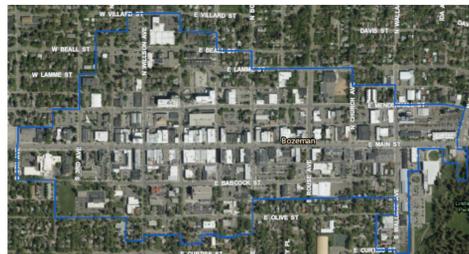


Project Summary

The focus of this project was to model the effects of parking occupancy in Downtown Bozeman, Montana. More specifically, the goal was to provide a visual model for the Bozeman City Parking Commission that could be used as a visual tool to help the members better understand quantitatively how different factors affect parking concerns. The results of the Current State Model and Future State Model will achieve this goal, while providing data driven recommendations for future implementations.



Data Collection



5-minute video at each of the perimeter intersections

	Intersection Name	Inter-arrival rate	Right turn	Left Turn	Straight	Total
Top						
Bottom						
Left						
Right						

Template used to convert video data to useable data

	Name	Car/min	Right	Left	Straight	Total
Top	Black		0.6	3	0	3
Bottom	Black		0.4	0	0	2
Left	Olive		0.6	1	1	3
Right	Olive		2	0	1	9
						10

Intersection of Black and Olive data

Recommendations

Passenger Loading Zone

A passenger loading zone is an area specifically for the use of loading and unloading passengers.

Possible Positive Outcomes

- A decrease in traffic disturbances
- The number of cars parking for a short term, less than 5 minutes, are not taking up ideal on-street parking spots for longer term business patrons

Incremental Paid Parking

This form of paid parking is based on demand to set the price of parking.

Possible Positive Outcomes

- More even occupancy rates through the downtown area
- On-street parking is seen as more of a short-term option



Current State On-Street Parking



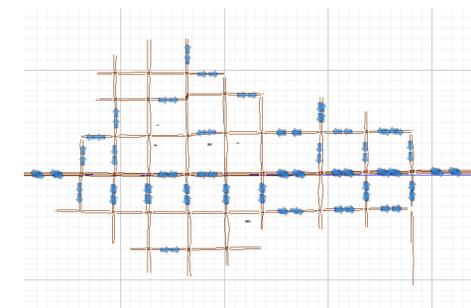
Future State On-Street Parking

Key	Occupancy Rate
Yellow	60% - 84.99%
Red	85% - 100%

Skeleton of the Model

The foundation for the models was created using SIMIO software.

- Step 1:** The paths lengths were measured using the interactive Downtown Bozeman map
- Step 2:** Stop sign intersection logic was created for 3-way and 4-way intersections
- Step 3:** Street light intersection logic was created for 3-way and 4-way intersections
- Step 4:** The on-street and off-street parking spots were represented with servers
- Step 5:** The parking logic was created for both on-street and off-street parking options



Current State Model

The Current State Model was created by adding the appropriate data to the skeleton of the model.

- Step 1:** The speed limits on each street were added
- Step 2:** At each intersection turning probabilities were implemented
- Step 3:** The appropriate size of each intersection was implemented and adjusted
- Step 4:** Inter-arrival times were added as sources at each of the perimeter intersections
- Step 5:** The occupancy rates were implemented to each parking option, on-street and off-street
- Step 6:** Animations were added to the model

Future State Model – Year 2045

The Future State Model was built by using the Current State Model as a base and changing the data accordingly

- Step 1:** The adjusted 2045 inter-arrival times were implemented



Model Validation and Limitations

The Current State Model was validated to ensure an accurate data outputs.

- Step 1:** The occupancy rate from the output of the SIMIO models were exported into excel
- Step 2:** The model occupancy rate was compared to the WTI occupancy rates
- Step 3:** The occupancy rate percent error was calculated
- Step 4:** Systematic changes were made to each model to get mitigate the percent error as much as possible

The project limitations are as follows:

- Data:** The foundational data that was used in this project was collected in 2017 and the new data that was collected was in winter of 2021 during a global pandemic. The assumption that the data had a linear relationship had to be made due to lack of past occupancy rate data.
- Time:** This project had an ambitious scope that was able to be met. However, with more time there is a possibility of more data collection and a wider confidence interval.

Street	0	41	0	100
Mendenhall St				
3rd to Grand	0	49	0	100
Grand to Willson	50	51	94.37	100
Willson to Tracy	71	67	99.87	100
Tracy to Black			0	0
Black to Bozeman	0	0	0	0
Bozeman to Rouse	29	64	53.92	92.77
Rouse to Church	39	36	91.36	95.72
Church to Wallace	23	9	95.44	43.0043
Wallace St				
S 5th to S 3rd	7	24	27.47	48.35
S 3rd to Grand	63	67	88.97	90.27
Grand to Willson	87	80	97.53	88.13
Willson to Tracy	87	97	99.499	100
Tracy to Black	93	88	99.67	99.67
Black to Bozeman	89	86	94.42	96.37
Bozeman to Rouse	77	70	95.37	98.9
Rouse to Church	61	64	95.5	99.39
Church to Wallace	44	65	91.65	90.213
Wallace to end	27	49	93.74	91.02
Blackfoot St				
Start to Grand	0	0	0	0
Grand to Willson	0	41	0	63.74
Willson to Tracy	55	55	98.13	74.32
Tracy to Black	47	20	72.54	47.35
Black to Bozeman	0	76	0	99.76
Bozeman to Rouse	0	39	0	52.45
Rouse to Church	22	26	26.38	10.66
Church to Wallace	92	39	99.96	46.65

Key	Occupancy Rate
Green	0% - 59.99%
Yellow	60% - 84.99%
Red	85% - 100%