

June 11, 2022

Ms. Kira Beckham
Lead Specialist
Environmental Sustainability
City of Fort Collins
300 LaPorte Avenue
Fort Collins, CO 80521
submitted via email: kbeckham@fcgov.com

SUBJECT: Final Report - Trash Collection Street Maintenance Impact Analysis

Dear Ms. Beckham:

R3 Consulting Group, Inc. (R3) was engaged by the City of Fort Collins (City) to update our trash collection street maintenance impact analysis that was prepared for the City in 2008. Specifically, to compare the impacts of residential trash, recycling, and yard waste collection vehicles (Refuse Vehicles) on the City's residential streets and associated street maintenance costs for the City's current open competition system as compared to a contracted or districted collection system with a single hauler operating in any given area of the City. This Letter Report provides the results of our analysis.

Project Objectives

- To project the impact of the City's licensed haulers' Refuse Vehicles on the City's residential and collector streets, and determine the associated annual street maintenance cost for the current open competition system.
- To calculate the associated annual street maintenance cost savings that would result from a contracted or districted collection system.

Limitations

Our analysis is based on a number of underlying assumptions for which reasonable ranges exist, including the average number of vehicle trips per day per residential street, the percentage of those trips made by various vehicle types, and the associated axle loadings of each vehicle type. Changes to those assumptions can have a material impact on the resulting findings.

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We appreciate the opportunity to be of service to the City. Should you have any questions regarding our letter report or need any additional information, please contact me by phone at (916) 947-4880 or by email at wschoen@r3cgi.com.

Sincerely,



William Schoen | *Senior Project Director*
R3 Consulting Group, Inc.
916.947.4880 | wschoen@r3cgi.com

Summary Findings

Street Maintenance Budgeted Expenses

Under the current open competition system with an average of three and a half (3.5) licensed haulers operating on each residential street, Refuse Vehicles are projected to be responsible for **24.4%** of the vehicle impacts (i.e., wear and tear) on those streets, and **10.9%** of the vehicle impacts on collector streets. The portion of the City's annual residential and collector street maintenance budget attributed to Refuse Vehicles currently operating within the City's open competition system is projected at **\$889,000** annually.

Under a contracted or districted system, Refuse Vehicles are projected to be responsible for **8.0%** of the vehicle impacts on residential streets, and **3.3%** of the vehicle impacts on collector streets. The portion of the City's annual residential and collector street maintenance budget attributed to Refuse Vehicles operating under a contracted or districted system is projected to be **\$286,000** annually; **\$603,000** less than under the current open competition system.

Street Maintenance Unfunded Backlog

The City's current residential and collector street maintenance unfunded backlog expenses are **\$82 million** and **\$43 million**, respectively. Based on the vehicle impacts reported above, and all other factors the same, approximately **\$16 million** of that current **\$82 million** residential backlog expense can be attributed to residential Refuse Vehicles, and approximately **\$5 million** of the **\$43 million** collector backlog attributed to Refuse Vehicles. Had the City historically had in place a contracted or districted system, all other factors the same, the total residential and collector street backlog would be **\$14 million** less.

Refuse Hauler Vehicle Impact Fees

If the City's costs to repair street pavement impacts caused by Refuse Vehicles were charged back to the haulers in the form of a Refuse Hauler Vehicle Impact Fee, under the current open competition system the monthly charge to the haulers would be **\$1.50** per month per residential account. Under a contracted or districted system that charge falls to **\$0.50** per month; **\$1.00** less than under the current open competition system. Those fees do not account for any recouping of the existing backlog attributed to Refuse Vehicles, which if considered would increase those fees.

Contracted, Districted and Open Competition Systems Considerations

If effectively implemented, the City can move from an open competition residential collection system to a contracted or districted system and likely realize a cost (customer rate) savings, and/or improved services. This is due to the significant operational efficiencies and economies of scale that contracted and districted collection provides versus an open competition system. A contracted system with a single contracted hauler serving the entire City is the most operationally efficient and cost effective collection system.

There is currently a competitive market place in the region with the three largest national haulers competing for regional market share. The regional market is likely to remain competitive regardless of what happens with the City's residential collection system. Under a contracted or districted system rates can be effectively controlled and flow control can be maintained. Moving to a contracted or districted collection system will not create a monopoly and likely will not significantly impact the three national haulers (Republic Services, Waste Management and Waste Connections). It is not known what the impact would be on Mountain High Disposal if it lost its residential market share.

As a condition of a contracted collection system, the City could require the selected hauler to hire all qualified displaced drivers and mechanics as a condition of the award of the contract. The City could also require the selected hauler to maintain displaced employee seniority, honor any scheduled vacations, provide a matching 401K program, and/or other conditions it may wish to establish.

A contracted or districted collection system does not enable residents to select their hauler although residents could opt-out of those services if they choose to. The City can however charge an opt-out fee for doing so. To the extent that residents were to opt out of a contracted or districted collection system, the benefits associated with contracted or districted collection would be negatively impacted. The City's regulatory oversight would also need to increase with an opt-out provision with multiple haulers to regulate.

Background

In Fort Collins, residential trash, recycling, and yard waste services are provided by the following four (4) licensed private trash haulers:

- Mountain High Disposal
- Republic Services
- Ram Waste Systems (Waste Connections); and
- Waste Management

Residents are free to subscribe to collection services from any of the licensed haulers, with trash haulers competing for market share. Under this open competition system, multiple haulers provide service on each residential street each week, with resulting street maintenance and other impacts.

In 2008, R3 assisted the City with a Trash Services Study to determine opportunities to reduce the impacts of trash collection services in the City and increase diversion. That review included projecting the relative impact of trash, recycling, and yard waste vehicles (Refuse Vehicles) on the City's streets and associated street maintenance costs for the City's open competition residential collection system. The analysis also projected Refuse Vehicle street maintenance impacts associated with a "districted" residential collection system under which the City would be broken into service districts with a single hauler operating in each district. Moving from an open competition collection system to a districted collection system would reduce the number of Refuse Vehicle miles traveled on any given residential street with a corresponding decrease in the associated street maintenance impacts.

All other factors the same, moving from an open competition residential collection system to a districted collection system would reduce the number of Refuse Vehicle miles traveled on the City's residential streets. As a result, there would be a significant corresponding decrease in the associated vehicle street maintenance, emission, and noise impacts, improved neighborhood aesthetics, and fewer Refuse Vehicle accidents and related property damage.

Overview

Road maintenance is based on deterioration. While roads will deteriorate if simply left unused, most deterioration is associated with use, and the damage caused by vehicles increases exponentially with size and weight. Therefore, costs associated with maintenance are greater for trips made by heavy vehicles. A single large truck can cause as much damage as thousands of automobiles, and the configuration of the truck can affect the amount of damage as well. If the load is spread over more axles, there is less weight on each wheel, and damage is reduced.¹

Refuse Vehicles are typically the heaviest vehicles regularly operating on residential streets and are a significant contributor to the wear-and-tear experienced by those streets. While Refuse Vehicles also contribute to the wear-and-tear on commercial streets, those streets are designed to a higher standard and experience significantly more vehicle trips and large truck trips than residential streets. As such, the relative impact of a Refuse Vehicle on commercial streets is significantly less than that on residential streets.

The Pavement Condition Index (PCI) is a common unit of measure used to rate the condition of pavements. The PCI rates pavements on a scale of 0 to 100, with a higher value indicating better pavement condition (see **Table 1** below). Rapid deterioration of pavement typically occurs after roadways drop to a PCI of 60 or lower, and studies have shown that every dollar spent performing preventative maintenance on a roadway with a PCI of 70 or higher saves \$4 in the future – it would otherwise cost about \$5 to rehabilitate the same roadway once rapid deterioration occurs² (**Figure 1**). Assuring adequate funding for an effective pavement management system is therefore critical to achieving a cost-effective pavement management system.

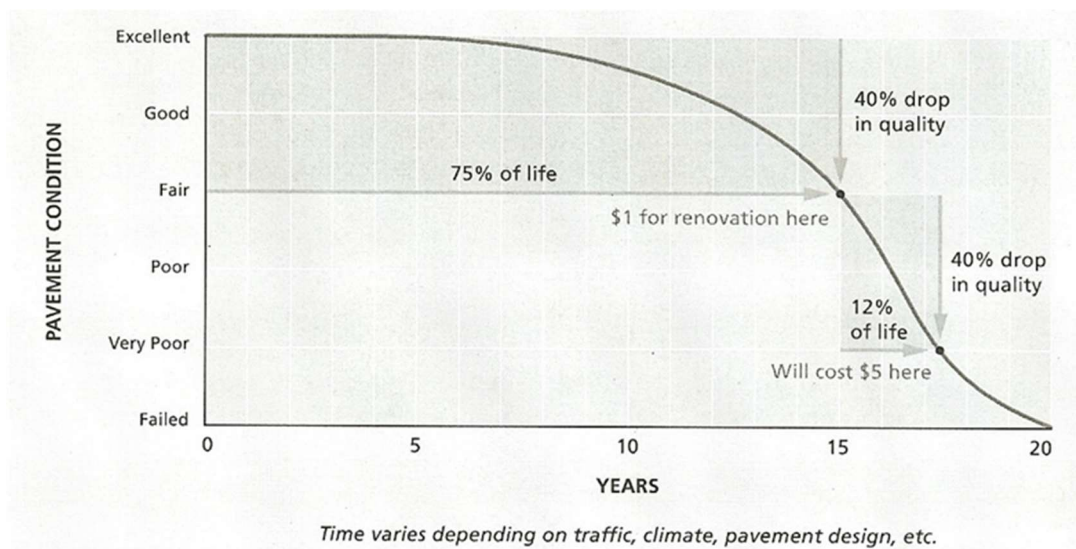
¹ A. Rufolo, *Cost-Based Road Taxation*, Cascade Policy Institute, November 1995.

² J. Gerbracht, *Bay Area Roads Close to "Tipping Point"*, Metropolitan Transportation Commission, Street Talk, March 2006.

Table 1 - PCI by General Street Condition Rating (Class)

PCI range	Class
85-100	Good
70-85	Satisfactory
55-70	Fair
40-55	Poor
25-40	Very Poor
10-25	Serious
0-10	Failed

Figure 1 - Pavement Life Cycle



Source: Metropolitan Transportation Commission

The goal of a pavement management program is to bring all roads up to “good” or “excellent” condition where they can be maintained most cost-effectively.³ The strategy often recommended is referred to as the “best first approach”, which concentrates spending initially on routine and preventative maintenance on roads that are currently in fair to good condition. This extends the useful life of those roads, preventing rapid deterioration. Spending money now on routine maintenance prevents additional spending in the future on more expensive repairs.

The average PCI of the City’s streets is 74, which is in the “Satisfactory” range. **Attachment A** provides a projection of the City’s PCI based on a number of funding scenarios. As shown, based on the assumptions noted, the City’s PCI is projected to drop from 74 (Satisfactory) to 68 (Fair) by 2032; approaching the point at which maintenance cost begin to escalate dramatically.

Relative Impact of Refuse Vehicles

The relationship between axle weight and inflicted pavement damage is not linear but exponential, and a single Refuse Vehicles can have an impact on the City’s streets equivalent to more than 1,000 automobiles. As part of the analysis of trash truck impacts we evaluated the impacts of trash trucks relative to other types of vehicles, including delivery trucks and buses. **Table 2** below provides a comparison of the average

equivalent single axle load (ESAL) factors for the various vehicle types noted⁴ to the estimated ESAL's of residential trash and recycling trucks operating in the City. The impacts are presented in Passenger Car Equivalents.

Table 2 - Comparison of Refuse Vehicle Street Impacts with Other Vehicle Types

Vehicle Type		Number of Axles	ESAL Factor ⁽¹⁾	Passenger Car Equivalents
General Classification	AASHTO Classification			
Cars	Passenger Cars	2	0.0008	1
Vans/Pickups	Other 2-Axle/4-Tire Trucks	2	0.0052	7
Large Pickups / Delivery Vans	Panel and Pickup Trucks	3	0.0122	15
Large Delivery Trucks	3 or More Axle Trucks	3	0.1303	163
Local Delivery Trucks	2-Axle/6-Tire Trucks	2	0.1890	236
Residential Recycling Trucks		2	0.7500	938
Buses	Buses	2 or 3	0.6806	851
Residential Trash/Yard Waste Trucks		3	1.0000	1,250
Long Haul Semi-Trailers	Various Classifications	3 - 5+	1.1264	1,408

⁽¹⁾ AASHTO Guide for Design of Pavement Structures; Table D-21 with exception of Refuse Vehicles

As shown, it is estimated that residential recycling vehicles exert an impact on the City's streets of more than 900 automobiles, while residential trash and yard waste trucks have an impact equivalent to 1,250 automobiles. The above analysis is based on a passenger car ESAL Factor of 0.0008. R3 is aware of other analyses that use a passenger car ESAL Factor as low as 0.0004, which if used would double the Passenger Car Equivalents for residential recycling and trash and yard waste trucks shown in **Table 4**.

Approach

Our approach to projecting Refuse Vehicle street maintenance impacts is based on common principals of pavement design and vehicle loadings. The basic premise is that all vehicles, including Refuse Vehicles, exert an impact on streets that can be quantified. That impact or "vehicle loading" can be expressed as an ESAL, which is a function of the vehicle's weight and the distribution of that weight over the vehicle's axles. By projecting the number and type of vehicles (i.e., cars, trucks, Refuse Vehicles) that travel on a street over its design life, and the average ESAL associated with each vehicle type, the total ESALs that street will experience can be calculated. The relative impact associated with a specific type of vehicle (e.g., Refuse Vehicle) can then be determined based on the percentage of total ESALs attributed to that vehicle type.

Refuse Vehicle impacts, as determined above, were projected for the current open competition system under a "base case" assumption that, on average 3.5 licensed haulers provide weekly residential refuse and yard waste collection and every other week recycling collection services on each residential street, making two passes down each residential street to provide each service. This equates to a total of five (5) passes down each residential street each week for each, for an total of 17.5 total Refuse Vehicle passes down each residential street each week. Under a districted system, with one hauler providing all three services in a given geographic area of the City, the total number of weekly residential Refuse Vehicle passes on a given residential street is five (5); two passes each for refuse and yard waste, and one (1) for recycling service; approximately 30% of the vehicle passes under the open competition system.

⁴ Based on sample data reported by American Association of State Highway and Transportation Officials (AASHTO) Guide for Design of Pavement Structures.

Methodology

- › The City's budgeted residential and collector street maintenance costs were assigned to Refuse Vehicles in proportion to the projected impacts of Refuse Vehicles as a percentage of the vehicle impacts on the City's residential and collector streets.
- › The City's existing residential and collector unfunded backlog costs were assigned to Refuse Vehicles in the same proportions as for the current street maintenance budgets above.

Major Assumptions

Funding / Backlog Expense

- › The City's current residential street maintenance annual budget is **\$5.5 million**.
- › The City's current collector street maintenance annual budget is **\$2.0 million**.
- › The City's current residential street maintenance backlog expense is **\$82.0 million**.
- › The City's current collector street maintenance backlog expense is **\$43.5 million**.

Residential Street Impact and Budget Allocation Assumptions

- › Thirty percent (30%) of residential streets are in home owner associations that are serviced by one (1) licensed hauler. It is assumed that 30% of the City's residential street maintenance budget is spent on those streets. Switching to a contracted or districted system would not change the impact of Refuse Vehicles on those streets or impact that portion of the residential street maintenance budget.
- › Twenty percent (20%) of residential streets have solid waste service provided in alleys, with those residential streets not experiencing any Refuse Vehicle impacts. It is assumed that 20% of the City's residential street maintenance budget is spent on those streets. Switching to a contracted or districted system would not change the impact of Refuse Vehicles on those streets or impact that portion of the residential street maintenance budget.
- › Fifty percent (50%) of the City's residential streets receive curbside service from an average of 3.5 licensed haulers operating on each of those streets each week. It is assumed that 50% of the City's residential street maintenance budget is spent on those streets. Switching to a contracted or districted system would change the impact of Refuse Vehicles on those streets. This portion of the City's budget, which is impacted by Refuse Vehicles, is referred to as the "Impacted Residential Street Maintenance Budget" in the analyses below, and equals **\$2.75 million** annually.

Vehicle Loadings / Impacts

- › ESAL loadings for residential and commercial Refuse Vehicles, cars and other trucks are based on data from various sources including the American Association of State Highway and Transportation Officials (AASHTO).

Residential Streets

- › There are an average of 1,000 vehicle trips per day on a typical residential street each day, with 3.0% of those trips made by heavy trucks, not including Refuse Vehicles.
- › Each licensed hauler's vehicles make a total of five (5) passes down each residential street that they provide services on each week, with refuse and yard waste service provided weekly, and recycling provided every other week.

Collector Streets

- › There is an average of 2,500 vehicle trips per day on a typical collector street, with 3.0% of those trips made by heavy trucks, not including Refuse Vehicles.
- › Each licensed hauler's vehicles make a total of five (5) passes down a typical collector street each week with refuse and yard waste service provided weekly, and recycling provided every other week.
- › All residential accounts on collector streets receive curbside service.

Findings

Street Maintenance Budgeted Expenses

Our analysis considered the following two scenarios, each assumes an average of 1,000 vehicle trips per day per residential street and 2,500 vehicle trips per day per collector street, with 3% of those trips made by trucks other than Refuse Vehicles. For each scenario the annual street maintenance costs for the current open competition system are compared to the costs for a contracted or districted collection system with a single hauler providing service on each residential and collector street.

- **Scenario 1**

An average of **3.5 licensed haulers** operating on each residential and collector street, each making a total of **5.0 weekly vehicle passes**; **17.5 total weekly Refuse Vehicle** passes residential and collector street per week.

- **Scenario 2**

An average of seven (7.0) licensed haulers operating on each residential street making a total of 5.0 weekly vehicle passes; 35 total weekly Refuse Vehicle passes per residential and collector street per week.

Scenario 1 – 1,000 Vehicles per Day per Residential Street - 3.5 Haulers

Under this scenario, the projected annual street maintenance cost savings to the City for a contracted or districted residential collection system, versus the current open competition system is **\$603,000**, as shown in **Table 3** below.

Table 3 – Scenario 1 Analysis

	Residential Street Assumptions			Collector Street Assumptions			
	3.5	Licensed Haulers		3.5	Licensed Haulers		
	1,000	Vehicles per Day		2,500	Vehicles per Day		
	3.0%	Truck Percentage		3.0%	Truck Percentage		
	Residential Streets			Collector Streets			Total Annual Cost
	Annual Impacted Residential Street Maintenance Budget	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	Annual Collector Street Maintenance Budget	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	
Open Competition	\$ 2,750,000	24.4%	\$ 670,000	\$ 2,000,000	10.9%	\$ 219,000	\$ 889,000
Contracted or Districted	\$ 2,750,000	8.0%	\$ 220,000	\$ 2,000,000	3.3%	\$ 66,000	\$ 286,000
Annual Savings with Contracted/Districted Collection =			\$ 450,000			\$ 153,000	\$ 603,000

Under the City's current open competition collection system it is estimated that, on average, Refuse Vehicles account for **24.4%** of total vehicle impacts on the City's residential streets. Under a districted collection system with only one licensed hauler providing services on any given residential street that impact is **8.0% (67% less)**. Refuse Vehicles have much lesser impacts on collector streets as they represent a smaller percentage of all vehicle trips, and there is a larger percentage of other truck traffic on collector streets.

Scenario 2 – 1,000 Vehicle Trips per Day per Residential Street – 7.0 Haulers

Under this scenario, the projected annual street maintenance cost savings to the City under a contracted or districted residential collection system, versus the current open competition system is **\$1.251 million**, as shown in **Table 4** below. That is roughly double the projected Refuse Vehicle cost impact for Scenario 1 above.

Table 4 – Scenario 2 Analysis

	<u>Residential Street Assumptions</u>			<u>Collector Street Assumptions</u>			
	7.0	Licensed Haulers		7.0	Licensed Haulers		
	1,000	Vehicles per Day		2,500	Vehicles per Day		
	3.0%	Truck Percentage		3.0%	Truck Percentage		
	Residential Streets			Collector Streets			Total Annual Cost
	Annual Impacted Residential Street Maintenance Budget	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	Annual Collector Street Maintenance Budget	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	
Open Competition	\$ 2,750,000	41.2%	\$ 1,133,000	\$ 2,000,000	20.2%	\$ 404,000	\$ 1,537,000
Contracted or Districted	\$ 2,750,000	8.0%	\$ 220,000	\$ 2,000,000	3.3%	\$ 66,000	\$ 286,000
Annual Savings with Contracted/Districted Collection =			\$ 913,000			\$ 338,000	\$ 1,251,000

Sensitivity Analysis

Changes to the assumptions used for the above analyses can have a material impact on the results. To provide a sense for the sensitivity of the resulting financial impacts to changes in the underlying assumptions we considered the following changes to Scenario 1:

- **Scenario 1A**
 2,000 vehicles per day per residential street with 3.0% of those trips made by trucks other than Refuse Vehicles.
- **Scenario 1B**
 1,000 vehicles per day per residential street with 5.0% of those trips made by trucks other than Refuse Vehicles.

Table 5 provides the resulting financial impacts for each of the above sensitivity scenarios. As shown, as the number of vehicle trips per day and the percentage of those trips made by trucks other than Refuse Vehicles increases, the associated impact of Refuse Vehicles decreases, although is still significant.

Table 5 – Sensitivity Analyses

	Scenario 1	Scenario 1A	Scenario 1B
Residential Street Assumptions ⁽¹⁾			
Licensed Haulers	3.5	3.5	3.5
Vehicles per Day	1,000	2,000	1,000
Truck Percentage	3.0%	3.0%	5.0%
Total Annual Residential Refuse Vehicle Street Maintenance Cost			
Open Competition	\$ 889,000	\$ 587,000	\$ 590,000
Contracted or Districted	\$ 286,000	\$ 286,000	\$ 286,000
Savings with Contracted/Districted Collection	\$ 603,000	\$ 301,000	\$ 304,000

Street Maintenance Unfunded Backlog

The above cost projections do not account for the City’s current deferred (unfunded) street maintenance backlog. That unfunded backlog consists of pavement maintenance that is needed but cannot be performed due to lack of funding.. The City has a **\$82 million** residential street unfunded backlog and a **\$43 million** collector street backlog. If it is assumed that Refuse Vehicles contributed to those backlogs in a similar proportion to Refuse Vehicles current projected impact on residential and collector streets, it is reasonable to assign an associated portion of those costs to Refuse Vehicles.

Table 6 provides that allocation for Scenario 1 (1,000 vehicle trips). As shown, it is projected that **\$20.7 million** of the total residential and collector street unfunded backlog expense is attributed to Refuse Vehicles. Had the City historically had in place a contracted or districted system, all other factors the same the total residential and collector street backlog would be **\$14.0 million** less.

Table 6 – Scenario 1 Backlog Allocation to Residential Refuse Vehicles

	Residential Streets			Collector Streets			Total Annual Cost
	Current Residential Street Maintenance Backlog Expense	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	Current Collector Street Maintenance Backlog Expense	Refuse Vehicle Impact as Percent of Total Vehicle Impacts	Portion Attributed to Residential Refuse Vehicles	
Open Competition	\$ 82,000,000	24.4%	\$ 15,978,000	\$ 43,000,000	10.9%	\$ 4,703,000	\$ 20,681,000
Contracted or Districted	\$ 82,000,000	8.0%	\$ 5,247,000	\$ 43,000,000	3.3%	\$ 1,427,000	\$ 6,674,000
			\$ 10,731,000			\$ 3,276,000	\$ 14,007,000

Alley Maintenance Costs

The above analyses are specific to the City’s residential and collector streets, and as noted assume that 20% of residents receive alley service. While information was not available that would allow us to perform a specific analysis of the impact of Refuse Vehicles on the City’s alley repair costs, the City spends approximately **\$60,000** annually on residential and commercial alley repair. It is reasonable to assume that

Refuse Vehicles are responsible for some, potentially significant portion of that expense specific to the maintenance of residential alleys.

Refuse Vehicle Hauler Impact Fees

Regardless of whether or not the City decides to maintain its current open competition residential collection system or move to a contracted or districted collection system, it may wish to consider charging licensed haulers a fee to offset the street maintenance cost impacts of their residential Refuse Vehicles. While we are not aware of any cities in Colorado that charge such a fee, “Refuse Vehicle impact fees” have been applied in California for more than 15 years and in many cases the amount of those fees were based on studies that used the same methodology R3 used for this analysis. **Table 7** provides the projected monthly and annual Refuse Vehicle Impact Fee charge per residential account for Scenario 1 (3.5 haulers)

As shown, under the current open competition system a monthly fee of **\$1.50** per residential account would fund the portion of the City’s current street maintenance budget associated with Refuse Vehicle impacts. Under a contracted or districted system that monthly fee would be **\$0.50** per residential account; **\$1.00** less per month than for the open competition system.⁵

Table 7

	Monthly Refuse Vehicle Street Maintenance Impact Fee per Residential Account	Annual Refuse Vehicle Street Maintenance Impact Fee per Residential Account
Open Competition	\$ 1.50	\$ 18.00
Contracted or Districted	\$ 0.50	\$ 6.00
Savings with Contracted/Districted Collection	\$ 1.00	\$ 12.00

Note: The calculated fees in **Table 7** do not account for any recouping of the existing unfunded backlog attributed to Refuse Vehicles, which if considered would increase those fees potentially significantly depending on the period of time over which they were recouped.

Contracted, Districted, and Open Competition Systems Considerations

R3 is a consulting firm that has worked exclusively for municipal agencies for more than 15 years, we do not work for private haulers. We do however have good working relationships with Waste Management, Republic Services, and Waste Connections (National Haulers), as well as many other regional and local haulers, and regularly interact with their local and regional staff on behalf of our clients. We have direct experience with all types of residential and commercial solid waste collection system structures, and specifically contracted, districted, and open competition services.

In support of the City’s consideration of contracted or districted solid waste collection services we offer the following considerations, based on our experience:

- 1. Community Outreach and Education is Critical** - Residents typically have a lot of questions about how they would be impacted by a contracted or districted residential collection system. It is important that they receive accurate information, that addresses the major issues and concerns so that residents have an informed understanding of the associated impacts.

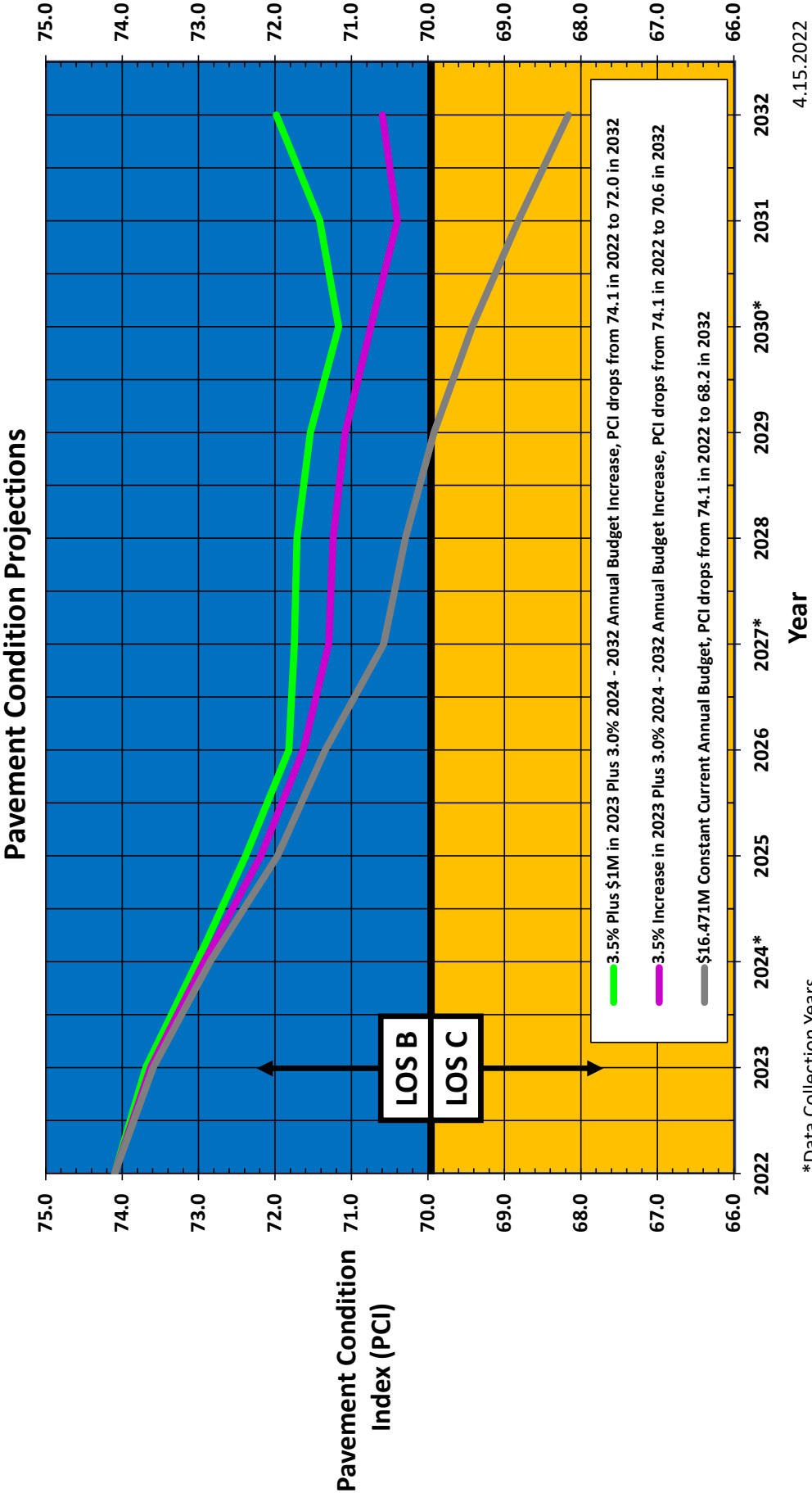
⁵ This analysis assumes the calculated cost impact is spread across all residential accounts evenly.

- 2. Maintaining Flow Control** - Flow control can be established as a condition of any contracted or districted system. In either case, the City would contractually require the selected hauler(s) to use City designated facilities (e.g., Larimer County landfill), or allow proposers to offer an alternative site, which the City could allow at its sole discretion.
- 3. Benefits of Contracted or Districted System versus an Open Competition System** - In addition to reduced Refuse Vehicle impacts, which can be significant, a major advantage of districted and contracted collection as compared to open competition are the significant operational efficiencies to be realized. The operational efficiencies that are gained by collecting every account on a street rather than only a portion are substantial. As collection operations comprise the majority of costs (monthly rates), there is a potential for significant cost savings (and/or service improvements) to be realized within a contracted or districted system.
- 4. Benefits of Contracted versus Districted Collection System** - A single hauler contracted system provides for economies of scale with respect to required management, administration and operational resources when compared to a multiple hauler districted system, and there are potential associated cost savings and/or service improvements that can be realized. City contract management requirements are also significantly less with a single contracted hauler versus multiple districted haulers.
- 5. Opt Out Provisions Undercut the Benefits of Contracted and Districted Collection** – If the City chooses to contract or district collection services, Colorado law preserves the right for residents to choose their waste hauler, although residents could be charged an opt-out fee for doing so. If the City contracts or districts collection services, to the extent that residents opted-out from the City's selected hauler the benefits associated with districted or contracted services would be negatively impacted. Our experience has been that in those jurisdictions that have contracted (franchised) collection the vast majority of residents would not support moving to an open competition system with multiple haulers operating on their street. Under a contracted or districted system the National Haulers' operations while not interchangeable, are from the residents interface generally similar, with programs and operational standards dictated by contractual requirements.
- 6. Meeting Zero Waste Goals** – Many but not all of the City's zero waste goals are achievable under the current open competition system. The next step for the City on the path to zero waste is to increase yard trimmings, and food scrap collection once infrastructure is available within a reasonable haul distance. Yard trimmings and food scrap collection can take place under an open market or contracted system but would be much more affordable under a contracted system. A contracted system supports addressing zero waste goals and other community livability goals through the same action.
- 7. National Haulers Routinely Win and Lose Contracts** - The three National Haulers that operate in the City routinely compete for franchised collection services. Winning and losing contracts is part of the industry and should any National Hauler not be awarded a residential collection system contract with the City going forward they would reassign their assets and move on. The National Haulers are not going to be significantly impacted by losing their existing residential market share should the City contract with an exclusive hauler. It is not known the extent to which Mountain High Disposal would be impacted should it lose its residential market share.
Note: It is not uncommon for the winning hauler to reimburse a city for the cost of a competitive procurement process.
- 8. There is a Competitive Local Marketplace** - Districting for purposes of maintaining competition in the City is not necessary. If the City enters into an exclusive contract with a hauler, if and when that contract goes back out for a competitive procurement, all of the National Haulers and other regional haulers will likely have a significant interest. The most significant step the City can take to ensure ongoing competition for its residential collection system is for it to own the corporation yard that its contracted hauler operates out of. Access to a local corporation yard location is a major factor impacting a hauler's interest/ability to compete for a collection franchise. If the City owns the corporation yard any hauler in the State or nationally that wanted to compete for the City's contract would have the ability to effectively do so. They simply come in and set up shop at the City's refuse corporation yard and pay the City a monthly rent.

- 9. Contracted or Districted Services do not Create a Monopoly** - Contract term lengths and the annual rate adjustment mechanism need to be contractually established, and if you have a strong performance-based franchise agreement that holds the hauler to objective safety, customer service, public education and outreach, financial and operational standards, you have an effective regulatory framework.
- 10. Rate can be Effectively Controlled** - With contracted or districted services the competitive marketplace establishes the reasonableness of the initial rates. An annual rate adjustment mechanism needs to be defined and made known to the haulers at the time they prepare their proposals. A Refuse Rate Index (RRI) is one method for annual adjustments that uses a number of indices (e.g., labor, fuel, vehicle capital cost, vehicle maintenance cost, consumer price), and is intended to model actual changes in major cost items. An option for an special rate adjustment can also be provided to address extraordinary circumstances (e.g., change in law, force majeure, costs beyond contactor's control). Alternatively, costs can periodically be set to actual expenses, plus a reasonable profit.
- 11. Street Maintenance Costs and Refuse Vehicles Contribution to those Costs are Going to Increase Unless City is Able to Maintain its Current CPI** - At current budgeted levels the average PCI of the City's streets is projected to decrease from "good" to "fair" by 2032. The most significant step the City can do to maintain the quality of its residential streets and starve off the significant street maintenance cost increases that begins as streets fall from good to fair to poor quality is eliminate the current open competition residential collection system and not allow for an opt-out provision.
- 12. City Can Require Winning Hauler to Hire All Displaced Drivers and Mechanics** - There is a shortage of qualified drivers and mechanics throughout the industry, and any hauler that wins a contract in the City would likely look to hire as many of the drivers and mechanics from those companies that did not win a contract as it could. Any Request for Proposals can require the winning hauler to offer employment to all displaced qualified drivers and mechanics as a condition of the award of the contract. Additional requirements can also be established including require the selected hauler to maintain displaced employee seniority, honor any scheduled vacations, provide matching 401K program, and/or any other conditions the City may wish to establish or encourage.
- 13. Municipal Operations Generally Cannot Compete with Private Sector Operations** - We are not aware of any jurisdiction that has moved from a collection system operated by private haulers to a municipal operation. The price of entry alone may make this option a non-starter given that fully automated solid waste vehicles can approach \$400,000 each, and obtaining qualified drivers, mechanics, and other staff is extremely difficult in the current employment market. Even if the City could afford to implement a municipal collection system, it is very unlikely that it could effectively compete with a private sector hauler operating under a well-designed performance based franchise agreement. This is due to the fact that Municipal operations:
 - a) Do not have the economies of scale of regional or national haulers;
 - b) Do not have access to the significant corporate safety, customer service, vehicle maintenance and other resources of regional or national haulers, and
 - c) Unlike private haulers, municipal collection managers do not have direct control over a city's safety, vehicle maintenance, or customer service functions, all of which are fundamental to collection system performance. It is not uncommon for a city's safety resources to be inadequate for the safety management demands of solid waste collection operations, and for fleet services to prioritize the maintenance of police and fire vehicles above that of Refuse Vehicle. City customer service functions also commonly fill a broader demand than just solid waste customer service needs, which can impact performance versus an industry specific customer service function with objective contractual performance standards.

Attachments:

- A** Pavement Condition Projections



June 6, 2022

Ms. Kira Beckham
Lead Specialist
Environmental Sustainability
City of Fort Collins
300 LaPorte Avenue
Fort Collins, CO 80521
submitted via email: kbeckham@fcgov.com

SUBJECT: Final Report - Trash Collection Vehicle Emission, Noise, and Safety Analysis

Dear Ms. Beckham,

R3 Consulting Group, Inc. (R3) was engaged by the City of Fort Collins (City) to update our trash collection vehicle emission, noise, and safety analysis that was prepared for the City in 2008. This Letter Report provides the results of our analysis.

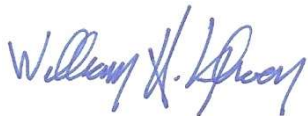
Project Objective

To compare the vehicle emission, noise, and safety impacts of residential trash, recycling, and yard waste collection vehicles (Refuse Vehicles) of the City's current open competition system to a contracted or districted collection system with a single hauler providing services in any given area of the City.

* * * * *

We appreciate the opportunity to be of service to the City. Should you have any questions regarding our letter report or need any additional information, please contact me by phone at (916) 947-4880 or by email at wschoen@r3cgi.com.

Sincerely,



William Schoen | *Sr. Project Director*

R3 Consulting Group, Inc

916.947.4880 | wschoen@r3cgi.com

Summary Findings

The vehicle emissions from the City's licensed hauler Refuse Vehicles are in large part directly related to the number of miles those vehicles drive on the City's streets. As such, contracting or districting solid waste collection services and limiting services in any given area of the City to one hauler and reducing the associated miles driven by Refuse Vehicles, is the most significant immediate step the City can take to reduce Refuse Vehicle emissions. If you assume that all four licensed haulers provide service on both sides of every residential street in the City, switching from the open competition to a contracted or districted system would reduce the number of haulers on any given residential street from four (4) to one (1); a 75% reduction in the number of haulers and Refuse Vehicle miles driven, with a reduction in the associated vehicle emissions. If we assume an average of three (3) haulers currently operating on each residential street the vehicle miles driven would decrease by 67%. At two (2) haulers there would be a 50% reduction in miles driven and associated vehicle emissions.¹

It is estimated that under the current open competition system, and assuming an average of three and a half (3.5) licensed haulers operating on each residential street, Refuse Vehicles emit approximately 830 carbon equivalent tons annually. Under a contracted or districted residential collection system that figure would be reduced to approximately 300 carbon equivalent tons annually.

Vehicle emissions can also be reduced by expanded use of compressed natural gas (CNG) vehicles, and/or potentially electric vehicles at some point in the future. Similarly, both CNG and electric vehicles generate less noise than diesel powered engines. Those and other emission and noise reduction technologies can be required as part of the City's hauler licenses or contracts. Requirements we recommend the City consider include: limiting the age of Refuse Vehicles unless retrofitted with City required emission, noise and/or safety technologies (e.g., operate-in-gear-at-idle, automatic engine shut off systems, LED headlights and strobe lights, vehicle safety cameras, "smart" back-up alarms, on-board video event recorders (e.g., DriveCam)).

Whether or not the City maintains the current open competition residential collection system or switches to a contracted or districted system, we recommend that it consider developing an (exclusive/non-exclusive) Solid Waste Franchise Agreement (Agreement). That Agreement should provide detailed and objective performance standards with respect to safety, customer service, public education and outreach, required programs, diversion requirements (e.g., minimum required diversion rates), City fees, and other specifics. If the City maintains its current open competition system, we recommend that all haulers be required to agree to the City's contract (franchise agreement) terms as a condition of doing business in the City. If the City issues a request for proposals (RFP) for contracted or districted services, we recommend that the RFP include a draft of the City's Agreement. All proposers should be required to identify any terms of the Agreement that they take exception to, and provide acceptable replacement language as part of their proposals, with the understanding that the City will only consider negotiating those terms identified in the haulers' proposals.

Note: A copy of a recently executed franchise agreement between Waste Management and the City of Beaumont, CA has been provided to the City under separate cover. That document provides an example of the types of general terms and conditions that Waste Management, Republic and other haulers have committed to under existing contracts. While the City may wish for a more abbreviated agreement, we recommend that many of the provisions of that document be included in any Agreement the City develops.

¹ Vehicle emission reductions would be somewhat less than the associated reduction in vehicle miles driven since the emissions associated with vehicles while they are physically dumping residential carts does not change regardless of the number of haulers. Similarly, noise associated with vehicles traveling down residential streets would decrease but the amount of noise generated at the point of collection would not change regardless of the number of haulers operating on a given street.

Background

In Fort Collins, residential trash, recycling, and yard waste services are provided by the following four (4) licensed private trash haulers:

- Mountain High Disposal
- Republic Services
- Ram Waste Systems (Waste Connections); and
- Waste Management

Residents are free to subscribe to collection services from any of the licensed haulers, with trash haulers competing for market share. Under this open competition system, multiple haulers provide service on each residential street each week, with resulting street maintenance and other impacts.

Under a contracted system, a single hauler would provide all residential services citywide. Under a districted system, the City would be broken into multiple service areas (districts), with a single hauler providing service in each district.

All other factors the same, moving from an open competition residential collection system to a contracted or districted collection system would reduce the number of Refuse Vehicle miles traveled on the City's residential streets. As a result, there would be a significant corresponding decrease in the associated vehicle street maintenance, emission, and noise impacts, and improved neighborhood aesthetics. All of the factors the same, there would also be fewer Refuse Vehicle accidents and related property damage corresponding to the decrease in the number of Refuse Vehicle miles driven in the City.

Refuse Vehicle Emissions

Background / Overview

The greatest contribution to human Greenhouse emissions comes from transportation, followed closely by electricity generation and industry. There is a tremendous amount of pressure on the top 3 economic sectors to reduce their GHG emissions, with most goals set for 2035 and 2050. Within the transportation sector, municipalities deploy the highest GHG-emitting vehicles daily, including public transportation vehicles and refuse trucks. On a per-mile basis, the refuse truck is the most egregious contributor,² with an average fuel efficiency of approximately 2.5 miles per gallon.³

Options for reducing Refuse Vehicle Emissions include the following, which are discussed in more detail below:

- Converting to CNG⁴, liquefied natural gas (LNG), or electric engines;
- Requiring operate-in-gear-at-idle systems; and
- Requiring automatic engine shut off systems.

Natural Gas and Electric Vehicles

Natural Gas Vehicles

While the majority of refuse vehicle fleets are powered by diesel engines, that is changing. By the end of 2020, 53% of Waste Management's collection fleet had been transitioned to CNG vehicles, comprising the largest heavy-duty natural gas fleet of its kind in North America. Over half of Waste Management's CNG vehicles use dairy or landfill biogas, including gas captured from landfills. In California, Oregon and Washington, 100% of Waste Management's natural gas fleet runs on renewable natural gas (RNG).⁵ By the end of 2019, Republic had more than 3,100 of its total vehicles running on alternative fuels; more than

² Source: EPA: Sources of Greenhouse Gas Emissions

³ Source: US Dept. of Energy - Alternative Fuels Data Center

⁴ CNG is the more economical and accessible option for U.S.-based refuse fleets.

⁵ Source: Waste Management 2021 Sustainability Report

20% of the company's fleet, and Waste Connections, has been running a fleet of around 1,100 CNG vehicles; 11% of its fleet. According to NGV America, more than 17,000 refuse and recycling trucks in the United States run on natural gas and about 60% of new collection trucks on order will be powered by natural gas.

According to NGVAmerica,⁶ natural gas vehicles are 90% cleaner than the EPA's current NOx⁷ standard and emit up to 21% fewer GHG emissions than comparable gas and diesel vehicles. When fueling with RNG, GHG emissions can be reduced up to 382%. While burning natural gas in vehicles emits less carbon dioxide than burning diesel, the drilling and production of natural gas leaks methane, a potent greenhouse gas, and those leaks offset some of natural gas' carbon dioxide (CO₂) benefit.⁸

Burning natural gas for energy results in fewer emissions of nearly all types of air pollutants and CO₂ than burning coal or petroleum products to produce an equal amount of energy. About 117 pounds of CO₂ are produced per million British thermal units (MMBtu) equivalent of natural gas compared with more than 200 pounds of CO₂ per MMBtu of coal and more than 160 pounds per MMBtu of distillate fuel oil. The clean burning properties of natural gas have contributed to increased natural gas use for electricity generation and as a transportation fuel for fleet vehicles in the United States.⁹

Electric Vehicles

While natural gas-powered vehicles are the solid waste industries preferred form of alternative fuel, Waste Management, Republic, and Waste Connections are all testing electric refuse vehicles, which do not directly generate any vehicle emissions. In July 2020, 15 states, including Colorado, and Washington D.C, signed a memorandum of understanding to work toward a goal of 100% of medium- and heavy-duty zero-emissions vehicle sales by 2050. An added advantage of electric vehicles is that they generate significantly less engine noise.

Eco-Cycle of Bolder recently unveiled what it claims to be the country's first electric compost truck, and the move toward electric vehicles is in line with Colorado's draft Greenhouse Gas Pollution Reduction Roadmap, which calls for an accelerated move to electric vehicles.

Operate-in-gear-at-idle Technology

Operate-in-gear-at-idle technology can also reduce emissions. Operate-in-gear-at-idle systems allow an engine to run at much lower revolutions per minute (RPM) and thus conserve fuel when compared with collection vehicles that do not have the technology. Operate-in-gear-at-idle systems save fuel by using a larger hydraulic pump that produces the extra flow of fluid needed for a trash collection vehicle to load and compact garbage at standard speeds while the engine remains at idle. Without the systems, truck operators must shift the transmission and throttle the engine to power the hydraulic system every time they make a route stop or want to pack the load. There is minimal effect on truck performance and fuel savings of as much as 20% have been attributed to operate-in-gear-at-idle systems.¹⁰ Operate-in-gear-at-idle technology is generally standard on new side loading equipment.

An added advantage of operate-in-gear-at-idle technology is that it significantly reduces engine noise. Most of the loud engine noise associated with garbage trucks comes from revving the engine to pack the load. With an operate-in-gear-at-idle trash truck the hydraulic system is capable of packing without revving the engine and generating the associated engine noise.

⁶ Natural Gas Vehicles for America (NGVAmerica) is a national organization of roughly 200 companies and organizations dedicated to the development of a growing, profitable, and sustainable market for vehicles, ships and carriers powered by natural gas or biomethane.

⁷ Nitrogen oxides (NOx) are a collective term for toxic gas molecules that are chemical compounds between nitrogen and oxygen and are an essential component of air pollution.

⁸ Source: <https://www.usatoday.com/story/news/nation/2014/02/13/natural-gas-leaks-methane-beyond-epa-estimates/5452829/>

⁹ Source: U.S. Energy Information Administration; <https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php>

¹⁰ Ideal Idle Idea; K. Simpson, Waste Age, Sep 1, 2006 12:00 PM

Automatic Engine Shut-Off Systems

Idling engines can burn up to one (1) gallon of fuel per hour. A 2013 report from the Argonne National Laboratory-Center for Transportation Research estimated that garbage trucks waste approximately 27.5 million gallons of fuel per year through idling, whether they're waiting in line to drop off a load or providing a comfortable place for a driver to take a break.

On-board engine controls can be installed that automatically cut off the engine after a set time period if a driver leaves it idling. Waste Management, Republic, and Waste Connections all have installed automatic engine shut off devices that shut the engine down after five minutes of idling on some of their vehicles. This five-minute standard is consistent with the proposed time frame in EPA's Model State Idling Law and in accordance with the American Transportation Research Institutes Compendium of Idling Regulations.

Waste Management has mandated an idle shutdown policy, which means all of the company's trucks with electronic engines are programmed to shut down after five minutes of idling. Additionally, with the installation of on-board computer GPS tracking technology, Waste Management can review how, when, and where trucks idle, which will inform them as they develop new policies on the issue.¹¹

Diesel Fuel Emissions¹²

A diesel engine, like other internal combustion engines, converts chemical energy contained in the fuel into mechanical power. Diesel fuel is a mixture of hydrocarbons, which during an ideal combustion process would produce only carbon dioxide (CO²), and water vapor (H₂O). Diesel emissions, however, also include other pollutants, most of which originate from various non-ideal processes during combustion. Common pollutants include unburned hydrocarbons (HC), carbon monoxide (CO), nitrous oxides (NO_x) or particulate matter. Total concentration of pollutants in diesel exhaust gases typically amount to some tenths of one percent, with much lower, "near zero" levels of pollutants emitted from modern diesel engines equipped with emission after treatment devices such as NO_x reduction catalysts and particulate filters. Given the relatively low levels of those pollutants, our review of diesel emissions focused on the production carbon dioxide, which is the major greenhouse gas produced by burning diesel fuel.

Contracted/Districted vs. Open Competition System Vehicle Emissions Projections

Implementing a contracted or districted collection system would also reduce overall vehicle emissions as a result of the reduction in the number of residential trash collection vehicle miles traveled. **Table 1** provides a comparison of projected Refuse Vehicle engine carbon dioxide (CO₂) emissions for a contracted or districted collection system, with one hauler per residential street, versus an open competition collection system with an average of 3.5 and 7.0 haulers per residential street.

Table 1

Average Number of Haulers per Street	Annual Refuse Vehicle Miles	Average Miles / Gallon of Diesel	Annual Gallons of Diesel	Annual CO ₂ Emissions (Carbon Dioxide)					
				Pounds / Gallon Diesel	Total Pounds	Total Tons	Carbon Equivalent Factor	Carbon Equivalent Tons	Tonnage Increase vs. Single Hauler
1.0	294,840	3.0	98,280	22.46	2,207,000	1,104	0.27	301	0
3.5	810,810	3.0	270,270	22.46	6,070,000	3,035	0.27	828	527
7.0	1,533,168	3.0	511,056	22.46	11,478,000	5,739	0.27	1,565	1,264

¹¹ Solving the truck-idling Problem; Laura Waldman 2013; Sustainable America.

¹² Source: https://dieselnet.com/tech/emi_intro.php

As shown, one hauler operating in the City providing weekly solid waste and yard waste service, and biweekly recycling, is estimated to generate approximately 300 tons of carbon equivalents annually.^{13,14} Assuming that on average 3.5 licensed haulers provide service on each residential street under the current open competition system, a total of 828 carbon equivalent tons are generated by their Refuse Vehicles; 527¹⁵ more carbon equivalent tons annually.

Recommendations

- ***Contract or district collection services to reduce Refuse Vehicle emissions.***
- ***Require all Refuse Vehicle engines be equipped with emission after treatment devices such as NOx reduction catalysts and particulate filters.***
- ***Require all Refuse Vehicles to be equipped with operate-in-gear-at-idle technology, and automatic engine shut-off systems.***
- ***Consider requiring the testing/use of at least one electric Refuse Vehicle should the City contract Citywide services to a single hauler.***

Refuse Vehicle Noise

Background / Overview

Noise from trash trucks can be related to a number of factors including:

- Engine noise;
- Backing alarms;
- Noise at the point of collection (dumping material such as glass in curbside recycling systems);
- Time of collection; and
- Vehicle maintenance.

The specific strategies and options to reduce those noise impacts depend in large part on the source of the noise. Some jurisdictions have established specific noise standards that haulers must comply with during collection operations (e.g., decibel ratings within a specified distance from the vehicle).

Engine Noise

Engine noise associated with residential trash trucks is largely related to revving of the engine when the vehicle is packing. Diesel garbage trucks can generate noise levels of up to 100 decibels. Two of the most significant options available to reduce trash truck engine noise are:

- Converting to CNG, LNG, or electric engines; and
- Using “operate-in-gear-at-idle” technology¹⁶.

In addition to the above options, a well-built, tight-fitting, well-maintained vehicle can also help reduce noise.

¹³ A CO₂ equivalent (CO₂e) is a unit of measurement that is used to standardize the climate effects of various greenhouse gases.

¹⁴ This is for on-route miles driver only and does not account for miles driven back and forth from the route to the corporation yard, landfill, and yard waste and recyclable material processing facilities.

¹⁵ The analysis assumes that 30 percent of the City’s residential streets are in home owners associations with a single hauler providing service on those streets.

¹⁶ With non-operate-at-idle vehicles the engines need to rev when the body is packing. With an operate at idle vehicle there is a hydraulic system on the body which is capable of providing the hydraulic pressures need to pack without revving the engine, which creates noise.

A study in the Netherlands found there were noise reductions with natural gas vehicles of 90% inside the truck, 98% beside the truck, and 50% behind the truck compared to diesel powered vehicles.¹⁷ Our understanding is that Waste Management has its own natural gas fueling station and currently operates a natural gas fleet in the city, while the other licensed haulers operate diesel vehicles. Electric vehicles offer the potential for further significant vehicle noise reduction, although their technical viability within the solid waste industry has yet to be proven.

In addition to fuel savings, operate-in-gear-at-idle technology also significantly reduces engine noise. Most of the loud engine noise associated with garbage trucks comes from revving the engine to pack the load. With an operate-in-gear-at-idle trash truck there is a separate hydraulic system on the truck body. This separate hydraulic system provides the pressure needed to pack the load without revving the engine and generating the associated engine noise. Many Refuse Vehicle manufacturers offer operate-in-gear-at-idle technology standard on vehicle models, including Heil and McNeilus.

Backing Alarms (Beepers)

Vehicle backing and noise associated with vehicle backing alarms are most often associated with commercial collection activities. Placing limits on the time of commercial collection activities near residential neighborhoods can help address related noise issues. “Smart” back-up alarms can also be used. These alarms sense the level of ambient noise and adjust accordingly. In quiet conditions the alarm beeps at a much quieter level. Smart Alarms are also available that sound at a minimum decibel level only when radar detects an object and makes a sound only as long as the danger exists.¹⁸

Noise at Point of Collection

Noise at the point of collection (i.e., emptying containers) can be reduced by taking various actions to reduce engine noise, as discussed above. In addition, efforts to reduce noise associated with the dumping of materials, particularly glass recovered through the curbside program can also be taken. These include commingling of glass with other recyclable materials, reducing dump heights and potentially eliminating glass from the curbside program, although we are not recommending the City consider doing so.

Overall noise associated with residential collection operations at the point of collection would not be reduced under a districted collection system since it does not reduce the number of pickups, only the number of vehicles making those pickups. The noise produced in transit from point-to-point would be reduced however due to fewer vehicles. The noise associated with collection operations would also be limited to a specific day in each neighborhood.

Time of Collection

Section 15.423 of the City’s Municipal Code [Hours of Operation] states that, “*No collector shall operate any vehicle for the purpose of collection of solid waste, recyclables, food scraps, or yard trimmings on any non-arterial street as designated by the City’s Master Street Plan between the hours of 7:00 p.m. and 7:00 a.m.*” Time restrictions placed on residential collection activities are common. Some jurisdictions also limit the time of commercial collection activities, which by their nature are noisy, within a specified distance of residential neighborhoods (e.g., not before 7:00 a.m. within 200 feet of a residential area). The City’s municipal code does not place any limits on the time of commercial collection other than as specified above.

Vehicle Maintenance

Effective vehicle maintenance can also reduce noise. Assuring that vehicles are well built, tight-fitting and well maintained will help reduce vehicle noise.

Recommendations

- ***Contract or district collection services to reduce Refuse Vehicle noise.***
- ***Require all Refuse Vehicles to be equipped with operate-in-gear-at-idle technology.***

¹⁷ Ahhhh...the Peaceful Sounds of Garbage Trucks; N. Stiles; MSW Management May/June 2007.

¹⁸ Note: Any vehicle specification requirements need to consider applicable local, state and federal requirements.

- ***Consider requiring the testing/use of at least one electric Refuse Vehicle should the City contract Citywide services to a single hauler.***

Refuse Vehicle Safety

Background / Overview

Solid waste operations can pose safety risks to employees and the general public. The consideration of “Safety First” is central to an effective solid waste management operation as safe operations enhance productivity and profitability.

According to the Department of Labor Statistics, Refuse and Recyclable Material Collectors have the one of the most dangerous jobs in the country with a fatality rate approximately 10 times the national average. A University of Miami study found that the leading cause of on-the-job fatalities for refuse and recyclable material collectors is impatient motorists who try to pass the garbage truck and hit the collector.

Trash collection activities also result in interaction with the general public and as such generate the potential for public safety issues. Efforts to reduce those interactions (e.g., contracted or districted collection), make the public more aware of collection vehicles and drivers (e.g., signage, lights), and providing drivers with additional training and tools to provide for safer collection operations (e.g., video recorders) all contribute to increasing public safety as it relates to trash collection services.

Waste Management, Republic Services, and Waste Connections all have reported safety records that compare favorably to the industry average. Waste Management Inc., the largest solid waste services provider in the country, has a model “Mission to Zero” plan and has significantly reduced worker injuries since the model was implemented. Republic, the second largest solid waste provider in the country, has paid particular attention to vehicle safety, including adding or replacing all incandescent lights with LED’s and additional LED strobe lights on each side and the front of the vehicles.

Many of the vehicle specifications, and other best practice industry safety initiatives have been embraced by the National Haulers to varying degrees. Best practice vehicle safety systems include:¹⁹

- **Collision Avoidance Systems and Advance Driver Assistance Systems** - Smart vision sensors can detect possible collisions with other vehicles, pedestrians, cyclists, and fixed objects and alter the driver visually and audibly to take proper measures to avoid collisions. The addition of smart sensors to the sides of large trucks addresses the blind zones and obstacles experienced by the operators.
- **In-Cab Recording Systems** - Automotive recording systems have become a staple for many companies. In-cab recorders typically have two cameras, one facing inside the cab and the other showing the view outside of the windshield. Most systems allow for extra cameras that can offer supporting views including backup views, side views and extra interior views. Recorders serve multiple purposes for both the operator and fleet manager. For the driver, most recorders also incorporate an event alert system that will chime when an event such as speeding or harsh braking occurs. The chime reminds the driver to take action to correct or avoid another event. Many are used as a “what happened” tool after an accident and can provide irrefutable evidence to exonerate drivers if they are the subject of a false liability claim. In-cab recorders can also offer live tracking and streaming via 4G LTE allowing managers to track vehicles throughout the route.
- **Multi-Camera Systems** - Camera and monitor kits can act as extra eyes and ears for drivers. The most commonly used camera is the backup camera used to show the otherwise “blind area” behind a vehicle during reversal. This may be sufficient for standard cars, but larger vehicles have many more blind zones to cover around the vehicle. New surround view camera systems provide a 360° aerial view of the vehicle and cover the immediate perimeter around the vehicle. This is achieved by “stitching” together the image from multiple cameras—typically four. This is a game changer for

¹⁹ Source: <https://wasteadvantagemag.com/how-to-maximize-the-safety-for-waste-trucks-and-operators/>

waste truck operators. With the use of a surround view system, immediate blind zones around the vehicle are visible to the truck operator.

The City may also wish to require haulers to report overweight vehicles periodically (e.g., monthly or quarterly) and potentially establish fines for overloaded vehicles. Overloaded vehicles present a safety hazard and are of particular concern with respect to Refuse Vehicle impacts on the City's streets, most notably residential streets. The impact of Refuse Vehicles on the City's streets increases exponentially with weight, and as such overloaded vehicles exert significantly greater impacts on the City's streets than vehicles that do not exceed their legal load weights.

Recommendations

- ***Contract or district collection services support increased Refuse Vehicle safety.***
- ***Consider requiring that all Refuse Vehicles be equipped with the state-of-the-art safety technologies as conditions of the City's hauler licenses or contracts.***
- ***Consider requiring haulers to track and report overweight vehicles.***

February 8, 2023

City of Fort Collins
300 LaPorte Avenue
Fort Collins, CO 80521

SUBJECT: Final Report – Weekly vs. Biweekly Recycling Street Maintenance and Vehicle Emissions Impact Analysis

R3 Consulting Group, Inc. (R3) was engaged by the City of Fort Collins (City) to update our trash collection street maintenance impact analysis that was prepared for the City in 2008. Our updated analysis was provided to the City in our Final Report – Trash Collection Street Maintenance Impact Analysis (Final Report) dated July 11, 2022. That analysis assumed biweekly (i.e., every other week) residential recyclable materials collection. The City subsequently requested that R3 update that analysis to compare weekly and every other week recycling. This letter report presents the results of that analysis.

Project Objective

To compare the impact of weekly versus biweekly residential recyclable material collection service on the City's residential and collector street maintenance costs and vehicle emissions. This analysis compares the current open market system that includes every-other-week recycling to a single hauler system with either weekly or every other week recycling.

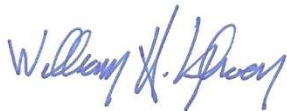
Limitations

Our analysis is based on a number of underlying assumptions for which reasonable ranges exist. Changes to those assumptions can have a material impact on the resulting findings.

* * * * *

We appreciate the opportunity to be of service to the City. Should you have any questions regarding our letter report or need any additional information, please contact me by phone at (916) 947-4880 or by email at wschoen@r3cgi.com.

Sincerely,



William Schoen | *Senior Project Director*

R3 Consulting Group, Inc.
916.947.4880 | wschoen@r3cgi.com

Findings

Based on the assumptions noted below:

Annual Street Maintenance Costs

Switching from biweekly to weekly recycling service is projected to increase the City's residential street maintenance costs by \$142,000 annually under the current open competition system, and \$51,000 under a contracted or districted collection system with one hauler serving any given area of the City (**Table 1**).

Table 1

Annual Street Maintenance Costs				
Collection System Structure	Biweekly	Weekly	Weekly Increase	
			Carbon Equivalents	Percentage
Open Competition	\$899,000	\$1,041,000	\$142,000	16%
Contracted or Districted	\$286,000	\$337,000	\$51,000	18%
Savings	\$613,000	\$704,000		
	68%	68%		

Annual Vehicle Emissions

Vehicle emissions are projected to be 23% higher for weekly versus biweekly recycling service, consistent with the increase in total Refuse Vehicle miles driven. Under the current system with an average 3.5 haulers assumed to operate on each residential street the total annual carbon equivalent tons are projected to increase by 166 tons from 721 tons to 887 tons. Under an exclusive single hauler system the total annual carbon equivalent tons are projected to increase by 61 tons for weekly versus biweekly service, from 262 to 323 tons (**Table 2**).

Table 2

Annual Carbon Equivalents				
Collection System Structure	Biweekly Vehicle Passes/Street	Weekly Vehicle Passes/Street	Weekly Increase	
			Carbon Equivalents	Percentage
Open Competition	721	887	166	23%
Contracted or Districted	262	323	61	23%
Savings	459	564		
	64%	64%		

Major Assumptions

Our analysis accounts for the following updated assumptions:

- Yard trimmings collection is provided eight (8) months per year. Trash and recycling collection service is provided year round;

- 75% of residents receive yard trimmings collection service, however, the vehicles collecting yard trimmings need to drive down every street to service those 75% of accounts that subscribe to service; and
- Twenty percent (20%) of the City's total residential and collector streets are located in home owner associations, with a single hauler providing service on those streets.

All other assumptions are consistent with those listed in our Final Report.

Key Take Aways

Weekly recycling service provides greater convenience to residents and as a result could potentially result in increased recycling levels. Street maintenance expenses and associated vehicle emissions however would increase under a weekly versus biweekly residential recycling collection system as shown in Tables 1 and 2 above. The monthly rate charged to residents would also be expected to be more for weekly versus biweekly service. Given that residents are currently provided with biweekly recycling service and that there are additional cost and emission impacts associated with weekly recycling, it seems that weekly recycling should only be pursued if the City determines that associated advantages (e.g., increased convenience and potential increased recycling levels) outweigh those additional cost and emission impacts.

<https://r3cgi.sharepoint.com/Shared Documents/R3 Shared/+Projects/Fort Collins, CO - Trash Collection Vehicle Impact Analysis -122025/Project Report/Weekly vs. Biweekly Recycling Final Report 020823.docx>
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