

Performance Audit of Public Works: Sanitation Division

October 2017

City Internal Auditor's Office

City of College Station

File#: 17.04

Why We Did this Audit

Sanitation services are one of the most direct and frequent ways a citizen interacts with the City of College Station. Moreover, the Sanitation Division has not received audit coverage since the formation of our Office in 2007.

In fiscal year 2016, the Division collected about 77,000 tons of waste through a combination of services provided by City employees and contractors. The Division was budgeted to expend about \$9 million in fiscal year 2016, which would be covered by a revenue of about \$9.5 million.

What We Recommend

Recommendations 1 & 2

Investigate routing methods to increase employee and citizen accountability.

Recommendations 3 & 4

Adjust some workforce management strategies including hiring guidelines and employee advancement systems.

Recommendations 5, 6, & 7

Revise some City policies to better reflect Sanitation needs including collection scheduling and construction and development standards.

Recommendation 8

Develop Sanitation safety videos for the public.

Audit Executive Summary:

Public Works: Sanitation Division

What We Found

In general, we found that the Sanitation Division effectively provides a very high level of service to its commercial and residential customers. While not inappropriate, this culture of customer appeasement leads to increased costs for the City of College Station. These cost increases are driven by the following obstacles:

Slower Collections. We noted that many collection services are hindered by “obstructions” created by customers. These obstructions typically make it more difficult for a route manager to efficiently pick up their canisters each day. This being said, the Division does not have an effective enforcement method in place to curb these behaviors. Furthermore, as the City continues to grow collections will take more and more time, requiring effective route balancing on which hiring strategies are based.

Acceptance of Risks. These obstructions also tend to increase the frequency with which route managers engage in risky behaviors (e.g. dismounting and backing up). Moreover, we noted that other citizen behaviors – including reckless driving and pedestrian interaction – can increase the risk of harm to City property, employees, and citizens themselves.

City Regulations. We found that these obstructions are occasionally exacerbated by some City development standards. Additionally, residential customers can request additional services (refuse, bulk, brush, and recycling) at no charge. Finally, the City’s commercial business routing methodology limits the Division’s flexibility and decreases efficiency.

Sanitation Division Audit

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Introduction

The Office of the City Internal Auditor conducted this performance audit of the Sanitation Division pursuant to Article III Section 30 of the College Station City Charter, which outlines the City Internal Auditor's primary duties.

A performance audit is an objective, systematic examination of evidence to assess independently the performance of an organization, program, activity, or function. The purpose of a performance audit is to provide information to improve public accountability and facilitate decision-making. Performance audits encompass a wide variety of objectives, including those related to assessing program effectiveness and results; economy and efficiency; internal control; compliance with legal or other requirements; and objectives related to providing prospective analyses, guidance, or summary information. A performance audit of the Sanitation Division was included in the fiscal year 2017 audit plan based on direction given by the Audit Committee.

Audit Objectives

This audit addresses the efficiency and effectiveness of the City's solid waste management activities and answers the following questions:

- Do City policies, procedures, and practices promote effective solid waste management?
- Does the Sanitation Division align with best practices, as stated by the Environmental Protection Agency?
- How does the Sanitation Division mitigate inherent solid waste management risk?

Scope and Methodology

We conducted this performance audit in accordance with generally accepted government auditing standards (with the exception of a peer review).¹ Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives. The following paragraphs further detail the audit procedures used to obtain this evidence:

¹ Government auditing standards require audit organizations to undergo an external peer review every three years. We are scheduled to receive a peer review in fiscal year 2018.

Interviews. To obtain general and background information on the Sanitation Division’s operations, we interviewed Public Works and Sanitation administrators. We discussed operations more specifically with Sanitation staff including: route managers, container coordinators, the recycling and environmental compliance manager, and customer service representatives. Finally, we interviewed staff within the City’s Code Enforcement and Traffic Divisions to learn about street parking and code enforcement as related to Sanitation.

Documentation. To identify criteria, we examined the work of auditors in other jurisdictions and researched professional literature including: Environmental Protection Agency (EPA) guidelines, Texas Commission on Environmental Quality regulations, and web design rules. We also reviewed City policies and procedures including: College Station annual budgets; Sanitation collection guidelines based on the City’s Sanitation Ordinance Section 11-5; Sanitation policies and mission statement; customer satisfaction survey results; collection maps; recycling service contracts; and a draft copy of Sanitation’s most recent Cost of Service and Rate Design Study.

Work Orders. To further explore the types and effects of reactive services (i.e. services initiated by requests) on the Sanitation Division, we obtained work order data for fiscal year 2016. Work orders are typically generated by a customer service representative after a customer calls the Division to request something. To better analyze these effects, we categorized each work order into the service types listed below.

Service Requests	Extra Services	Extra Collections	Complaints
New Service	Damaged Container	Commercial	Missed (Brush)
Remove Service	Dead Animal	Residential	Missed (Refuse)
Extra Container Request	Return Charge	Bulk/Brush	Missed (Recycling)
Service Change	Daily Rental	Roll Off	Missed (Bulk)
Misc. Service Request	Recycling Kit/Bags Request		Missing Container
	Install Dumpster Lock Bar		
	Lost Compactor Key		

Overtime. To examine the Division’s ability to cope with short staffing, we retrieved pay stub overtime data for fiscal years 2013 through 2016. We adjusted this information to reflect the number of hours actually worked during the correct time period and analyzed it by year and month. We also identified all route manager employees and compared overtime for this position to the Division’s overtime policy. Additionally, we constructed a regression to identify variables that had a significant effect on overtime hours. Finally, we analyzed overtime by service type and evaluated the Division’s decision making practices.

Truck Maintenance. To investigate the operational impact of vehicles breaking down, we procured truck maintenance records from the Fleet Division after verifying a truck list with Sanitation. We then identified instances where more than one vehicle of the same type was out of service at the same time for at least a day.

Insurance Claims. To examine the Division's risk, we obtained insurance claims data from the Risk Management Division for fiscal years 2013 through 2016. For each claim, we identified the following categories: fiscal year, service type, who was at fault, employee activity during the incident, type of incident, and type of loss. We then combined claims that were made for the same accident into "incidents" and analyzed these by each category. There were 186 claims and 166 incidents during this time.

Single Stream Recycling. To explore the effects of single stream recycling, we obtained waste disposal data including recycling, refuse, and number of households summarized by month from fiscal year 2014 through fiscal year 2016. We then calculated the average number of recycled, refuse, and waste² pounds per household and tested if the average of each was significantly different before and after single stream implementation in January 2016.

Collection Information. To explore the feasibility of changing collection days, we conducted an experiment to test the ease with which individuals could locate their collection day using the City's MyWaste Directory. See Appendix B for further details and results from this experiment.

Ride-a-Longs. The bulk of our audit work and evidence was collected during a two week period (July 17th through July 28th) wherein the entire audit staff rode with Sanitation's route managers during their daily collections. During this time, all collection services were observed for at least one full day – with most being observed for two days. During this observation period, audit staff collected several pieces of information: general times, weights, and pickups separated by trips to the landfill; and the time it took to collect obstructed pickups. Appendix A further details this process and the subsequent analysis.

It is important to note that this ride-a-long experiment was conducted during the summer. Due to the City's large transient student population, observations from this experiment most likely underestimate the effects and amounts of obstructions route managers face during fall and spring. For this reason, our office plans on conducting a follow-up audit to repeat this procedure during the Division's busier times.

² Where waste is the total recycled and refuse pounds collected.

Background

Sanitation is a division of the City of College Station's Public Works Department and is devoted to managing and collecting the municipality's solid waste. This Division is funded out of a separate enterprise fund and, in fiscal year 2016, employed 37.5 full-time equivalent (FTE) employees. The table below shows the breakdown of these FTEs:

Table 1: Division FTE Summary

Position	FTE
Sanitation Superintendent	1.0
Can Coordinator	2.0
Sanitation Foreman	2.0
Recycling & Environmental Compliance Manager	1.0
Customer Service Representative	1.0
Staff Assistant	1.0
Route Manager	27.0
Equipment Operator	2.0
Public Works Intern	0.5

Route manager's make up the bulk of the Division's work force and are supervised by the Sanitation foremen. These individuals perform the actual collection each day – that is they drive the Sanitation trucks that pickup customer waste – and manage customer issues in the field. They are divided into two collection categories: Commercial and Residential. The table below shows how much waste was collected in the last three fiscal years per category.

Table 2: Division Workload Summary (Tonnage)

Fiscal Year	Residential		Commercial		Recycled Waste
	Refuse	Customers	Refuse	Customers	
2014	21,396	20,866	37,856	1,122	17,147
2015	21,602	21,526	39,291	1,160	14,136
2016	21,577	22,291	40,302	1,172	19,063
Average:	21,525	21,561	39,150	1,151	16,782

Within these collection categories, the City provides a number of services using several different truck types to current utility customers. These services are listed below:³

Commercial Dumpster Service. City collection of a two, four, or eight cubic yard container or compactor between one and six times each week as decided by the customer. These canisters are collected by vehicles that lift the dumpster up and over the truck cab before



³ Collection times listed throughout this section are based on actual observations.

continuing to the next location. On average, it takes about twenty-five seconds to collect a dumpster.



Commercial Cart Service. City collection of 90, 300, or 400 gallon carts between one and six times each week as decided by the customer. These canisters are collected by vehicles which lift the cart using a semi-automated gripper on the right side of the truck, just behind the cab. They then return the cart to the ground and continue to the next location. On average, it takes about seven seconds to collect a cart.

Commercial Roll Off Service. City collection of 20, 30, or 40 cubic yard roll off open top or compactor containers scheduled or by request. These canisters are collected by vehicles that must load a roll off onto the truck's bed before unloading the contents at the landfill and returning the canister to its original location. Collection times depend upon the position of the canister and surrounding environment.



Residential Refuse Cart Service. City collection of 70 gallon carts weekly. Refuse is collected by trucks that, similar to the commercial cart service, lift a cart using a semi-automated gripper on the right side, just behind the cab. On average, it takes about seven seconds to collect a cart.



Residential Large Bulk and Brush Service. City collection of large bulky items and brush weekly. Bulk and brush are collected by a two-vehicle team: one truck carries an open top canister and follows another that uses a claw-like grapple that lifts objects from the ground and into either its own open top or the other vehicle. This two-vehicle system allows the Division to separate bulky items and brush, the latter of which can be composted and sold back to the public. Collection times depend on the size and make up of items set out.

Residential Small Bulk and Brush Service. City collection of smaller bulky items and brush weekly. These items are loaded into the rear of a vehicle which automatically compacts the items collected by a two-person route manager team – one employee drives and the other rides on the back of the vehicle to speed pickups. Collection times depend on the size and make up of items set out.

Residential Satellite Service. City collection of refuse and small bulky and brush items for households unable to move their carts to the curb due to disability and households in rural areas; also responds to citizen requests and complaints for pick up. Residential carts are moved by the driver to the back of the truck and then lifted into the compactor by a gripper similar to other cart services; bulky

items and brush are lifted into the compactor by the driver. Collection times vary depending on the service being provided.

Residential Recycling Service. Contractor collection of 96 gallon carts every two weeks currently provided by Brazos Valley Recycling. This contract was approved in October 2015 and went into effect in January 2016. It will cost the City about \$840,000 annually for the next two years.



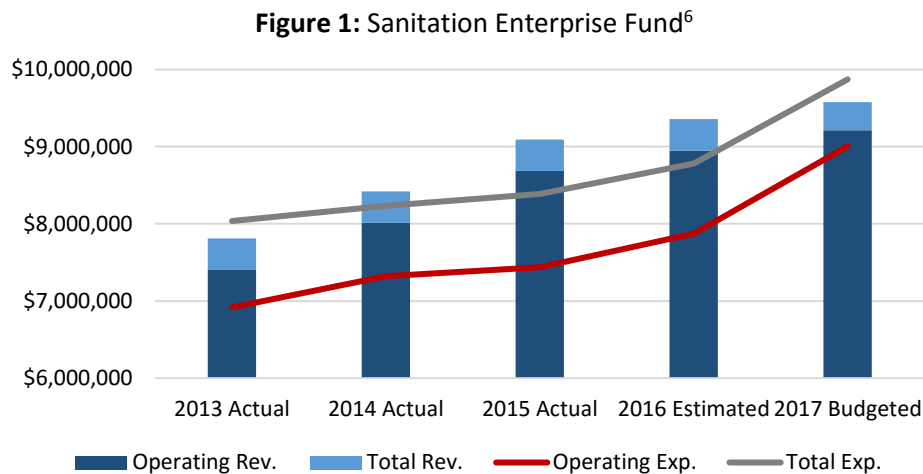
From these services, the Division collects about 6,500 tons of waste each month, which are delivered to Twin Oaks Landfill each collection day.⁴ While commercial customers generate the most waste per canister, residential customers drive the total number of pickups each day. Typically, the Division collects an average of 1,470 commercial canisters each day, while it collects about 3,260 residential canisters each day;⁵ however, these estimates were made during the summer.

Due to Texas A&M enrollment, the City of College Station's population typically drops during the summer. For example, during the summer of 2016 Texas A&M had about 21,000 enrolled students; however, during the fall and spring semesters Texas A&M had about 60,000 enrolled students. This transient population can create route balancing issues as work load is more likely to fluctuate and can make educational efforts more costly and difficult to maintain.

For each of these services, the customer is charged a monthly fee detailed in the City's Sanitation Ordinance Sec. 11-5. Commercial fees are based on the type, size, and frequency of collection and range from \$18 per month for weekly collection of a 90-gallon cart to \$1,494 per month for six-day-a-week collection of a six cubic yard compactor. For residential customers, the fee includes provision of one (1) 70-gallon cart, refuse, recycling, bulky items and brush collection, and costs \$14.40 per month. Additional carts can be procured for an additional fee dependent on the cart's size (70 or 300 gallons). Figure 1 below shows the Division's revenues and expenditures for the last five fiscal years.

⁴ Recycling collections are not taken to the landfill but are sorted by BVR.

⁵ These estimates do not include non-canister pickups – in other words bulk & brush services or satellite pickups.



The revenue and expense increases seen in Figure 1 can mostly be attributed to customer growth. This being said, the large spike in fiscal year 2017’s budget is attributed to vehicle replacement costs. Over the last five fiscal years, the Division has replaced three vehicles with the help of the City. These costs are then repaid by the Division, most of which was budgeted for fiscal year 2017. The table below shows the average cost for each vehicle type the City purchases:

Table 3: Vehicle Purchase Price

Vehicle Type	Average Purchase Price
Automatic Side Loader	\$317,000
Rear Loader	\$221,000
Grapple	\$163,000
Open Top	\$113,000
Satellite Rear Loader	\$131,000
Roll Off	\$222,000
Frontend Loader	\$271,000

In 2016 and 2017, the City hired Burns & McDonnell, a “full-service engineering, architecture, construction, environmental and consulting solutions firm,” to conduct a cost of service and rate design study for the Sanitation Division. This study found that using the City’s current fee schedule, Sanitation would fall below its 15 percent working capital target by fiscal year 2019. After reviewing the consultant’s methodology, we believe its estimates in this regard are reasonable. The consultant recommends increasing fees to offset these rising costs, however, we have several recommendations we believe could help cut costs if implemented.

The following report contains hyperlinked videos that require internet access to view.

⁶ Service revenue and expenditures reflect the “Residential” and “Commercial” revenue and expense line item for each fiscal year.

Findings and Analysis

Customer Actions Hinder Collection Efficiency

According to their mission statement, the City’s Sanitation Division endeavors “to provide safe, efficient and cost effective solid waste and recycling collection . . . with world class customer service.” During our review, we found evidence that providing such exemplary customer service hinders the Division’s ability to meet its other goals.

High Service Level Leads to Poor Customer Behavior

Obstructions add about six and half hours to residential cart collection every week.

Residential cart collection faces many customer-driven obstructions. Each week, the Division receives about 21 complaints. We observed residential customer behavior throughout the entire City for a week (one route cycle). Of the 8,409 canisters we documented during this period,⁷ about 14.4 percent involved some violation of the City’s residential collection guidelines (as codified in the City Ordinances Sec. 11-5). While this is not necessarily a large percentage, these “obstructions” add an estimated six and a half hours of time to collections each workweek. The video linked below compares pickup of a typical unobstructed canister to a canister too close to a recycling bin.

[Video 1: Residential Cart Collection Comparison](#)

Using data collected on obstructions from our ride-a-long observations, we ran a regression to identify the average time it took to collect a residential cart given a certain obstruction⁸ and found that all types were significant above the 95 percent level. The results can be seen in Table 4, and a more complete regression methodology and output is detailed in Appendix A.

Table 4: Residential Cart Obstruction Observations

Obstruction	Percent of Pickups	Avg. Seconds
Car	0.92%	14
Other Cart	2.90%	16
Recycling Bin	6.30%	14
Bulky Item	0.07%	13
Telephone Pole or Mailbox	0.19%	14
Overloaded Canister	2.93%	13
Canister Facing the Wrong Direction	0.63%	14
Prohibited Item	0.34%	14
Other	0.36%	27

⁷ This included half (2) of the residential routes Monday-Thursday and all (1) Friday routes for a total of nine observed collection routes.

⁸ No unobstructed cart observations were included in this regression.

Moreover, traffic affects the time it takes to collect canisters. In particular, many vehicles are forced to sit at stop signs as citizens drive by causing delays – especially during Texas A&M’s Fall and Spring semesters. We found that on average, residential route managers spend about 22 minutes each day (about five percent of a work day) transitioning from neighborhood to neighborhood.

Single stream recycling is a system in which all recyclables (including newspaper, cardboard, plastic, aluminum, etc.) are placed in a single cart for recycling.



Same-day residential recycling slows residential waste collection. From Table 4, we can see that recycling bins are the most common obstruction and generally double the time it takes for a route manager to collect an obstructed canister. While observing residential route managers collecting carts on recycling days, it was clear that same-day recycling makes collection more difficult, not only because it obstructs refuse carts, but because it increases the chance a cart will be obstructed. Using a regression, we found that there are likely to be about 13 more obstructions on a recycling day versus a non-recycling day per 100 carts collected. For this reason, we believe separating residential recycling collection and residential refuse collection to different days would improve efficiency.

The single stream process has significantly impacted recycled waste disposed. On the other hand, the implementation of single stream and same-day recycling increased recycled material per household from about seven to eighteen pounds per month (157 percent increase). Though this is a significant increase in pounds recycled, there was not a statistically significant decrease in refuse material (see Table 5). This is most likely because recycling on average makes up a small percentage of residential waste collected in carts as seen in Table 5. Moreover, the rejected material rate – or material collected to be recycled that cannot be – has increased almost seven times since single stream recycling began.

Table 5: Single Stream Impact on Cart Collection by Month

Measure	Pre Implementation	Post Implementation
Recycled Lbs./Customer	6.86	18.19
Refuse Lbs./Customer	167.28	157.43
Average Rejection Rate	3.74%	34.81%
Percent of Waste Recycled	3.98%	10.06%

This is not to say that single stream recycling is ineffective, only that the City’s current culture does not fully embrace recycling efforts. This can most clearly be seen in the City’s diversion rate (i.e. the percentage of total waste recycled, or diverted from the landfill). On average, the City’s annual diversion rate is about 21.6 percent, which is slightly higher than the average municipal diversion rate for the state of Texas of 18.9 percent.⁹ However, the Environmental Protection Agency estimated that in 2013 the United States diverted about 34.3 percent of waste.

Collection information is difficult to locate. The City switched to same-day recycling at the same time they switched to single stream recycling with the hopes to improve setout rates. The MyWaste

⁹ Based on 2013 data collected by the Texas Recycling Data Initiative

Directory application was developed to aid residential customers in identifying their waste collection days, as most have at least two per week – one for cart collection and one for bulk and brush. To explore the feasibility of changing collection days, we conducted an experiment to test the effectiveness of the Division’s communication of collection information – particularly regarding recycling (see Appendix B for more detail).

While we found that this application was generally easy to use, it is not easy to locate on the Internet. Of a 31 person sample, about 30 percent were able to locate the MyWaste Directory and use it to their advantage, while a little over 15 percent gave up trying to find the information. On average, it took these individuals a little over three minutes to identify an address’ recycling collection day. Moreover, several individuals expressed surprise at learning recycling was every other week instead of weekly and frustration at the difficulty they experienced in locating the information.

Additionally, we attempted to locate the MyWaste Directory ourselves. When googling “City of College Station collection day,” this application originally appeared fifth on the results page. We also noted that even when we knew exactly how to identify the collection day, the information required four clicks and about thirty seconds of time (see Video 2). This violates the “three-click” rule of web design. For this reason, developing a method to adequately communicate collection information is crucial to changing collection days.

[Video 2: MyWaste Directory](#)

Sanitation communication efforts have been extensive. This being said, the Division has devoted significant resources to communicating major collection changes. For example, when switching to single stream recycling, the Division communicated this collection change in a number of different ways including posting on social media, appearing on local news stations (both radio and television), distributing collection guideline posters and collection schedule refrigerator magnets, updating the MyWaste Directory and the City’s website, and even creating public service announcements (see Video 3).

[Video 3: Single Stream Recycling Guide](#)

Other service types face similar obstruction problems. Though we spent the most time observing residential cart collection, we also observed two routes for all other collection types except the small bulky item and brush route. Table 6 shows the number of pickups uncollected for each service type due to obstructions:

Table 6: Collection Pickup Summary

Collection Type	Uncollected	Total Pickups	Percentage
Commercial Dumpster	2	240	0.83%
Commercial Cart	0	576	0.00%
Commercial Roll Off	1	11	9.09%
Large Bulk & Brush	3	253	1.19%
Small Bulk & Brush	0	251	0.00%
Satellite ¹⁰	N/A	N/A	N/A

Other Residential Collections. We noted that some customers combined bulk items and brush into the same pile. While this may not negatively affect pickup times, it prevents the Division from composting this brush. Moreover, placing bulky items and brush too close to stationary obstructions, such as cars, poles, mailboxes, etc., can increase the time a crew spends trying to collect the waste, as well as increase the risk of employee injury or property damage.

The small bulky item and brush collection service seemed to be least affected by obstructions; however, if items could not be picked up by the large bulk and brush crew, these employees would be called in to collect them – potentially putting them at risk for personal injury. Similarly the satellite service was not highly affected by obstructions. However, this route also completes most work orders for residential collections. For this reason, some carts left due to obstructions may be collected later in the day by this service.

Commercial Collections. Commercial dumpster and cart services begin at 4 AM on workdays. There are two reasons for this earlier start time which are avoiding traffic and reducing the risk of reversing in business and multi-family parking lots. This being said, the landfill does not open until 7 AM, which can occasionally force a full commercial vehicle to sit and wait for up to an hour to dump its load. Moreover, the City of College Station's Noise Ordinance (Sec. 7-2) prevents these commercial trucks from collecting multi-family dumpsters before 7 AM, forcing route managers to double-back on their route later in the day, which limits efficiency.

Additionally, these drivers must occasionally dismount to move bulky items out of the way so a canister can be collected – increasing risk of employee injury. Sometimes, prohibited material or bulky items are placed inside the canister so they cannot be collected – frequently requiring a route manager to return after the property manager has removed the item. Moreover, the City's Unified Development Ordinance requires many businesses to store their dumpsters in gated enclosures. While this provides citizens with a more pleasing aesthetic, it forces route managers to dismount their vehicles twice each time they collect a dumpster. This not only increases the time it takes to collect these dumpsters but also increases the chance that an employee is injured on the job.

Likewise, the City requires many roll off containers and compactors to be covered by a roof to limit the amount of precipitation that enters the sanitary sewer system. However, we observed that

¹⁰ This percentage could not be calculated due to data inconsistencies.

these roofs occasionally impede the route manager's ability to load and unload canisters from their trucks. These roofs not only make Sanitation's job more difficult and time consuming but also increase the risk of damaging customer property – particularly the roof itself.

Furthermore, some businesses have canisters where the compactor or container door is facing the incorrect way when initially loaded (i.e. the door out of which waste is dumped at the landfill is next to the cab). This forces the route manager to first load the canister onto the truck to pull it away from the building, unload the canister in the parking lot, and then reload it before driving to the landfill. This process is then repeated after dumping the contents at the landfill so the canister is more easily returned to the pickup location.

Customer Behavior Leads Route Managers to Accept Risk

Division policy could be adjusted to reduce risk further. While some collection services are inherently higher-risk than others, the Division has taken steps to limit employee risk where possible. For instance, commercial dumpster and cart service as well as residential cart services are fully automated, preventing injury by limiting physical movement and decreasing the weight manually collected by employees each day. This being said, we noted that risk of personal injury persists.

Specifically, most route managers must dismount or back up while completing their routes. These activities place the employee at risk. For example, climbing into and out of the cab for every pick up places the driver at a higher risk of injury than only dismounting at the end of the day or for breaks. Similarly, all Sanitation trucks are large vehicles with limited visual range – especially when backing up. To mitigate this risk, the Division has backup cameras installed on front end loaders and automatic side loaders, however, engaging in this activity still puts the City at a higher risk of property damage or injury to pedestrians. While these activities are necessary for some service types, they should be reduced. We found that citizen behavior and the City's high service level leads to route managers engaging in these risky activities more often than necessary.

Dismounting. For most service types dismounting is necessary, however, the automation of residential cart service and commercial dumpster and cart service should prevent a route manager from dismounting their cab while on-route. This being said, we observed instances of route managers dismounting for all automated service types – these are summarized in Table 7:

Table 7: Automated Collection Dismounts

Collection Service	Dismounts	Pick Ups	Percentage
Commercial Dumpster	93	240	38.75%
Commercial Cart	1	576	0.17%
Residential Cart	106	8,409	1.26%

While ideally dismounting should be nonexistent, we found this activity is unavoidable due to citizen obstructions. For instance, the most common cause of dismounting for residential cart collection is another cart (either recycling or refuse) being too close to the cart being collected. This can

occasionally cause a route manager to spill the contents of the canister, forcing them to dismount and clean the polluted area. In this way, the Division's goal to deliver high service to customers (i.e. always collect their canisters even if they are in violation of City ordinance) leads to a higher level of risk as route managers are forced to dismount more often.

In terms of commercial dumpster collection, the most common cause of dismounting was gated dumpster enclosures. As mentioned previously, these enclosures force a route manager to dismount twice during collection. This policy – though more aesthetically pleasing – does not have a functional effect on disposal, and encourages riskier behavior.

Backing Up. Similarly to dismounting, backing up is necessary for some collection services. For instance, due to the way commercial dumpster trucks are designed, the driver must back up each time a dumpster is collected. Moreover, commercial roll off collection requires a driver to back up to a container or compactor to load it on the back of their truck (see Video 4).

[Video 4: Commercial Roll Off Loading](#)

This being said, most collection services should not require backing. Table 8 presents the percent of time spent backing up during each collection service on average each route.

Table 8: Backing Up by Collection Service

Collection Service	Avg. Number of Backups	Percent of Time Backing
Commercial Cart	50	2.41%
Residential Cart	58	1.91%
Large Bulk & Brush	54	0.92%
Small Bulk & Brush	23	0.59%
Satellite	10	0.30%

Construction standards may put the Division at a higher risk. From our observations, many of these back ups are due to routing inefficiencies or developments ill-designed for Sanitation vehicle navigation. For instance, we observed several neighborhoods and streets where a Sanitation vehicle was unable to safely turn around, requiring the driver to back up for large stretches of road (at most backing up continuously for over two minutes). This can be seen in Video 5:

[Video 5: Backing Up in a Tight Area](#)

Similarly, Sanitation vehicles often had to slowly navigate between parked cars to collect residential waste. These tight spaces increase the likelihood a vehicle will cause damage to both City and citizen property. This being said, route managers are inclined to accept these risks, as leaving a canister may impact their performance review and going around may be impossible or take too much time.

Furthermore, trucks are often forced to back up to accommodate cars – both moving and parked. For instance, the large brush and bulk service often takes up the whole width of a neighborhood

street since it requires two trucks to be parked side-by-side. During our observations, we noted that occasionally, citizens would pull up to the vehicles and honk, urging a route manager to back up and move out of the way.

Furthermore, street parking is detrimental in cul-de-sacs. Due to the dense nature of these areas, obstructions – including parked cars – are more likely to occur. Moreover, developers are incentivized to build cul-de-sacs with smaller diameters (i.e. they use less material and less land), further condensing the area and forcing trucks to make tighter turns, many of which result in backing up.

According to staff, cul-de-sacs were more efficient for Sanitation in the past because there was less distance between canisters. However, the Division has begun using larger vehicles with looser turning radii, causing this efficiency to be lost and typically making cul-de-sac collections less efficient than collection on a straight road (see Video 6). Since this change, the City's cul-de-sac standards have not been revised to incorporate the needs of Sanitation.

[Video 6: Cul-de-sac versus Straight Street Collection Comparison](#)

When we investigated the City's procedure for removing parking on one side of a street, we noted that the City's largest consideration in this process was emergency vehicles – specifically fire trucks. After comparing the specifications for both fire and sanitation trucks we found that their widths were very similar, indicating that Sanitation trucks are at least inadvertently benefited. However, if parking is not removed for safety reasons, residential Sanitation trucks must still maneuver through these tight spaces, stopping every few feet to collect a canister. The difficulty and risk of this activity is more accurately shown in Video 7.

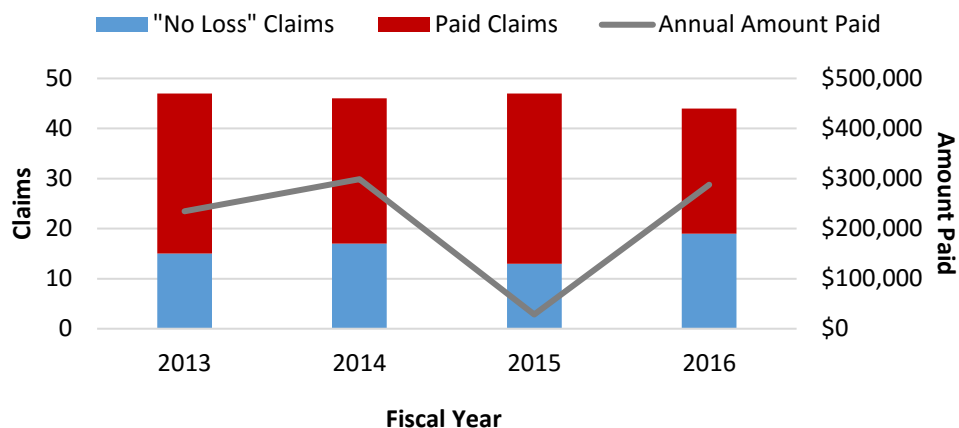
[Video 7: Street Parking as an Obstacle](#)

Solid waste collection is an inherently high-risk function. Based on insurance claims, the Sanitation Division is one of the riskiest in the City.¹¹ Moreover, the Bureau of Labor Statistics (BLS) cites refuse and recyclable material collection as one of the top ten most dangerous occupations, with a fatal injury rate of 38.8 deaths per 100,000 full-time equivalent (FTE) workers – over ten times the average fatal injury of all occupations (3.4 deaths per 100,000 FTE).

On average, the City receives about 46 Sanitation related claims each year, averaging \$5,118 each. This being said, a major Sanitation incident – where a number of claims are related to a distinct accident – can cost the City considerably more money than a typical claim. During fiscal years 2013 through 2016, three of these major incidents occurred, totaling \$732,574 – a little over 86 percent of all money paid out during this period for Sanitation claims. All of these incidents involved a motor vehicle accident.

¹¹ Compared to all other areas of the City in 2016, the Sanitation Division received the second highest number of claims per employee.

Figure 2: Sanitation Claims¹²



When we reviewed incidents by service type, we found that commercial dumpster collection had the most frequent incidents (see Table 9). Based on our observations, this is most likely due to the nature of the trucks this service uses – front end loaders (FEL). These trucks must pull the dumpster up and over the cab before setting them back on the ground. If large bulky items remain stuck in the dumpster as it is set down they can break or crack the windshield resulting in City property damage. This is supported by claims data, as 40.8 percent of all FEL accidents occurred during dumpster pickups, which is slightly higher than the percentage of pickup incidents of all other services not including commercial dumpster incidents (32.1 percent).

Table 9: Incidents by Service Type (FY13-FY16)¹³

Service Type	Incidents	Employee Injuries	Amount Paid
Commercial Dumpster	49	6	\$252,310
Large Bulk & Brush	24	2	\$296,349
Residential Cart	18	2	\$264,954
Commercial Roll Off	15	0	\$5,765
Small Bulk & Brush	11	5	\$3,542
Commercial Cart	7	1	\$4,778
Satellite	4	2	\$657
<i>Total:</i>	128 (of 166)	18 (of 46)	\$849,554

We also noted that both large and small bulk and brush collections were generally more risky for City employees than other services. These typically require route managers to pick up large piles of bulky, potentially heavy objects or brush, in which sharp or hazardous objects may not be visible. Moreover, route managers must dismount each time they collect refuse. Finally, during small bulk and brush collection a route manager rides on the rear of the truck gripping only a handle as they

¹² "No Loss" Claims – The City received an insurance claim, but did not pay out any money.

¹³ Due to the nature of the data service type could not be identified for all incidents. Additionally, some incidents were not due to the service being provided (i.e. bee stings, truck maintenance, etc.)

stop to collect heavy items on the sides of busy streets. This is the most dangerous activity performed by route managers and can be seen further in Video 8.

[Video 8: Small Bulk & Brush Collection](#)

Citizen actions occasionally put themselves and City employees at risk. While many Sanitation risks are either inherent to the job or can be mitigated, citizen actions are one of the riskiest and most costly variables affecting Division safety. While conducting our observations, we noted that often times citizens exhibit reckless behavior when driving near Sanitation vehicles. Indeed, about 33.3 percent of motor vehicle accidents are the fault of citizens instead of City employees. An example of this can be seen in Video 9.

[Video 9: Reckless Driving](#)

Additionally, we observed two separate incidents where a child attempted to grab the residential cart collection gripper. While both route managers were able to stop the equipment before an injury occurred, this piece of machinery is potentially deadly and should never be touched while in use. Although these were the most troubling incidents we also observed many other instances of citizens acting recklessly around Sanitation vehicles. This indicates that the City may need to provide additional education to citizens about safety around Sanitation vehicles.

Enforcement Efforts of Sanitation Regulations are Ineffectual

Sanitation enforcement methods focus on educating residential customers. Though residential obstructions are specifically prohibited via City ordinance and result in the City taking on more risk, no additional fees may be charged to customers who violate these regulations. Instead, the Division has two procedures meant to modify these behaviors – tagging carts and levying fines.

Tagging is most readily available to residential cart route managers and is meant to inform and educate customers as to why a canister was not collected. To tag a cart, a route manager must first identify the issue on the tag (see Figure 3) and then dismount their vehicle to place the notice. We found that while drivers have the option to tag carts in violation, few chose to do so (0.02 percent of pickups observed).

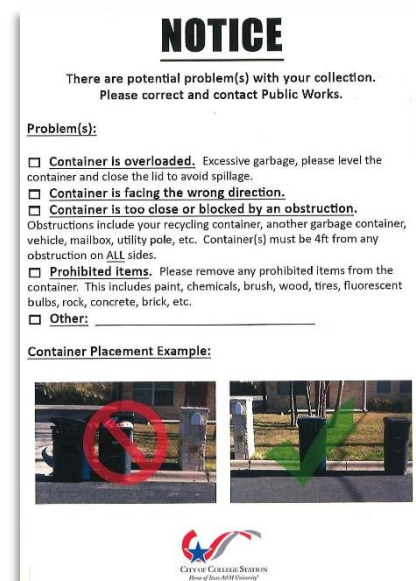


Figure 3: Residential Tag

This appears to be for several reasons. First, route managers often do not wish to take time out of their day to tag carts. Also, many route managers feel that tags are not effective behavior modifiers, as the refuse is often collected even if the cart is tagged – either by the driver who placed the tag, or later (after a citizen calls into the office) by the satellite service. We found evidence that tagging an

already obstructed canister adds about 1 minute and 19 seconds to collection time¹⁴ – over eleven times longer than the 7 seconds needed to collect an unobstructed can.

Moreover, there is evidence that the Division does not consistently communicate problematic customers or properties to the City’s Code Enforcement Division. According to City staff, there have been fewer than five Sanitation related citations issued in the last few years. While this is most directly due to a lack of communication between the two divisions, we were told that Code Enforcement is most focused on educating customers when they violate an ordinance. Additionally, some ordinance violations are not caused by the owner of the property and thus it would be unfair to fine them.

Finally, though the City ordinances allow for a fine when there is a violation, there is no charge prescribed for extra residential pickups. This policy discourages compliance with the Ordinance as customers can have their refuse collected for free at any time. On the other hand, the City does charge commercial customers for extra pickups. Table 10 below shows the number of extra collection work orders by whether or not a fee is charged.

Table 10: Extra Collections by Fee (Fiscal Year 2016)

Service	Work Orders	Percentage
<i>Fee</i>		
Extra Collection – Commercial	1,101	29.7%
Return Charge – Commercial	51	1.4%
<i>No charge</i>		
Extra Collection – Residential	1,457	39.3%
Complaints – Residential	1,091	29.4%
Complaints – Commercial	6	0.2%
Total:	3,706	100%

As can be seen in Table 10, the majority of extra collections are requested by residential customers. Based on the City’s policy of not charging residential customers for extra services, we estimate that the City does not charge for extra collections 70 percent of the time.

The ordinance also allows for a fine of \$19.85 to be charged to “any location (other than residential) where the container was blocked and the collection vehicle must return to provide service.” We found 51 instances of this “return charge” being levied throughout fiscal year 2016; however, we also observed a route manager return to a commercial dumpster without calling in to charge the business. This is most likely because there is no easy way for route managers to report blockages due to their 4 AM start time. Moreover, route managers may experience poor reactions from customers who have been levied a return charge if they feel it was unwarranted.

¹⁴ The total time to tag an obstructed can is greater than 1 minute and 19 seconds and depends on the type of obstruction.

High Service Level Comes at a Cost

Apart from regularly scheduled pickups, the Division provides a variety of additional services on customer request; these range from collecting waste for the City's "Adopt-A-Street" program, to retrieving dead animals, to replacing lost compactor keys. A break out of these reactive services can be seen in Table 11.

Table 11: Fiscal Year 2016 Work Orders

Type	Annual	Weekly
Extra Collection	4,828	93
• Roll Off	2,270	44
• Residential	1,172	23
• Bulk & Brush	1,121	22
• Commercial	265	5
Extra Service	1,911	37
• Container Rental/Damage/Return	1,820	35
• Dead Animal	49	1
• Other	42	1
Service Requests	1,770	34
• Service Adjustment	1,570	30
• Extra Container	200	4
Complaints	1,274	25
• Missed Collection	1,099	21
• Missing Container	175	3
Internal Services	168	3
Total:	9,951	191

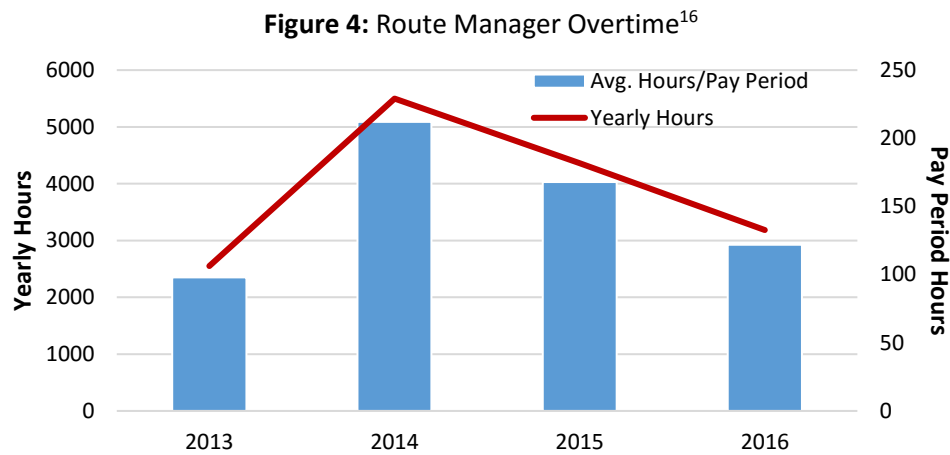
Work orders significantly affect overtime. Given that most collection services take the same amount of time each week (with some variability due to set out rates), work orders are the most significant factor in determining overall workload. To verify this, we regressed overtime hours with several variables and found that the number of work orders and the number of route managers were the most significant. Since the number of work orders is driven by customers and thus cannot be controlled,¹⁵ adding a new employee is the most straightforward method of decreasing overtime hours. This being said, paying out overtime can be a more cost effective option than hiring additional staff and an appropriate cost benefit analysis should be conducted before beginning the hiring process.

Division Hiring Policy may be Unsuitable for its Intended Use

According to staff, the Division requests a new route manager position in the budget process once overtime reaches 1,040 hours for a specific service type. In fiscal year 2016, the Division requested and received funding for two additional route managers, which significantly reduced overtime per

¹⁵ Unless the City decides to offer a lower level of service.

pay period from 168 hours to 121 hours. That being said, the Division exceeded its overtime budget in fiscal year 2015 and 2016 by about 54 and 27 percent respectively.



Division hiring guidelines should not be based on overtime. As can be seen in Table 12 (see next page), it is unlikely that overtime costs specific to a particular service type could increase enough to warrant the cost of a new route cycle.¹⁷ For this reason, overtime may not be an appropriate method to determine when a new route manager should be hired. Instead, routes and route cycles should be added once the daily work load is too large to be completed before the landfill closes.

If route managers are unable to make it to the landfill by 5 PM, this presents a risk to the City because they must leave their trucks with collected waste in the Division’s yard overnight. In addition to causing odor problems, this can be dangerous for drivers as it attracts pests and prevents them from performing daily maintenance. Of the 28 routes we observed two, (seven percent) did not make it back to the landfill before the end of the day.

For this reason, route manager hiring decisions should most directly be informed by route balancing. This being said, adding a “spare”, or an employee who is trained on multiple service types to complete the collection for each day, is an effective temporary method to decrease overtime as it does not require purchasing a new truck and spares can cover multiple route types – increasing Division flexibility.

¹⁶ One pay period accounts for two weeks of collection services.

¹⁷ A route cycle is a collection of routes assigned to a single driver and vehicle each week specific to one service type.

Table 12: Additional Service Cost versus Overtime Costs

Service	Est. Annual Cost	Overtime Hours	Actual Overtime Costs
Commercial Dumpster	\$143,711	913.00	\$24,343
Commercial Cart	\$145,996	335.75	\$7,365
Commercial Roll Off	\$81,230	81.75	\$2,305
Residential Cart	\$126,042	768.75	\$20,196
Large Bulk & Brush	\$87,333	242.50	\$6,386
Small Bulk & Brush	\$67,276	253.00	\$6,127
Satellite	\$54,103	14.00	\$418
Spare	\$29,141	386.50	\$8,411
	<i>Total:</i>	2,995.25	\$75,552

Obstacles to Overtime Mitigation Exist

In our investigation of overtime, we found that route managers and foreman had an average turnover rate of about 14 percent - placing it lower than the state and local government average as well as similar industries.¹⁸ This being said, the Division had three route managers (of twenty-seven) during our observation period who were not able to drive vehicles for the Division due to legitimate circumstances.¹⁹ While this level of absence is not typical, we also found that the average route manager takes about 378 hours of paid leave annually – about 18 percent of the average work year. This, along with overtime levels, indicate that the Division may occasionally be short staffed on particular services or truck types.

Short staffing mitigation methods could be improved. To relieve these circumstances, the Division utilizes spares; however, they generally have less experience with routes and thus are less effective than the typical route manager. In the past, training on multiple vehicles and becoming a spare was incentivized by a skill-based pay system, which rewarded route managers for each truck they trained on with a pay raise. However, this system has been eliminated making these spare positions more difficult to fill. We estimated it took a spare over one and a half times longer to collect each canister than a more experienced route manager (see Table 13). Increasing cross-training and working to ensure that route managers are knowledgeable about the routes they run will allow the Division to more effectively mitigate the effects of short staffing.

Table 13: Effects of Spare Drivers

Service Type	Avg. Experienced Time	Spare Time	Multiplier
Residential Cart	26 sec.	36 sec.	1.38
Commercial Dumpster	219 sec.	389 sec.	1.78
		<i>All Observed:</i>	1.58

¹⁸ Based on Bureau of Labor Statistics data and including the transportation, warehousing, and utilities industry.

¹⁹ Two drivers are out due to injury and illness, and the other is a management decision.

Vehicle maintenance is adequately mitigated. Currently, the Sanitation Division maintains one spare truck for each service type provided. Using fiscal year 2016 maintenance records, we evaluated the adequacy of this policy. From Table 14, we can see that this is sufficient for most truck types, however, roll off and front end loaders may need additional contingency methods.

Table 14: Maintenance Time by Truck Type

Truck Type	Spare Trucks	Total Trucks	Time Out of Service ²⁰
Roll Off	1	6	21.98%
Front End Loader	1	5	17.58%
Rear Loader	2	6	4.12%
Automatic Side Loader	2	7	2.20%
Grapple	1	4	0.00%

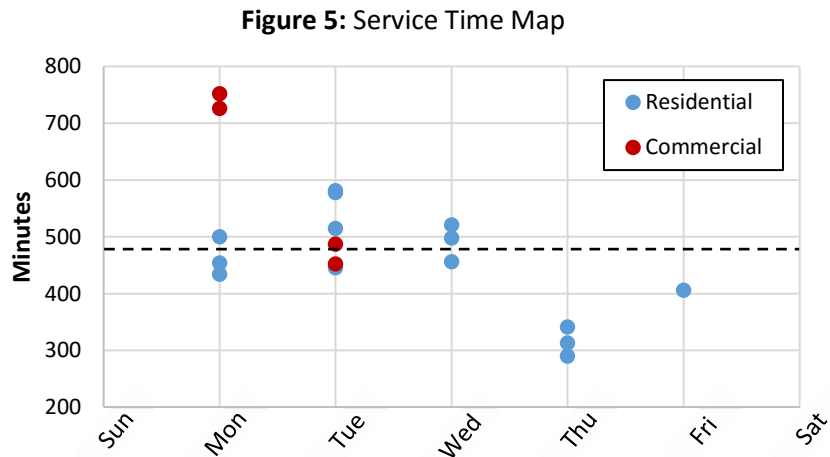
From conversations with staff, we learned that when more than one roll off truck is out of service the Division does not run the complete large bulk and brush service. Instead, only the Grapple truck is driven, requiring the Division to complete its roll off and large bulk and brush services less efficiently. While this adequately mitigates roll off vehicle time out of service, it also prevents the Division from splitting brush and bulk into separate canisters, prohibiting composting.

Occasionally, when there are more trucks out of service than spares, Sanitation coordinates with the City of Bryan to use their spare vehicles. The City also allows Bryan to use their spare vehicles when necessary. An agreement is made on a case-by-case basis for these events. However, during our review period, the City had to rent a front end loader when four trucks needed maintenance. According to staff, this was the first time the City rented a Sanitation vehicle in decades.

²⁰ Calculates the percentage of days two or more trucks of the same type were out of service for maintenance.

City Demographics and Policies Impede Route Balancing Efforts

Based on the Environmental Protection Agency’s Heuristic Routing Guidelines, “total collection plus handling times should be reasonably constant for each route.” While we found most collection types were balanced, residential cart service and commercial dumpster and cart collection were not. As we can see in Figure 5 below, there is much variation around the eight-hour workday (dashed line), where each dot represents the time one employee spent on a route each day.



Accommodating Customers Disrupts Balanced Routes

The City’s rapid growth and transient population impedes residential route balancing. Due to the geographical nature of routing, the houses in new developments are generally incorporated into the nearest route without thoroughly evaluating the impacts on route balance. This generally aligns with the EPA’s heuristic guidelines – specifically regarding routes “consisting of street segments clustered in the same geographical area” – which assumes any slight inefficiency would typically be corrected when routes were rebalanced every one to two years.

However, over the last few years many residential developments have sprung up in southern sections of the City (i.e. Castlegate, Pebble Creek, etc.) – all generally adding new collection locations to one particular pick up day. The density and quantity of these additions may make the Division’s infrequent (every five years or so) rebalancing attempts inadequate.

Moreover, the City of College Station is unique in its large university population. Since our observations were made during the summer, routes may be particularly unbalanced due to student vacancies. For instance, we estimated that only about 67 percent of residential carts were set out by customers at the curb²¹ as opposed to typical set out rates of about 90 percent. In order to test this further, our office plans on conducting a follow-up audit of Sanitation during Texas A&M’s school year to better assess the impact students have on Sanitation’s operations.

²¹ This estimate is based on two residential cart route, where cans that were not at the curb but were visible were counted.

Allowing commercial customers to control collection demand hinders route balancing. As a courtesy to commercial customers, the Division allows them to decide what days and how frequently their refuse is collected. While commercial customers are charged an increased monthly fee for more frequent collections, this limits the Division's scheduling flexibility. This is most apparent in commercial dumpster service. While the City generally allows businesses with dumpsters to select their own collection frequency and day, multi-family dumpster collections are scheduled by the Division. The evidence of this unbalance can be seen in Table 15.

Table 15: Route Balance of Commercial Dumpster Service

Day of Week	Number of Dumpsters		
	Multi-Family	Business	Total
Monday	181	426	607
Tuesday	226	249	419
Wednesday	144	319	460
Thursday	180	252	256
Friday	230	389	559
Saturday	183	238	424
<i>Average:</i>	<i>191</i>	<i>312</i>	<i>454</i>
<i>Range:</i>	<i>86</i>	<i>188</i>	<i>351</i>
<i>Std. Dev.:</i>	<i>30</i>	<i>73</i>	<i>112</i>

Though other factors affect commercial route balance (i.e. weight collected, distance between locations, etc.), the number of dumpsters assigned to each route is most significant. Limiting when and how frequently businesses can request collection, or charging a higher price for collection on busier days may aid the Division in balancing these routes.

Mitigating Routing Risk has Unintended Consequences

Subjective routing decreases efficiency. Moreover, we found evidence that route managers do not typically follow a designated heuristic route as defined by the EPA's guidelines. While most commercial vehicles have a route book on board, they first collect businesses and then must double back to the assigned apartments due to the City noise ordinance (Sec. 7-2) that prohibits noise exceeding 56 decibels in residential areas between 10 PM and 7 AM. Moreover, the route book is a list of addresses, which is not necessarily ordered for efficiency or safety.

On the other hand, most residential routes do not have a route book on board. Instead route managers must be knowledgeable about their area and then decide how it is best run. This not only decreases efficiency, but can also put the driver at a higher level of risk (e.g. making more left-hand turns, turning around more often and in hazardous conditions, stalling on-route because of confusion, etc.). While employee experience can decrease the effects of this type of routing, spares do not have this advantage – increasing the chance that carts will not be collected from some areas of the City.

Route manager synergy promotes Division efficiency. The Division recently hired a consultant to develop route maps, which will aid route managers in their collections. Furthermore, the Division has developed a policy that would place route managers at fault for any accidents they are involved in that occur off-route – incentivizing route compliance. While this policy would limit the City’s liability and may increase driver efficiency, there could be some unintended consequences.

Specifically, we noted route managers of some service types collected canisters assigned to other drivers. Towards the end of the day, employees providing the same service would check in with each other on the status of their routes. If an employee was running behind, another route manager would typically aid them in finishing their route, enabling the Division to more quickly complete all routes for each day. This also allows route managers to demonstrate their dedication to the Division’s mission statement. Unfortunately, this new policy would discourage these cooperative efforts.

Recommendations

As exemplified in this report, the City's Sanitation Division provides a high level of service to College Station citizens including not only the frequency and type of collections offered, but also their responsiveness to customers' requests. This service level is not necessarily inappropriate, however, it comes at a cost to the City. As mentioned previously, solid waste collection is an inherently dangerous function and providing this level of service can result in employees making riskier decisions. When faced with risk, an organization typically has three options: acceptance, mitigation, or transference. There are advantages and disadvantages to all three; however, we will discuss transference in more detail.

Transferring risk may allow the City to rid itself of potentially expensive personal injury and property damage claims and could increase the City's ability to respond to changes in technology. On the other hand, the City must be willing to lose control over many operational facets if risk is transferred. Specifically, the City may be unable to continue to offer citizens the same high service level of solid waste management. For this reason, a thorough examination of costs and benefits is necessary when examining risk transference.

This being said, the City may feel accepting the risks presented in this report is the best course of action, however, if mitigation is chosen we have developed the following recommendations:

1. **Investigate accountable routing methods.** Recently, the City hired a consultant to develop new routes. While this will help with route balancing, it does not ensure that routes will be driven as designed. For this reason, we recommend investigating on-board computers for Sanitation vehicles. These systems have many benefits including accountability for drivers and customers, potential integration with billing, and turn-by-turn route directions. This being said, on-board computers would require several operational changes to be most effective including: placing customer service representatives as the main educator of customers; changing policy to embolden drivers to leave obstructed canisters as defined by the Division; and increasing scheduling flexibility through additional cross-training.
2. **Develop stronger enforcement methods for obstructed canisters.** Tagging residential carts is not an effective deterrent to disregarding collection guidelines since carts are typically collected anyway. For this reason, a process should be established that compels customers to follow guidelines. For this process to be effective, the Division must communicate the change in procedure to the public before it goes into effect, and an "obstruction" must be clearly defined by the Division. This recommendation could be fulfilled through recommendation 1.
3. **Develop hiring guidelines based on route balancing.** At this time, Sanitation typically requests new positions once overtime exceeds a certain level, however, overtime is not a

suitable method for identifying hiring needs. Instead the Division should develop route balancing standards based on current collection times, heuristic guidelines, and managing experience to signal a need for new route cycles, new employees, and investment in equipment and vehicles.

4. **Institute a hierarchal promotional system for route managers.** The Division is currently faced with short staffing issues, which are compounded by single-service drivers. Creating a hierarchal system for route managers based on the vehicle types they can operate will increase scheduling flexibility for the Division and may indicate employee motivation levels. Moreover, this system could give employees a further sense of direction and growth in a Division with few opportunities to advance.
5. **Separate residential recycling and refuse collection days.** Residential refuse and recycling cart collection are negatively affected by same-day collection. Splitting the two collections to separate days would increase efficiency for both the Sanitation Division and Brazos Valley Recycling. This being said, adequate communication of this change is critical, and collection information is currently difficult to find. It is key that the Division not only run communication campaigns, but make collection information easier to locate if either the recycling or refuse collection day is to be changed. These communications will help to mitigate confusion and criticism from customers.
6. **Review Sanitation's role in the City's construction and development process.** Many City construction standards delay the Division in their collection efforts. Currently, Sanitation reviews some development plans before they are approved, but these comments are not always fully incorporated into the final plan set. Greater consideration of Sanitation requests and comparing the costs and benefits of some construction standards could increase the Division's efficiency.
7. **Adjust commercial customer scheduling procedures to aid route balancing.** As a courtesy, the City allows commercial customers to control what day their refuse is collected, which creates inconsistency in commercial routes throughout the week. Ending this practice would help balance routes, however, we understand that some business may need collection on a certain day. For this reason, an appeal process should be established to allow these businesses to request a certain collection day.
8. **Design and communicate videos addressing safety surrounding Sanitation vehicles to the public.** Sanitation has developed videos in the past to educate the public on collection standards. We believe developing a video showing the risks Sanitation vehicles present could increase pedestrian safety.

Appendix A: Ride-a-Long Experiment

In our audit of Sanitation, we wanted to answer the following questions about each service type:

- How efficient are they?
 - How much time do obstructions add to routes?
 - Do route managers have to dismount to deal with these obstructions?
 - How much time does inappropriate garbage add to route times?
 - How long do route managers spend off-route?
- How effective are they?
 - How many cans are route managers forced to leave behind?
 - How many cans or piles do route managers return for?
 - Why are these cans left or returned to?

To answer these questions, we conducted an experiment to identify the different obstacles Sanitation's route managers face and how they handle these obstacles. To do this, we observed each of the following service types:

1. Commercial Dumpster (2 routes)
2. Commercial Cart (2 routes)
3. Commercial Roll Off (2 routes)
4. Residential Refuse Cart (9 routes)
5. Residential Large Bulk and Brush (2 routes)
6. Residential Small Bulk and Brush (1 route)
7. Residential Satellite (2 routes)

For this experiment, we used a stop watch, counter, and ride-a-long observation worksheets. The uses for these items are further explained in the following pages. The most important is the ride-a-long observation worksheet (a truncated example worksheet is shown below). We recorded all experiment data in these worksheets as shown in the example. These terms and data points are explained on the following pages.

Figure A-1: Ride-a-Long Observation Example Worksheet

#	Category	Time	#	Category	Time	#	Category	Time	#	Category	Time	#	Category	Time	#	Category	Time
1	BLK - D	1.26	1	HIB - L	0.00	1	DIR - T	1.19	1	MNT	2.03	1	BLK - D	1.34	2	CAN	0.42
1	CON	3.45	1	OVL - L	0.00	1	BIN	0.46	1	OVL - D	10.27	1	POL - L	0.54	2	CON	4.36
1	CAN - T	2.01	1	CAR	0.29	1	BIN	0.39	1	CAR	3.02	2	CAN	0.25	2	DIR - D	1.15
												WT		Time		CT	
Trip 1		Trip 2		Trip 3		Trip 4		Trip 1:		11037		02:59		462			
BREAK:	00:00	BREAK:	00:15	BREAK:	00:00	BREAK:		Trip 2:		11489		03:03		487			
TO:	00:23	TO:	00:25	TO:	00:24	TO:		Trip 3:		598		01:36		239			
LANDFILL:	00:13	LANDFILL:	00:19	LANDFILL:	00:14	LANDFILL:		Trip 4:									
BACK:	00:27	BACK:	00:26	BACK:	00:25	BACK:		Total:		23124		07:38		1191			
TOTAL:	01:03	TOTAL:	01:25	TOTAL:	01:03	TOTAL:		Maintenance:									

Trip Totals: These can be seen at the bottom of Figure A-1 in the right hand corner.

- *Trip* – consists of all activities and time between leaving the garage in the morning to when the collected waste is dumped at the landfill. Subsequent trips will start when a truck is back in-service (picks up its first new canister, bulk, or brush pile).
- *WT* – the total weight in tons that a truck collects during a trip. For most trucks, the drivers will receive a receipt indicating the weight they were carrying upon entering the landfill.
- *Time* – the total time it takes for a driver to make one complete trip, starting either from the garage (trip 1 only) to beginning a subsequent trip or from beginning a subsequent trip returning to returning to the garage. Time-keeping starts over for each new trip, and is recorded as hh:mm.
- *CT* – the total number of canisters, bulk, or brush piles collected in one trip. Counting starts over for each new trip and a running tally is kept on the counter.
- *Maintenance* – the amount of time route managers spend cleaning and performing work on their truck at the end of the day after their routes are complete.

	WT	Time	CT
Trip 1:			
Trip 2:			
Trip 3:			
Trip 4:			
Total:			
Maintenance:			

Out of Service Time Calculations: This section can be seen on the bottom of the table starting from the left. They are labeled with trip (as defined previously) numbers. All times in this section are recorded as hh:mm.

- *BREAK* – recorded any time drivers are not actively picking up canisters or driving to the next area (EX, lunch break).
- *TO* – recorded time it takes from the last pickup to when the truck enters the landfill (passes through the gates).
- *LANDFILL* – recorded total time it takes for the truck to enter the landfill (pass into the gates), dump its load, and exit the landfill (pass out the gates).
- *BACK* – recorded time it takes from exiting the landfill gates to when the truck begins its next round of pickups or returns to the garage.
- *TOTAL* – the total out of service time taken by the driver (includes the TO, LANDFILL, BACK, and BREAK times).

Trip 1		Trip 2		Trip 3		Trip 4	
BREAK:		BREAK:		BREAK:		BREAK:	
TO:		TO:		TO:		TO:	
LANDFILL:		LANDFILL:		LANDFILL:		LANDFILL:	
BACK:		BACK:		BACK:		BACK:	
TOTAL:		TOTAL:		TOTAL:		TOTAL:	

Obstruction Observations: This section consists of most of the worksheet and is on top of the other two sections – a small example is shown on the next page. This consists of six columns of forty-five observation slots on the front and six columns of 50 observation slots on the back, as well as an area for the auditor's name, the date, and the route.

- *#* – this number indicates the trip number during which the observation was noted.
- *Category* – indicates the type of obstruction the route manager encountered. A list of obstruction codes is provided below. An obstruction code reference sheet was attached to the clip board

#	Category	Time

auditors took into the field.

- *Time* – indicates the amount of time taken for the route manager to handle an obstacle. These were timed using a stop watch and were recorded as mm.ss.

Table A-1: Obstruction Codes

Code	Description	Code	Description
CAR	Indicates cars or other modes of transportation	CON	Indicates construction work
CAN	Indicates garbage cans or dumpsters	OVL	Indicates an overloaded can or dumpster
BIN	Indicates recycling bins	DIR	Indicates can was positioned incorrectly
BLK	Indicates bulky items	HIB	Indicates inappropriate or prohibited items in can or dumpster
POL	Indicates telephone poles or mailboxes	MNT	Indicates maintenance on the truck while in the field
HIT	Indicates truck has hit an obstacle (ex: gas/water line, mailbox, car, etc.)	OTH	Indicates any obstruction not listed

- To indicate a can was left place a “- L” on the code
- To indicate the driver dismounted due to an obstacle place a “- D” on the code
- To indicate a can was tagged (implies a dismount) place a “- T” on the code

Residential Cart Regression: After completing the ride-a-long experiment observations, we entered and verified the data collected into a spreadsheet by service type. The number of obstructions and pickups by each service is recorded in Table 4 in the report. We then wanted to estimate the effects of each obstruction type on residential cart collection based on the codes identified in Table A-1. Table A-2 shows a summary of each code.

Table A-2: Residential Cart Obstruction Summary

Obstruction	Num. Left	Num. Dismounted	Num. Tagged	Total	% of Total Pickups
Car	1	12	0	77	0.92%
Can	0	18	0	244	2.90%
Bin	0	28	0	530	6.30%
Bulk	0	0	0	6	0.07%
Mailbox or Pole	0	0	0	16	0.19%
Hit	0	0	0	0	0.00%
Construction	0	0	0	0	0.00%
Overloaded	1	15	1	246	2.93%
Direction	3	20	0	53	0.63%
Prohibited Item	1	5	1	29	0.34%
Other	2	7	0	30	0.36%
<i>Total:</i>	8	104	2	1,214	14.44%
<i>% of Total Pickups:</i>	0.10%	1.24%	0.02%	14.44%	8,409

We added a variable for each obstruction type (except “Other” due to multicollinearity), along with indicating if a canister was left, tagged, or if a route manager had to dismount. In this way, we

accounted for all these factors and were able to estimate the effects of each obstruction type individually. The table below shows a simplified regression output.

Table A-3: Regression Output

Regression Coefficients			Regression Statistic	
	Coefficients	P Value		
Intercept	0.46	0.0000	Multiple R	0.5608
Tagged	1.32	0.0000	R Square	0.3145
Left	-0.31	0.0028	Adjusted R Square	0.3082
Dismount	0.53	0.0000	Standard Error	0.2449
CAR	-0.22	0.0000	Observations	1214.0000
CAN	-0.19	0.0000	F Statistics	50.1365
BIN	-0.22	0.0000	Significance F	0.0000
BLK	-0.24	0.0234		
POL	-0.22	0.0022		
OVL	-0.24	0.0000		
DIR	-0.22	0.0000		
HIB	-0.23	0.0001		

It is important to note that the coefficients above represent time in minutes (i.e. the intercept equals 28 seconds). For this reason, we have included Table A-4 below with coefficients converted into seconds.

Table A-4: Average Seconds

Obstruction	Seconds	Obstruction	Seconds	Obstruction	Seconds
CAR	14	POL	14	OTH (Intercept)	28
CAN	16	OVL	13	Tagged	107
BIN	14	DIR	14	Left	9
BLK	13	HIB	14	Dismount	59

Appendix B: Management Responses

TO: Ty Elliott, City Internal Auditor

THROUGH: Kelly Templin, City Manager

FROM: Donald Harmon, PE, PMP, Director of Public Works

SUBJECT: Management Response to Sanitation Audit

DATE: October 16, 2017

The following is the response from the Public Works Department to the recommendations made in the Sanitation Audit Report by the City Auditor's Office. Each of the eight recommendations includes a response describing how the recommendation will be addressed by the Public Works Department.

1. Investigate accountable routing methods. Recently, the City hired a consultant to develop new routes. While this will help with route balancing, it does not ensure that routes will be driven as designed. For this reason, we recommend investigating on-board computers for Sanitation vehicles. These systems have many benefits including accountability for drivers and customers, potential integration with billing, and turn-by-turn route directions. This being said, on-board computers would require several operational changes to be most effective including: placing customer service representatives as the main educator of customers; changing policy to embolden drivers to leave obstructed canisters as defined by the Division; and increasing scheduling flexibility through additional cross-training.

Management Response:

Management concurs with this recommendation. The division will investigate on-board computer systems and associated operational changes in order to improve safety, accountability, and efficiency in solid waste operations.

2. Develop stronger enforcement methods for obstructed canisters. Tagging residential carts is not an effective deterrent to disregarding collection guidelines since carts are typically collected anyway. For this reason, a process should be established that compels customers to follow guidelines. For this process to be effective, the Division must communicate the change in procedure to the public before it goes into effect, and an "obstruction" must be clearly defined by the Division. This recommendation could be fulfilled through recommendation 1.

Management Response:

Management somewhat concurs with this recommendation and will be investigating best practices in the industry to determine an effective method of communicating collection guidelines. However, regardless of the reason for an uncollected cart, returning for collection of that cart is a customer service issue and prevents issues with the next scheduled collection.

3. Develop hiring guidelines based on route balancing. At this time, Sanitation typically requests new positions once overtime exceeds a certain level, however, overtime is not a suitable method for identifying hiring needs. Instead the Division should develop route balancing standards based on current collection times and industry guidelines to signal a need for new route cycles, new employees, and investment in equipment and vehicles.

Management Response:

Management concurs with this recommendation. Staff will research industry best management practices to revise hiring guidelines to reflect metrics associated with route balancing.

4. Institute a hierarchal promotional system for route managers. The Division is currently faced with short staffing issues, which are compounded by single-service drivers. Creating a hierarchal system for route managers based on the vehicle types they can operate will increase scheduling flexibility for the Division and may indicate employee motivation levels. Moreover, this system could give employees a further sense of direction and growth in a Division with few opportunities to advance.

Management Response:

Management concurs with this recommendation. The division is working on a hierarchal system by updating job descriptions that will allow employees to advance based on their ability to operate different vehicle types.

5. Separate residential recycling and refuse collection days. Residential refuse and recycling cart collection are negatively affected by same-day collection. Splitting the two collections to separate days would increase efficiency for both the Sanitation Division and Brazos Valley Recycling. This being said, adequate communication of this change is critical, and collection information is currently difficult to find. It is key that the Division not only run communication campaigns, but make collection information easier to locate if either the recycling or refuse collection day is to be changed. These communications will help to mitigate confusion and criticism from customers.

Management Response:

Management concurs with this recommendation. Dual collection schedules were initially implemented for citizen convenience. The division conducts a city wide balancing project every five years in order to help balance collection routes between all operations. The next city wide balance will occur around mid-year of 2018. As part of this city wide project, the division plans to separate recycling days from refuse days in order increase efficiency in both areas.

6. Review Sanitation's role in the City's construction and development process. Many City construction standards delay the Division in their collection efforts. Currently, Sanitation reviews some development plans before they are approved, but these comments are not always fully incorporated into the final plan set. Greater consideration of Sanitation requests and comparing the costs and benefits of some construction standards could increase the Division's efficiency.

Management Response:

Management concurs with this recommendation. Some examples of standards that hinder collections are cul-de-sac streets that are not wide enough for our collection vehicles to make a complete turn without backing up and dumpster enclosures that have been grandfathered from the

old conventional rear load collection system that the city used prior to moving to an automated system. Sanitation staff will continue to communicate with planners on changes to the design guidelines and standards needed for efficient and effective solid waste collection operations.

7. Adjust commercial customer scheduling procedures to aid route balancing. As a courtesy, the City allows commercial customers to control what day their refuse is collected, which creates inconsistency in commercial routes throughout the week. Ending this practice would help balance routes, however, we understand that some business may need collection on a certain day. For this reason, an appeal process should be established to allow these businesses to request a certain collection day.

Management Response:

Management concurs with this recommendation. Staff will be investigating various methods to balance the commercial customer demand across the work week.

8. Design and communicate videos addressing safety surrounding Sanitation vehicles to the public. Sanitation has developed videos in the past to educate the public on collection standards. We believe developing a video showing the risks Sanitation vehicles present could increase pedestrian safety.

Management Response:

Management concurs with this recommendation. Staff will be working closely with our Public Communications department to develop educational videos with the intent of improving pedestrian and vehicular safety.