



AEI Housing Center

[AEI.org/housing](https://www.aei.org/housing) | June 2024

How Zoning Policies Affect the Housing Supply: City of Denver Case Study

Tobias Peter

Co-director and Senior Fellow, AEI Housing Center

(Tobias.Peter@aei.org)

Hanlu Zhang

Data Analyst, AEI Housing Center

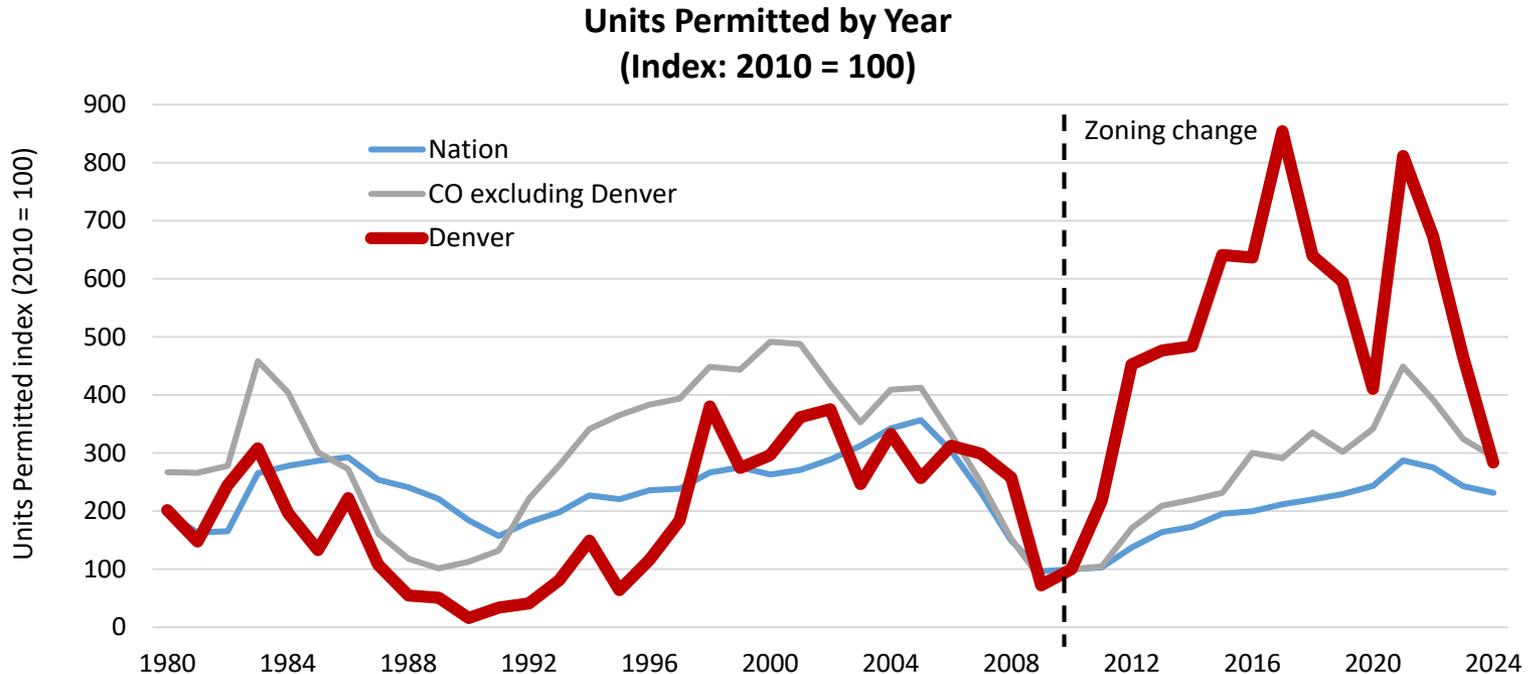
(Hanlu.Zhang@aei.org)

How zoning policies are affecting the housing supply

The City of Denver switched to a new zoning code in June 2010. Most areas were upzoned, but some were downzoned.

Overall, the policy encouraged housing construction in Denver.

- Compared to the entire state or the nation, Denver experienced a massive building boom after 2010. Before then, Denver had always been a bit of a laggard in construction activity.
- We find the same trends for only larger Colorado cities (shown in the appendix).
- Most of the new units built were townhomes and multifamily units.



Source: Census Bureau Building Permits Survey and AEI Housing Center, www.AEI.org/housing.

Units built before and after the 2010 zoning change

After the zoning change, most of the new units built were townhomes and multifamily units.

Condos disappeared (perhaps due to defect laws), while fewer single-family homes were built (presumably because builders could build townhomes instead).

Units Built by Period and Type

	2000-2010	2011-2021	Units Change	% Change
Single Family	11,759	8,727	(3,032)	-26%
Duplex	2,226	2,644	499	19%
Townhome	2,170	7,022	4,902	224%
Condo	8,609	2,026	(6,531)	-76%
Multifamily	11,461	36,470	16,138	218%
Condo & Multifamily combined	20,070	38,496	9,607	92%
Total	36,225	56,889	9,607	57%

How the zoning change must have affected multifamily

Denver expanded its housing supply by tweaking its policies on multifamily (MF) buildings. It allowed:

1. Greater density in areas already zoned for MF, largely achieved by:
 - A 23% increase in average number of units per story (after controlling for lot size).
 - Some of this increase is likely attributable to slightly smaller unit sizes.
 - A 24% increase in the average number of stories.
2. Allowing MF buildings to be built in more areas (see Table 2 and on map on next slide).

The supply effect from 1. and 2. was about the same, but it is unclear how the disappearance of condos factors in.

These supply additions could not have been achieved without zoning changes.

Table 1: Avg. number of units and stories: by period and type*

Multifamily	2000-2010	2011-2021	% Change
Avg. Units per Story	28.6	35.3	23%
Avg. Number of Stories	3.3	4.1	24%

Table 2: Units built by Period and Zoning**

Multifamily (MF)	2000-2010	2011-2021
Zoned for MF before 2010	10,091	23,951
Not zoned for MF before 2010	0	8,101

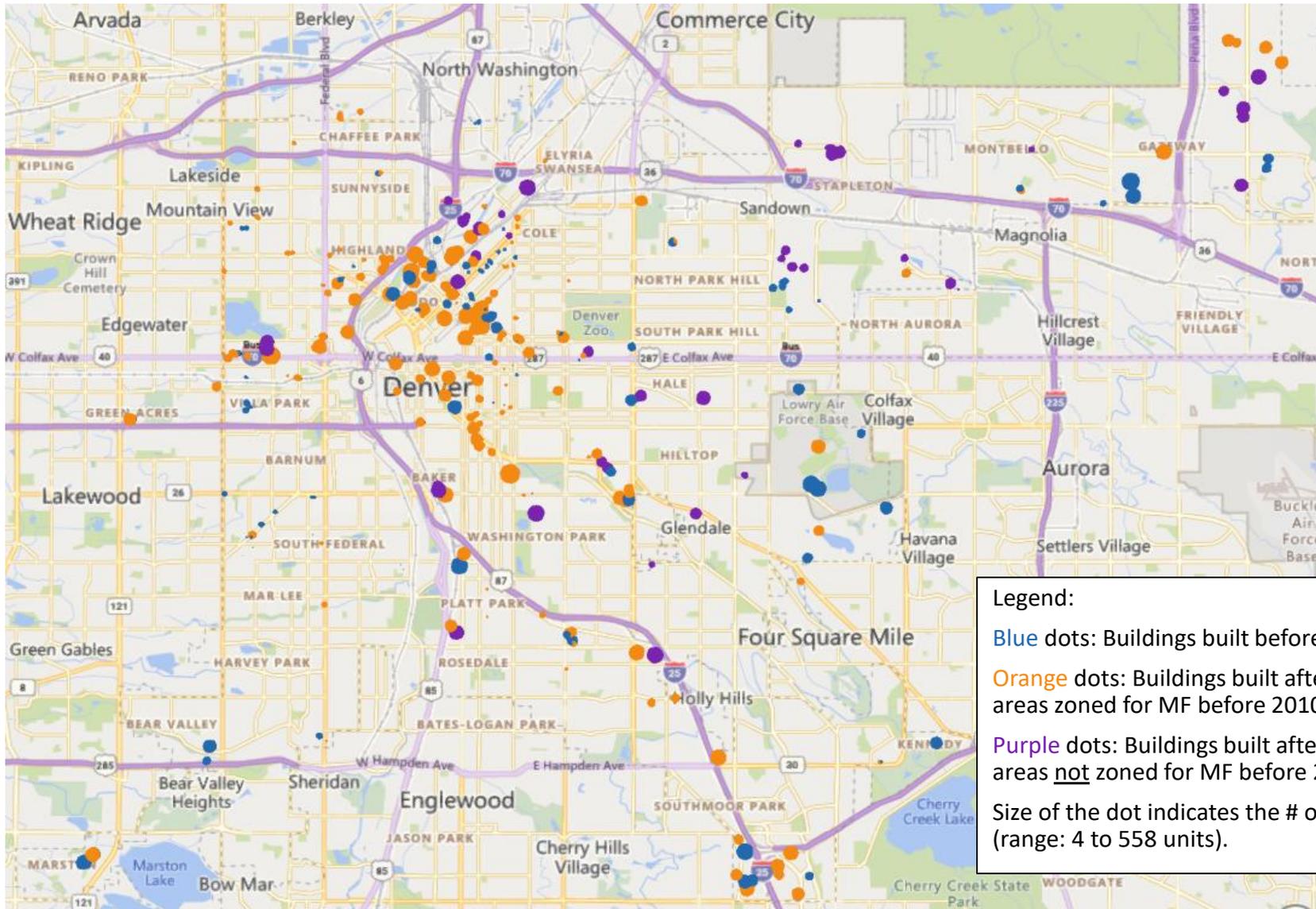
* The results control for the lot size and the zoning category that existed before 2010.

** Some buildings are not properly geocoded and are thus excluded.

Source: AEI Housing Center, www.AEI.org/housing.

How the zoning change must have affected multifamily (cont.)

Map of Multifamily Buildings



Legend:

- Blue dots: Buildings built before 2010.
- Orange dots: Buildings built after 2010 in areas zoned for MF before 2010.
- Purple dots: Buildings built after 2010 in areas not zoned for MF before 2010.

Size of the dot indicates the # of units (range: 4 to 558 units).

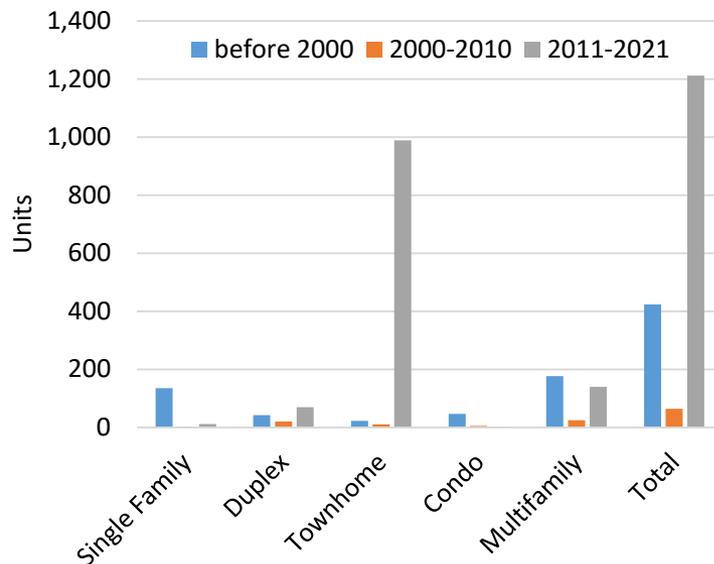
Source: AEI Housing Center, www.AEI.org/housing.

How the zoning change has benefited townhome construction

Denver expanded its housing supply by legalizing townhomes in more areas.

- One example: The areas zoned previously R-2 (allowed one and two units per parcel), which were expanded to G-MU-3 (allows multi-family units up to 3 stories per parcel).*
- Since 2011, these areas have added almost 1,000 townhomes alone, up from virtually 0 before.
- This explosion in townhome construction would not have happened without the zoning change.
- Newly built townhomes in this area utilize about 1/5 of the land of older single-family (SF) homes but are comparable in size and price point – despite being new. Building at moderately greater density has allowed Denver to add lots of moderately-priced starter homes.

Units Built by Period and Type
(Areas zoned from R-2 to G-MU)



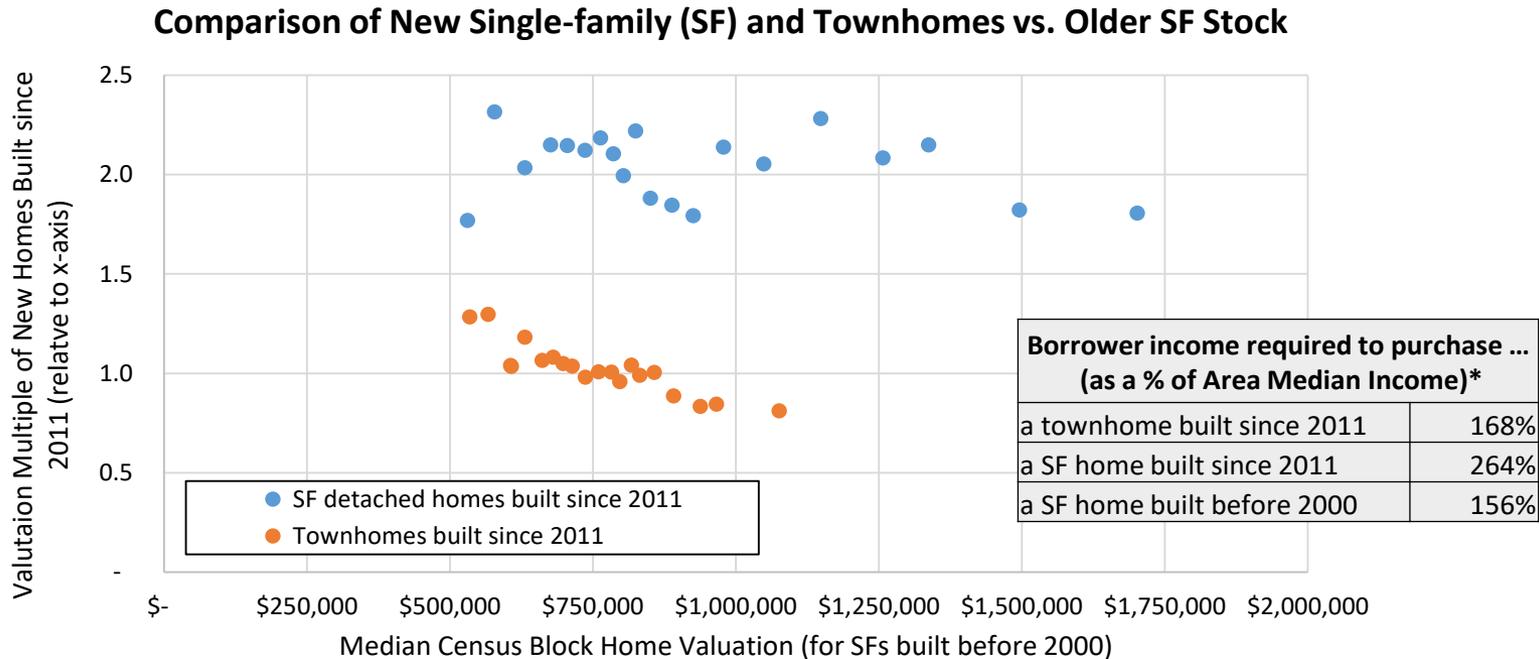
	Single Family	Duplex	Townhome
Year built	1900-1999	2011+	2011+
Counts	118	70	989
Median Lot Size (in sq. ft.)	6,250	3,050	1,140
Median GLA (in sq. ft)	1,450	2,150	1,480
\$ Valuation (as of Dec. 2023)	712,000	958,000	751,000
Avg. # of Stories	1.1	2.2	3.0
Avg. # of Bedrooms	2.5	3.7	2.3
Avg. Floor Area Ratio	0.27	0.78	1.33

* G-MU-3: This is a general neighborhood zoned for multi-family units up to 3 stories.
Source: AEI Housing Center, www.AEI.org/housing.

Townhome construction allows new housing to match the price of existing homes

Not only has this resulted in more housing and attractive price points, it has also opened up areas of opportunity (since higher priced areas generally have access to more and better amenities).

- Despite common fears,
 - the new townhomes are valued at the around the price point of existing housing, and
 - the new townhomes are attracting people of roughly the same income levels as those that purchase existing housing.
- The alternative are even more single-family (SF) McMansions, which are expensive and out or reach for most.



Note: Valuations come from a Dec. 2023 AVM. Scatterplot is based on 20 equally sized bins for each land use type. Extreme outliers are excluded.

* Data are for loans originated between 2012 and 2023. Regression controls for the block's median home valuation for SFs built before 2000.

Limited to tracts with a 20-80% townhome share.

Source: HMDA and AEI Housing Center, www.AEI.org/housing.

Townhome construction has expanded the city's tax base

Since townhomes are built on smaller lots, they pack more structure value per acre on a smaller space. Since developable land is limited, this has obvious benefits.

- On a value per sq. ft. of land and on a block-by-block comparison:
 - Townhomes built since 2011 are about 1.75x as valuable as single-family (SF) detached homes built since 2011.
 - Townhomes built since 2011 are about 5x as valuable as single-family detached homes built before 2000.

Home valuation per sq. ft. of lot size*	
Townhome built since 2011	\$ 532
SF home built since 2011	\$ 299
SF home built before 2000	\$ 111

* Regression controls for the census block of the property. The valuation is using an AVM from Dec. 2023.
Source: AEI Housing Center, www.AEI.org/housing.

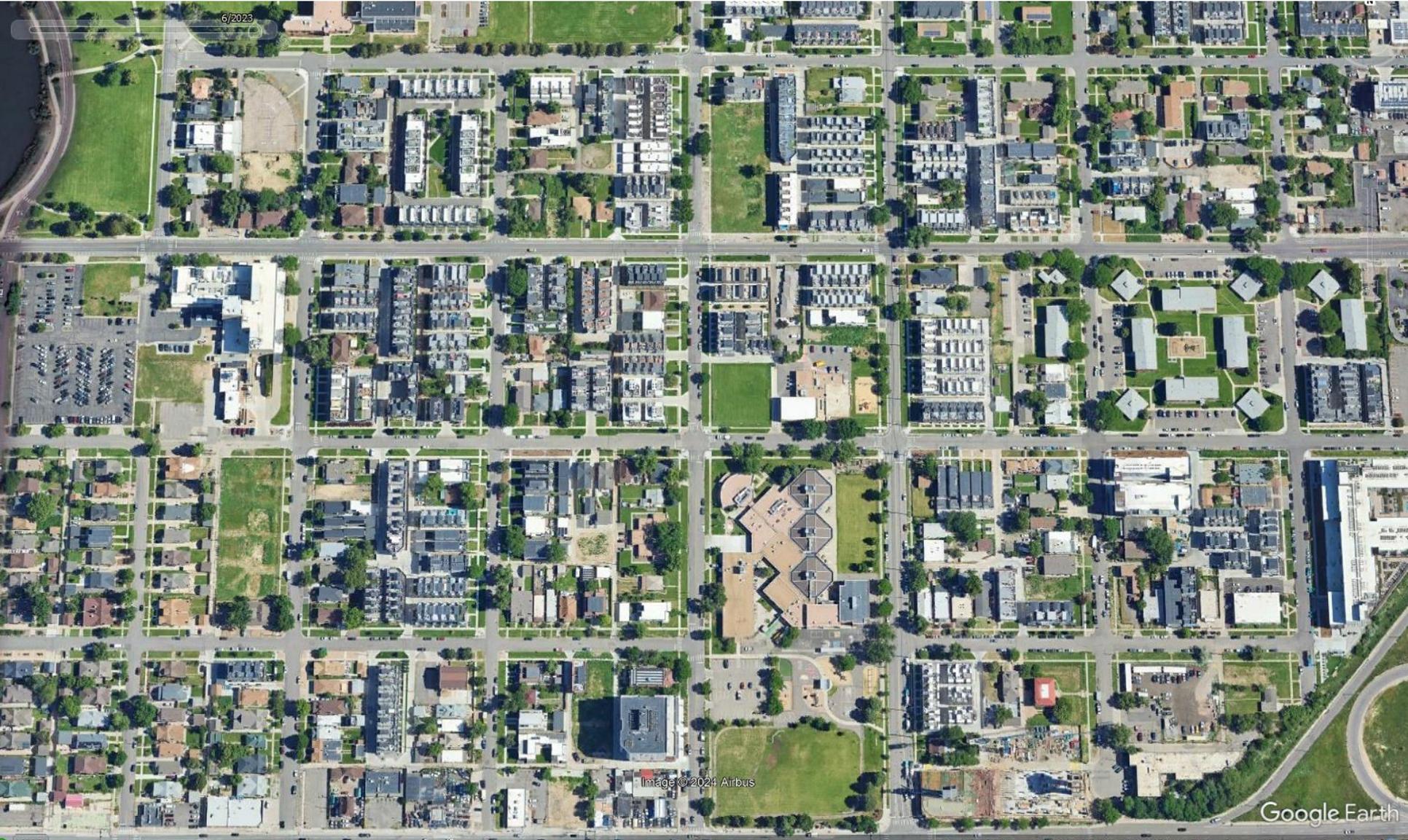
How the zoning change has benefited townhome construction (cont.)

Neighborhood just west of the Empower Football Stadium in June 2010



How the zoning change has benefited townhome construction (cont.)

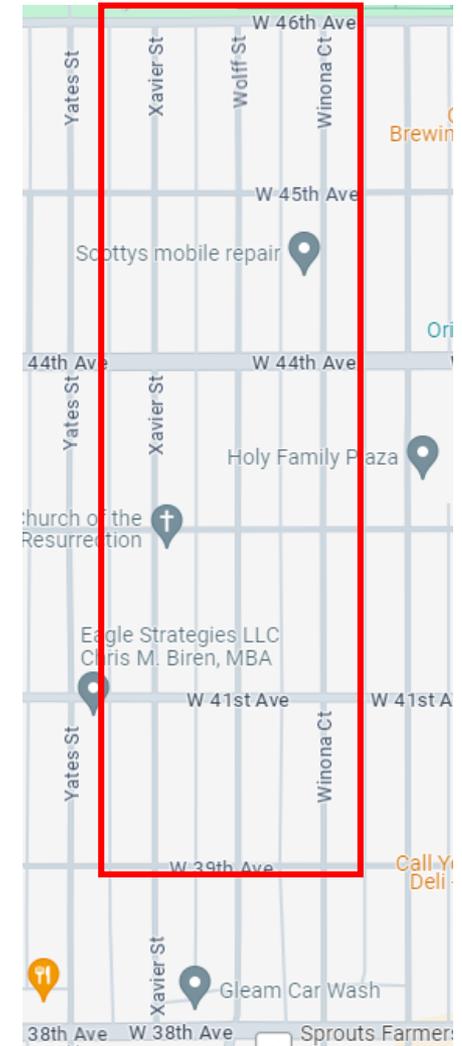
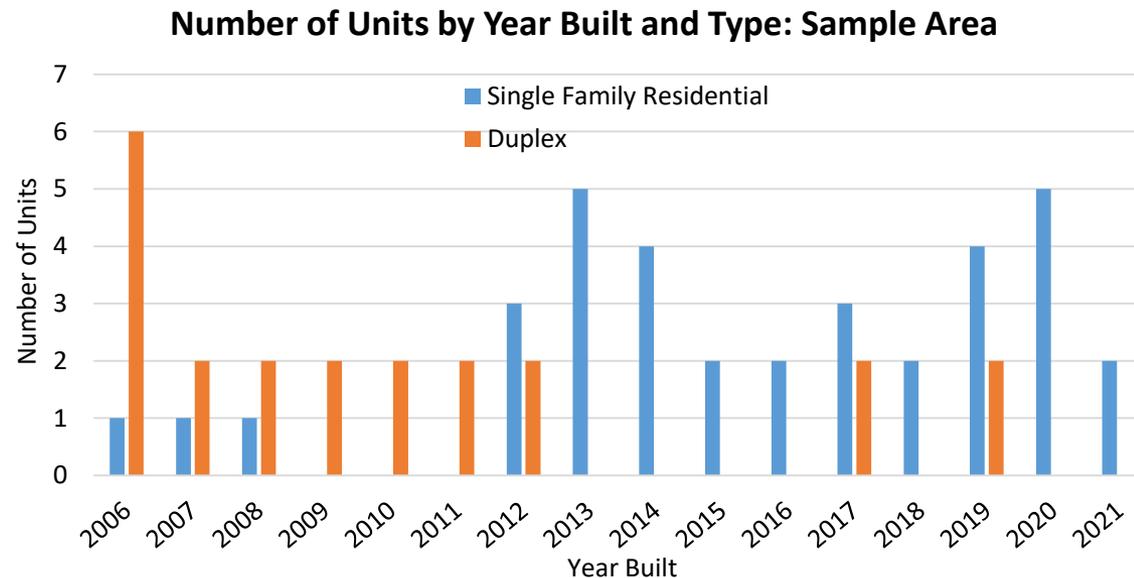
Neighborhood just west of the Empower Football Stadium in June 2023



Example 1 - Downzoning a neighborhood

One example from a Berkeley neighborhood in the NW of Denver that was downzoned in 2010 from allowing up to 2 units to just 1 unit and an ADU.

- Up until the 2010 zoning change, single-family detached homes started to get converted to duplexes due to rising housing pressures. At the time, Duplexes were the highest and best legal use of the land.
- However, under the new zoning code implemented in 2010, duplexes are no longer permitted in single-unit zones (U-SU-C1).
- This zoning code change led to a transition from duplex to McMansions construction in the Urban Single Unit part of this neighborhood.
- This has kept the housing supply constant and worsened affordability (see next slide).



Note: Some duplexes were likely permitted before the zoning change in June 2010 and completed in later years.
Source: Zoneomics, Google Maps, and AEI Housing Center, www.AEI.org/housing.

Example 1 - Conversions in the One-Unit Zone

Left: 4414/4416 Wolff St

- Converted in 2009 to a duplex
- Current lot size: 3,125 sq. ft. (per side)
- Current building area : 2,725 sq. ft. (per side)
- Estimated current price: \$1.1M each



Left: Converted to Duplex in 2009



Right: Converted to McMansion in 2017

Right: 4404 Wolff St

- Converted in 2017 to a McMansion
- Current lot size: 6,250 sq. ft.
- Current building area: 4,309 sq. ft.
- Estimated current price: \$1.9M



Around 1.2% of Denver's single-family housing stock has already been converted to McMansions and we estimate another 8% being in high risk of conversion.

Example 2 - Upzoning a neighborhood

Example from a NW Denver neighborhood just one block south of Berkeley Lake.

- Before 2010, this area was zoned R-2 allowing single-family detached (SFD) homes and duplexes.
- Most of the homes in the neighborhood were built around the 1920s as SFDs, as back then housing pressures were low.
- In 2002, each block had around 13 SFDs.
- The average lot size of these properties was around 5,000 sq. ft.

The neighborhood in 2002

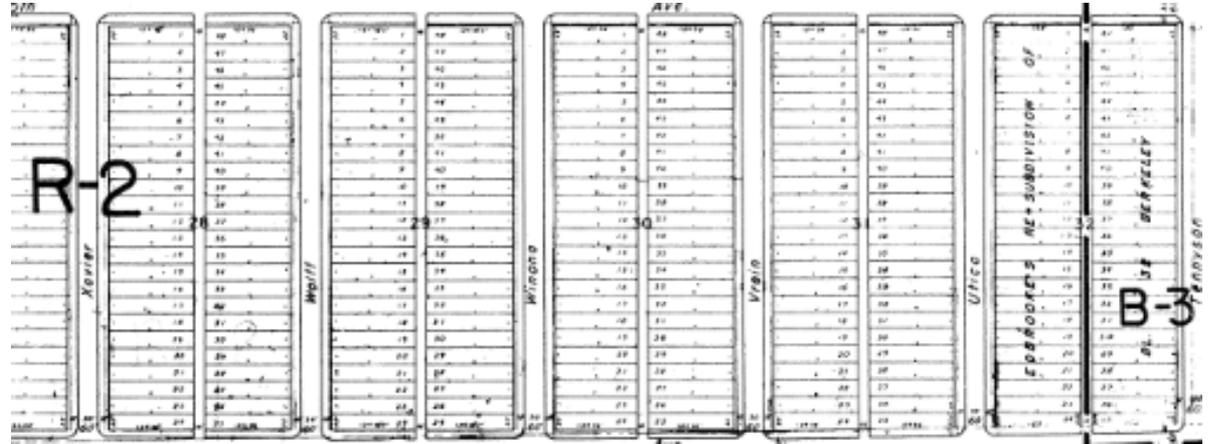


Example 2 - Zoning maps before and after 2010 zoning code change

This zoning change allows us to illustrate the concept of the highest and best use and to demonstrate the effects of zoning laws on structure type and supply.

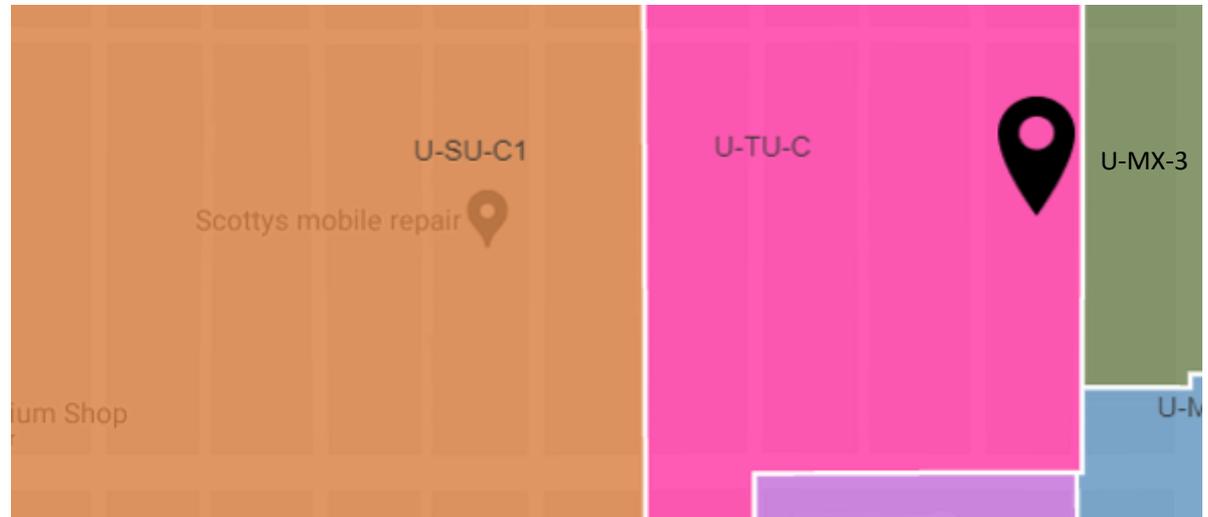
Before 2010:

- **R-2:** Single unit dwelling and multiple unit dwelling
- **B-3:** Single unit dwelling, multiple unit dwelling, assisted living facility, and residence for older adults



After 2010:

- **U-SU-C1:** Urban Single Unit (ADU allowed but no duplex, Minimum Zone Lot Size: 5,500 sq. ft.)
- **U-TU-C:** Urban Two Unit (Minimum Zone Lot Size: 5,500 sq. ft.)
- **U-MX-3:** Urban Mixed Use (Maximum Height: 3 Stories)



Example 2 – Conversions in two-unit and mixed use zones

4421 Vrain St

(Urban Two Unit Zone)

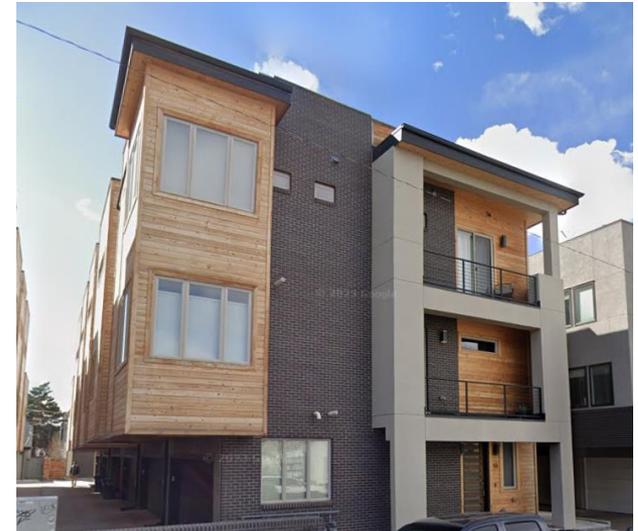
Converted to a duplex in 2013



4445 Tennyson St

(Urban Mixed Use Zone)

Converted to 6 townhomes in 2015



Example 2 – The same NW Denver neighborhood today

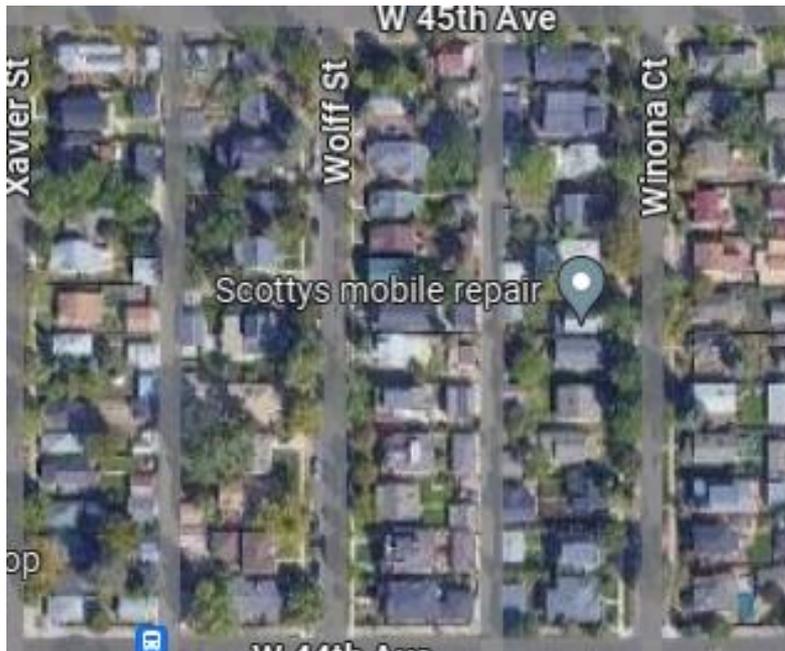
By 2024, many of the houses built in the 1920s are still in existence, but many have been converted to McMansions, duplexes, and townhomes. The type and rate of conversion varies by area.

The outcome clearly demonstrates the need for more housing and how zoning is constraining the highest and best use of the land. Clearly, zoning is arbitrary as most areas in this neighborhood have access to the same level of amenities that justified urban mixed use/townhome zoning.

Urban Single Unit Area:

Mostly unchanged.

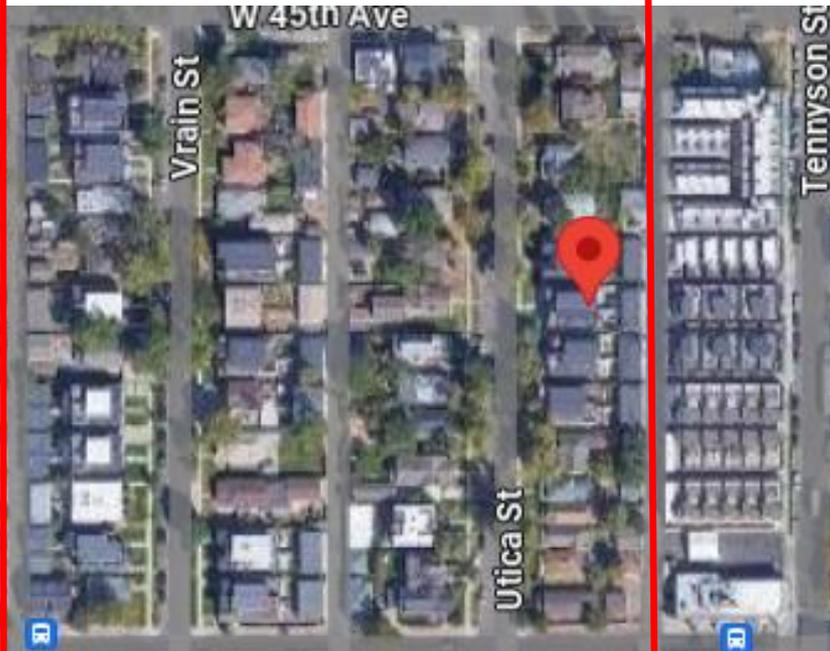
~100 units in 2002 and today



Urban Two Unit Area:

Duplex conversions have added to the housing stock.

~80 units in 2002, ~90 units today



Urban Mixed Use Area:

Townhome conversions have expanded the housing supply.

~15 units in 2002, ~60 units today

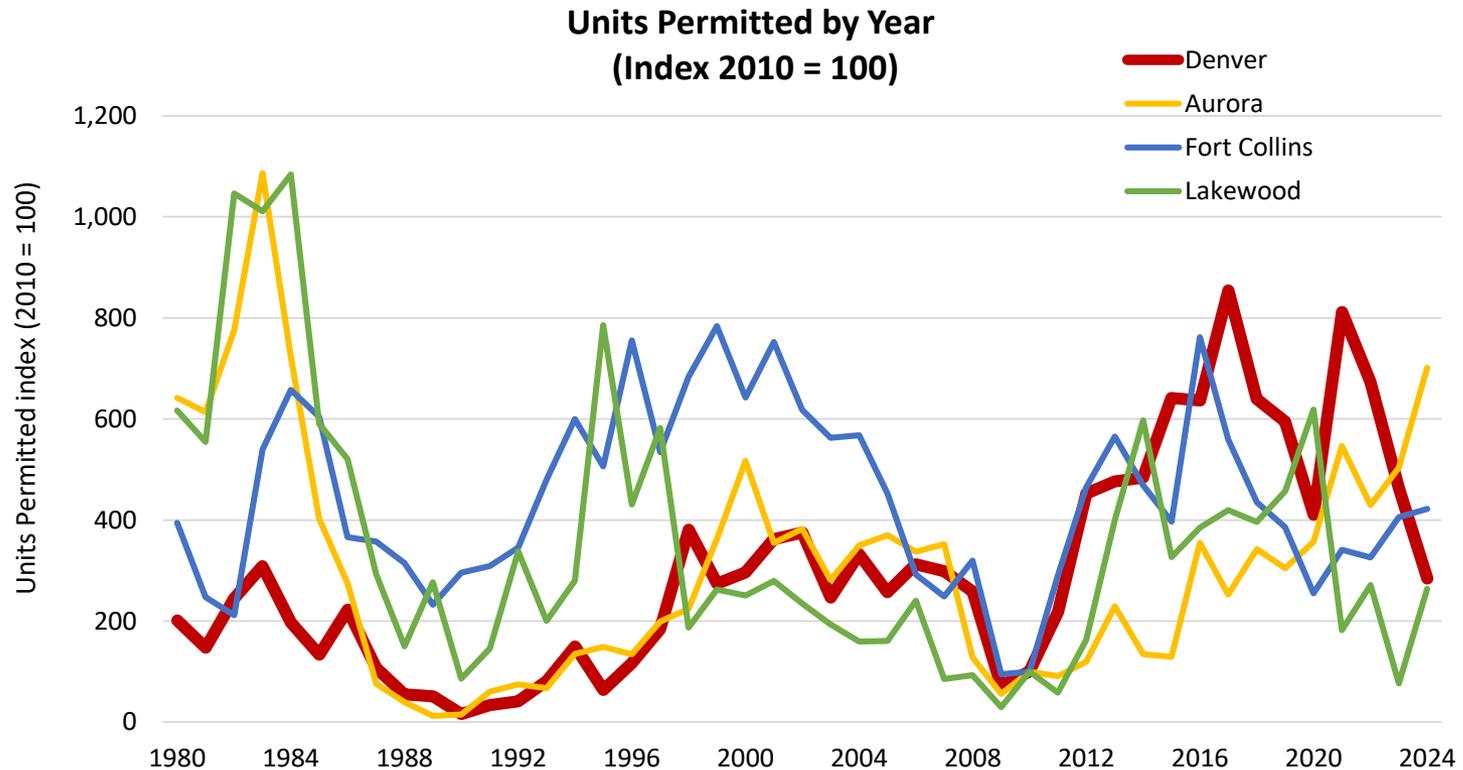
Appendix

Denver: How zoning policies are affecting the housing supply

The City of Denver switched to a new zoning code in June 2010. Most areas were upzoned, but some were downzoned.

Overall, the policy encouraged housing construction in Denver.

- Compared to other large cities in Colorado, Denver lagged behind those in other large cities in Colorado, while it exceeded other cities after the new zoning code was released.



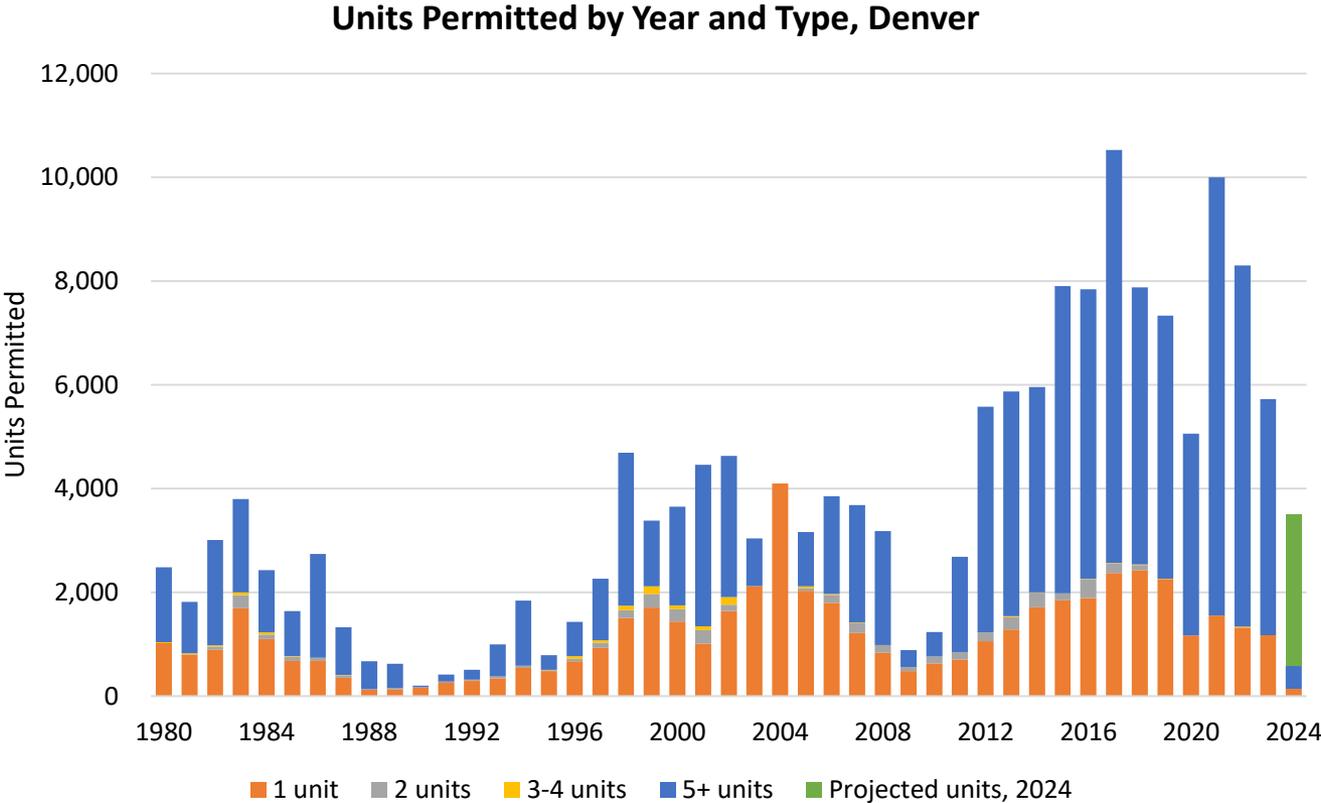
Note: Data for Colorado Springs are not available

Source: Building Permits Survey and AEI Housing Center, www.AEI.org/housing.

How zoning policies are affecting housing supply

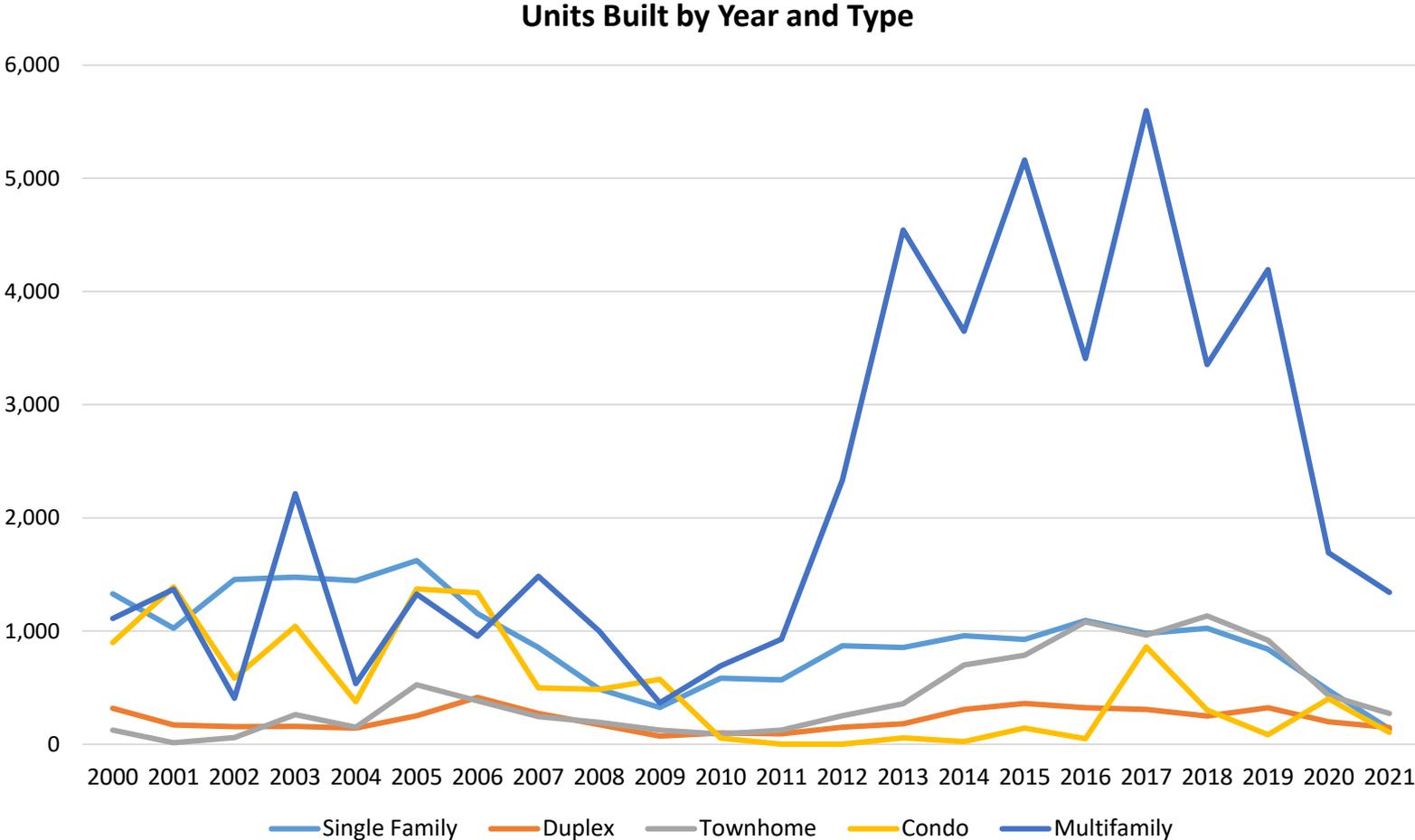
The City of Denver switched to a new zoning code in June 2010. Most areas were upzoned, but some were downzoned.

Overall, the policy encouraged construction, especially for properties with 5+ units, but more could be done.



Note: 2024 includes data from January and February. The remainder of the year is extrapolated from the monthly rate from January and February 2024.
 Source: Census Bureau Building Permits Survey and AEI Housing Center, www.AEI.org/housing.

Units built before and after the 2010 zoning change



Source: AEI Housing Center, www.AEI.org/housing.