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Daniel Baldwin Hess Jeffrey Rehler

ABSTRACT

Problem, research strategy, and findings: Cities today face considerable land use, environmental, and economic challenges resulting from policies prioritizing automobiles and requiring ample off-street parking. In an effort to influence travel behavior and reduce parking supply, Buffalo (NY) adopted the Green Code in 2017. This zoning code reform repealed minimum parking requirements citywide and provided a “natural experiment” to investigate effects of parking deregulation among 36 major developments in its first 2 years. Our research produced two key findings. First, 47% of major developments included fewer parking spaces than previously permissible, suggesting earlier minimum parking requirements may have been excessive. Second, mixed-use developments introduced 53% fewer parking spaces than would have been required by earlier minimum requirements as developers readily took advantage of the newfound possibility to include less off-street parking. Aggregate parking spaces among single-use projects exceeded the earlier minimum requirements, suggesting developers of such projects were less motivated to deviate from accepted practices in determining the parking supply for urban development.

Takeaway for practice: Eliminating parking minimums can reduce unnecessary parking supply and encourage development constrained by excessive minimum requirements. Land use, location, and transportation demand initiatives affect the quantity of off-street parking supplied in response to market conditions. Our findings suggest mixed-use developers are likely to take advantage of the ability to provide less parking in highly accessible locations. Though many developers quickly pivot to the newfound possibilities of providing fewer parking spaces, others continue to meet earlier requirements. Cities of all types stand to benefit from undoing constraining parking policies of the past and allowing developers to transform parking lots to “higher uses.”

Keywords: form-based zoning, land use, minimum parking requirements, parking, parking deregulation

In the United States, planners and policymakers have become increasingly critical of automobile dependence in recent years. Land use, environmental, and economic concerns have fueled interest in encouraging travelers to consider non-automobile travel modes. Efforts to disincentivize automobile use reflect shifting perceptions regarding America’s dominant travel mode—private automobiles—and amenities such as parking that were once widely considered community assets.

Despite interest in promoting alternatives to automobiles, interventions to encourage using competing modes have been largely unsuccessful. A key reason why shifting drivers to other travel modes (public transit, walking, biking) is difficult is that parking is plentiful and, in most cases, free (Shoup, 2017). Private automobiles remain an extremely convenient and underpriced mode of transportation because drivers do not bear the

full cost of using and storing their vehicles (Shoup, 2017).

Vehicle storage is necessary for most private automobile trips. Because most parking in urban America is free, increasing costs and reducing parking quantities can produce various benefits: urban densification, pollution reductions, increasingly equitable transportation options, lower housing costs, economic development, and desirable pedestrian environments (Shoup, 2014). Despite these benefits, reducing the parking supply can be extremely challenging because Americans are accustomed to driving and parking. One tactic to restrict the supply involves reducing or removing minimum parking requirements (MPRs) common in municipal ordinances across the United States (Hess, 2017).

A 2018 *Planning* article by Sara Bronin detailed two citywide reforms to remove parking minimums from municipal zoning codes in Hartford (CT) and Buffalo (NY). Bronin characterized the elimination of MPRs as

having potential to become “the single most impactful zoning regulatory reform of the 21st century” and advised planners to “keep a close eye on the impacts” in Hartford and Buffalo (Bronin, 2018, p. 9).

Large-scale parking reforms are a recent phenomenon. Scholarship on the results of repealing MPRs has, to date, been restricted in geographic scope (Antonson et al., 2017; Cutter & Franco, 2012; Gabbe, 2018; Manville, 2013; McCahill et al., 2014). Studies on the effects of eliminating MPRs are available for locations such as London (UK; Guo & Ren, 2013) and Gothenburg (Sweden; Antonson et al., 2017) but remain relatively scant for U.S. cities. Our research fills a gap in knowledge by investigating the actual results from a citywide “natural experiment” within the U.S. planning regulatory framework. Specifically, we sought to understand whether the shift to market-driven parking policy in Buffalo resulted in introducing fewer off-street parking spaces among major developments. We also investigated characteristics (such as land use and location) of developments including more, the same, or less parking than required by minimums in the preceding code.

Analyzing the first 2 years of the reform in Buffalo, we find 47% of projects earned major site plan approval with fewer parking spaces than mandated by previous MPRs. Developers of mixed-use projects in transit-rich locations took advantage of the newfound ability to provide fewer parking spaces. Mixed-use developments introduced 53% fewer parking spaces than mandated by preceding MPRs. At the same time, aggregate parking spaces among single-use residential, commercial, and civic projects exceeded previous MPRs.

In this study, we review the rise of minimum parking in the United States and our study site, Buffalo. We discuss the possibilities associated with repealing MPRs, review scholarly research associated with such reform, and detail our work in quantifying parking among major developments in the absence of minimum requirements. We conclude by exploring how eliminating MPRs can encourage mixed-use development styles constrained by excessive parking requirements, how response to such reform may vary among developers, and possibilities for practitioners working toward a more market-driven approach to parking in their municipality.

Background and Scholarly Literature

Minimum Parking Requirements

MPRs originated in the mid-20th century as the automobile rose to prominence and municipalities sought to reduce congestion (Willson, 2013). These zoning mechanisms limited the potential for parking spillover, a nuisance whereby high demand at one site leads to occupancy of nearby (and in many cases free) on-street

parking spaces to the frustration of those at neighboring sites (Nichols, 2019; Shoup, 1999). In efforts to mitigate congestion and spillover, the adoption of MPRs led to a number of inefficiencies: parking lot proliferation, underpriced automobile storage, inability to share parking, and deprioritizing of non-automobile travel modes (walking, bicycling, public transport; Hess, 2001). MPRs can exacerbate sprawl and limit development potential if market or site conditions do not lend themselves to accommodating private automobiles (Willson, 2013).

Donald Shoup (1999, 2014, 2017) has found that parking prioritization spurs more driving and results in harmful consequences such as traffic congestion, air pollution, and sprawl. MPRs reduce accessibility, decrease sustainability, and produce undesirable economic returns as costs are passed along to consumers (including non-drivers) in the form of higher rents, higher prices of goods, and lower salaries (Willson, 2013). In light of negative externalities, cities such as San Francisco (CA) and Minneapolis (MN) have followed the lead of Buffalo and Hartford in eliminating parking minimums entirely (Nichols, 2019). Other U.S. cities—including Chicago (IL), Fargo (ND), New Orleans (LA), Pittsburgh (PA), Lexington (KY), Spokane (WA), and Santa Monica (CA)—have deregulated parking in key development districts (Nichols, 2019; Spivak, 2018). MPRs no longer apply to certain affordable housing developments in Seattle (WA), Portland (OR), and New York (NY; Spivak, 2018). In such places, parking reform can lower tax rates, revive business districts, decrease property vacancies, and allow development of fewer off-street parking spaces as property becomes available for other uses (Hess, 2017).

Parking Policy in Buffalo

The impacts of 1950s car culture, peaking population, and expansionary parking policies remain evident today in the overabundant supply of parking infrastructure in Buffalo (Hess, 2017). In the late 1950s, Buffalo city officials introduced MPRs to accommodate suburban commuters and maintain economic activity in the urban core (Bronin, 2018; Hess, 2017). Like other Great Lakes Rust Belt cities, Buffalo lost manufacturing jobs and experienced postindustrial decline in the latter half of the 20th century (Hess & Almeida, 2007).

Unemployment, poverty, urban population loss, and regional suburbanization accompanied Buffalo’s downward economic trajectory (Bronin, 2018; Hess, 2005; Katz, 2012). In the mid- to late 1900s, city officials continued to prioritize parking despite favorable conditions (high residential densities, mixed-use neighborhoods, and an established public transit network) for active and public transportation in many locations (Hess, 2017).

Following decades of decline, Buffalo is again attracting development interest. Economic development initiatives promote a strategic location for trade with Canada, legacy amenities and infrastructure, and emerging innovation sectors (research and development, advanced manufacturing, and clean energy; Katz, 2012). Recognizing a need for updates, city officials began re-evaluating outdated land use, zoning, and transportation policies. In 2017, Buffalo replaced a 1950s-era use-based approach with a new form-based zoning code, known as the Unified Development Ordinance or Green Code (City of Buffalo, n.d.).

A New Zoning Code Encourages Non-Automobile Travel

Buffalo eliminated off-street parking minimums on April 3, 2017, by enacting a form-based zoning code seeking to encourage walkability, promote mixed-use neighborhoods, and reverse suburban development patterns (The Public Staff, 2017). Prior to adopting the Green Code, Buffalo's last comprehensive changes to the city zoning code occurred in 1953 (City of Buffalo, n.d.). The reform made Buffalo the first U.S. city of its size to eliminate parking minimums in their entirety (Hess, 2018). The new approach allows developers to provide off-street parking quantities appropriate to their particular project constraints and community context. In Buffalo, municipal law no longer mandates parking lots of specific sizes, a policy that often results in excessive parking supply (Hess, 2017).

The adoption of the Green Code signified a shift to deprioritize automobiles and encourage equitable alternatives such as active transportation and transit-oriented development (TOD) in Buffalo. Article 8.2 of the Green Code introduced bicycle parking minimums; multiple-unit dwellings require one bicycle space per five beds with a minimum of 90% long-term bicycle spaces (City of Buffalo Mayor's Office of Strategic Planning, 2016). Article 5.1 of the Green Code includes a Metro Rail overlay zone that promotes light rail TOD via increased building height minimums, increased density requirements, and parking to the rear of buildings (City of Buffalo Mayor's Office of Strategic Planning, 2016). Article 8.4 of the Green Code introduced transportation demand management (TDM) plans as a means to establish modal share objectives for developments seeking major site plan approval (City of Buffalo Mayor's Office of Strategic Planning, 2016).

According to Article 8.4 of the Green Code, a TDM policy guide mandates strategies to "reduce single-occupancy vehicle trips, reduce vehicle miles travelled by site users, and promote transportation alternatives such as walking, cycling, ridesharing, and transit" (City of Buffalo Mayor's Office of Strategic Planning, 2016, p. 8-12). A TDM

plan is required for "new construction of a principal building in excess of 5,000 square feet" and "substantial renovation of a principal building with a gross floor area of at least 50,000 square feet involving a change of use" (City of Buffalo Mayor's Office of Strategic Planning, 2016, p. 8-12). The Green Code does not require a TDM plan for single-unit dwellings, double-unit dwellings, or any project in a flex commercial, light industrial, or heavy industrial zone (City of Buffalo Mayor's Office of Strategic Planning, 2016).

Under Section 3.5 of the *TDM Policy Guide*, developments seeking major site plan approval must reduce accompanying travel and parking demand by applying TDM strategies from a list of options including share programs, employee incentives, and design amenities (City of Buffalo Mayor's Office of Strategic Planning, 2017). The TDM plan formalizes strategies the developer commits to implementing and quantifies off-street parking, shared parking arrangements, and bicycle storage (including short and long-term spaces) corresponding to the development (City of Buffalo Mayor's Office of Strategic Planning, 2017).

Potential Impacts on Development

Although the City of Buffalo intended for parking deregulation to spur real estate investment, some were skeptical (Epstein, 2018). As the urban core began to attract development and residents, certain developers anticipated parking shortages (or price increases) could make downtown less attractive for tenants, visitors, and businesses accustomed to automobile use (Epstein, 2018). Conversely, research has suggested MPRs constrain development in dense, centrally located neighborhoods with frequent transit service (Gabbe, 2018; Guthrie & Fan, 2016). Recognizing the potential for parking to create negative impacts, Buffalo city officials were wary of encouraging oversupply because they anticipated TOD, bicycle infrastructure upgrades, and disruptive technologies could make parking obsolete in the long term (Epstein, 2018). Scholars expect shared autonomous vehicles and on-demand mobility options (such as carshare and rideshare) to continue to disrupt personal transport and decrease off-street parking demand in urban areas (Greenblatt & Shaheen, 2015; Nichols, 2019).

Buffalo's future-oriented Green Code removed mandates for a minimum number of off-street parking spaces proportional to development size and type. Instead, according to Article 8.4, major site plan approval requires a project-specific TDM plan implementing strategies from a menu of options with implications for parking such as public transit pass subsidies, roadway improvements, shared parking, and carpooling programs (City of Buffalo Mayor's Office of Strategic

Planning, 2016). Developers can provide more or less parking than the modal share objective for their project (after accounting for TDM strategies); doing so by 10% or more requires written justification (City of Buffalo Mayor's Office of Strategic Planning, 2017). These new policies allow considerable deviation from earlier parking requirements, allowing the market to influence parking supply considerations. It is now legally possible for residential, commercial, and mixed-use projects to provide no off-street parking.

Contemporary literature suggests MPRs produce an oversupply, and that removing such requirements is likely to reduce parking excess (Cutter & Franco, 2012; Guo & Ren, 2013; McCahill et al., 2014; Shoup, 2017; Weinberger, 2014). In areas with too much parking, repealing mandatory minimums can allow developers to reap benefits at both micro and macro scales. With no minimums, developers are free of their legal obligation to provide an amenity that may not be of value to a given project. If multiple developments provide less parking, each can take advantage of an increasingly walkable and dense urban form (Hess, 2017).

Parking Reform as a Natural Experiment

The removal of MPRs in Buffalo is a natural experiment, providing a rare opportunity to evaluate initial impacts of a citywide parking reform. Our study adds to a substantial base of recent scholarly work that has addressed implications of MPRs on land use and value (Cutter & Franco, 2012), housing affordability and supply (Lehe, 2018; Manville, 2013), and resident parking perceptions and behavioral responses (Antonson et al., 2017). Studies focusing on TOD have suggested MPRs constrain developers of affordable and inexpensive housing (Gabbe, 2018; Guthrie & Fan, 2016). Guthrie and Fan (2016) find that developers perceive MPRs as barriers to TOD because they increase costs and decrease buildable land. Similarly, research has suggested parking minimums in central business districts inhibit development as artificially high thresholds necessitate substantial infrastructure and land commitments (Manville, 2013; McCahill et al., 2014). Manville's (2013) study of parking quantity and location mandates in downtown Los Angeles (CA) revealed that these regulations restrict choice and inhibit the offering of options such as unbundled and off-site parking.

Despite a considerable body of research on parking policy, few opportunities for studying quantifiable effects of citywide parking reform have presented themselves for analysis. One such study in London (UK) lends support to market-based approaches, finding a parking supply reduction of 49% in residential developments following removal of MPRs and implementation of maximum parking requirements (Li & Guo, 2014). An earlier

study of parking reform in London found the removal of MPRs produced a 40% reduction in off-street supply among residential developments (Guo & Ren, 2013).

Given the uncertain nature of the Buffalo reform, we sought to understand initial outcomes of repealing MPRs related to parking provision and property development. We investigated major developments in the first 2 years under the Green Code and analyzed whether developers included the same, more, or less parking than previously allowable (less than 2 years earlier) under the preceding zoning code. We contribute to the growing knowledge base on U.S. parking reform with quantifiable, citywide results to inform scholars and practitioners about potential near-term outcomes of eliminating MPRs.

Research Strategy, Data, and Methods

Research Approach

Our research investigates the effects of a natural experiment in eliminating MPRs in Buffalo. We analyzed results among major developments in the initial 2-year period subsequent to adoption of the Green Code (April 2017 to April 2019). We compared quantities of off-street parking approved under the City of Buffalo's major site plan review process with MPRs that the same developments, as proposed, would have been required to meet under the previous code.

We used TDM plans from the City of Buffalo Office of Strategic Planning as our primary data sources (The City of Buffalo Planning Board, n.d.). Property owners or developers submit a TDM plan to obtain project approval from the City of Buffalo planning board under the major site plan review process. Major site plan review documents, including TDM plans, are publicly available from the City of Buffalo Office of Strategic Planning.

Data Set

We analyzed publicly available data from the City of Buffalo for development attributes such as parking, land use, and gross size. TDM data from the City of Buffalo planning board meeting minutes and correspondence with the City of Buffalo Office of Strategic Planning informed and contextualized our findings. Our data set consists of 36 TDM plans approved by the City of Buffalo planning board in the first 2 years of the Green Code. These plans include residential, commercial, civic, and mixed-use developments. We excluded development proposals for single-use industrial and surface parking because these uses did not require TDM plans for major site plan review.

We compared parking approved after the April 3, 2017, enactment of the Green Code with MPRs that would

have applied to identical projects submitted under the previous code (the latest version of which was in effect as of October 15, 2004; City of Buffalo Mayor's Office of Strategic Planning, 2004). We used development attributes (such as land use designation, size, and quantity of residential units) to compare parking approved under the Green Code with MPRs in the previous zoning code. As shown in [Technical Appendix Table A-1](#), we calculated MPRs for residential developments at one parking space per unit, restaurants at one parking space per 150 ft² of gross floor area, and so on (City of Buffalo Mayor's Office of Strategic Planning, 2004).

We also contextualized the recent development impact of removing MPRs in Buffalo by examining parking development prior to the Green Code. By reviewing site plan documentation under the preceding code, we determined whether developers provided more, less, or the same amount of parking as the MPRs while those minimums were still in effect. Using a list from the City of Buffalo Office of Strategic Planning (personal communication, August 4, 2020), we examined off-street parking for 16 pre-Green Code developments that would require major site plan approval under the present code. We analyzed these comparable developments over a 5-month period before the enactment of the Green Code.

Limitations

We recognize limitations in generalizing our results elsewhere because we examined parking in Buffalo's unique social, economic, and geographic contexts. Furthermore, we note real estate market and regulatory conditions could influence applicability of our findings to other municipalities. Our research quantified initial results of the reform, but our 2-year time frame may be restrictive because the point at which developers respond to deregulation is unclear. Developers providing fewer parking spaces demonstrated response to the reform, but it is unknown whether those who provided the same amount were simply adhering to the earlier minimum standards or whether they considered the newly available possibility to provide less parking.

Our research relied on public records for projects seeking major site plan approval from the City of Buffalo planning board. We analyzed all 36 publicly available TDM plans at the time of our research and our analysis was limited to projects requiring such plans. Relying on TDM data, we omitted smaller developments (new construction less than 5,000 ft², single- or double-unit dwellings), renovations less than 50,000 ft² or with no change in use, and industrial sites from our analysis. We also omitted seven projects from this analysis because of unavailable or incomplete data (such as parking counts, land use, and square footage) to arrive at our final 36-development data set.

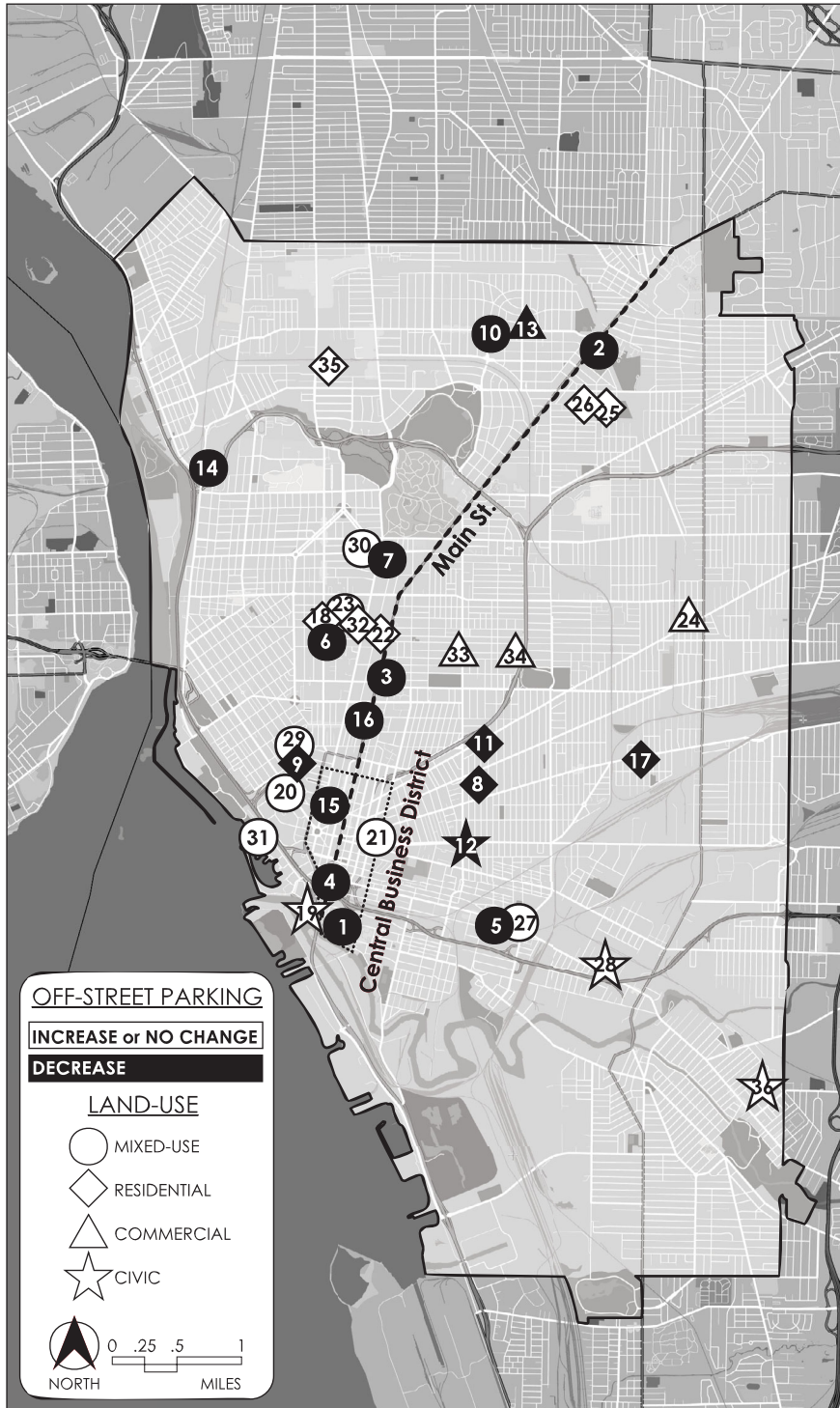
Analysis of parking provision prior to deregulation in Buffalo presented challenges because considerable changes to documentation and application requirements coincided with the introduction of the Green Code. The earlier code did not require major site plan approval or TDM plans with detailed parking information. As a result, our pre-Green Code analysis was limited to 16 developments that include data comparable to those for newer developments. Comparable data were available only for these select developments occurring within the 5 months directly before the Green Code. Project characteristics during this time frame likely differ from earlier periods when adoption and enactment of the new code and accompanying parking reform were not yet imminent.

Findings

Major development projects following parking deregulation in Buffalo vary in scope, represent a range of land uses, and facilitate site access via a variety of transportation accommodations (including parking). [Figure 1](#) depicts the spatial arrangement of major developments in the city of Buffalo in the first 2 years of implementation of the Green Code. [Figure 2](#) contrasts differences between the number of parking spaces approved under the Green Code and requirements of preceding MPRs. Additional attributes of each development are available in [Technical Appendix Table A-2](#). Development numbers are consistent across figures and tables. For example, Development 1 is located in the central business district ([Figure 1](#)), provides 91% fewer parking spaces under the Green Code than required by previous MPRs ([Figure 2](#)), and has a gross size of 65,500 ft² ([Technical Appendix Table A-2](#)).

Parking Development Preceding the Green Code Reform

To provide context to parking developments after the repeal of MPRs in Buffalo, we also present information on developments preceding enactment of the zoning reform in [Figure 3](#) and [Technical Appendix Table A-3](#). As the April 2017 transition to repeal minimums approached, projects were approved with less parking than the minimums required. This suggests that parking variances became more common closer to the shift. In this 5-month window, we find the same number of developments (44%, or 7 projects) provided parking in excess of the minimum as those that provided less, whereas 13% (2 projects) introduced the same amount as the code required. Combined parking among the 16 developments was 22% (364) more spaces than the minimum requirement, and the average development



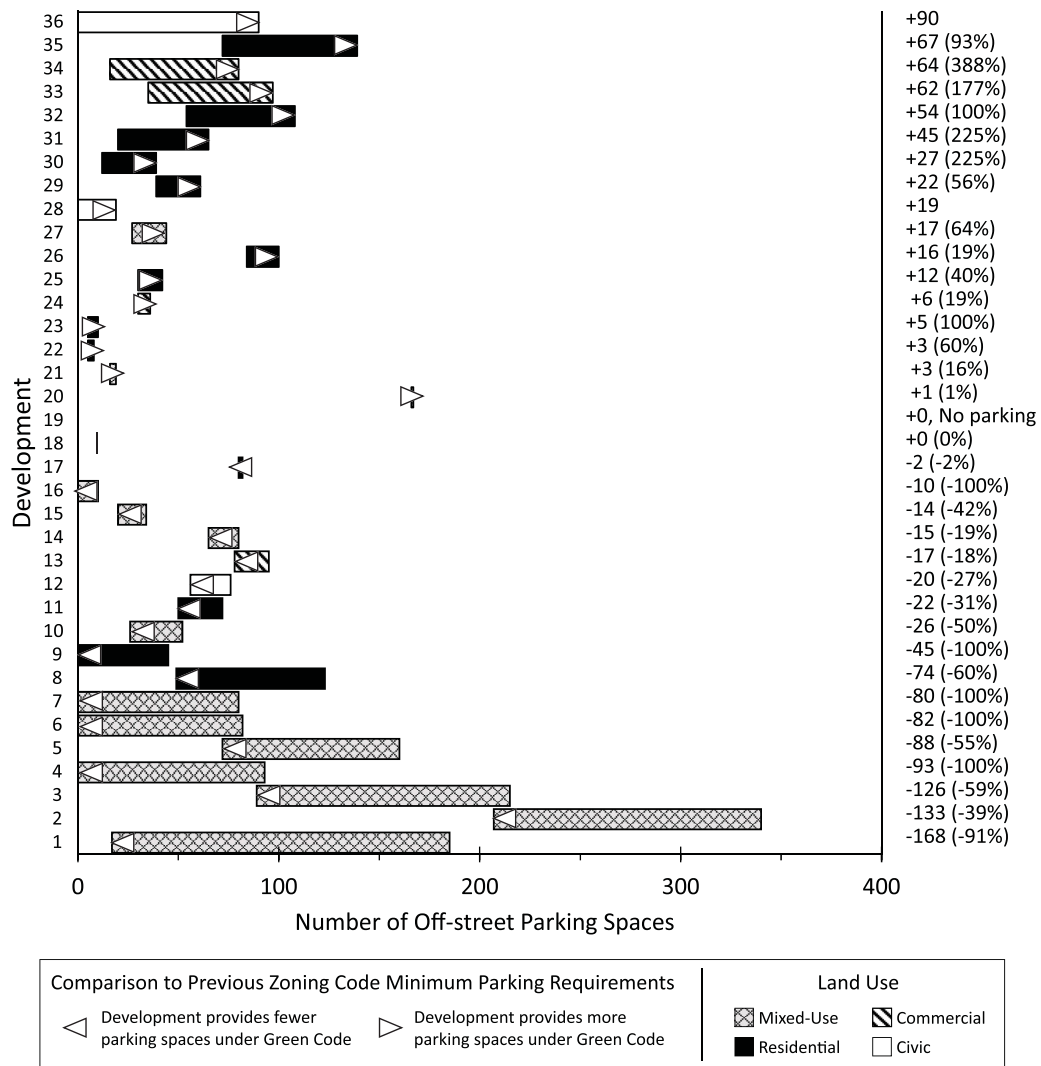
Note: Development numbers correspond to Figure 2 and refer to additional development attributes included in Table A-2 in the supplemental online material.

Figure 1. Spatial arrangement, parking supply, and land use of major developments in Buffalo (NY): First 2 years of minimum parking requirement repeal under the Green Code (April 2017 to April 2019).

provided 23% (23) more parking spaces above the minimum. The eight mixed-use developments preceding the Green Code introduced 21% (275) more aggregate parking spaces in excess of the MPRs, and the average

mixed-use development provided 16% (34) above the minimum.

Following enactment of the Green Code, we compared parking associated with developments under



Note: Development numbers correspond to locations in Figure 1 and refer to additional development attributes included in Table A-2 in the supplemental online material.

Figure 2. Parking supplied by major developments: First 2 years of the Green Code (April 2017 to April 2019) compared with minimum parking requirements previously in effect (prior to April 2017).

deregulation with MPRs that would have applied to the same projects prior to the code reform. Our study of developments in the first 2 years following the repeal of MPRs produced two key findings.

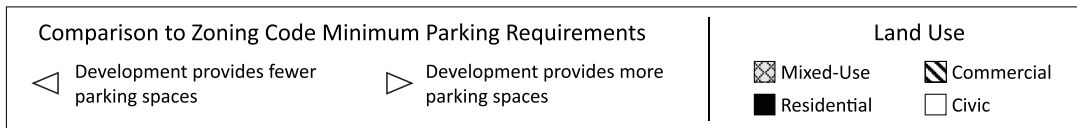
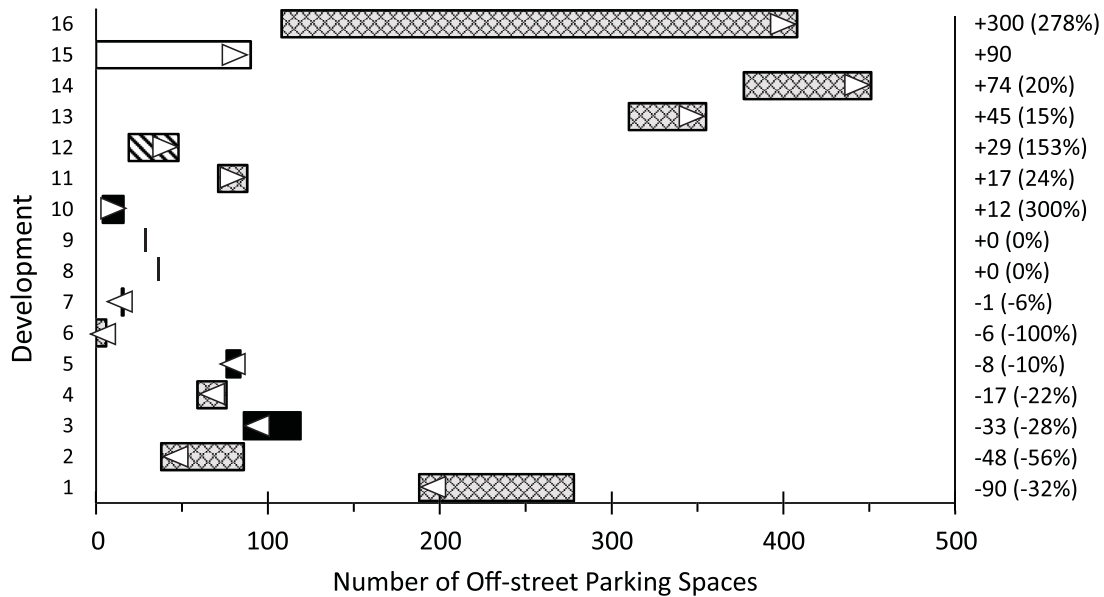
Parking Supply Reductions Among Mixed-Use Developments Emerge Following the Reform

As shown in Table 1, 21% (502) fewer off-street parking spaces accompanied 36 total developments in the first 2 years of the Green Code than would have been mandated by earlier MPRs. On average, the reform produced 21% (14) fewer parking spaces per development than required by minimums of the preceding zoning code. A paired *t*-test at the 95% confidence level revealed whether the provision of off-street parking under the Green Code was significantly different than earlier MPRs

would produce. The mean difference in parking spaces ($M = -13.95, SD = 58.96, N = 36$) was not significantly less than 0, $t(35) = -1.42$; two-tailed $p = .165$, indicating that the code reform has thus far not achieved a statistically significant reduction in off-street parking overall.

The effect on parking supply following elimination of MPRs in Buffalo varied considerably by land use. Developers of mixed-use sites (39% of projects analyzed) took advantage of the reform, but single-use residential, commercial, and civic projects specified a parking supply in excess of that required by earlier minimum requirements. Table 1 categorizes developments by land use, highlighting equivalent MPRs in effect under the previous code and actual number of parking spaces introduced subsequent to deregulation under the Green Code.

A paired *t*-test at the 95% confidence level revealed significantly fewer off-street parking spaces among



Note: Development numbers correspond to additional development attributes included in Table A-3 in the supplemental online material.

Figure 3. Parking supplied by major developments: Five months preceding the Green Code (November 2016 to March 2017) compared with minimum parking requirements in effect during the same period.

Table 1. Development and parking supply characteristics by land use category (Green Code vs. previous minimum parking requirements).

Land use category	Developments				Off-street parking spaces				
	No.	Share of total (%)	No. units (residential)	Gross area, ft ² (non-residential)	No. approved under Green Code	Previous MPRs	Green Code approved (as % of previous MPRs)	Total difference	% difference
Mixed use	14	39	1,034	313,193	726	1,539	47	-813	-53
Residential	14	39	566	19,100	760	652	117	+108	+17
Commercial	4	11	0	129,959	291	177	164	+114	+64
Civic	4	11	0	134,358	165	76	217	+89	+117
Mean					54	68	79	-14	-21
Total	36	100	1,600	596,610	1,942	2,444	79	-502	-21

mixed-use projects compared with minimum requirements under the preceding code. The mean difference in parking spaces ($M = -58.09$, $SD = 59.03$, $N = 14$) was significantly less than 0, $t(13) = -3.68$, two-tailed $p = .003$. In total, mixed-use projects after the reform provided 53% (813) fewer off-street parking spaces than the former zoning code required. These mixed-use projects all included a residential component in addition to retail or restaurant (6 featured both). Substantial office space was less

common, but Developments 1 and 5 each added more than 45,000 ft². As shown in Figure 1, most mixed-use developments clustered along Main Street, a primary corridor with regular bus and light rail service (Niagara Frontier Transportation Authority, n.d.).

Figure 2 reveals most mixed-use developments provided fewer parking spaces under the Green Code than allowable under previous zoning. A notable exception exists at Development 27; this site intentionally

shared parking with Development 5 and yielded a net of 71 fewer parking spaces relative to MPRs in the preceding code. Of six projects that featured no off-street parking, four were mixed use, and each implemented shared parking as a TDM strategy. In total, these four projects added 265 fewer parking spaces than specified by MPRs existing before April 2017.

Despite accommodating mixed-use projects scaling back automobile storage, eliminating MPRs did not produce such impact among single-use developments in the first 2 years. Table 1 shows single-use residential developments (39% of projects analyzed) introduced parking spaces in excess of previous code minimums by 17% (108 spaces). Commercial and civic projects provided parking spaces beyond the earlier MPRs by 64% (114 spaces) and 117% (89 spaces), respectively. The previous zoning code did not specify minimums for civic uses (such as schools and community centers) and, as a result, we note a lack of reductions in parking among such uses.

Deregulation Facilitates Choice: Some Choose to Provide More Parking and Some Choose to Provide Less

In a conversation regarding this research, Chris Hawley (City of Buffalo Office of Strategic Planning; personal communication, February 21, 2019) used the phrase “the sky is not falling” to describe initial outcomes of repealing MPRs on development patterns and parking accommodations in Buffalo. This phrase is a particularly concise and effective way of communicating the response to a market-driven parking policy some feared would lead to severe changes in development patterns and parking availability. Despite the unprecedented scope of the reform, parking lots did not vanish from development proposals. Projects submitting TDM plans still provided 54 parking spaces on average in the first 2 years of the Green Code.

Among developments receiving major site plan approval since the Green Code’s enactment, Table 2 shows 47% (17) included fewer off-street parking spaces than mandated by previous MPRs, whereas 53% (19) included

the same number of parking spaces (or more). Collectively, developments providing fewer parking spaces reduced the total parking supply by 56% (1,014 spaces). On average, each development introduced 60 fewer parking spaces than previously required at minimum. The considerable range in differences (2–168 fewer parking spaces than previously required) suggests certain projects benefited substantially from the ability to provide less off-street parking following the code reform.

Indeed, as shown in Figure 2, three developments each provided 100 fewer parking spaces than earlier minimums required. Using shared parking, Development 1 provided 91% (168) fewer parking spaces than required by previous MPRs. Developments 2 and 3 introduced student housing along Main Street in the Green Code’s C-M Metro Rail Overlay zone. According to Article 5.1 of the Green Code, this zone is “intended to facilitate an elevated level of urban intensity and transit orientation” (City of Buffalo Mayor’s Office of Strategic Planning, 2016, p. 5-3). Private student housing developments at the scale of Developments 2 and 3 (more than 200 units each) were previously uncommon in Buffalo. The removal of MPRs and resulting allowance of 39% (Development 2) and 59% (Development 3) fewer parking spaces facilitated this new development type along a primary transit corridor.

A smaller scale example providing less parking (Development 16) rehabilitated a structure, retaining a historic façade in a transition to mixed use (10 apartments above a 1,500 ft² retail space; Epstein, 2017). Though the structure occupies nearly its entire parcel (making off-street parking unfeasible), it is close to a nearby light rail station and medical campus from which the owner hoped to attract residential tenants (Epstein, 2017). Though now possible under the Green Code, this project would require 10 off-street parking spaces under the previous code, severely limiting redevelopment possibilities despite favorable conditions for excluding vehicle storage.

As shown in Table 2, developments that supplied off-street parking at or in excess of earlier code minimums collectively provided 82% (512) more parking spaces than previously required. On average, each

Table 2. Development and parking supply characteristics by quantity of off-street spaces (Green Code vs. previous minimum parking requirements).

Off-street parking quantity (Green Code vs. previous MPRs)	Developments		Off-street parking spaces							
	No.	Share of total (%)	No. approved under Green Code	Previous MPRs	Green Code approved (as % of previous MPRs)	Min	Max	Mean	Total difference	% difference
Fewer	17	47	809	1,823	44	-168	-2	-60	-1,014	-56
The same or more	19	53	1,133	621	182	0	+90	+27	+512	+82
Total	36	100	1,942	2,444	79	-168	+90	-14	-502	-21

introduced 27 parking spaces more than earlier minimums. The range among developments providing the same or more parking was substantially smaller than the range of those providing less. Two developments showed no change in parking provision under the new code relative to previous requirements. The maximum quantity of parking spaces in excess of earlier MPRs was 90 spaces. Few reductions were apparent among single-use commercial and civic developments. Two commercial sites (Developments 33 and 34) provided off-street parking substantially in excess of previous MPRs (by 177% and 388%, respectively); both included office space.

The removal of parking minimums and requirement of TDM plans for projects seeking major site plan approval did not eliminate the possibility of including parking in development plans. These policies did, however, appear to nudge developers toward carefully considering parking without erecting insurmountable hurdles against new projects.

The Green Code encourages various possibilities for non-automobile travel that complement efforts to reduce parking burdens on new development. Automobile and bicycle share programs, transit pass subsidies, and enhancing public transit and bicycle facilities are among TDM strategies available to developers (City of Buffalo Mayor's Office of Strategic Planning, 2017). More than one-third of developments in this study used unbundled parking (selling parking spaces separately from building space to ensure only those using the amenity bear the direct cost) and one-quarter used shared parking arrangements (allowing multiple users, destinations, or land uses to use the same parking spaces). Overall, developments in our study provided both short- and long-term bicycle parking spaces in excess of new minimums specified in Article 8.2 of the Green Code (City of Buffalo Mayor's Office of Strategic Planning, 2016). Bicycle infrastructure was a particular priority; a 2016 update to the Buffalo Bicycle Master Plan called for implementing 300 miles of bikeways over a 10-year period (Olson et al., 2016).

Discussion and Implications

Removal of Minimum Parking Requirements

The parking reform in Buffalo does not rigidly require reductions in supply; however, it encourages alternatives to automobiles and allows developers to provide less off-street parking. The shift has eliminated inflexible minimums based on outdated development styles and land uses (the previously enforced code specified guidelines for bowling alleys, dance halls, and skating rinks but not mixed-use developments or daycare centers; City of Buffalo Mayor's Office of Strategic Planning, 2004). It also encourages parking management strategies, unbundling, and shared parking via a menu of

TDM strategies (City of Buffalo Mayor's Office of Strategic Planning, 2017).

In the 5 months preceding the Green Code, our findings reveal developments introduced off-street parking spaces in excess of the minimum by 22% (364 spaces) in aggregate. This contrasts with the first 2 years of the reform, in which developments provided 21% (502) fewer parking spaces than that same minimum. These findings suggest that the parking reform may indeed contribute to off-street supply reductions, especially when taking into account projects were approved with off-street parking below the minimums prior to enactment of the new code. In total, mixed-use developments approved in the 5 months preceding the Green Code provided 21% (275) more parking spaces than required by MPRs in place at the time. This contrasts with our findings that mixed-use developments after the Green Code provided 53% (813) fewer parking spaces than those MPR thresholds in the first 2 years. This supports the notion that parking reform could spur reductions among mixed-use projects.

Approximately the same percentage of developments provided fewer off-street parking spaces relative to pre-April 2017 MPRs both before (44% fewer) and after (47% fewer) the reform. This may suggest the reform produced no effect, but conversations with officials from the City of Buffalo Office of Strategic Planning suggested our time frame of analysis preceding the code reform may be too limited (only 5 months) to capture the influence of MPRs on development patterns before the Green Code was imminent. According to an employee of the City of Buffalo Office of Strategic Planning, "getting a parking variance was not too common" under the preceding zoning code (personal communication, August 4, 2020). Although developers often sought variances for high-priority issues affecting project feasibility, parking reduction was a low priority in a city with plenty of developable land. It was also common for developers to avoid seeking variances for an issue that was frequently contentious among neighbors valuing a plentiful supply of off-street parking spaces. A shift in this mindset, particularly among mixed-use developers, appears to have taken place as site plan applications seeking to scale back parking preceded the repeal of MPRs.

The Green Code's removal of MPRs allows flexibility; developers can now match off-street parking to demand and the unique characteristics of a development project, site, and surrounding context. Excessive parking spaces are no longer mandatory, and many mixed-use projects with less parking than previously possible are now feasible. In contrast to expectations from our literature review suggesting MPRs produce oversupply (Cutter & Franco, 2012; Guo & Ren, 2013; McCahill et al., 2014; Shoup, 2017; Weinberger, 2014), the parking reform in Buffalo has not

yet resulted in the introduction of significantly fewer parking spaces than would have been produced under preceding requirements.

Varying Developer Responses

Given the unprecedented action taken to repeal MPRs in Buffalo, it is perhaps unsurprising to note varying developer responses. Awareness of the zoning reform was considerable due to a drafting and public engagement process in excess of 6 years (Hess, 2017). Developers facing parking constraints likely looked forward to the repeal of minimums; 47% took advantage of a newfound ability to provide less parking in the first 2 years. Those facing fewer parking-related development constraints may have been more hesitant to cut back supply due to an uncertain understanding of demand, instead opting for a “business as usual” approach. Marketability also influences financing decisions for developments; in Buffalo, tenants traditionally expect plentiful onsite parking (Hess, 2017).

Parking approaches to single-use projects differed from those of mixed use. Our findings regarding mixed-use parking reductions along Main Street (Buffalo’s primary transit corridor) following the removal of MPRs are consistent with other research (Gabbe, 2018; Guthrie & Fan, 2016), suggesting MPRs constrain development in dense, centrally located neighborhoods with frequent transit service. We also find that the statistically significant parking reduction (mean of –58 parking spaces) among mixed-use projects aligns with findings (Cutter & Franco, 2012) suggesting MPRs are restrictive for retail uses (all mixed-use projects in our analysis featured retail or restaurant). Our findings regarding mixed-use developments suggest the previous version of the Buffalo zoning code featured excessive MPRs that likely contributed to significant reductions following the repeal. These findings suggest Euclidean zoning cannot adequately accommodate mixed-use trends toward shared parking, a finding of relevance to the large number of municipalities relying on such codes.

Under deregulation, each developer can choose how much parking to supply. Though some continue to provide the same or more parking spaces in Buffalo, MPRs no longer force this practice. The 47% of developments including fewer off-street parking spaces reflect an eagerness to deregulate amid favorable conditions for letting the market determine supply. Hess (2017) describes local developer viewpoints in advance of Buffalo’s reform, noting their perceptions that MPRs unnecessarily increase development costs despite parking supply well in excess of demand. Should projects providing fewer parking spaces prove successful, they could become even more commonplace. Supplying less parking may align with future demand should on-demand and shared mobility

trends prove to decrease personal automobile ownership, as suggested by Greenblatt and Shaheen (2015). Developers supplying excess off-street parking spaces in the short term may find opportunities to share with future developments choosing to provide less parking, a scenario not possible if MPRs set floors for parking quantities on each site.

Future Directions

The 2020 COVID-19 pandemic makes a compelling case for a market-driven approach to parking supply. In a July 2020 *Planning* article, Shima Hamidi and Keshia M. Pollack Porter examine the pandemic response of 20 large U.S. cities. The authors find most of these municipalities introduced street closures, fare-free public transit, and public transit service reductions in response to COVID-19. Short-term implications for off-street parking supply are likely, but the net effect has yet to become evident. Such measures may also persist and influence travel behavior and parking provision in the long term. Supply of off-street automobile parking could increase in response to greater demand in situations where available on-street parking reductions persist or public transit remains unappealing to the public. Alternatively, the off-street supply could contract with fewer people visiting worksites and retail spaces. If prioritization of infrastructure accommodating walking and biking persists, demand for supplying off-street parking spaces could wane. In any of these scenarios, deregulation leaves developers free to respond to these uncertain conditions in the manner best suiting their particular project.

Our research reveals a variety of possible directions for future study to inform planners, developers, and policymakers about the impacts of parking reform. Qualitative study of developer perceptions and decision making would likely increase understanding of site constraints and supply considerations. Our present study could provide a useful baseline for future longitudinal research as long-term implications of Buffalo’s parking reform unfold. Insights into whether or not development approaches change as developers become familiar with new regulations would be informative to planners considering reform, as would understanding the timing of any such shift. Researchers in other municipalities may find our results provide a useful comparison with their own efforts to quantify parking reform results. Consistent with Gabbe (2018), we call on municipalities to increase accuracy, transparency, and accessibility of development data (including proposed and actual parking) to enhance understanding of the impacts of parking policy.

Conclusion

By removing MPRs citywide, the 2017 Green Code zoning reform took a bold approach to rethinking parking supply

and providing developers with choice in Buffalo. Analyzing the first 2 years of parking deregulation, we find 21% (502) fewer total off-street parking spaces (than previous minimums would require) in the absence of MPRs. This is not significantly different from what the supply preceding MPRs would produce. Single-use developments supplied parking at or above the minimum requirements of the previous zoning code, but mixed-use developers appeared to take advantage of the newfound flexibility by providing fewer parking spaces.

Mixed-use developments in transit-rich locations along primary commercial corridors tended to provide fewer off-street parking spaces relative to preceding MPRs. Removing MPRs allows densification of mixed-use development in areas where support already exists because access to non-automobile transportation reduces the risk of underproviding parking spaces. Well-connected corridors and the central core appear more likely to support dense, mixed-use developments with fewer parking spaces than peripheral sites.

Even in areas with plentiful transportation options, a comprehensive approach to parking management may be necessary to reduce parking supplies and encourage use of non-automobile modes. In Buffalo, TDM plans complemented the removal of MPRs by requiring developers to calculate parking demand, take steps to reduce that demand, and consider alternatives to automobile travel. Simply deregulating parking without taking such measures may prove insufficient to generate reduced demand, accommodate reductions in parking supply, and encourage affordable housing and mixed-use development.

In Buffalo, development has begun to reflect choice in the absence of MPRs. Relative to the pre-existing code, 47% of projects provided fewer off-street parking spaces, whereas 53% (mostly single-use projects) constructed the same number of parking spaces or more. Developments providing fewer parking spaces (17 in total) did so by 56% relative to preceding MPRs. Projects providing the same or more parking spaces (19 in total) did so by 82% relative to earlier minimums. In Buffalo and other cities pursuing parking deregulation, the removal of minimums allows flexibility to pursue development possibilities without the burden of supplying unnecessary parking. Those seeking to develop at lower cost or construct onsite configurations where MPRs limit project feasibility stand to benefit from repealing minimums.

Time will tell whether preference skews away from automobile prioritization and excess provision of off-street parking and whether trends toward walkability and TOD persist in Buffalo and elsewhere. In the absence of MPRs, off-street parking lots can transform into parks, shops, workplaces, and residences. Conversion of excess off-street parking spaces to such “higher uses” benefits not only municipalities such as Buffalo looking to introduce a denser (and more walkable) urban form but also highly urbanized areas where developable land is limited. In

Buffalo, the early response by developers to eliminating MPRs suggests promise, but opportunity abounds to reduce excess parking.

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SUPPLEMENTAL MATERIAL

Supplemental data for this article can be found on the publisher's website.

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