Striving for New Urbanist Transportation in an AASHTO World: Stapleton’s Challenges and Opportunities

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ABSTRACT

This research considers the implications of building places that possess many of the qualities that make New Urbanism so desirable but also marginalize them with other qualities that prioritize automobility, in order to meet the demands of conventional traffic engineering standards. By examining the existing built environment of Stapleton – a New Urbanist development in Denver, Colorado – in terms of street network characteristics, street designs, and intersection designs, I investigate the inconsistencies of the resulting built environment with respect the latest research and state-of-the-practice New Urbanism design ideals. The outcomes are then considered in terms of how people actually use the transportation system by way of travel diaries and vehicle speed studies. After a review of the obstacles hindering systematic improvements to Stapleton's transportation system, I then consider the opportunities that exist for such improvements and how long-term success could still be realized.

INTRODUCTION

There will never be a single, cookie-cutter approach to designing a transportation system supportive of New Urbanism ideals; however, there are a few underlying principles subscribed to by the majority of New Urbanists. These tenets typically include narrow street cross-sections supported by a compact and connected street network (Congress for the New Urbanism 2012). While such designs must be coordinated with a multitude of other urban elements – such as mixed-use zoning, supportive transit, and good placemaking – in order to truly achieve the sought after transportation behavior benefits, the reality of simply trying to attain the fundamental street and street network designs is that most New Urbanists face an uphill battle. One issue is that there is usually no single core antagonist in this struggle, as conflicts are often found at the local level as well as the regional and federal levels in publications such as *"A Policy on Geometric Design of Highways and Streets"* published by AASHTO. This speaks to the systematic nature of the problems that many planners and designers face, even in situations where the priorities are seemingly aligned with those supported by New Urbanists.

In an effort to actually get things built, many New Urbanist design teams find that they need to compromise, and in effect, merge what the designer views as the ideal solution with more conventional traffic engineering elements. The problem is that the resulting transportation designs are then often a hybrid mix of various influences. The bigger problem is the inherent disconnect between these influences. In other words, what happens when we make such compromises and build places that possess many of the qualities that make New Urbanism so desirable but also marginalize them with other qualities that prioritize automobility? More specifically, what are the resulting travel behaviors, and perhaps more importantly, the safety implications? Improving our understanding of the complexities of these issues is vital, not only to achieving the anticipated benefits of New Urbanism, but also to sustain the market success of New Urbanism. Failure on deliver on some key performance measures, such as those related to travel behaviors and road safety, could relegate New Urbanism, and smart growth efforts in general, toward niche markets as opposed to better overall vision for a safer and more sustainable society.

This research delves into the design realities of Stapleton, a New Urbanist development in Denver, Colorado by examining the existing built environment – with respect to street network characteristics, street designs, and intersection designs – and investigating the inconsistencies of those designs with the latest research and state-of-the-practice New Urbanist thinking. The results are then considered in terms of how people are actually using the system, by way of travel diaries to assess behaviors such as mode choice, and vehicle speed studies to assess issues such as safety and the perception of safety. After a review of the obstacles hindering any systematic improvements to Stapleton's transportation system, I then consider the opportunities that exist for such improvements and how success could still yet be realized.

STUDY BACKGROUND

The Plan for Stapleton

This research was based on the Stapleton development in Denver, Colorado. Since 1929, Stapleton served as the region's primary airport before being decommissioned in 1995 upon the open of Denver International Airport (DIA). Figure 1 depicts the location of the Stapleton site with respect to the regional context (Forest City 2011). Five years prior to decommissioning, a nonprofit group called the Stapleton Development Association was formed with the goal of coming up with a plan for redevelopment. After an official partnership agreement with the city of Denver in 1993, the group conducted extensive community outreach with over one hundred meetings and two years later produced a document, ironically dubbed the "Green Book," that set forth a redevelopment plan for the 4,700 acres of land based upon what many would consider to be New Urbanist ideals. In terms of a general approach to transportation and land use, the document states:

> *"Land use planning and community design stress compact, mixed use communities that are walkable and transit-oriented. These characteristics can reduce automobile dependence and emissions… Transportation technologies emphasize bus and rail transit, bicycling, walking, and alternative fuels for vehicles" (Stapleton Redevelopment Foundation 1995).*

A master developer, Forest City, was selected in 2001 and by late 2002, the first residents began calling Stapleton home amidst heavy construction throughout, in particular with the town center and the adjacent Quebec Square commercial area. Almost a decade later, Stapleton is home to over 10,000 residents, several schools, hundreds of acres of open space, as well as commercial and office space. Full build-out is anticipated to include over 30,000 residents and 35,000 workers.

In terms of the plan laid out by Stapleton's Green Book, the document also establishes community objectives and a set of guiding principles. The guiding principles address common sustainability realms such as environmental responsibility, social equity, and economic opportunity in addition to physical design, transportation systems and corridors, and city street grid and urban development patterns. Under each heading are listed several principles that are intended to guide decision-makers in the implementation of the overall plan. For example, the first principle listed under the city street gird and urban development patterns is:

> *"Principle 1: Extend the surrounding street and block configuration into the southeast and southwest of the site as an extension of the city"* (Stapleton Redevelopment Foundation 1995).

Other principles also echo those that many consider keys to good New Urbanism. To highlight some of those related to transportation and land use, the Stapleton Development Plan sought to build each mixed-use neighborhood organized around its own walkable center with high enough densities (~12 units per acre) to support transit with even higher densities around the neighborhood centers, transit stops, and other public amenities. The plan was to provide for a *"variety of mobility options beyond the automobile including walking, bus, bicycling, rail transit (along the Smith Road corridor) and the use of telecommunications to substitute for the need for travel"* (Stapleton Redevelopment Foundation 1995) with the explicit performance goal of reducing automobile reliance and vehicle miles traveled (or vehicle kilometers traveled). In other words, the intent was to prioritize accessibility and transit, walking, and biking over mobility and driving.

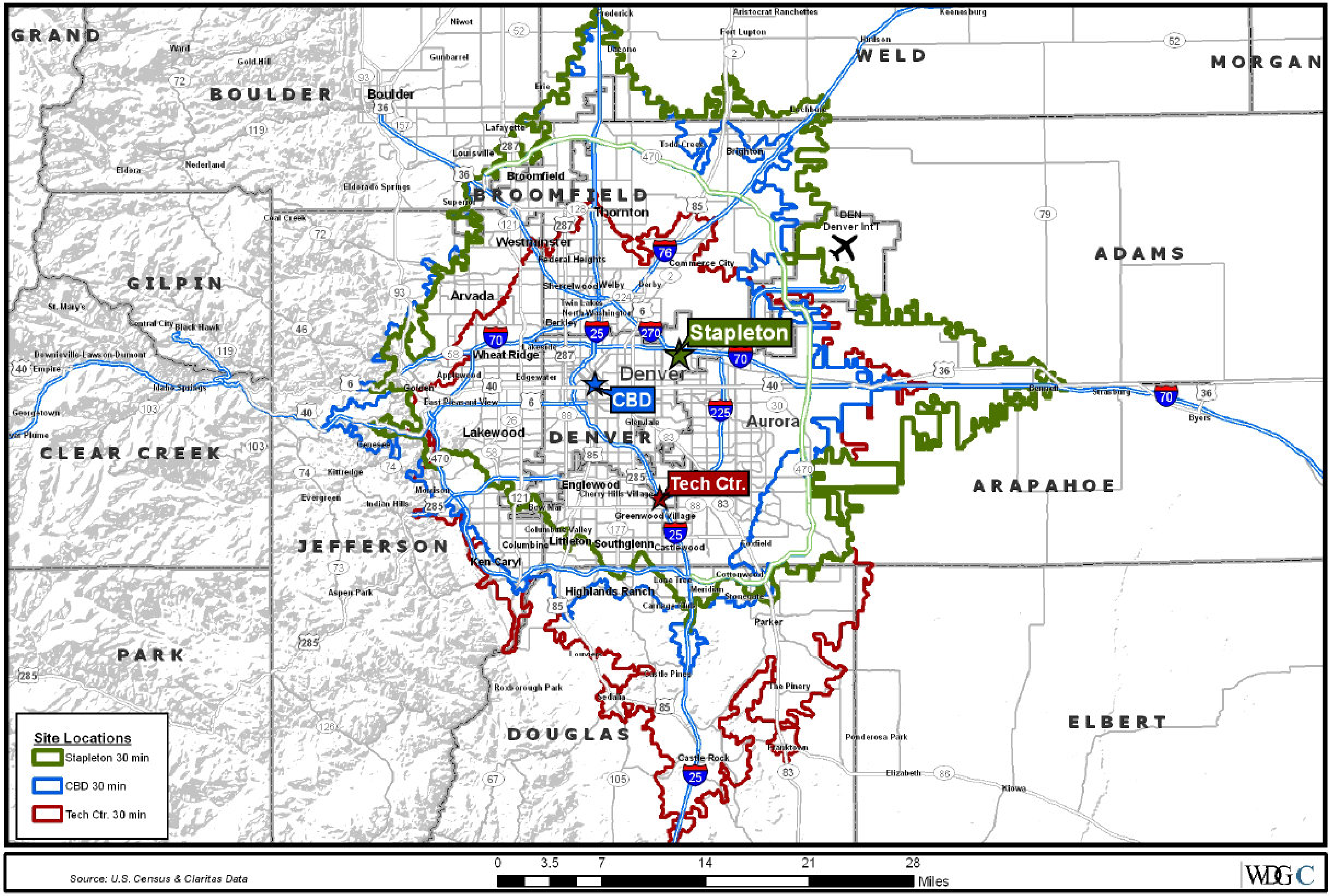


Figure 1 Stapleton Site Reference Map

The Current Incarnation of Stapleton's Transportation System

The Street Network

According to Stapleton's Green Book, one of the primary goals of the development was to connect to the existing gridded street network. Figure 2 depicts the historical concept of the original 1920s street grid expansion plan for Denver and illustrates the mindset that the development plan had in place for connecting Stapleton back to the historic street grid. Compact and connected street network designs have long been known to provide greater accessibility through more direct routes as well as increase overall network efficiency and reliability, in part through the added redundancy (Kulash 1990; Southworth and Ben-Joseph 1997; Handy, Paterson et al. 2003; Marshall 2005). More recent research highlights growing list of benefits, which include less driving (Ewing and Cervero 2010; Marshall and Garrick 2012), more active transportation (Marshall and Garrick 2010), better road safety (Ewing and Dumbaugh 2009; Marshall and Garrick 2010; Marshall and Garrick 2011), and at a tertiary level, even better health (Ewing, Schmid et al. 2003; Frank, Schmid et al. 2005).

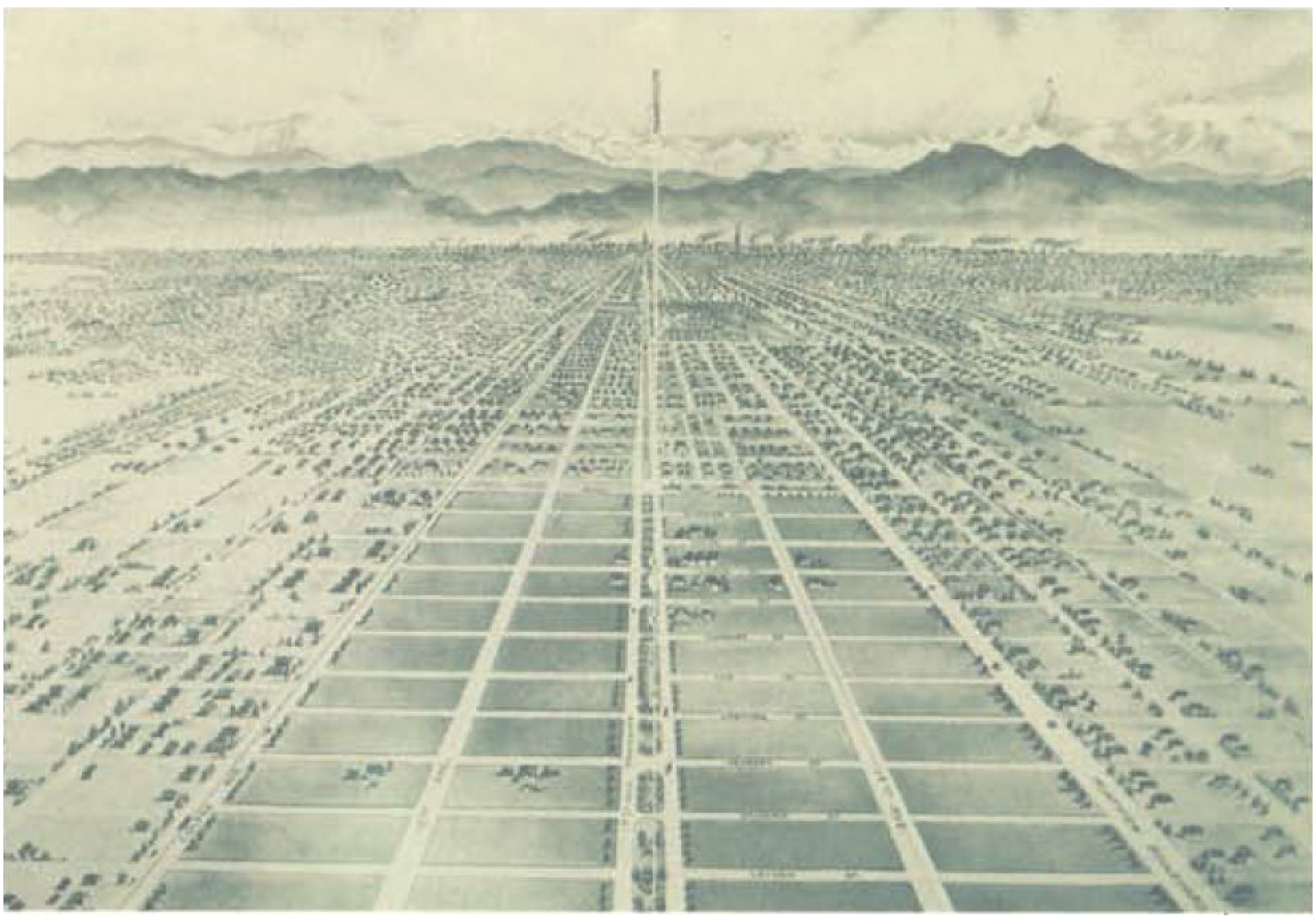


Figure 2 **Circa 1920s Depiction Of Denver Street Grid Expansion Toward Stapleton (Stapleton Redevelopment Foundation 1995)**

Street network compactness is typically defined by metrics such as intersection density and block length (Handy, Paterson et al. 2003; Marshall and Garrick 2012). Due to the sheer volume of parks and open space in Stapleton and the diversity found in the street network, such measures are relatively difficult to objectively determine. Average scores for the Stapleton street network show intersection densities approaching 200 intersections per square mile (77 intersections per square kilometer) and a mean block size of approximately 400' (122 m). While not as compact as well-known gridded networks such as Portland, the numbers are comparable to a highly walkable and bikable city such as Berkeley, CA. Stapleton's street network, however, is not particularly representative of either the orthogonal Berkeley grid or even those found in the neighborhoods surrounding Stapleton. Figure 3 depicts the portion of Stapleton south of Interstate 70 as well as the Park Hill neighborhood to the west and the city of Aurora to the south. Figure 4 highlights the Stapleton network itself, representing the area shaded by the white box shown in Figure 3. Note the subset of curvilinear streets mixed amongst the rectilinear network that is a result of the open space created by the greenways and parks. While these greenways and parks limit connectivity and direct routes for vehicles, they also provide additional connectivity and more direct routes for pedestrians and bicyclists. Due to such issues, street connectivity is decidedly more difficult to interpret than network compactness.

Street connectivity is most typically measured by the link to node ratio or the connected node ratio (Handy, Paterson et al. 2003; Marshall and Garrick 2012), both of which attempt to quantify the relative connectivity of different network designs. What such metrics fail to detect are differences between local neighborhood street connectivity and citywide street connectivity. In other words, street connectivity internal to the development is treated similarly to an external connection. Figure 5 illustrates a few examples of gridded network that are fundamentally different in terms of functionality. And in terms of metrics such as the link to node ratio or the connected node ratio, the first two networks depicted in Figure 5 would result in comparable numbers.

Stapleton does not exhibit full connectivity; rather, Stapleton can be better represented by the second image in Figure 5, that of the network with high neighborhood connectivity and low citywide connectivity. While a handful of roads connect Stapleton to the surrounding neighborhoods to the east and south, there are very few roads that run from one end of Stapleton to the other. Martin Luther King Jr. Boulevard (MLK) is the only one that provides east-west connectivity while Central Park Boulevard (CPB) provides for the main north-south movement (Syracuse Street and Roslyn Street support Central Park Boulevard but only reach far north as E. 35th Avenue). Such strategies help limit the through movement of vehicle traffic on residential streets; however, the disadvantage is that all through traffic finds its way to a select number of individual streets. And with the "predict-and-provide" approach to accommodating vehicles still prevalent with AASHTO and many municipalities, the decision to limit the street network in such a way directly affects the design elements of those individual streets.

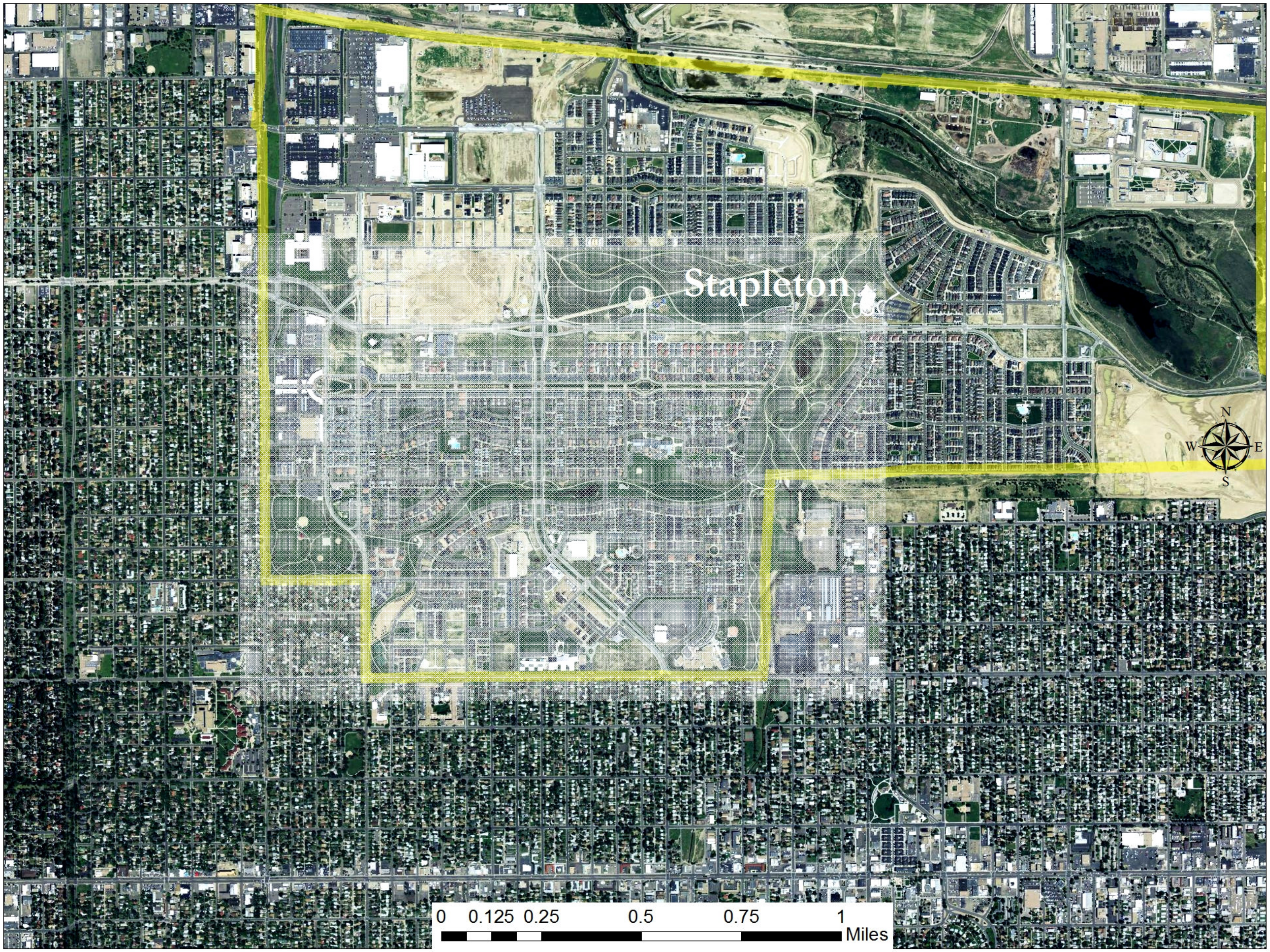


Figure 3 **South Stapleton's Street Network with Respect to the Surrounding Fully Gridded Neighborhoods**

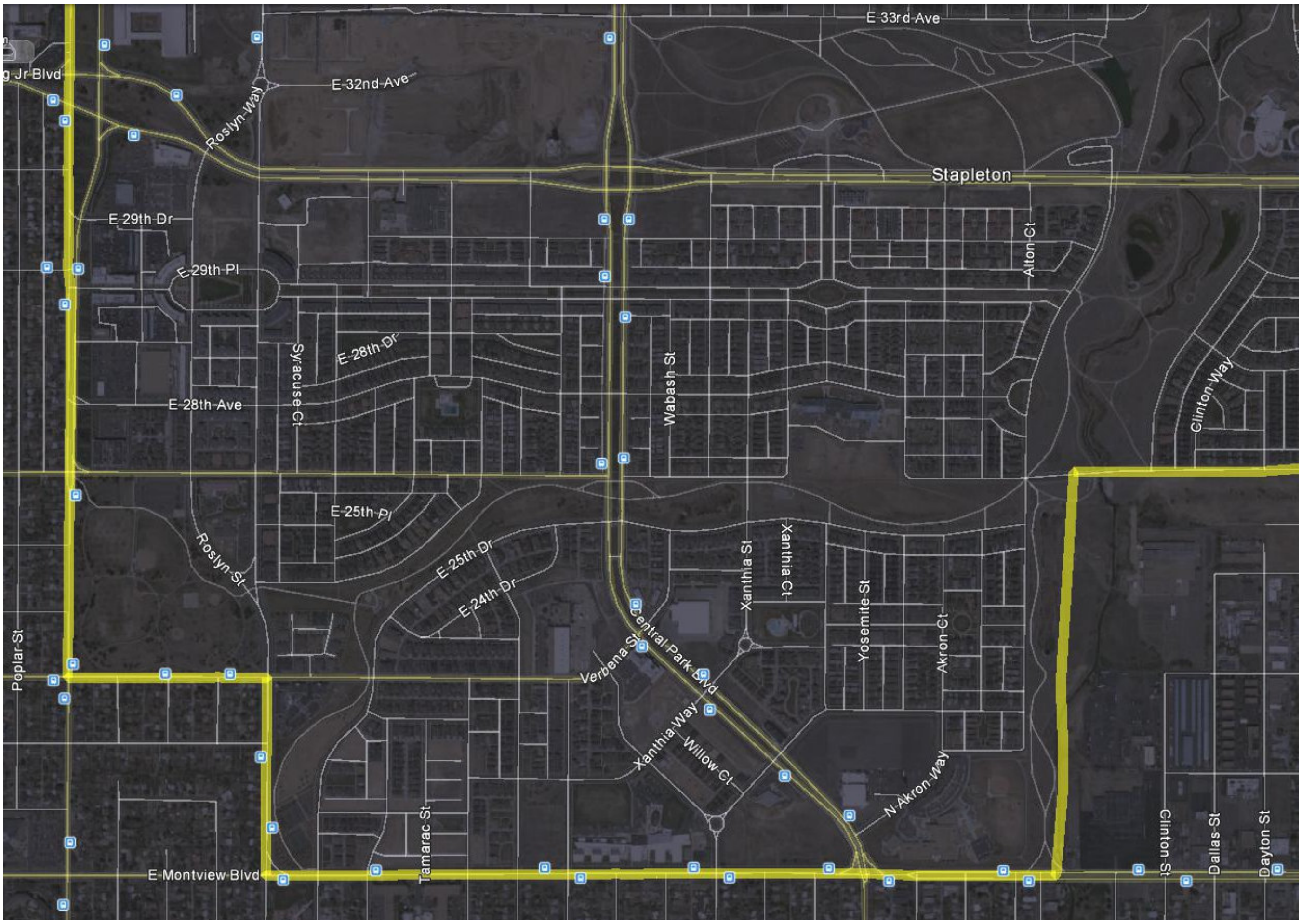


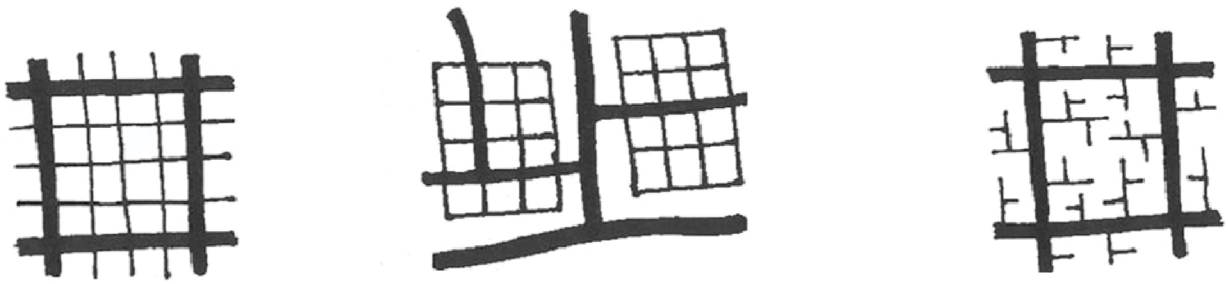
Figure 4 Close-up of Stapleton Street Network

Street Designs

CPB and MLK are defined as urban arterials according to the City of Denver and based upon AASHTO's functional classification system. Such arterials are intended for high traffic volumes and longer trip length but with service to adjacent land uses secondary to mobility (American Association of State Highway and Transportation Officials 2004). The design of CPB is best described as a parkway with two lanes of through movement separated by a 50' (15.2 m) raised median. Each direction also includes a bike lane, a parking lane, and turn lanes at certain intersections. MLK primarily has two travel lanes in each direction (one segment within Stapleton has three travel lanes in each direction) with on-street parking along certain stretches but no bike lanes. Figure 6 depicts these two arterials that run right through the heart of Stapleton. The speed limit on CPB is 30 mph (48.3 kph), and the speed limit on MLK is primarily 35 mph (56.3 kph) but includes a stretch of 30 mph (48.3 kph) near the future town center on the eastern edge of Stapleton.

While current traffic volumes do not warrant the appropriated capacity on these two roads, both were designed with future traffic demands in mind, as forecasted by the Denver Regional Council of Governments (DRCOG) 30-year regional travel demand model. This is particularly an issue for

CPB, even though current counts are less than 12,000 vehicles per day, because it will soon be connected to Interstate 70 to the north. Future demands on CPB are predicted to be 30,000 vehicles per day, and the resulting design reflects the mentality that the current design of the road must be able to accommodate that future level of traffic demand, despite the fact that vehicle speeds are high and that the road is already beginning to divide several neighborhoods within Stapleton.



Full Connectivity | **High Neighborhood Connectivity Low Citywide Connectivity** | **Low Neighborhood Connectivity High Citywide Connectivity**

Figure 5 Gridded Street Network Typology (adapted from Marshall, 2005)

Local roads in Stapleton are generally designed for 2-way traffic with on-street parking on both sides of the street. Such a cross-section, according to the City of Denver's regulations, requires a minimum of 30' (9.1 m) of width or 32' (9.8 m) on roads with three underground utilities. While most local roads in Stapleton have a curb-to-curb width of 30' (9.1 m), some local roads and all collector roads have at least a curb-to-curb width of 38' (11.6 m), which includes both lanes of travel and space for on-street parking on both sides. Figure 7 depicts both of these standard cross-sections. New Urbanists have long used narrow streets as a means to restrict travel speeds, and research continues to support the hypothesis that such roads are not only slower (Swift, Painter et al. 1997; Hansen, Garrick et al. 2007) but also safer (Noland 2000; Dumbaugh 2006). Other municipalities attempting to control vehicle speeds on local roads with parking on both sides encourage narrower cross-sections (Neighborhood Streets Project 2000). A related issue in Stapleton, which further contributes to higher vehicle speeds on local roads, is that fact that most dwelling units also possess two off-street parking spaces. Thus, most on-street parking spaces in Stapleton are infrequently occupied, which has been shown by several researchers to be associated with faster vehicle speeds.

City of Denver regulations, based upon AASHTO guidelines, also specify 30' (9.1 m) curb radii at all arterial road intersections. While larger radii are linked to an increase in vehicle speeds (American Association of State Highway and Transportation Officials 2004) and an increase in pedestrian crossing distances (Sacramento Transportation & Air Quality Collaborative 2005), the larger issue is that engineers have no flexibility to use a smaller radius in situations where the arterial road crosses a local street, or more critically, where on-street parking and/or bike lanes – in this case 8' (2.4 m) and 5' (1.5 m) wide respectively – increase the effective turning radius. Figure 8 depicts an intersection along CPB where the effective turning radius is more than 70' (21.2 m) even though the actual curb

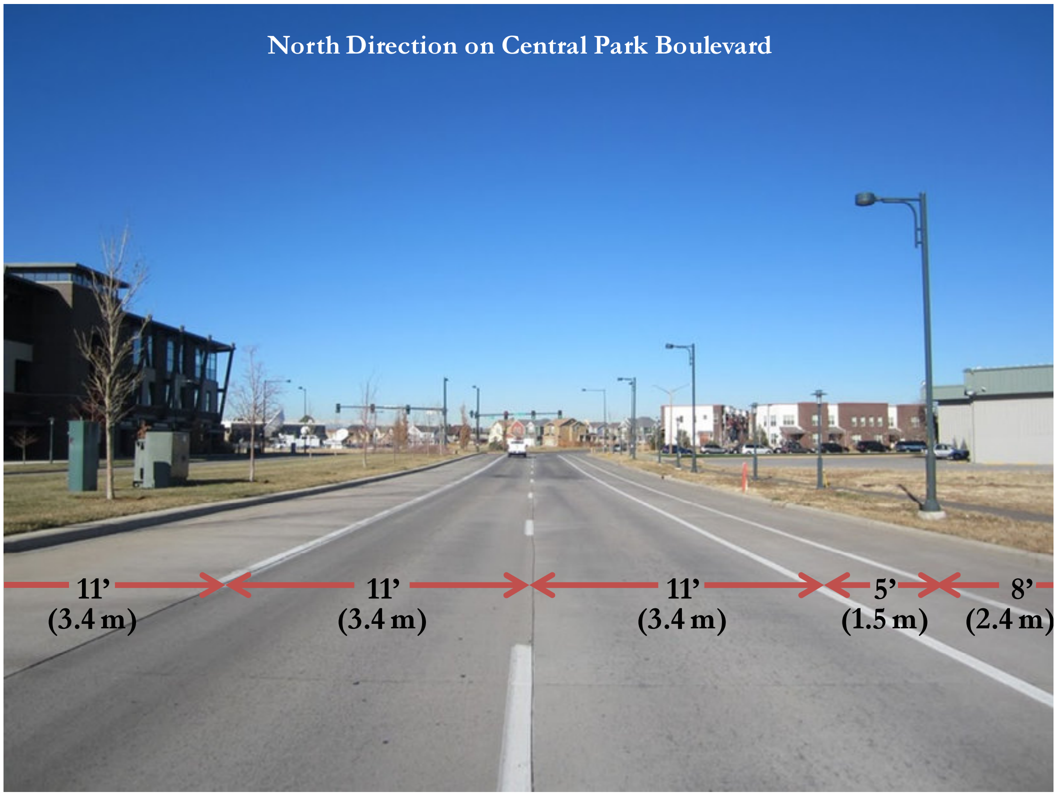


Figure 6 Stapleton’s Urban Arterials

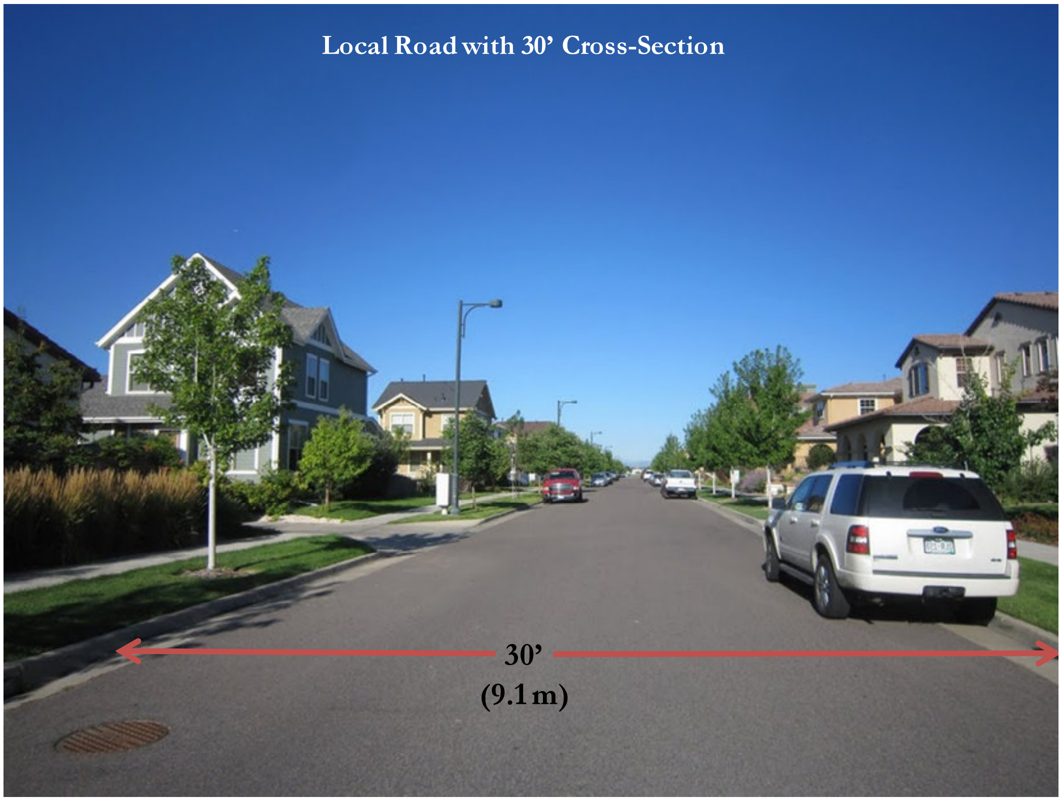


Figure 7 Stapleton's Local Roads

radius is 30’ (9.1 m). Generally, a curb radius greater than or equal to 30’ (9.1 m) results in a “free-right” turn condition for passenger cars (Chellman 2000). An effective turning radius of more than 70’ (21.2 m) extends this “free-right” turn condition to larger vehicles and leads to an increase in vehicle speeds for smaller vehicles.

While there is little justification for not properly considering the effective turning radius when designing a curb radius, the logic behind requiring a curb radius of 30’ (9.1 m) at all arterial road intersections in the first place is to make sure vehicles can turn quickly enough in their own lanes as not to impede through traffic. The problems, however, are not merely limited to the failure to consider the effective turning radius; rather, the initial design value of a 30’ (9.1 m) curb radii is also excessively large. Design guidelines from England deem any large curb radii to be anything larger than 23’ (7.0 m) (Chellman 2000). Rather than ensuring in-lane turning, the priority is shifted toward encouraging slower vehicle speeds and providing shorter pedestrian crossing distances. Similarly well informed design guidelines from the United States recommend designing curb radii to be as small as possible, typically 6’ (1.8 m) to 15’ (4.6 m) (Federal Highway Administration 2006; Tumlin 2012).

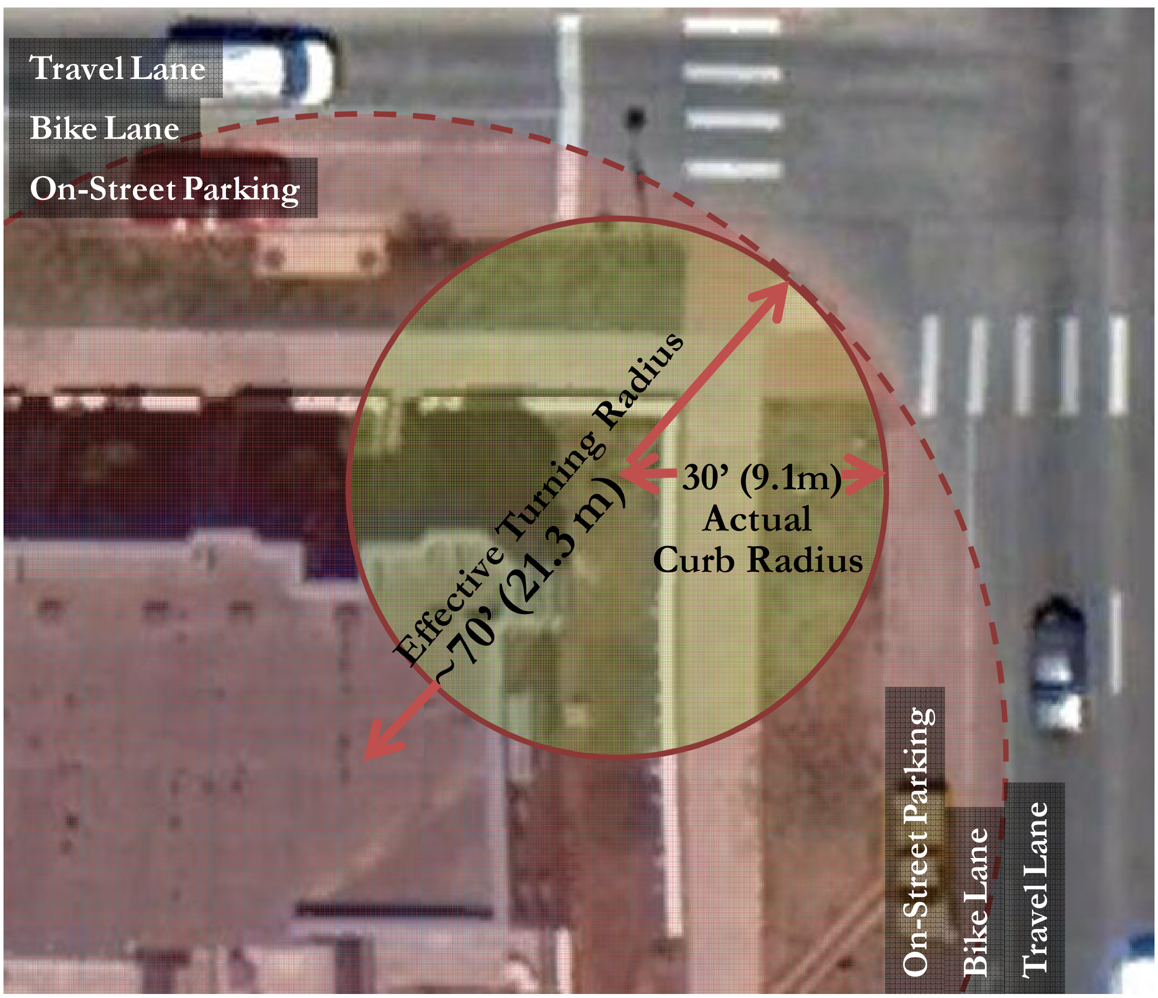


Figure 8 Required 30’ (9.1 m) *Curb* Radius vs. Effective ~70’ (21.3 m) *Turning* Radius

RESULTS

Vehicle Speeds

The Stapleton Master Community Association collected vehicle speeds on roads throughout Stapleton between 2007 and 2009. Table 1 displays the collected speeds for five representative segments. The first two listed are MLK and CPB, arterials with posted speeds of 35 mph (56.3 kph) and 30 mph (48.3 kph), respectively. Despite the fact that the speed data collected was not exclusively free flow traffic but rather included vehicles slowing due to turning movements, drivers were over the speed limit in over 18% of cases on MLK and over 35% of cases on CPB. Drivers were found exceeding 50 mph (80.5 kph) on both roads and vehicles were found to have exceeded 70 mph (112.7 kph) on a 35 mph (56.3 kph) stretch of MLK.

The other three examples represent local and collector roads along residential stretches, all with posted speed limits of 25 mph (40.2 kph). Beeler Street represents the 38' (11.6 m) cross-section type with sparsely used parking located on both sides. Over 63% of drivers exceeded the speed limit on Beeler with some surpassing 50 mph (80.5 kph). Very similar results were found along 26th Avenue, where a 30' (9.1 m) cross-section supported two-way traffic but only one parking lane; yet, speeds were greatly reduced along Willow Street where two-way traffic and on-street parking on both sides were fit into a narrower 30' (9.1 m) cross-section. In this last case, only 3% of drivers exceeded the speed limit and no drivers were found exceeding 40 mph (64.4 kph).

Other studies have shown that a pedestrian hit by a vehicle at 20 mph (32.2 kph) has a 5% risk of fatality, at 30 mph (48.3 kph)a 45% risk of fatality, and at 40 mph (64.4 kph), an 85% risk of fatality (Leaf and Preusser 1999). As a result, vehicle speeds have been shown to not only be significant in terms of road safety but also in the perception of safety. Both of which are extremely important in terms of user behavior and mode choice decisions.

Table 1 Stapleton Vehicle Speed Study

Name: Martin Luther King Jr. Boulevard

Description: 2 Lanes WB (parking one side) — Posted Speed: 35 mph/56.3 kph

Curb-to-Curb: 30' (9.1 m) — % Over Limit: 18.1%

Speed (mph)	1-20	20-30	30-40	40-50	50-60	60-70	70+
Speed (kph)	1.6-32.2	32.2-48.3	48.3-64.4	64.4-80.5	80.5-96.6	96.6+	112.7+
Volume	1406	3079	5749	686	24	1	2
% of Total	12.8%	28.1%	52.5%	6.3%	0.2%	0.0%	0.0%

Name: Central Park Boulevard

Description: 2 Lanes NB (bike lane & parking one side) — Posted Speed: 30 mph/48.3 kph

Curb-to-Curb: 35' (10.7 m) — % Over Limit: 35.6%

Speed (mph)	1-20	20-30	30-40	40-50	50-60	60-70	70+
Speed (kph)	1.6-32.2	32.2-48.3	48.3-64.4	64.4-80.5	80.5-96.6	96.6+	112.7+
Volume	1100	4840	3116	158	7	0	0
% of Total	11.9%	52.5%	33.8%	1.7%	0.1%	0.0%	0.0%

Name: Beeler Street

Description: 2-way Traffic (with parking both sides) — Posted Speed: 25 mph/40.2 kph

Curb-to-Curb: 38' (11.6 m) — % Over Limit: 63.9%

Speed (mph)	1-20	20-30	30-40	40-50	50-60	60-70	70+
Speed (kph)	1.6-32.2	32.2-48.3	48.3-64.4	64.4-80.5	80.5-96.6	96.6+	112.7+
Volume	780	3619	2235	40	2	0	0
% of Total	11.7%	54.2%	33.5%	0.6%	0.0%	0.0%	0.0%

Name: 26th Ave

Description: 2-way Traffic (with parking one side) — Posted Speed: 25 mph/40.2 kph

Curb-to-Curb: 30' (9.1 m) — % Over Limit: 55.0%

Speed (mph)	1-20	20-30	30-40	40-50	50-60	60-70	70+
Speed (kph)	1.6-32.2	32.2-48.3	48.3-64.4	64.4-80.5	80.5-96.6	96.6+	112.7+
Volume	705	3167	1223	30	1	0	0
% of Total	13.8%	61.8%	23.9%	0.6%	0.0%	0.0%	0.0%

Name: Willow Street

Description: 2-way Traffic (with parking both sides) — Posted Speed: 25 mph/40.2 kph

Curb-to-Curb: 30' (9.1 m) — % Over Limit: 3.2%

Speed (mph)	1-20	20-30	30-40	40-50	50-60	60-70	70+
Speed (kph)	1.6-32.2	32.2-48.3	48.3-64.4	64.4-80.5	80.5-96.6	96.6+	112.7+
Volume	5136	1056	46	0	0	0	0
% of Total	82.3%	16.9%	0.7%	0.0%	0.0%	0.0%	0.0%

Mode Choice

The 2009-2010 Front Range Travel Survey (FRTS) is an in-depth household travel survey conducted decennially by DRCOG, the regional MPO. With approximately 12,000 households across the Denver metropolitan area involved, it is the most comprehensive source of travel data available for the region. In an effort to better understand transportation and policy decisions, the City of Denver funded an oversampling of selected mixed-use neighborhoods. In addition to Stapleton, the oversampling included Lowry, another New Urbanist neighborhood, as well as three older, most established neighborhoods: Cherry Creek, East Colfax, and the Highlands. Figure 9 locates these five neighborhoods and shows a spatially interpolated raster image highlighting the probabilty that a resident walks or bikes to work. In this image, the darker the color, the more likely it is that a resident of that neighborhood uses active transportation. Table 2 further details the journey-to-work results of the FRTS. Overall, both Stapleton and Lowry are lagging behind all three of the other neighborhoods in terms of walking, biking, and transit mode shares. While it is expected that transit usage for Stapleton residents will likely increase once the east commuter line rail is completed in 2015, the high reliance on driving and the associated walking and biking mode shares for Stapleton are still disappointing. Even though various mitigating factors – such as proximity to downtown, high incomes, and lack of regional accessibility – likely play a role in these trends, the numbers certainly suggest that more needs to be done to better accommodate and promote walking, biking, and transit trips.

Table 2 Front Range Travel Survey Journey-to-Work Mode Choice Results

	Stapleton		Lowry		Cherry Creek		East Colfax		Highlands	
	(n=98)		(n=68)		(n=191)		(n=156)		(n=172)	
	n	%	n	%	n	%	n	%	n	%
Walk	2	2.3%	4	7.4%	21	16.7%	18	12.6%	17	11.7%
Bike	2	2.3%	0	0%	4	3.2%	18	12.6%	5	3.4%
Bus	3	3.4%	1	1.9%	6	4.8%	12	8.4%	10	6.9%
Light Rail	0	0%	0	0%	4	3.2%	1	0.7%	1	0.7%
Drive	81	92.0%	49	90.7%	91	72.2%	94	65.7%	112	77.2%

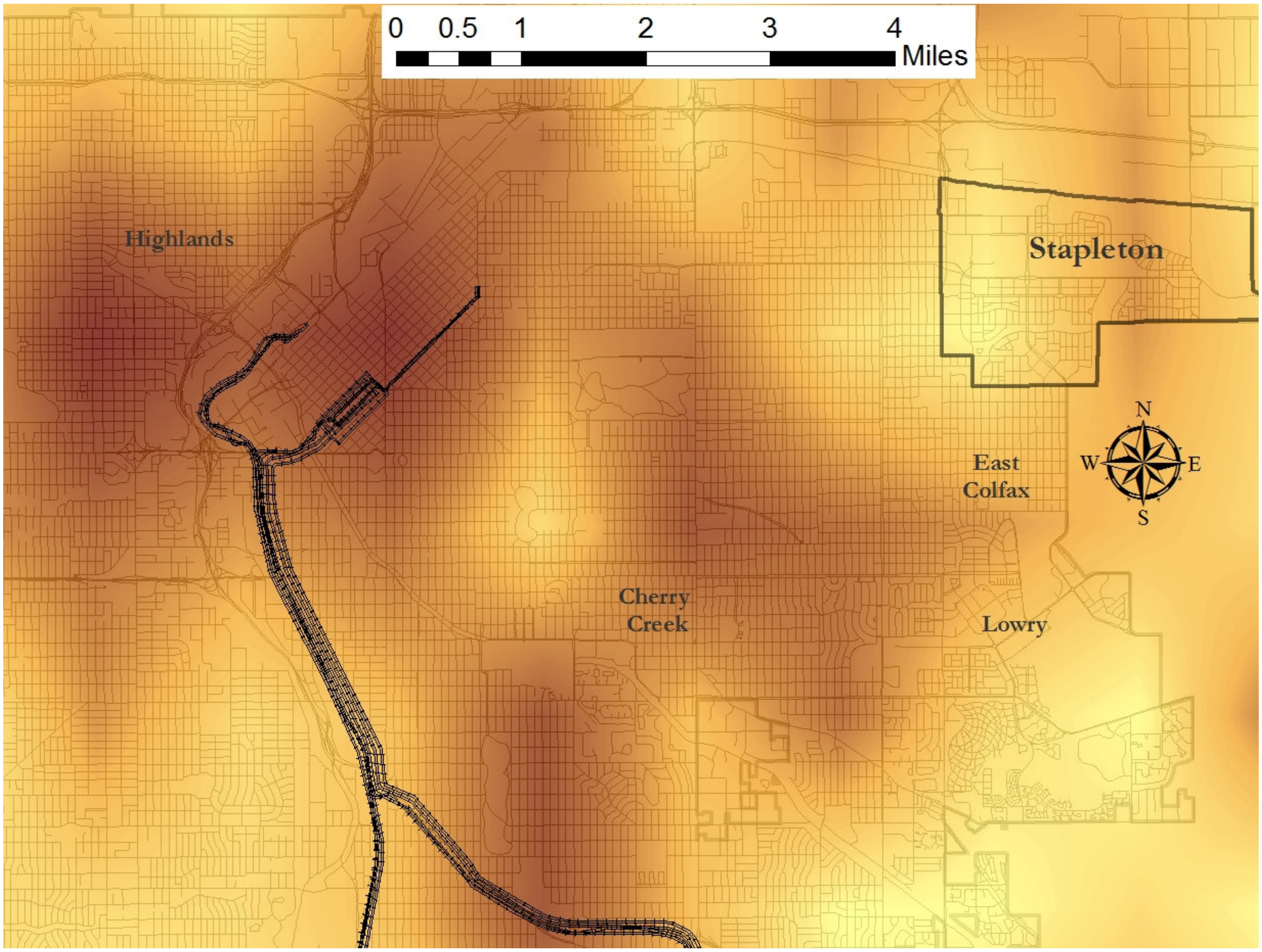


Figure 9 Front Range Travel Survey Journey-to-Work Mode Choice Results

DISCUSSION

In December of 2010, a pregnant woman was run over in a hit-and-run crash at a stop-controlled intersection along CPB near 29th Avenue. The woman survived, but tragically, the baby did not. Although many were concerned about traffic safety prior to this incident, the heartbreak sparked a number of stakeholders toward trying to come up with a better resolution for the many problematic roads in Stapleton that are inherently designed for high speeds.

Rather than address the systematic issues described previously, the City of Denver proposed the following three traffic control options for replacing the stop signs at the intersection where the crash occurred.

- Install a traffic signal
- Install a two-lane modern roundabout

- Close the median on CPB across 29th Avenue

Given this extremely limited subset of alternatives, the City determined that a traffic signal was the only viable option since a two-lane roundabout was too costly due to right-of-way requirements and that closing the median on CPB would impact traffic on parallel routes, particularly given the fact that the median across 26th Avenue was previously closed in an effort to limit high-speed though traffic on a residential road. Once residents learned that the City, with the approval of the master developer, was proceeding with the traffic light option, a community group organized a petition and received over 400 signatures in a week asking for the city to simply hold off on the light until a broader safety analysis could be conducted. One issue was that, given the current configuration and the known speed issues along CPB, a traffic light in a location that was likely to be green most of the time would promote even higher vehicle speeds, transform these streets into barriers in themselves, and actually result in less safe conditions for the community as a whole. This line of thinking is also reflected in the research. The traffic calming literature shows that traffic lights do not help control speed; rather, they can lead to an increase in mid-block speeds as drivers try to make up for lost time (Ewing 1999). In a safety study of stop signs that were converted to traffic signals in New York City due political pressure, crashes rose by 65% (Sandler, Schwaftz et al. 1989). Moreover, in answering the question: "does a traffic signal control speed?," the New York City DOT website states the following:

> *"No. In some areas where speeding is a problem, residents believe that a traffic signal is needed to address the speeding problem. In fact, traffic signals sometimes result in greater speeds as drivers accelerate to try to get through the signal before it turns red" (New York City DOT ; Kazis 2011).*

At this time of the decision in Stapleton to proceed with a traffic signal, the mayor-elect as well as one of the newly elected city council members agreed to postpone the construction until after they have taken office and a public meeting could be held. Once that meeting was scheduled, but before it was actually held, the City of Denver initiated construction of the traffic signal, a $1,000,000 project, by tearing out the 50' by 50' (15.2 m by 15.2 m) landscaped median. The stance of the city was that their engineers exhausted all available options and that a traffic light was the only feasible one given the traffic demand warrants, which as they mistakenly described them, are *"required by federal standards."* So rather than take a systematic look at solving the transportation issues through better network and street designs that help self-regulate speeds, the City of Denver and Forest City, the master developer, instead focus on band-aid solutions, such as promising better police enforcement, that ignore the root of the problem. At a public meeting, one officer described CPB as a *"smooth, flat, wide-open, thoroughfare perfect for speeding, which is why they patrol it as much as they can"* despite the fact that Denver currently only has seven officers dedicated to such duties across the entire city. Another response to the inherent problems of CPB was the decision of Denver Public Schools to provide buses for students that have to cross this road, even though they do not meet the minimum distance typically required to be eligible for a bus. In an interview on Colorado Public Radio, one mother walks her children *"about eight blocks to the east to catch the bus"* even though *"the school is eight blocks west"* (Barr 2011). If such a case exists in any New Urbanist community, then it is impossible to declare that place a success.

Beyond the disconnect between the New Urbanist design ideals and the resulting street and street networks that were implemented in Stapleton is a lack of political will for change in the right direction. One reason for this is Northfield Stapleton, the regional shopping center located to the north of I-70, which has not been as economically successful as either Forest City, the owner of the commercial area, or the City of Denver had hoped for. With the opening of the new interchange and a connection along CPB to the south, the perception is that providing for as many cars as possible to be able to reach Northfield in as short of time as possible will solve the problem. While things may indeed improve economically for this particular development with the new multimillion dollar interchange, there are also countless examples of commercial areas that only began to thrive once priorities shifted toward focusing on the provision of a walkable, bikeable, and transit-friendly built environment where the research is beginning to show that traffic delay can have a positive effect on a region's gross domestic product (Norquist 2011). As John Norquist states so eloquently in the same article after discussing the economic plights of cities, such as Detroit, that have successfully solved most of their congestion problems:

> *"After all, congestion is a bit like cholesterol - if you don't have any, you die. And like cholesterol, there's a good kind and a bad kind. Congestion measurements should be divided between through-traffic and traffic that includes local origins or destinations, the latter being the "good kind." Travelers who bring commerce to a city add more value than someone just driving through, and any thorough assessment of congestion needs to be balanced with other factors such as retail sales, real estate value and pedestrian volume."*

CONCLUSION

So how do we fix this? To begin with, there are complete, network-level solutions that would address both the needs of the community and continue to serve regional mobility. However, some of those solutions – such as better connecting the urban grid not just within Stapleton, but also to the surrounding neighborhoods, and in conjunction, narrowing roadway widths throughout the community to help control both vehicle speeds and potential increases in through traffic – would be difficult to implement, both economically and politically. As Stapleton's master developer continues to defend the design of roads like CPB under the guise of the principle in Stapleton's Development Plan related to the need to connect back into the existing street network, it has become clear that many of the design problems built into CPB are directly related to the lack of extending the urban grid in the first place.

While such network-level solutions are not out of the question, the opportunities they represent would require a clearer long-term vision of how New Urbanist communities like Stapleton can achieve success and significant reconciliation of that vision with conventional traffic engineering design standards required by most municipalities. Notwithstanding the looming revolution, there are still several significant changes that can be much more easily achieved, both economically and politically, within the constraints of the current street network. For instance, a solution such as a road diet – where roads like CPB and MLK are reduced to one through lane in each direction – is a viable, cost-effective option. Thus far, the city has suppressed the concept of a road diet for CPB due to the existing 50' (15.2 m) wide raised median and the erroneous belief that a two-way turn lane in a painted median is a requirement of a road diet. The reality is that road diets work because they continue to allow for relatively high traffic volumes, through the use of turn lanes at intersections, because road capacity in urban areas is a function of intersection capacity rather than capacity along segments. In no way would the existing median limit the ability to provide turn lanes in a case such as that on CPB, where an improvement could be as simple and inexpensive as striping a buffered bike lane (National Association of City Transportation Officials 2011). The result would be slower cars and shorter crossing distances for pedestrians, both of which would increase safety and keep these roads from continuing to take away travel choices from our citizens (Burden and Lagerwey 1999; Pawlovich, Li et al. 2005).

Another potential remedy could involve modern roundabouts that help reduce vehicle speeds though the intentional deflection of vehicles from a tangential path prior to reaching the stretches of road adjacent to the neighborhoods. Such roundabouts have also proven to be much safer – especially in terms of severe injuries and fatalities – than conventional signalized intersections and are also more efficient in terms of moving cars. In a Vissim micro-simulation model of Stapleton's existing configuration compared to a road diet solution for CPB combined with a modern single-lane roundabout at CPB and 36th Avenue that would help reduce vehicle speeds of cars coming off the highway prior to reaching the stretch of CPB adjacent to the neighborhoods, the results indicate that no intersection along CPB would drop below an LOS C. These results hold even when 50% of the traffic currently using both the I-70 Quebec Street interchange to the west and Havana Street interchange to the east end up on CPB. And even though LOS has proven to be a poor evaluator of urban transportation projects (Henderson 2011), the intent of this analysis is simply to encourage those that are paralyzed by the fear of congestion to consider such seemingly counterintuitive solutions.

Table 3 Comparison of Existing CPB with Road Diet + Roundabout Solution

	Existing CPB Configuration			CPB Road Diet & Modern Roundabout		
	Avg. Delay (sec)	Avg. Speed (mph / kph)	LOS	Avg. Delay (sec)	Avg. Speed (mph / kph)	LOS
Network Performance	219.5	21.4 / 34.4		323.8	16.4 / 26.4	-
CPB & 40th	14.9	-	B	23.3	-	C
CPB & 36th	13.6	-	B	15.1	-	B
CPB & 35th	11.1	-	B	25.5	-	C
CPB & MLK	6.8	-	A	12.6	-	B

The reality is that solutions such road diets and roundabouts are merely band-aids intended to suppress some of the more systematic network-level issues. While these ideas do not represent an exhaustive list of potential solutions, they do represent a sample of the type of ideas that New

Urbanist developments such as Stapleton need to truly consider in order to realize complete designs that are convenient, safe, and comfortable for all road users. Such thinking would begin to put Stapleton back on the path toward realizing the original vision that was set out for it whereas following the suggestions laid out by some stakeholders – such as more signage, more traffic lights, and expensive pedestrian overpasses – would only exacerbate the current problems.

To paraphrase Dan Burden after briefing him on Stapleton's predicament: we need to focus more on community building rather than capacity building. Focusing on community goals, such as those set forth in the original Stapleton vision, and looking for ways better understand the disconnects between New Urbanist transportation design ideals and conventional engineering solutions – and the insidious implications of those disconnects – will go a long way toward ridding ourselves of unsafe streets that are beginning to permeate, not through just Stapleton, but other large-scale New Urbanist developments as well. On the other hand, we could also follow the lead of one Stapleton resident (see Figure 10) that persistently reduces the effective width of Beeler Street, the same road where more than 63% of drivers were speeding, from 38' (11.6 m) to 24' (7.3 m) by parking his truck almost 4' (1.2 m) away from the curb on one side of the road and a trailer with a sign that reads: *"drive like your kids live here"* on the other.

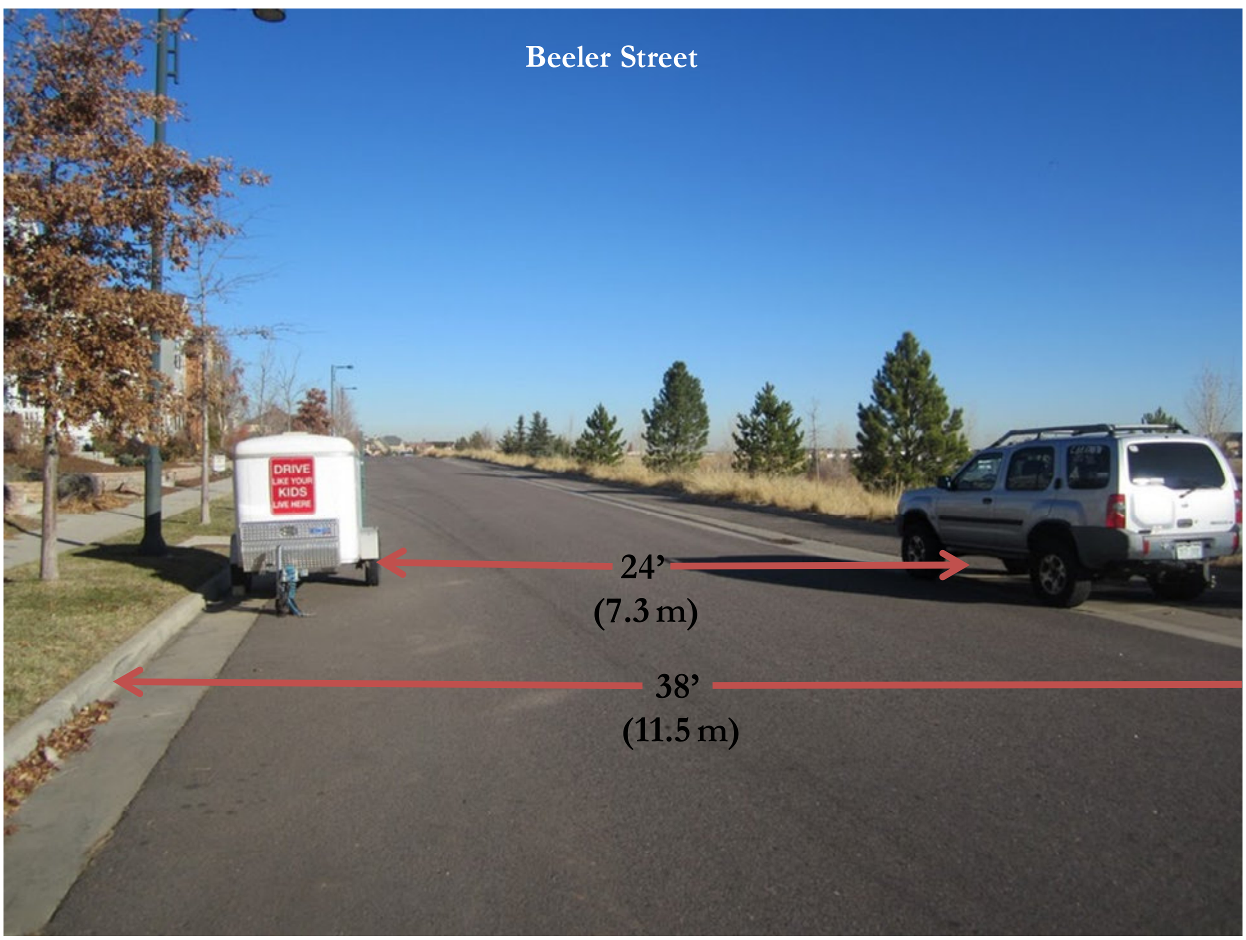


Figure 10 Ad Hoc Traffic Calming Along Beeler Street

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