city of Columbia

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City of Columbia Parking Rate Analysis

University of Missouri – Trulaske College of Business
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Study Overview

The City of Columbia's Finance Division oversees all financial services' coordination, direction, and administration. Within the parking utility sector, the City manages nearly 1,700 on-street parking spaces, along with 2,300 spaces across six garages, 535 spaces in six parking lots, and 100 accessible parking spaces, all within the downtown Columbia area. These facilities serve the students, residents, employees, and visitors with an emphasis on ensuring safe and affordable parking.

This study analyzes *ParkMobile* app-based parking data for on-street parking in the downtown district. The City currently employs a fixed-rate parking fee structure; however, this analysis seeks to develop a variable-rate model to raise parking rates with minimal impact to the community. By conducting thorough research and cross-referencing Columbia's busiest periods, this study aims to provide valuable insights and recommendations to develop alternative parking rate structures for the City of Columbia.

Study Region

Figure 1. *City of Columbia Parking Map*

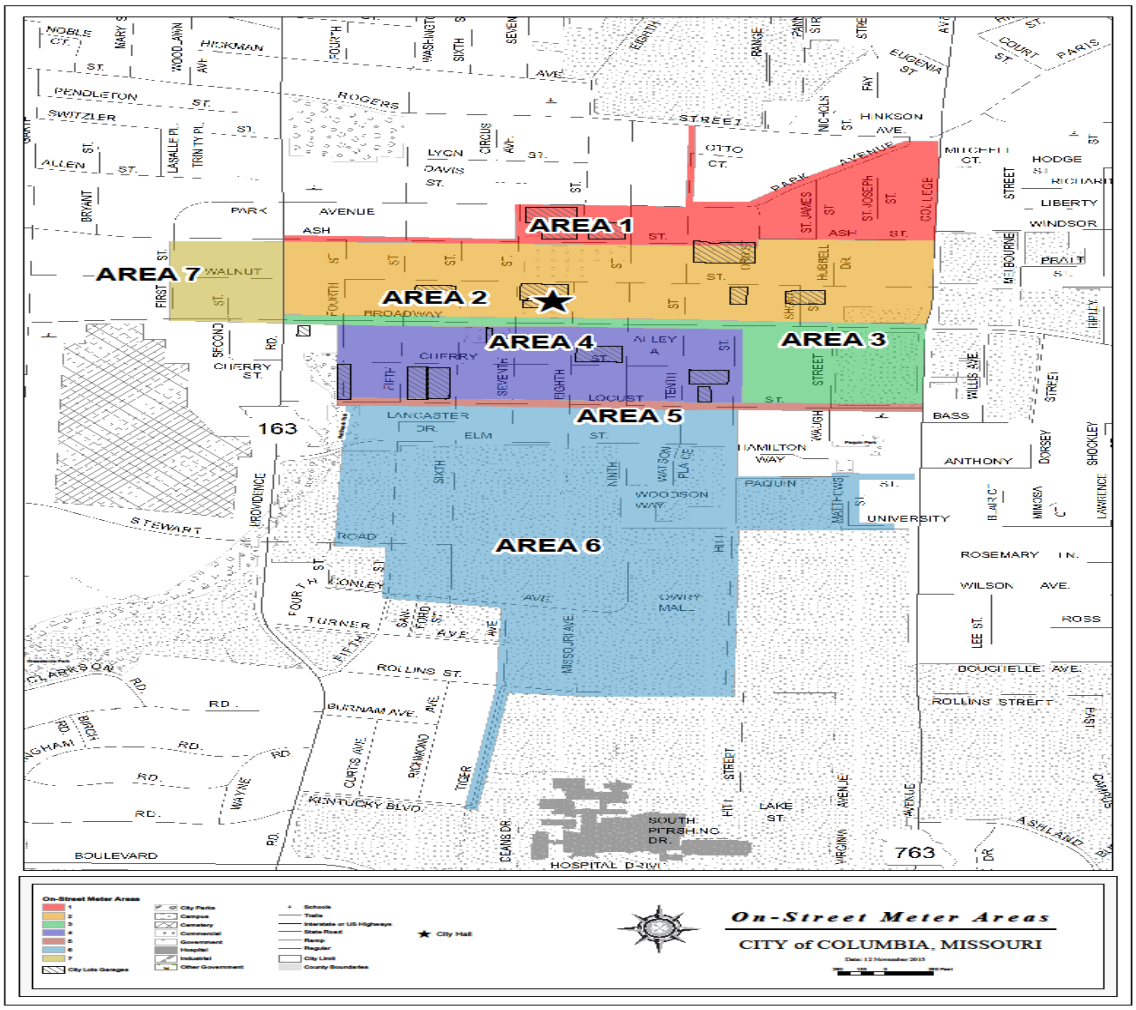


Figure 1 illustrates the areas of parking enforcement across downtown Columbia, Missouri. Areas 1 through 7 are on-street parking meters, enforced from 8 am to 6 pm, Monday through Saturday. Parking lots and garages are enforced Monday through Friday, from 8 am to 6 pm. All forms of parking are not enforced on Sundays or the City of Columbia observed holidays. Parking fees vary across locations, from $0.60 to $1.00 per hour, throughout each fiscal year. In 2023, the base transaction fee increased from $0.45 to $0.55.

Research Methods

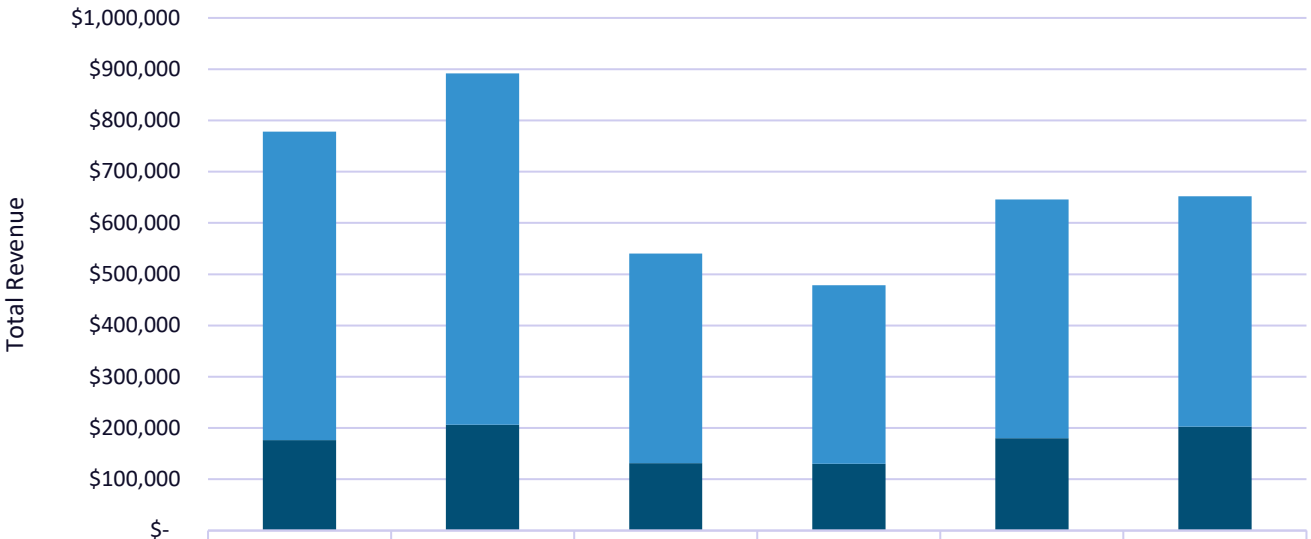
This research process started with gathering parking-related data from the City of Columbia. The City staff provided access to the *ParkMobile* app data, which contained seven years of parking usage history in the downtown area. Once the data was accessed, it was processed and cleaned using the statistical software R Studio, allowing for the analysis of daily, monthly, and yearly average parking durations, rates, and the corresponding revenue. This approach helped to identify the peak demand periods and form valuable recommendations to improve the City's revenue optimization and financial forecasting. The study findings and analysis can easily be replicated using the original dataset and any data analysis tool, such as R Studio, Excel, or Python.

Findings

As the data was refined, the trends were identified. The analysis highlighted key areas of high demand for each year. The analysis further focused on the parking demand on University of Missouri Football game days and explored the possibility of a dynamic pricing model to increase the City's revenue to match the increasing costs of managing and maintaining the City of Columbia's parking infrastructure.

The findings of this analysis are shown in the following figures and tables.

Figure 2. *Total Parking Revenue related to ParkMobile app users by Fiscal Year collected by the City of Columbia from the ParkMobile app users.*

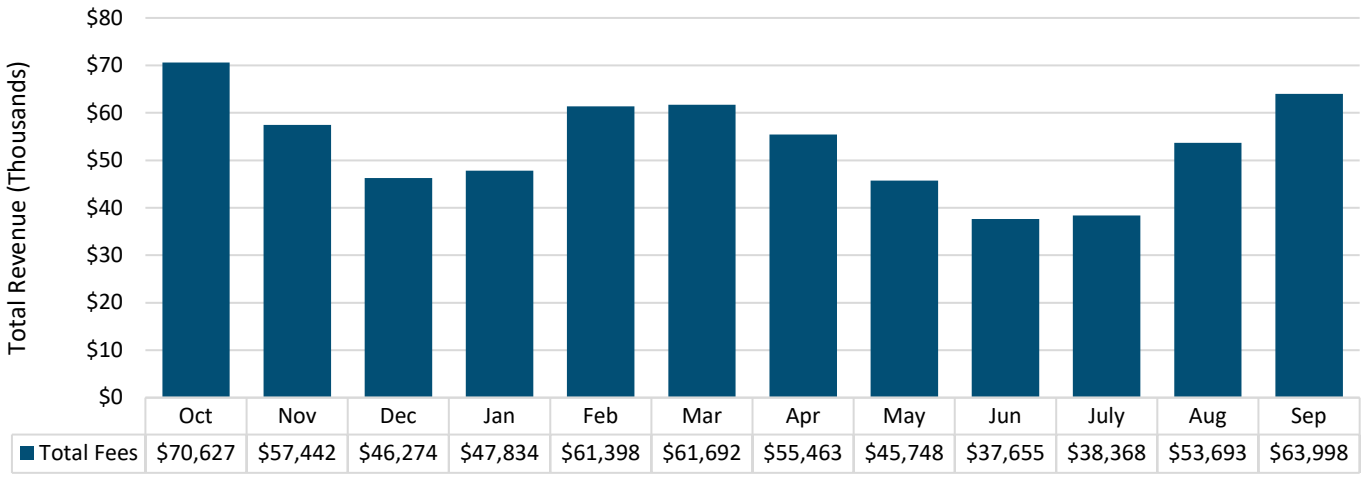


	2018	2019	2020	2021	2022	2023
Parking Fees	$601,579	$685,288	$408,872	$348,600	$465,201	$449,812
Transaction Fees	$176,582	$206,337	$131,582	$129,960	$180,444	$202,409

Parking fees consist of two components: 1) fixed and 2) variable costs. Fixed processing cost is a flat credit/ debit card processing fee occurring for each transaction, while variable cost (parking fees) is based on the duration of time at a parking location.

Figure 2 illustrates the total revenue by parking amount and transaction fees over each fiscal year. From 2019 to 2020, total revenue saw a huge decrease of 39.39%, while from 2020 to 2021, revenue decreased another 11.45%. This is likely due to the COVID-19 pandemic and lockdown measures. Revenue began to increase once again in 2022. By 2023, the revenue totaled $652,221, a 20.68% increase from 2020, the beginning of the pandemic year. While post-COVID-19 revenue has increased, it still has not recovered to pre-pandemic levels.

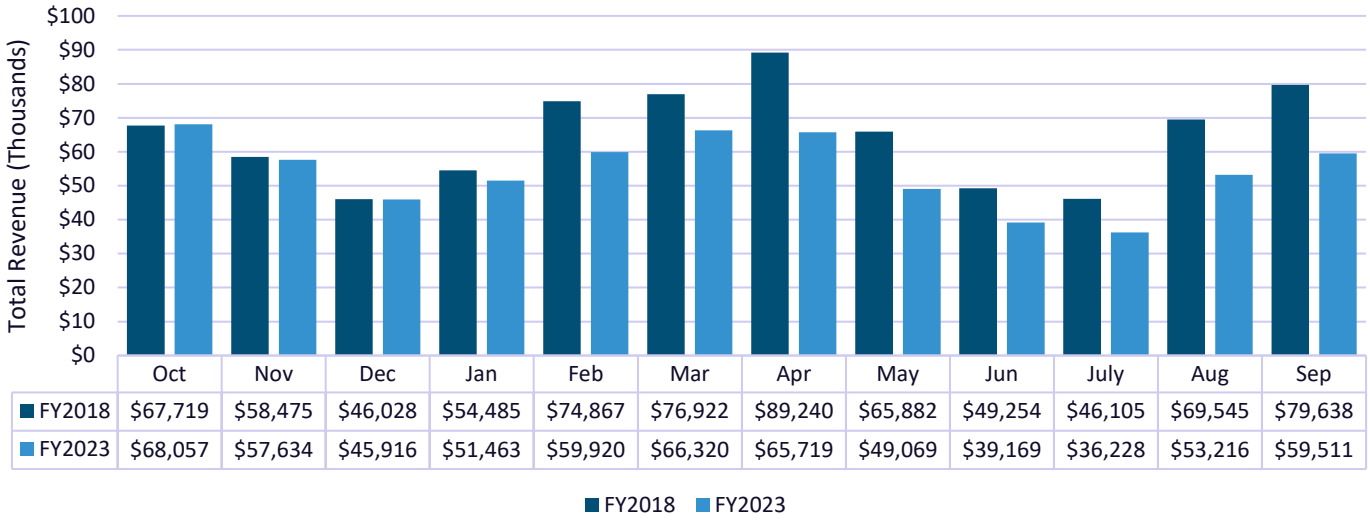
Figure 3a. *Average Parking Revenue by Month (Fiscal Years 2018-2023) collected by the City of Columbia from the ParkMobile app users.*



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Total Fees	$70,627	$57,442	$46,274	$47,834	$61,398	$61,692	$55,463	$45,748	$37,655	$38,368	$53,693	$63,998

Figure 3a shows the total revenue collected by the City through the *ParkMobile* app, highlighting a seasonal trend. Payments are lowest during the summer months (May, June, and July), likely due to reduced campus activity. The City's revenue collection peaked in the fall, aligning with the start of the University of Missouri's fall semester, which may increase the demand for parking during this period.

Figure 3b. *Comparison of FY 2018 vs FY 2023 Monthly Parking Revenue (Pre vs Post COVID-19) collected by the City of Columbia from the ParkMobile app users.*



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
FY2018	$67,719	$58,475	$46,028	$54,485	$74,867	$76,922	$89,240	$65,882	$49,254	$46,105	$69,545	$79,638
FY2023	$68,057	$57,634	$45,916	$51,463	$59,920	$66,320	$65,719	$49,069	$39,169	$36,228	$53,216	$59,511

Figure 3b compares monthly revenue between pre- and post-COVID-19, using the fiscal years 2018 and 2023. Data summary indicates that post-pandemic revenue has decreased overall, with the most significant differences occurring during the spring semester (January through May) and early fall semester (August and September). This is likely due to the pandemic increasing the amount and popularity of online classes, leading to fewer students using parking services.

Figure 4a. *Six years (FY 2018 - FY 2023) Average Fees by Day collected by the City of Columbia from the ParkMobile app users.*

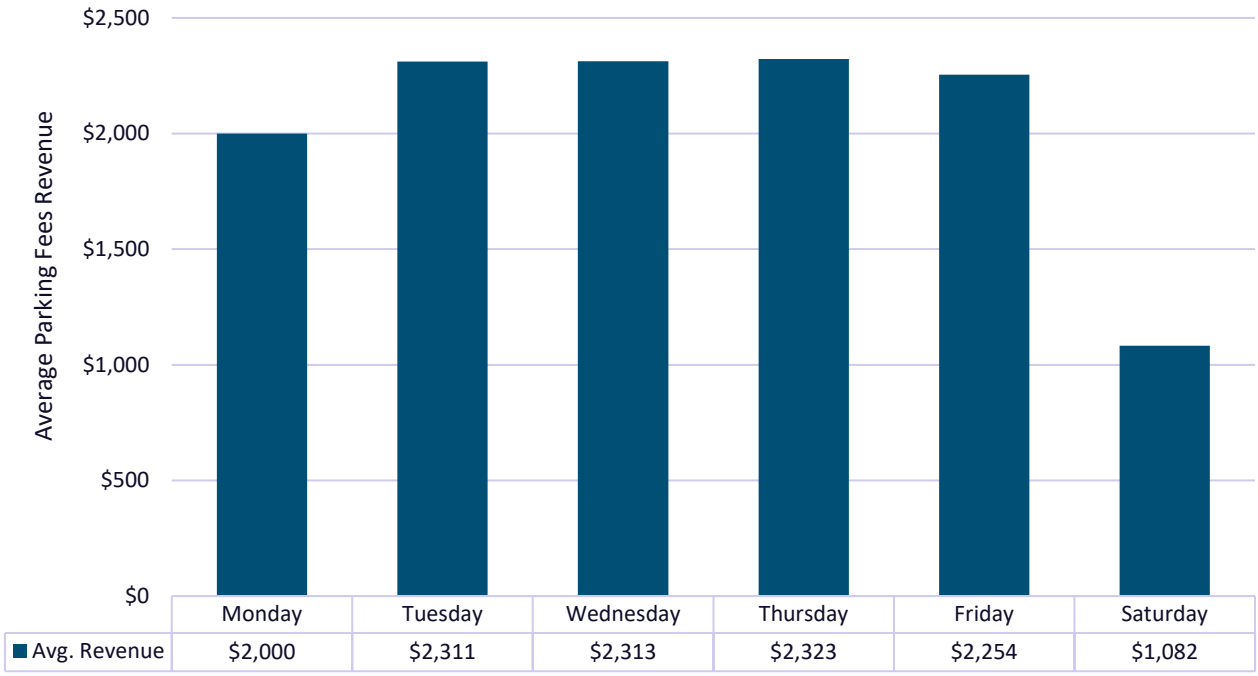


Figure 4a displays the average daily revenue generated over the period from 2018 to 2023. Lower parking fee collection on Saturdays may either be due to less enforcement or free parking at the garages and lots or both.

Figure 4b. *Comparison of FY 2018 vs FY 2023 daily average parking revenue (Pre vs Post-COVID-19) collected by the City from ParkMobile app users.*

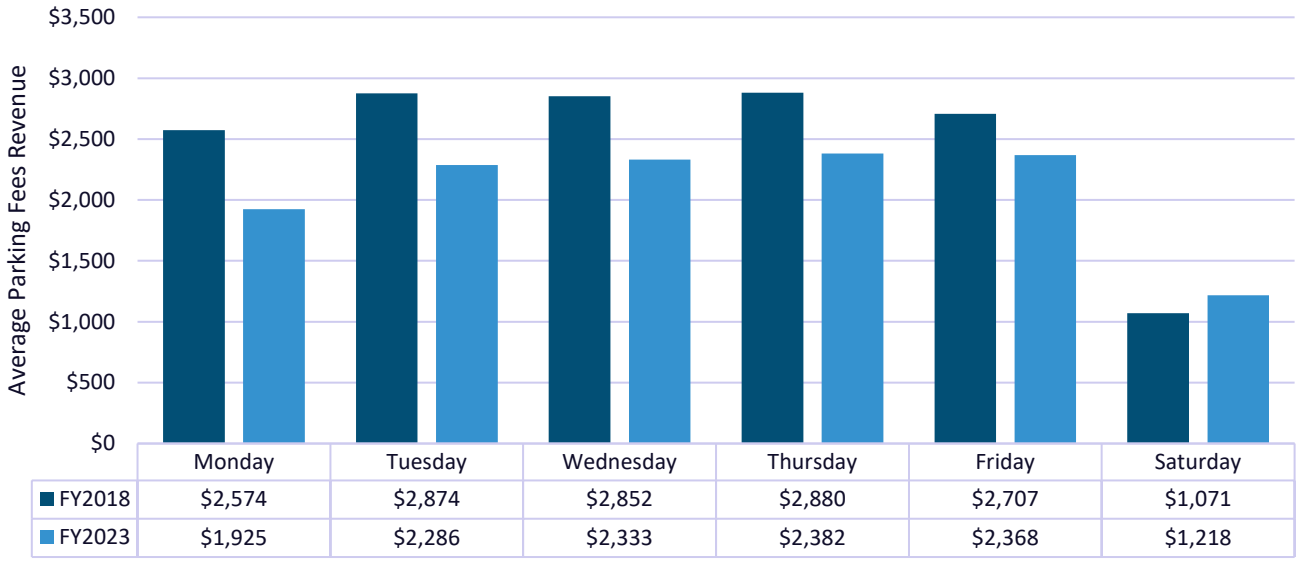
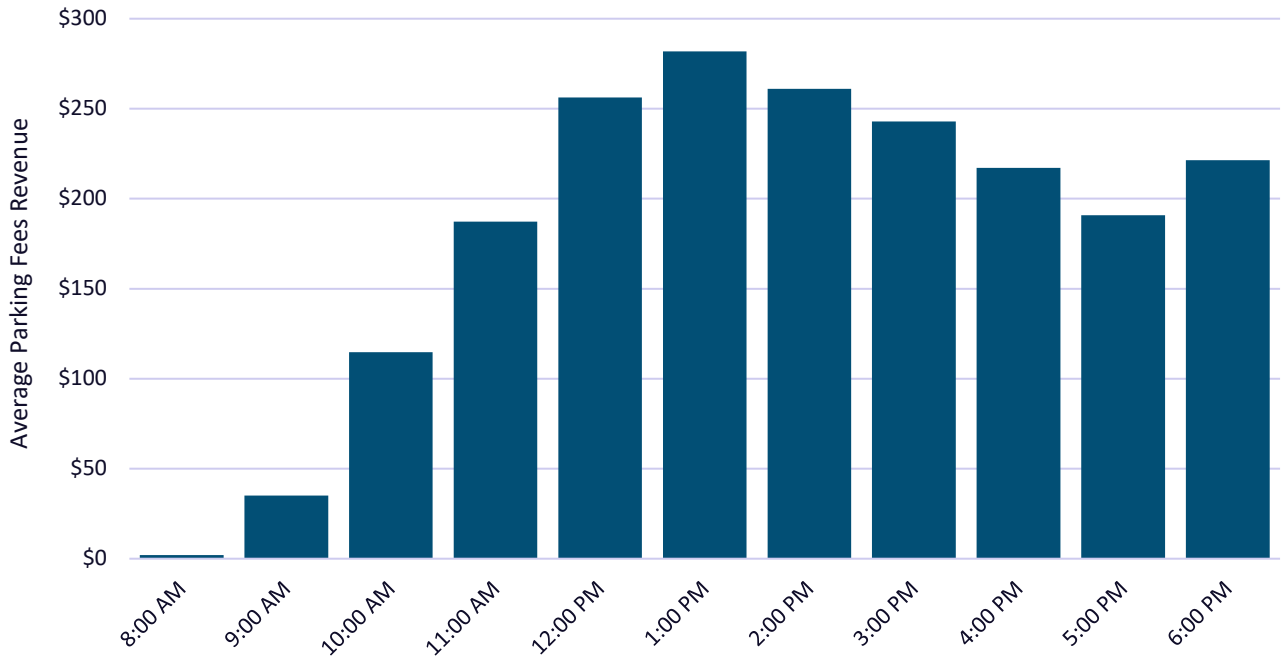


Figure 4b compares the fiscal years of 2018 and 2023, highlighting the distinction between pre- and post-pandemic daily revenue collection. There was a steep decline in daily revenue between these two periods, with 2023 being at or below average during a work week. This can be likely attributed to

the impacts of the COVID-19 pandemic, which resulted in fewer transactions between 2018 and 2023.

Figure 5. *Average parking Fees by Hour collected by the city from the ParkMobile app users in FY2023.*



This analysis shows trends in the average fees by hour in FY 2023. Parking fees increase during the morning hours, hitting the maximum of $281.92 at 1:00 pm; this may be due to office goers and visitors dine-in at the downtown restaurants. From that point onward, the average fee collection dropped slightly to $191 around 5:00 pm. At 6:00 pm, there is a further increase in average parking fee collections to $221.41, likely due to heightened downtown evening activities.

Note: The *ParkMobile* app records the parking duration when visitors or commuters leave a parking space.

Figure 6a. *Comparison of Homecoming 2023 (HC 2023) vs. Saturday Average (SAT AVG) Fees Collected by the City of Columbia from the ParkMobile app users*

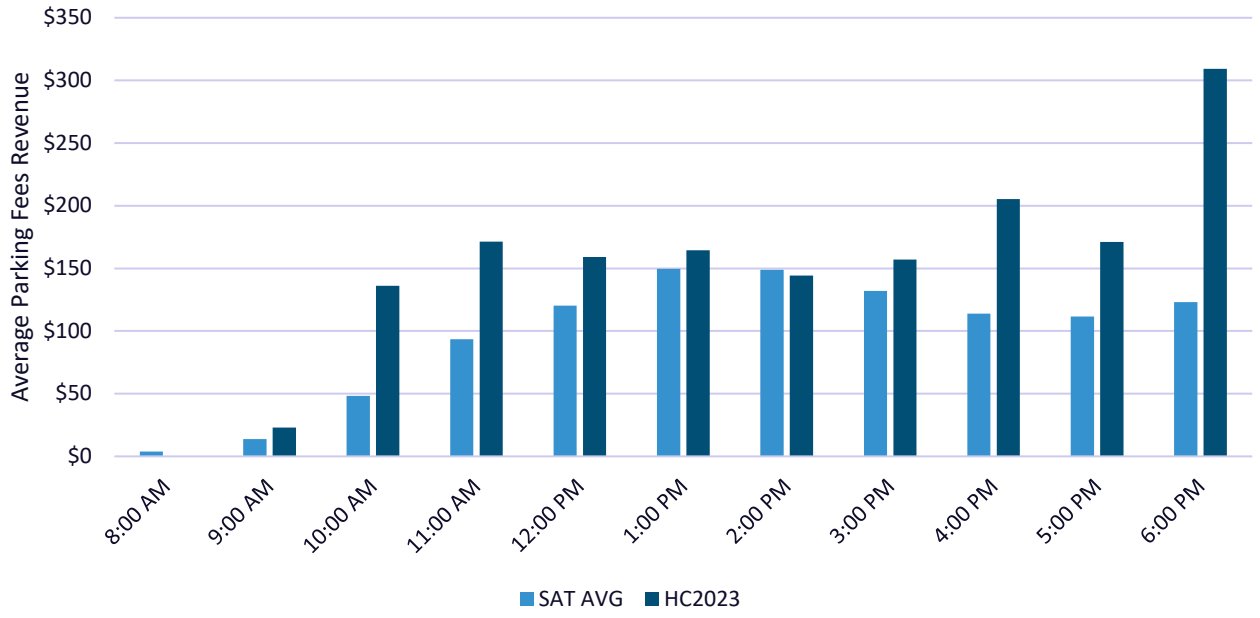


Figure 6a compares 2023's Homecoming fee collection to an average Saturday, the typical day for the University of Missouri's homecoming events. This analysis shows that fee collections are consistently higher on high-traffic days, such as homecoming, compared to that on an average Saturday.

Figure 6b. *Comparison of Homecoming 2018 (HC 2018) vs. Homecoming 2023 (HC 2023) Average Hourly Fees Collected by the City of Columbia from the ParkMobile app users.*

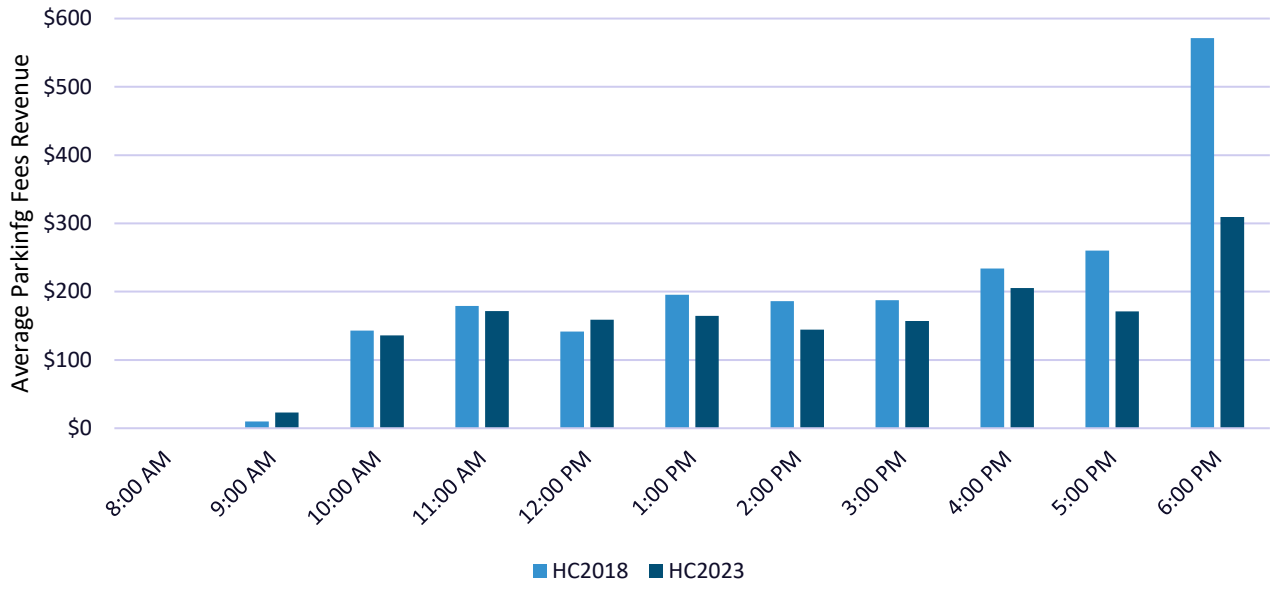


Figure 6b compares pre-COVID-19 homecoming revenue to post-pandemic revenue. Overall, homecoming revenue in 2018 is slightly higher than in 2023, likely due to the continuing effects of the pandemic. The City is anticipating that there will be more special event-related parking demand in the upcoming years, which may increase the parking revenue to the pre-COVID level.

Table 1. *Revenue by Parking Area collected by the City of Columbia from the ParkMobile app users.*

Area	2018	2019	2020	2021	2022	2023
1	$25,245	$38,122	$26,065	$25,646	$33,187	$39,929
2	$52,222	$73,071	$55,202	$58,564	$70,196	$71,315
3	$54,222	$68,649	$48,170	$54,492	$65,484	$71,227
4	$105,165	$131,277	$84,530	$87,128	$117,501	$120,616
5	$48,457	$56,907	$27,518	$23,179	$38,674	$41,218
6	$398,832	$400,456	$232,906	$222,441	$311,652	$297,762
7	$2,005	$1,646	$1,259	$763	$581	$507
L&G	$92,013	$121,497	$64,804	$6,347	$8,370	$9,647
Total	**$778,161**	**$891,625**	**$540,454**	**$478,560**	**$645,645**	**$652,221**

Table 1 breaks down revenue by area from fiscal year 2018 through 2023 for the City's seven parking areas, including lots and garages. These zones are shown in the map in Figure 1.

The revenue of each area was grouped and summed according to the corresponding area. Area 6, which covers the parking areas surrounding the University of Missouri campus, had the highest revenue, whereas Area 7, as shown in Figure 1was significantly lower in usage than any other area – as it is a much smaller lot and further to the campus compared to the other parking areas.

Recommendations

Dynamic Pricing Model

One recommendation is to implement a dynamic pricing model for parking, adjusting rates on high-demand days such as game days or major events. This strategy allows the organization to take advantage of increased demand, boosting fee collections by raising prices when parking spaces are more valuable. This demand can increase fee revenue by implementing higher prices when there is higher demand, without hurting Columbia's residents, and help the City offset some ongoing increasing operating costs.

Increasing Awareness and Parking Time Length for Gamedays

During high-demand events, such as University of Missouri college football -Mizzou gamedays, the City of Columbia can optimize its opportunities through its parking service. As it stands, the City is not fully capitalizing on the heavy demand generated by Mizzou gamedays and other key events, which often occur on Saturdays in the fall when the City does not charge for parking in lots and garages. This study recommends that the City of Columbia consider introducing special parking rates for these game days and other major events, particularly within its parking garages, to better align with demand.

Flat Price Increase

Inflation in the Midwest among cities with populations between 50,000 and 1.5 million has risen 26.03% from 2017 to 2024. The City of Columbia's parking prices have not risen to meet this benchmark. It is recommended that the City issue a flat price increase in fees to match inflation at the minimum. Additionally, matching inflation would help the City avoid a more significant adjustment in the future, ensuring a smoother transition for residents and visitors who rely on parking services.

Implementing Randomized Enforcement

To boost revenue, it is recommended that frequent and random parking enforcement be implemented throughout the day. It is believed that students have become familiar with the standard times of the enforcement schedule, allowing them to bypass paying parking fees. To address this, the study recommends that the City of Columbia implement enforcing zones randomly to discourage students from parking around enforcement periods. This approach will ensure that parking spaces are consistently paid for, not only during typical enforcement times. If enforcement agents check lots, garages, and meters frequently and randomly, the likelihood of unpaid parking will be significantly reduced.

Conclusion

In conclusion, this study aimed to provide insights into changes in parking demand over time. The analysis indicates that average parking durations peaked in 2018, followed by a significant decline likely caused by the COVID-19 pandemic, with the recovery still underway. Additionally, there has been a noticeable fluctuation in average payment amounts and total daily fees, with a sharp decline in payment amounts from 2019 to 2020.

This research supports the implementation of a dynamic pricing model, particularly during high-demand periods such as Mizzou football gamedays, to capitalize on increased parking demand and additional fee collection opportunities. Furthermore, it is recommended to introduce randomized and frequent parking enforcement to counteract users' familiarity with standard enforcement schedules. This strategy will ensure consistent fee generation and compliance with parking regulations.

Study Limitations and Future Suggestions

This study faced challenges, such as data collection and limitations due to the exclusive use of *ParkMobile* transaction data. If this study were to be continued, the analysis could be expanded to include data from parking meters and garages. If these recommendations are implemented, the impact of those changes could be measured using a time-series analysis. Additionally, comparing Columbia's data with other cities would provide valuable insights into parking demand patterns across various regions, contributing to a broader understanding at the state or national level.

Despite these constraints, implementing the recommendations and continuing to refine the approach based on ongoing data analysis will be crucial for the City of Columbia to fully leverage its parking assets in support of its financial goals.

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