PARKING SPACE ESTIMATION in the City of Portland, Oregon

TEAM:
Ashley Colder, Madison Weakley, Rob Zoeller

DATE:
June 8, 2016

INTRODUCTION

QUESTION 1
What is the number of off-street parking spaces required by the city of Portland according to minimum and maximum parking requirements issued in 1980?

QUESTION 2
How many fewer parking spaces has the city of Portland required due to the 2003 parking code change?

QUESTION 3
How many on-street parking spaces are available?
CONTENT
Data Quality
Methodology
Analysis and Results

DATA QUALITY

LEGEND
Buildings
COM
MFR
FLR
SFR
VAC
Transportation
BUS
MAX
Zoning
Zoning
Combined buildings, zoning, MAX Stops, and frequent bus lines
MAX Stops, frequent bus lines
METHODOLOGY_CREATE 3 DATASETS

PROCEDURES
2. Create bus buffer. Create LRT buffer. Combine into a transit buffer.
3. Perform intersection with transit buffer to extract buildings near transit that were built between 2004-2015.
4. Perform erode with transit buffer to extract buildings outside of the transit buffer that were built between 2004-2015.

The buffer includes sites well served by transit. As defined in Title 33, these include sites located less than 1500 feet from a transit station or less than 500 feet from a transit route with 20-minute peak hour service.

METHODOLOGY_EXTRACT TITLE 33 REQUIREMENTS

1980-2015 BASE ZONING

2004-2015 NEAR TRANSIT
### METHODOLOGY_BUILD_FORMULAS (10)

#### 1980-2015

**BASE ZONING**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Formula</th>
<th>Maximum</th>
<th>Formula</th>
<th>Minimum</th>
<th>Formula</th>
<th>Maximum</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
</tr>
<tr>
<td>1 per unit</td>
<td>$=UNITS_RES$</td>
<td>3 per 2,500 sq ft of site area</td>
<td>$=SITE_AREA/2500$</td>
<td>1 per 500 sq ft of floor area</td>
<td>$=BLDG_SF/500$</td>
<td>1 per 156 sq ft of floor area</td>
<td>$=BLDG_SF/156$</td>
</tr>
<tr>
<td>0-3 units &gt; 0 stalls</td>
<td>$=0$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4+ units &gt; 1 per 2 units</td>
<td>$=UNITS_RES/2$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 2004-2015

**NEAR TRANSIT**

<table>
<thead>
<tr>
<th>Minimum</th>
<th>Formula</th>
<th>Maximum</th>
<th>Formula</th>
<th>Minimum</th>
<th>Formula</th>
<th>Maximum</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-30 units &gt; 0 stalls</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
<td>None</td>
<td>$=0$</td>
</tr>
<tr>
<td>31-40 units &gt; 0.2 stalls/unit</td>
<td>$=UNITS_REST*0.2$</td>
<td>1 per 2,500 sq ft of site area</td>
<td>$=SITE_AREA/2500$</td>
<td>1 per 500 sq ft of floor area</td>
<td>$=BLDG_SF/500$</td>
<td>1 per 156 sq ft of floor area</td>
<td>$=BLDG_SF/156$</td>
</tr>
<tr>
<td>41-50 units &gt; 0.25 stalls/unit</td>
<td>$=UNITS_REST*0.25$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51+ units &gt; 0.33 stalls/unit</td>
<td>$=UNITS_REST*0.33$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### METHODOLOGY_CALCULATE

#### 2004-2015

**NEAR TRANSIT**

<table>
<thead>
<tr>
<th>FID</th>
<th>ADDRESS</th>
<th>UNITS</th>
<th>ZONE</th>
<th>USE</th>
<th>BLDG_SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>5481</td>
<td>15993 SE DIVISION ST</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>121</td>
</tr>
<tr>
<td>55388</td>
<td>15995 SE DIVISION ST</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>533</td>
</tr>
<tr>
<td>55387</td>
<td>15990 SE DIVISION ST</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>241</td>
</tr>
<tr>
<td>55389</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>307</td>
</tr>
<tr>
<td>55399</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>317</td>
</tr>
<tr>
<td>55399</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>317</td>
</tr>
<tr>
<td>55399</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>317</td>
</tr>
<tr>
<td>55399</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>317</td>
</tr>
<tr>
<td>55399</td>
<td>12214 SE POWER RD</td>
<td>NA</td>
<td>CG</td>
<td>COM</td>
<td>317</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARGING_MINIMUM</th>
<th>CODE</th>
<th>CALC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PARGING_MAXIMUM</th>
<th>CODE</th>
<th>CALC</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
RESULTS_MINIMUM

- **BASE 1980-2003**
  - 16,042 Spaces

- **BASE 2004-2015**
  - 3,978 Spaces

- **NEAR TRANSIT 2004-2015**
  - 1,804 Spaces

**TOTAL 1980-2015**
- 21,824 Spaces

RESULTS_MAXIMUM

- **BASE 1980-2003**
  - 19,654 Spaces

- **BASE 2004-2015**
  - 3,706 Spaces

- **NEAR TRANSIT 2004-2015**
  - 4,076 Spaces

**TOTAL 1980-2015**
- 27,436 Spaces
RESULTS

REDUCTION IN PARKING SPACES

How many fewer parking spaces has the city of Portland required due to the 2003 parking code change?

<table>
<thead>
<tr>
<th>Total (Question 1, Includes 2003 Changes)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings: 8,168</td>
<td></td>
</tr>
<tr>
<td>Min: 21,824</td>
<td></td>
</tr>
<tr>
<td>Max: 27,436</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total (Question 2, No 2003 Changes)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings: 8,168</td>
<td></td>
</tr>
<tr>
<td>Min: 22,803</td>
<td></td>
</tr>
<tr>
<td>Max: 27,842</td>
<td></td>
</tr>
</tbody>
</table>

Difference
Min: -979 parking spaces
Max: -406 parking spaces

Comparison (Min)
SP = 979 x (162 sf) = 158,598 sf
Acreage = 158,598 sf / 43,550 sf = 3.64 ac
City Blocks = 158,598 sf / 40,000 sf = 3.96

Due to the 2003 parking code change, the city has SAVED:

979 spaces

Total parking spaces, according to minimum code requirements, decreased by 979 after the 2003 zoning changes. Reduced minimum parking requirements, coupled with MAX stops and Park and Ride lots, likely discourages automobile use and encourages transit use, biking, and walking, effectively reducing traffic congestion and air pollution attributed to automobiles.

ON STREET PARKING
DATA QUALITY

LEGEND
- Streets and Curbs
- All Curbs Dissolved
- Streets No Parking
- Streets Without Curbs
- Buildings
- Bus Stops
  - Bus - Frequent
  - Bus - Infrequent
- No Parking Block
- No Parking Block Zone

METHODOLOGY_INFRASTRUCTURE LIMITATIONS

LEGEND
- Curb
- Meldot Paving
- Corner Hydrant
- Infrequent Bus Stop
- Curb Ramp
- No Parking this Block
- Curb Marked No Parking
- No Parking > 20 ft

NOT PICTURED
- Frequent Bus Stop
- Firehouse
- Blue Max No Parking
DEFINITIONS_PARKING

PARKING LENGTH

We accept that on-street parking length is 20 ft.

Federal standards and consultation with PBOT Traffic Engineer, Jennifer Tower

IMAGE SOURCE
US Dept of Transportation
Federal Highway Administration
Manual of Uniform Traffic Control Devices (MUTCD)
2009 Edition Part 3 Figure 39-21: Examples of Parking

RESULTS_PARKING SPACES

The number of on-street parking spaces (99,535) is nearly FIVE TIMES the number of off-street parking spaces (21,824) as set forth by the minimum code requirements revised in 2003.

According to federal standards, there would be:

99,535 parking spaces
79,053 ft of unused curb space

= 1,000 Spaces
RESULTS PARKING SPACES

But if everyone in Portland drove a Subaru Outback:

114,864 parking spaces
64,830 ft of unused curb space

RESULTS PERCENTAGE OF LAND AREA

What is the percentage of land area (excluding water bodies) in our TSP that is being used for both on street and off street parking?

<table>
<thead>
<tr>
<th>Land Area</th>
<th>609,648,162 sf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Area Sum:</td>
<td>2,757,118 sf</td>
</tr>
<tr>
<td>River Area Sum:</td>
<td>606,891,044 sf</td>
</tr>
<tr>
<td>Difference:</td>
<td>3,491,840 sf</td>
</tr>
<tr>
<td>Parking:</td>
<td>21,824 spaces</td>
</tr>
<tr>
<td>Off Street:</td>
<td>15,925,600 sf</td>
</tr>
<tr>
<td>On Street:</td>
<td>99,535 spaces</td>
</tr>
<tr>
<td>Total:</td>
<td>19,417,440 sf</td>
</tr>
</tbody>
</table>

Calculation:
19,417,440 sf / 606,891,044 sf = 3.2%

Comparison:

Acreage = 19,417,440 sf / 43,560 sf = 446 ac
City Blocks = 19,417,440 sf / 40,000 sf = 485

The total percentage of land area (excluding water bodies) in our TSP that is being used for both on and off street parking is 3.2%. Future studies could investigate whether this is appropriate for the area, or if it could be reduced even further so that part of the land area could be used for other purposes.
CONCLUSIONS

One of our goals was to study the impact of the change in minimum parking code requirements for total off-street parking spaces. We discovered that the city saved 979 spaces as a result of the change in code. While this is good news, we should also point out that the number of on-street parking spaces (99,535) is nearly FIVE TIMES the number of off-street parking spaces (21,824). If the city wants to decrease automobile usage, and therefore parking, then perhaps there would be a greater impact if future policy decisions were based on on-street parking instead.

LIMITATIONS

1. Neither building, nor streets were complete shapefiles. We believe that with improved data quality the City of Portland would be able to repeat our methodology to determine an accurate number of current available parking spaces.

2. Title 33 zoning requirements provide minimum and maximum parking conditions for each specific commercial building type (e.g. restaurant, health club, theater, etc.). However, our building data did not indicate each respective commercial type, so we had to treat all commercial buildings the same.

3. Parking spaces are no longer one size fits all. Compact cars and SUVs allow us to have a range of options for different vehicle types, but for the simplicity of our calculations, we had to assume that all parking spaces were the same width and length.
On-Street Basics
- Streets
- Curbs

** Problem - 33.18 miles of street does not have curbs.
Select by location, create new shape file of streets with no curb.

![Legend]

On-Street Basics
- Streets
- Curbs
- No-Curb Street

**Problem - no-curb street layer only has one line, when streets have 2 sides for parking.

Create new shapefile of no curb streets with two lines transforming 33.18 miles of parking opportunity to 66.36 miles.

Merge two files into one.

![Legend]
On-Street Basics

**Problem:** Some intersection of streets have do not have a break in the curb layer.

Infrastructure Limitations
- Hydrants
- Buses
- Curb Ramps
- No-Parking entire blocks
- No-Parking curb markings
- Fire Stations
- Street Width
- Burnside – Max Line

Building Limitations
- Driveway
- Entrances

Doesn’t account for park entrances.
Hydrants - Curb
Determined by proximity to street intersections.

Create point shape file via line intersection.
Create buffer accommodating for center line, and define corner. 50 ft from point.

Legend
- Corner Hydrants
- St_intersections
- St_Curbs
- Int.50ftBuff

Hydrant Corner
Problem: Hydrants are not placed on curb line.

- Measure 20 random hydrants. Create average, add that distance to the 5 ft buffer.
  - Buffer = 15.02 + 5/2
  - Buffer = 10.01 feet
Hydrants - Mid Block

Problem: Hydrants are not placed on curb line.

- Measure 20 random hydrants. Create average, add that distance to the 10 ft buffer.
  - Buffer = 20 + 28.2 / 2
  - Buffer = 24.1

Buses

Frequent – 60 feet clearance from stop
Infrequent- 40 feet clearance from stop

Bus stop point shape file

Select by attribute to make 2 files

Created polygon shape file using distance tool for the 2 shape files.
Curb Ramps

ADA regulations of ramp – 4ft throat, 3ft wings

Problem- Ramps are not placed on curb line.
  • Buffer=10+2.84/2
  • Buffer-6.42 ft

Problem- Not convinced that this is comprehensive data set.

Fire Stations

16.20.130 Prohibited in Specified Places

H. On any mass transit lane or street as defined in Section 16.50.

3 Fire House

Google Earth images to establish no parking zones.
No Parking Block
Internal CoP shapefile has point shape file denoting no parking this block sign.
Create line shape file.

Legend
- No-Parking sign
- No_prkg_blk_poly

No parking curb marking
Problem- line segments do not overlap with curb segments.
Created a 5ft buffer polygon.
Problem- This does extend the line by 5 feet on either end.

**These marks did not coincide with Bus stops.
Street Width - <20ft

No Parking on street less than 20ft wide
Create Polygon Layer from 90 line attributes

Street Width: 26ft> <20ft

Ignored this layer because they seemed to balance each other out.
Street Width
Problem: Not all streets are included in the streets layer or Curb layers downloaded from Metro or Portland Maps.

Burnside
No parking along light rail.
Created one long polygon.
via dissolve
Merge all limitations

Buildings
SFR- Driveways

Create a SFR shapefile.
Create a SFR structure centroid shapefile.
Using Near tool, create shapefile from XY table.

SFR Driveways

Standard driveway 15 feet wide. 9ft throat, 3ft wings.
Applied a 7.5ft buffer
Assuming all SFR have driveways.
SFR Driveways

A moment for Density
  • Mobile Home Parking

21,908 of 26,098 Buildings accounted for.

MFR- Curb Cut

Create a MFR shapefile.
Create a MFR structure centroid shapefile.
Using Near tool, create shapefile from XY table onto the curb layer.
Gather avg curb cut length per MFR building, 15ft, and create a 7.5 ft buffer the dissolves any buffer that connects.
80% confidence in sampling method.
Image- 97ft of buffer
  95 ft of curb cut.
Comm- Curb Cut

Create a Comm shapefile.
Create a Comm structure centroid shapefile.
Using Near tool, create shapefile from XY table onto the curb layer.
Gather avg curb cut length per Comm building, 34.8, and create a 17.2 ft buffer the dissolves any buffer that connects.
80% confidence in sampling method.
Image- Mall 205
208 ft of buffer
200 ft of curb cut

Vacant Buildings

*Nope - ignored vacant buildings – 111
69 units, 365,120 SqFt
Retrieving Parking Total

Combine all building curb buffers and infrastructure limitations in 1 layer, dissolve. Erase from all curb layer.

Using Multi-part to single-part make individual lines at every break.

Findings

Our definition of on-street parking length is 20 ft.

Federal standards and consultation with PBOT Traffic Engineer, Jenifer Tower

199,034 on street parking spaces.
79,053 feet of unused curb space.
Cars

OR’s 2013 best selling car- Ford F-series
Smallest option 227.6 = 18.9ft

- Mental Floss

114,864 Subarus with a 2 foot gap between between cars.
64,830 feet of unused curb space.