USING ROUTING SOFTWARE FOR ANALYZING RESIDENTIAL COLLECTION COSTS, DEFININGPROCUREMENT AREAS & ROUTES

SWANA Collection Symposium 2004

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Routing Software
Its Not Just for Routing Anymore

- Route optimization software is a sophisticated analytical tool for:
  - Creating routes
  - Analyzing collection costs
  - Defining procurement areas or districts for procurements for contract collection services
  - Evaluating locations for transfer, processing or disposal facility siting

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Analyzing Collection Costs The Old Way

- Use industry thumb rules to define resource needs
  - E.g., the average number of stops for a route per day can be used to determine the number of vehicles required
- Not accurate on an individual route basis
  - E.g., the number of stops and mileage per route can vary greatly based on the population density and distance from the depot and disposal facilities to the route
- Traditional approach is simple and convenient

Analyzing Collection Costs With Routing Software

- Routing software accurately defines:
  - Individual routes
  - Number of trucks required
  - Mileage and labor hours required to service a route
  - Optimum depot and facility(s) used
- Provides more accurate cost analysis and vastly improved definition of procurement areas/routes
- Counterpoints to using routing software
  - Takes more time
  - Not all routing software products will work

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How To Analyze Collection Costs

- Assess capital and operational expenses for a fleet to service a set of customers
  - Annual Debt Service
  - Annual Labor
  - Annual Fuel
  - Annual Maintenance

Debt, Labor, Fuel, Maintenance is Based On:

- Number of Trucks
- Number of Routes
- Hours to Service Each Route
- Mileage to Service Each Route

Other Factors Affecting Cost

- Types of Trucks (automated, semi-automated, or manual)
- Capacity of Trucks by Type
- Number of Spare Trucks Needed
- Crew Staffing (driver and 0-2 helpers)
  - Single or double pass collection
- Set-out Types (carts, bag, blue bin, back door/handicapped)
- Set-out Weights That Vary by Area
- Distances From Depot and Disposal Facility to Route
- Multiple Depots or Disposal Facilities
- Collection Day Changes
- Collection Frequency
- Jurisdictional Boundaries That Constrain Route Areas

Example of Collection Costs the Old Way

- Assumptions
  - 20 cubic yard manual rear load truck with a 2 person crew collects 600 homes in a nine hour workday
    - Each day route logs 85 miles
  - 27,000 homes evenly distributed over five collection days
- Analysis
  - Requires 9 trucks and 45 routes
    - ([stops/week] / [collection days/week]) / [stops/truck/day] = [trucks/day]
      - 27,000 / 5 / 600 = 9
    - [trucks/day] * [collection days/week] = [routes]
      - 9 * 5 = 45
  - Crew labor is 900 hours/week
    - [routes] * [hours/route] * [crew persons] = [hours/week]
      - 45 * 9 * 2 = 900
  - Weekly mileage is 3,825 miles
    - [routes] * [miles/route] = [weekly mileage]
      - 45 * 85 = 3,825

Collection Statistics from FleetRoute

Truck#	Hours Per Week	Total Weekly Labor Hours	Total Tons Per Week	Stops Per Week	Miles Per Week
1	45	90	66	2,641	602
2	47	94	69	2,767	637
3	46	92	72	2,888	535
4	44	88	94	3,750	163
5	44	88	90	3,595	220
6	43	86	69	2,751	490
7	43	86	74	2,969	400
8	45	90	82	3,279	382
9	38	75	55	2,193	451
Total	395	790	671	26,833	3,880

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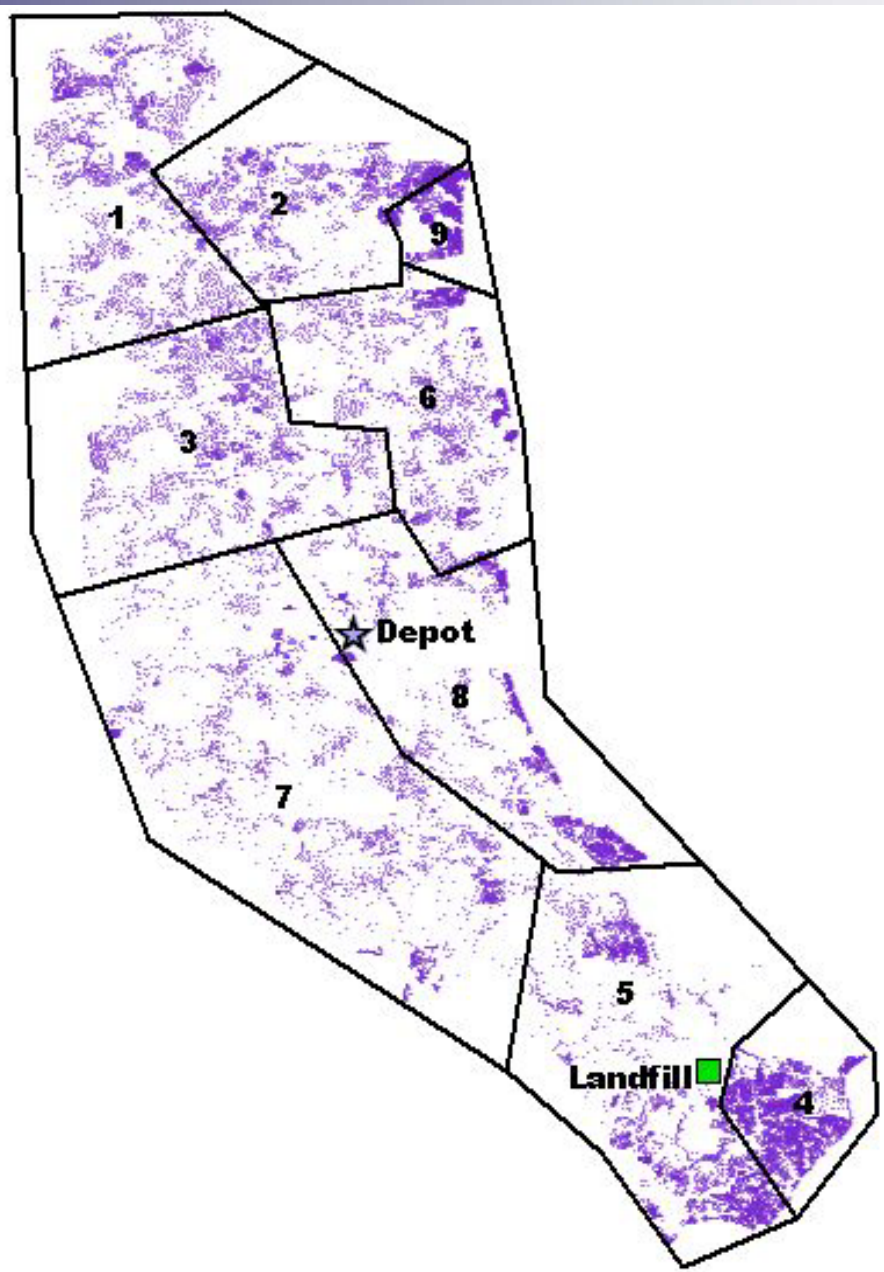
Old vs. FleetRoute

- Old overstated labor requirement
  - 900 vs. 790
- Old had 3000 stops per week, which actually varied from 2,641 to 3750
  - Area 4 had 42% more stops than the area with the least number of stops (Area 1)
- Old had weekly mileage of 3,825, which actually varied from 163 to 637

Why The Variations

- Wide geographic distribution of the communities
- Communities proximity to the landfill
- Dense populations are clustered in the North and South of the county
- Landfill is far in the South
- Travel times and mileage is substantially less for collecting the densely populated Southern area of the County



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Average Cost per Vehicle

Item		Units or Cost	Cost per Year
Vehicle Debt Service			$28,671
	Original Cost	$165,000	
	Years of Service	7	
Collection Crew Labor			$86,420
	Hours/Week	44	
	Driver Wages & Benefits	$48,011	
	Helper Wages & Benefits	$38,409	
Fuel			$4,004
	Miles/week	431	
	Gallons/week	62	
	Cost/gallon	$1.25	
Truck Maintenance			$24,590
	Mechanic Wages & Benefits	$7,240	
	Parts	$9,500	
	Tires	$5,600	
	Outside Repair	$2,250	
Sub-total Cost			**$143,684**
Overhead (35%)			$50,289
Sub-total Cost Plus Overhead			**$193,973**
Profit (20%)			$38,795
Total Annual Cost Plus Overhead and Profit			**$232,767**

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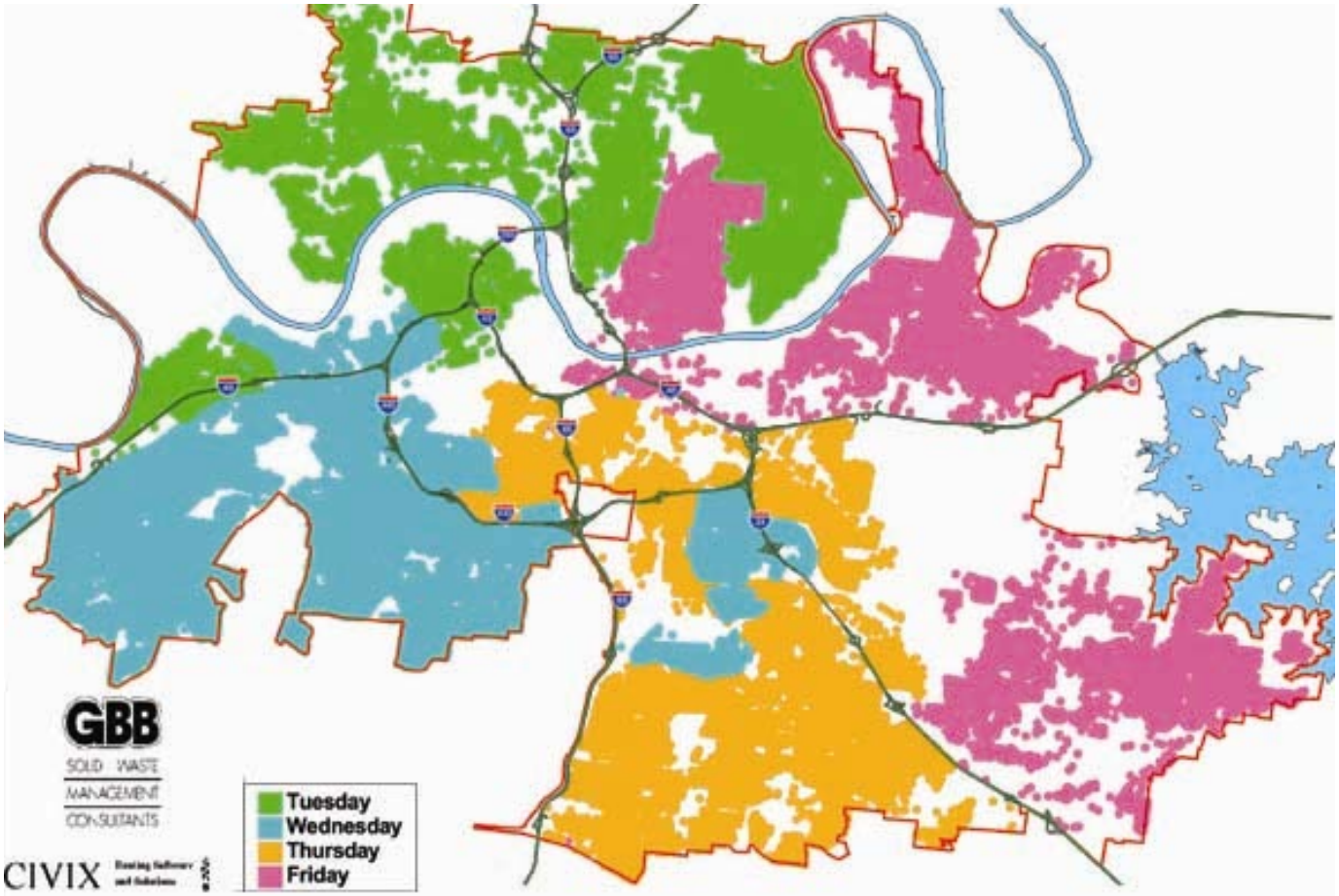
Costs by Area

Area #	Operating Costs Per Year	Annual Costs (Costs & Profit)	Annual Cost Per HH	Monthly Cost Per HH
1	200,607	$240,728	$91.15	$7.60
2	209,489	$251,387	$90.85	$7.57
3	203,221	$243,865	$84.44	$7.04
4	192,033	$230,440	$61.45	$5.12
5	192,364	$230,836	$64.21	$5.35
6	192,294	$230,753	$83.88	$6.99
7	191,550	$229,859	$77.42	$6.45
8	199,000	$238,800	$72.83	$6.07
Avg. 1-8	$197,570	$237,084	$76.98	$6.41
9	165,199	$198,238	$90.40	$7.53
Avg. 1-9	193,973	$232,767	$78.07	$6.51

Nashville Automated vs. Manual

- City needed more detailed understanding of cost savings from using wheeled carts versus bag collection for waste
- Two FleetRoute models were developed
  - For 28 cubic yard automated and 18 cubic yard semi-automated collection with carts, a model was developed for 121,000 households and small businesses
  - Model also developed for a mixed fleet of 18 cubic yard and 25 cubic yard manual collection vehicles servicing bag set-outs
  - Model did not factor additional costs for the program that are not specific to collection, such as public education and increased code enforcement

Nashville Downtown & Suburbs



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Costs for Automated vs. Manual

	Manual (no carts)	Automated/Semi-automated (carts)
Number of Customers	121,239	121,239
Downtown (18CY manual, 18CY semi-automated)	$3,055,528	$2,844,935
Suburban (25CY manual, 28CY automated)	$6,244,782	$3,479,242
Sub-total Cost w/Overhead & Profit	*$9,300,311*	*$6,324,177*
Collection Monthly Cost Per Household	$6.39	$4.35
Annual Cost of Cart Purchase & Maintenance (1)	NA	$6.49
Sub-total Cost of All Carts	*NA*	*$786,381*
Total Collection and Cart Costs	**$9,300,311**	**$7,110,558**
Monthly Collection and Cart Cost per Household	**$6.39**	**$4.89**

Note: (1) Includes $35/cart, financed over 10 years at 6% interest, plus $2/cart/year for maintenance.

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Auto vs. Manual Model Results

- Number of vehicles required varied significantly
  - Carts requires 21 of the 28CY automated trucks and 14 of the 18CY semi-automated trucks
  - Without carts requires 15 of the 18CY trucks and 31 of the 25CY trucks.
- Labor also varied significantly
  - 1,600 hours per week with carts versus nearly 3,000 hours per week with two person manual collection crews

Summary on Using FleetRoute for Cost Analysis and Procurements

- Provides another tool for municipal waste managers
  - Even for local governments that do not provide collection services
  - FleetRoute empowers contract managers to better understand their contractor's costs and to better control their performance by defining the collection areas and routes
- Traditional approach of using industry thumb rules for assessing average costs for collection (and collection procurement areas and routes) are often inaccurate on the individual route level
  - Provide procurement areas that don't factor population densities and proximity to facilities, i.e., haulers will have unbalanced areas
- Although using routing software is a more complex and time-consuming process, the results are more useful, accurate and comprehensive

Thank you

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