last Stop ***	119	0	119	3,784.20	1	6:45 AM	7:29 AM	0.19	0.26	0.00	0.00	0.00	0.44	2.5
1101G4	*** First Stop ***	*** Last Stop ***	134	0	134	3,782.80	1	6:45 AM	7:34 AM	0.20	0.29	0.00	0.00	0.00	0.49	2.6
1101G5	*** First Stop ***	*** Last Stop ***	120	0	120	3,765.40	1	6:45 AM	7:29 AM	0.18	0.26	0.00	0.00	0.00	0.44	2.4
1101G6	*** First Stop ***	*** Last Stop ***	137	0	137	3,726.40	1	6:45 AM	7:29 AM	0.14	0.30	0.00	0.00	0.00	0.44	1.9
1101G7	*** First Stop ***	*** Last Stop ***	131	0	131	3,747.20	1	6:45 AM	7:35 AM	0.21	0.28	0.00	0.00	0.00	0.50	2.8

# The Solution: Visuals





# Addressing the Challenge



ROUTE	Truck	SEO	AttCode	REPLACEMENT
4100RL	SNP916	208-LUGO,JOHNANTHON	TRAN	392-BRAHAM,MARVIN
4101G	SNP983	222-SEAGARS,CHAVIS	REG	
4102G	SNP956	217-ERVIN, LARRY	REG	
4103G	SNP971	205-VAZQUEZ, ISRAEL	REG	
4104G	SNP836	276 LILLY, SHAYETTA	VAC	211-ALFORD,KENNY
4105G	SNP108	221 GIVENS, DEVEAN	REG	
4106G		234 CARTER, CHARLES	TRAN	222, 217, 205, 211
4107G	SNP975	212 GALLAWAY, CEDRIC	REG	
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4111G	SNP961	218-GREGORY, GARY	REG	
4112G	SNP919	230 BAILEY,JOHN	REG	
4113G	SNP970	210-GRAY, JAMIE	REG	
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4118G	SNP875	224 HOPKINS, TIFFANY	REG	
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4120G	SNP958	249-PEEBLES,RAYMOND	REG	

# Route Segment Dissemination

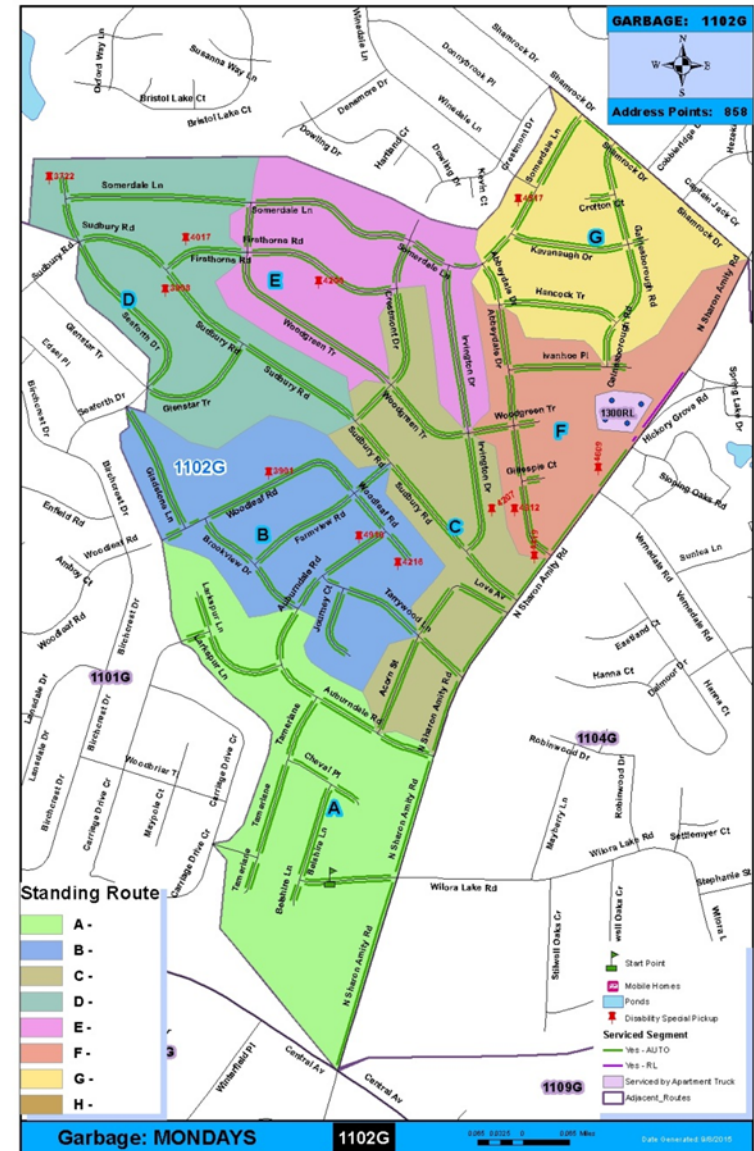
**SWS Route Manager**

GARBAGE

GARBAGE 2023-03-24

Route Code	Section	Truck Name	Start Time
5100RL		SNP916	06:00
5101G		SNP983	06:00
5102G		SNP956	06:00
5103G		SNP971	06:00

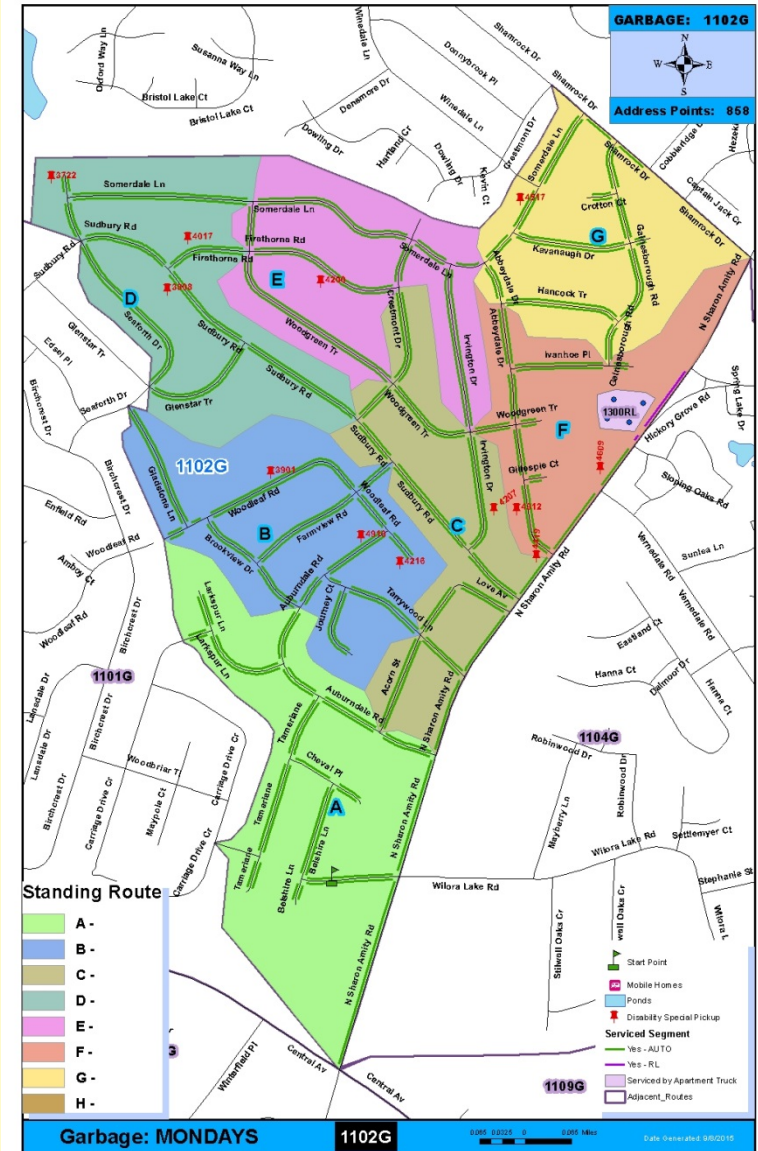
Section: A B C D E F G



## AVL Truck Status - Route Manager

SERVICE	TRUCK	POSITIONS	EVENTS
GARBAGE	SNP978	1996	680
GARBAGE	SNP979		
GARBAGE	SNP980		
GARBAGE	SNP982	1155	1
GARBAGE	SNP983	1397	2
GARBAGE	SNP985	1803	12
GARBAGE	SNP986		
YARD WASTE	SNP823	1288	1
YARD WASTE	SNP848	1294	
YARD WASTE	SNP850	1058	
YARD WASTE	SNP867	708	50
YARD WASTE	SNP869	851	71
YARD WASTE	SNP883	884	
YARD WASTE	SNP885	966	54
YARD WASTE	SNP886	1418	120
YARD WASTE	SNP887	782	

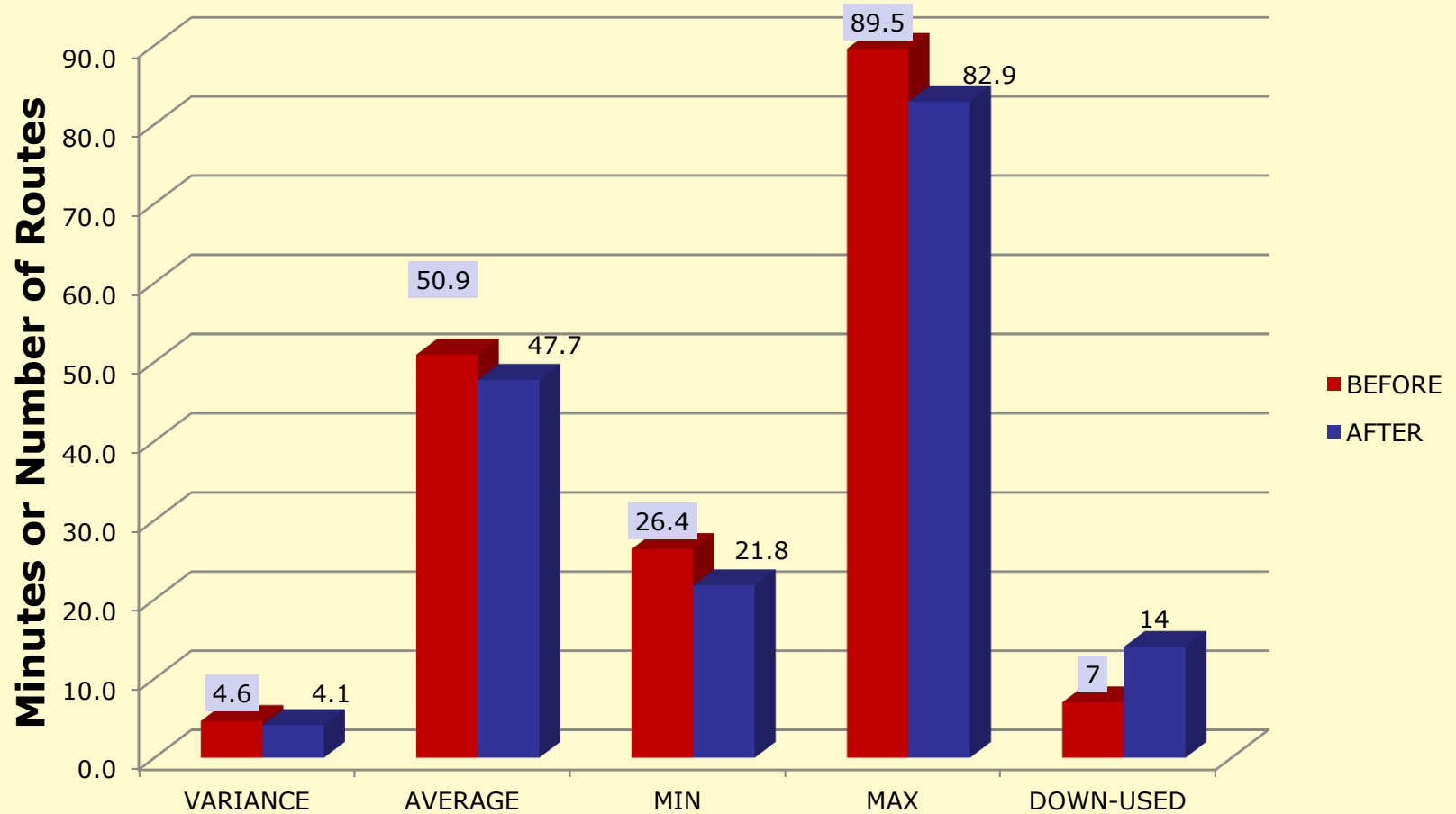
- **Highlighted street segments**
  - Defined route polygons and serviced segments
  - Mini Geo-fences
  - Ability to accurately track and assign work and additional tonnage to appropriate route
  - Improved benchmarking





- Reduction in variance between completion of standing routes (less than 5 minutes)
- Parity in route sharing (*known workload*)
- Reduction in field supervisor overtime by up to 1.5 hours (*no drawing or highlighting of standing maps*)
- Improved starting point without navigation
- Improved optimization
- Reduced complaint of overwork
- Easily and correctly identify which routes have persistent standing issues

# Comparisons: **Before** and **After**



*Effective technology and efficient  
route management requires  
continuous quality improvement*



## RouteSmart Navigation

Route: 1100RL

Solution Date: 10/24/2022 3:14 PM

Report Requested: 10/24/2022 3:14 PM

Seq	Address	ZIP	Name	Del Instr	Pkgs
39	4601 CORONADO DR, APT H	28212			26
40	4601 CORONADO DR, APT I	28212			26
41	4601 CORONADO DR, APT J	28212			26
42	4601 CORONADO DR, APT K	28212			26
43	4601 CORONADO DR, APT L	28212	Priority List	Back Door Service	26
44	4601 CORONADO DR, APT M	28212			26
45	4601 CORONADO DR, APT N	28212			26
46	4601 CORONADO DR, APT O	28212			26
47	4601 CORONADO DR, APT P	28212	Priority List	Back Door Service	26
48	4601 CORONADO DR, APT A	28212			26
49	4601 CORONADO DR, APT B	28212			52
50	4601 CORONADO DR, APT C	28212			26
51	4601 CORONADO DR, APT D	28212			26
52	4601 CORONADO DR, APT E	28212			26

- Better matching of route sequencing based on actual collection

- Crew/driver involvement

# Questions

**Thank you!!!**

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