

16TH STREET, DENVER CO

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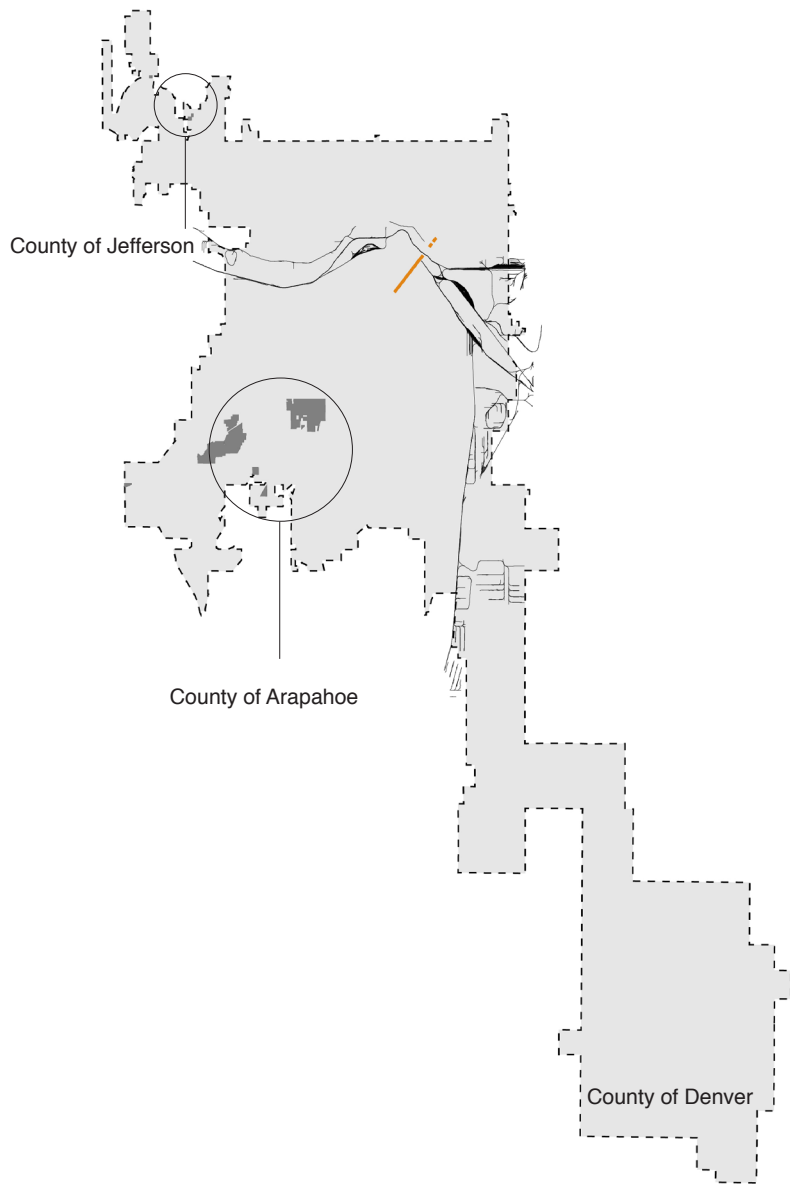
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CONTEXT

16th Street is located in the downtown area of County of Denver, Colorado creating the strong axis between the two major rail stations in Denver - Union station (DEN) and City Center park station. Union station railway is the major regional infrastructure for the commuters from remoted region around Denver that brings them directly to CBD area of downtown Denver. Therefore, while the most of the parallel streets that connect those two stations are having a lot of human traffic but 16th street become the main street because it links directly from the station exit to another and its free-ride shuttle bus that runs along the street.





Boundary of Denver

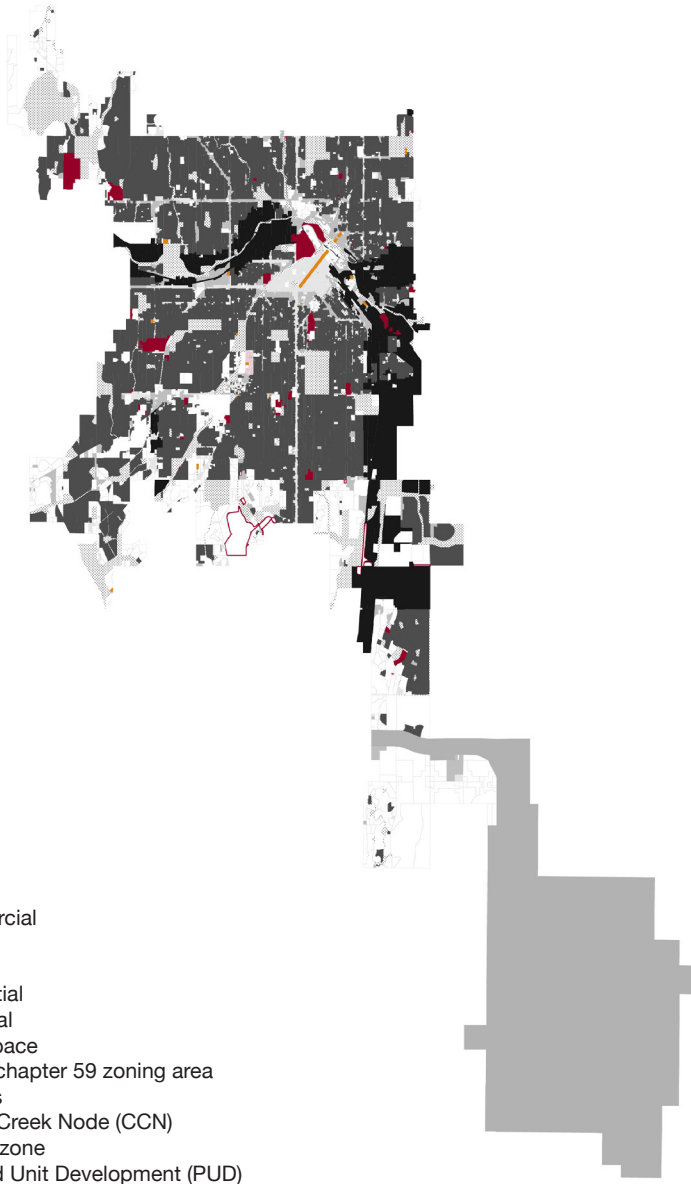
Denver is a capital of Colorado composed of three counties: County of Denver, County of Arapahoe, and County of Jefferson. 16th street is located in the western side of County of Denver branched out from commuter rail that drag commuters movements.

Reference: Denver Open Data Catalog



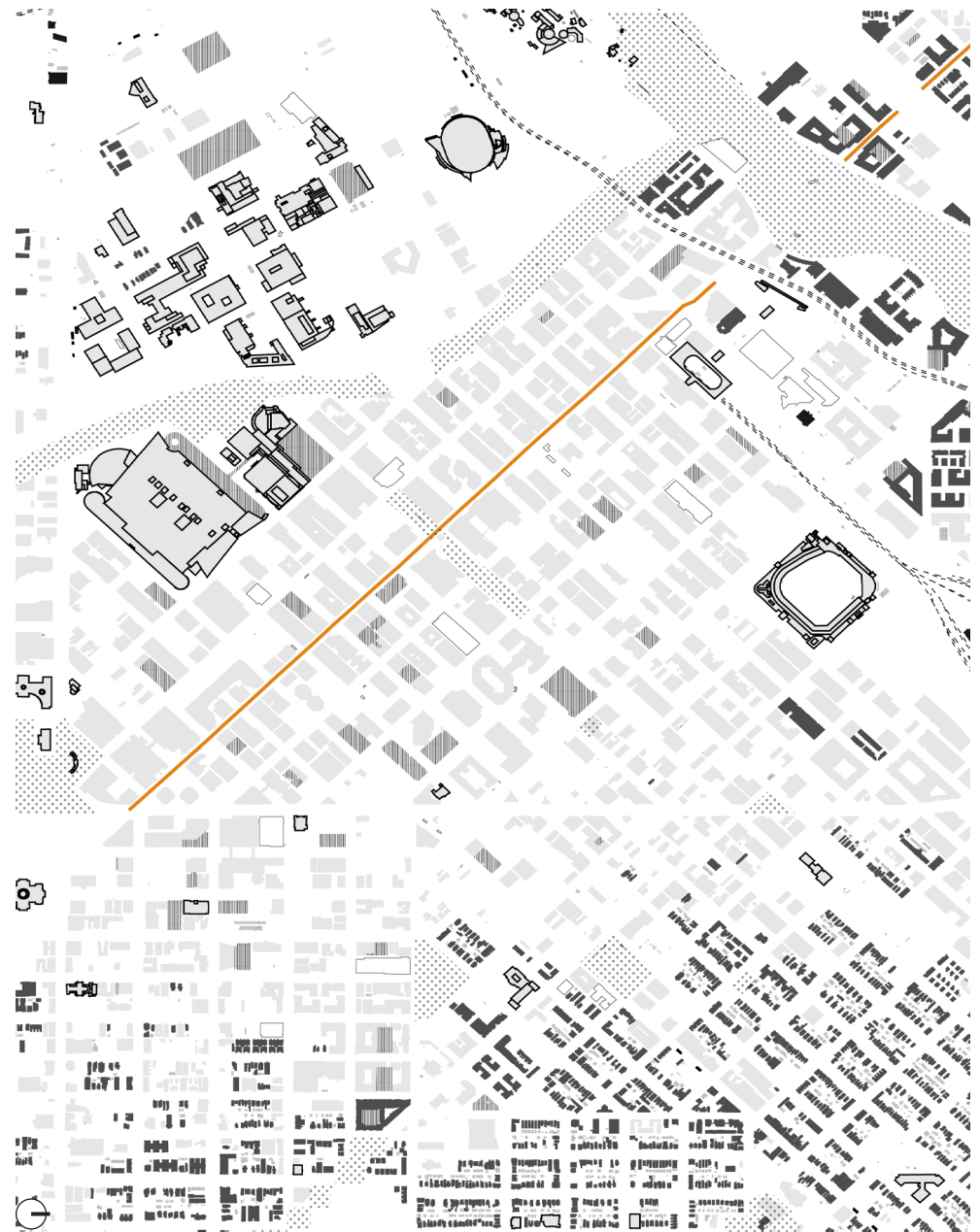
Street hierarchy of Denver Downtown

Street hierarchy of downtown area is quite monotonous. Series of streets and avenues are overlaid all over the downtown while the boulevard is cutting through the edge of the street fabric when there is a change of the street fabric.



Zoning of Denver

Most of the area in Denver is filled with residential zoning code while the area around 16th street is commercial oriented. Along their rail-road, series of open space and industrial area are laid.



Commercial-oriented zoning around 16th street

16th street in Denver is located in the business improvement district area which is full of commercial-oriented zoning. The street is bridging the rail station in on end and the light rail station in the another end, so active commercial activities of the street can be expected.

HISTORY

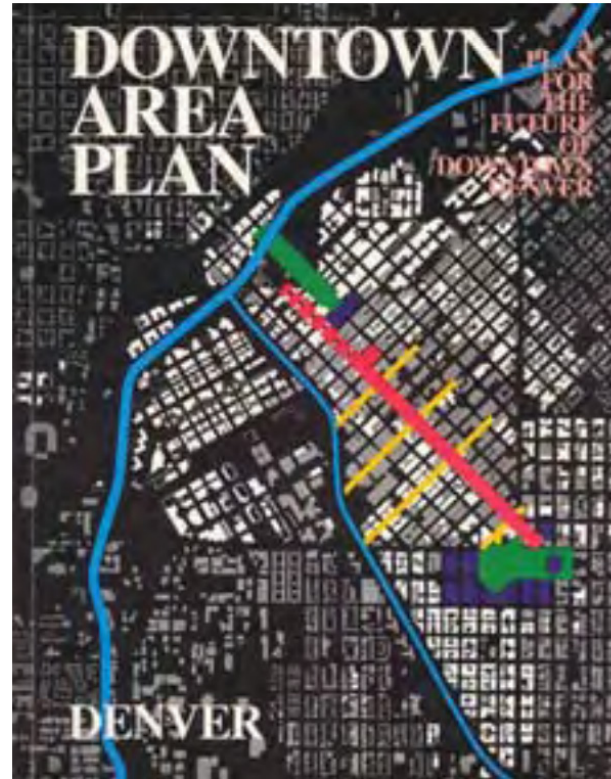
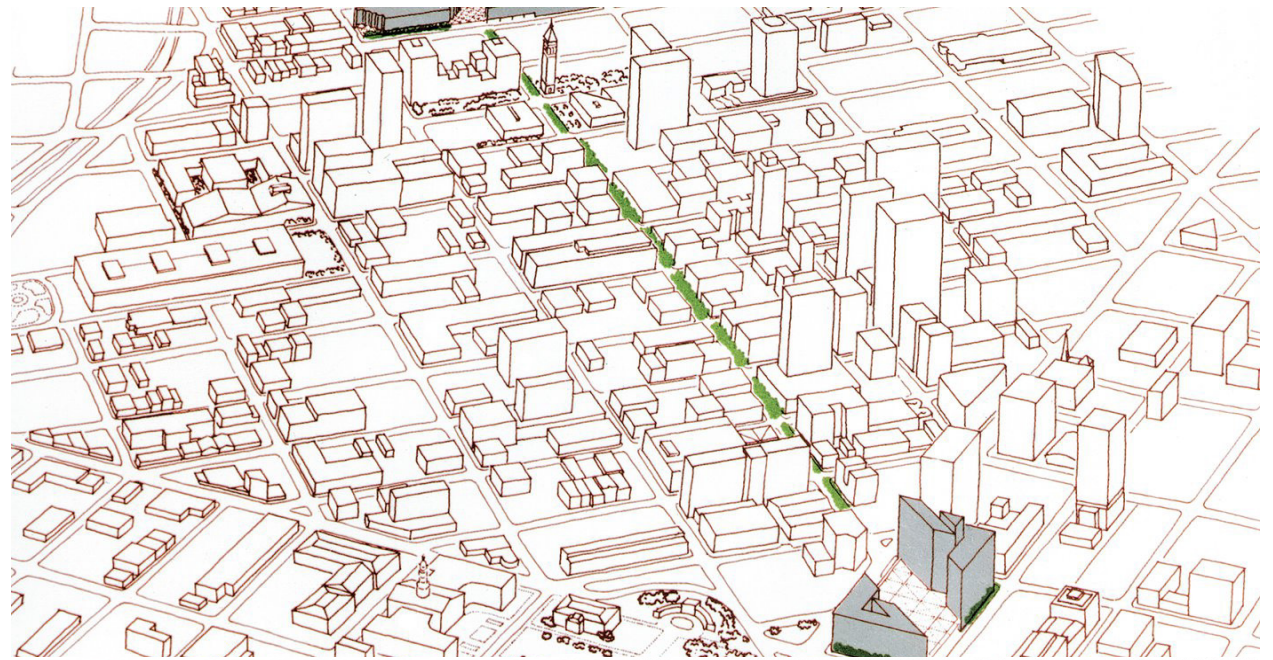
Throughout its history, Denver's 16th Street has been a transportation spine of commerce, retail shops, and restaurants that connected the city's commercial and financial districts, and the City and State Government Centers. The conversations about a pedestrian mall had begun as early as 1959 driven primarily by a need to decrease congestion on the narrow but lively street.

In 1971, A partnership between Downtown Denver Inc. (now the Downtown Denver Partnership), The City of Denver, Downtown Denver Business Improvement District, Regional Transportation District (RTD) proposed a transit mall concept for 16th Street, which involved closing nine blocks of the street to vehicular traffic except for buses. The idea meets resistance from downtown merchants, and the plan is abandoned.

After initial financial issues, the project finally got underway with a federal grant for design and engineering fees from the Urban Mass Transportation Administration (UMTA) in 1978. Further funding for the construction of the Mall was granted in April 1979. The mall opened to public in 1982.

One of the key motivations for how the street was finally designed came from the fact that the federal funding hinged on the successful integration of pedestrian/transit interests, in combination with local interests to revitalize the downtown. Other key stakeholders included the RTD, the city, DDP and various citizen groups from business, environmental and disabled communities.

Reference: RTD, Downtown Denver Partnership, City of Denver



1986



2007

1971

1977

1982

2007

2008-2015

2018

The creation of a mall is proposed with objectives to lessen traffic congestion, provide an efficient bus service and create a new pedestrian environment in the downtown — a place for people

Famed architects I.M. Pei and Partners are hired to design the pedestrian mall. They ultimately will receive \$3.4 million for the job.

The mall opens, with a celebration that attracts 200,000 people and features singer Lannie Garrett leading the crowd in a rendition of “Downtown.”

The Downtown Action Plan highlights the importance of the 16th Street Mall and recognizes it as a ‘spine’ of downtown Denver

16th Street Mall celebrates 30 year anniversary RTD and the City of County of Denver launch separate studies on bus lane surface replacement and placemaking on the mall

Denver, RTD recommend 16th Street Mall design that would expand side walks, improve pedestrian safety



Major design elements of the mall unchanged for 25 years. In 2007, the DDP and the City and County of Denver, convened the community to develop a the Downtown Action Plan - a bold vision to achieve a vibrant, economically healthy, growing and vital center city in the next 20 years. Highlighting the importance of the 16th Street Mall as a major economic engine and spine of the downtown area,

it recommended a study of Mall infrastructure to assess needs, and reconstruct to meet the goals of sustainability, usability, and respect for the existing design.

Following the DAP, the city along with DDP and RTD has conducted a series of studies to define the strategy and future of the 16th street mall. The mall, now 35 years old, is looking forward to a major overhaul.



16th street mall is the most popular destination for shopping, food and entertainment for visitors to Denver. Street furniture and kiosks can often be seen dotting the length of the mall.

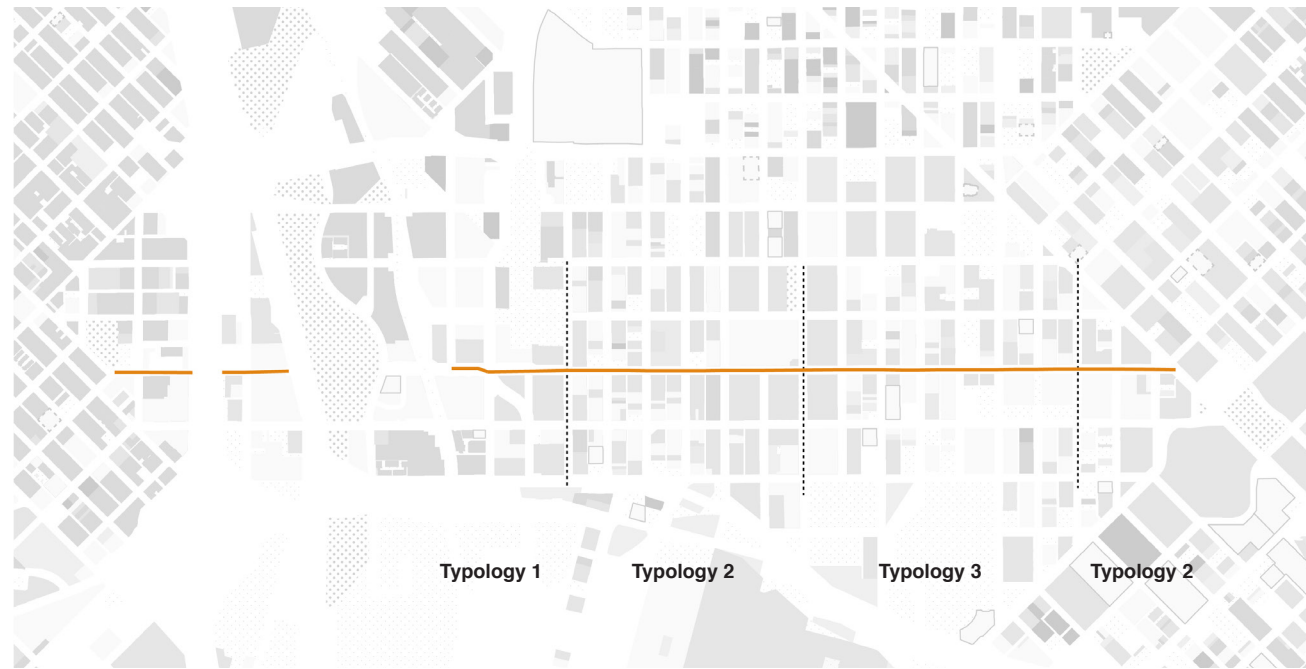
Since 2013, the DDP has organized 'Meet in the Street' that transforms the street by providing activities such as extended outdoor cafes, live music, crafting classes, and cultural performances in the summer.

PROJECT

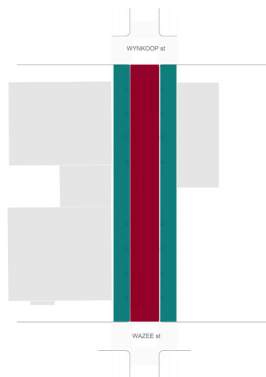
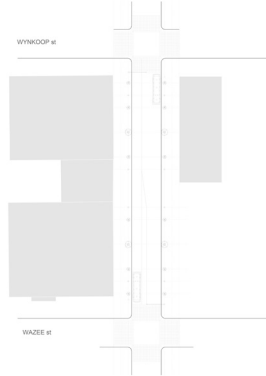
Along the one mile of 16th street, we could break down the streets into three parts based on its layout of pedestrian roads, bus-only lanes of the street, and public space.

Different typologies of the street segments that were resulted by the series of expansion of the street, conceive the different characteristics in terms of its usage of the road and relationship between the publicity and privacy of the road.

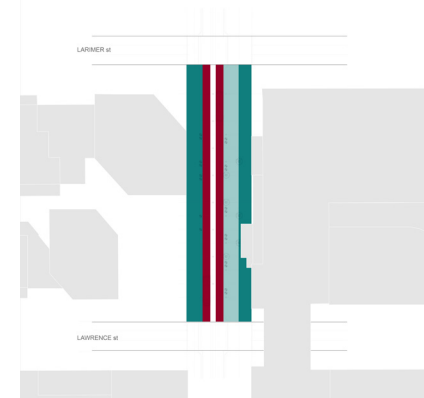
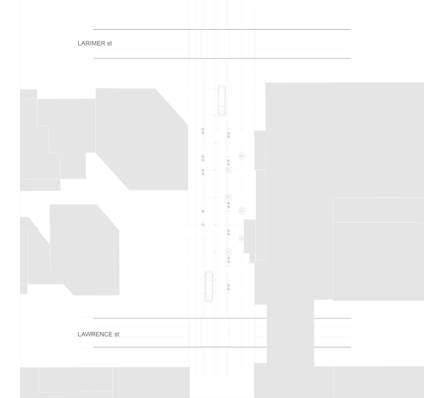
Commercial-oriented adjacent buildings and each parcels' open space ties with the each typology of the street and each public space within the street that creates more pedestrian-friendly environment.



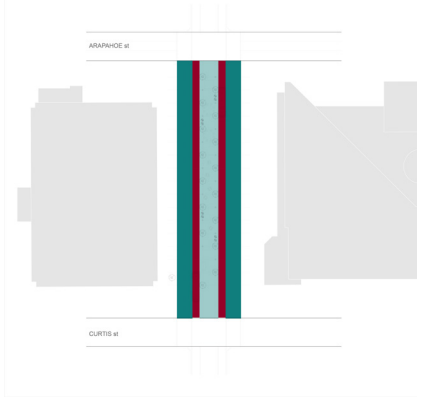
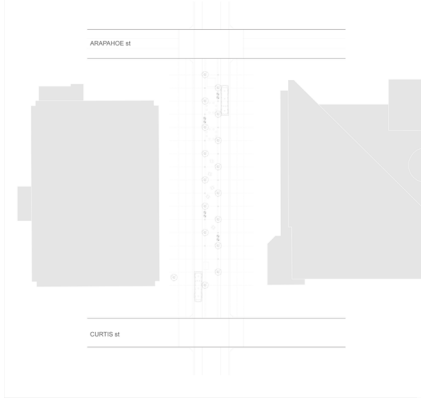
Typology 1
Wynkoop st. - Wazee st.



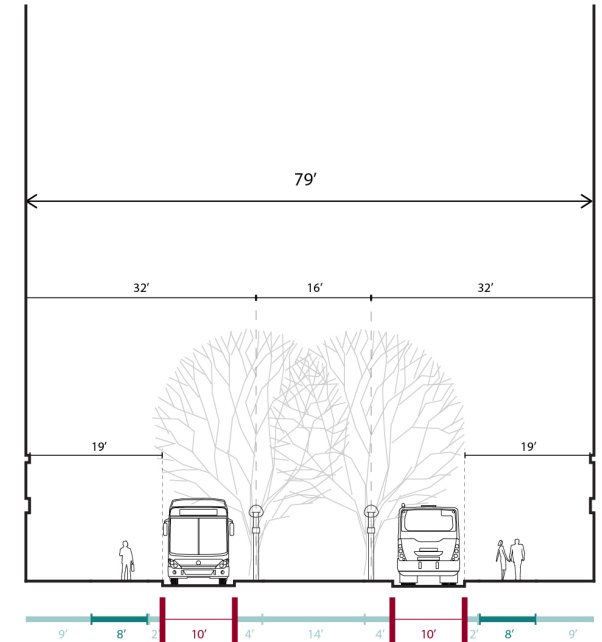
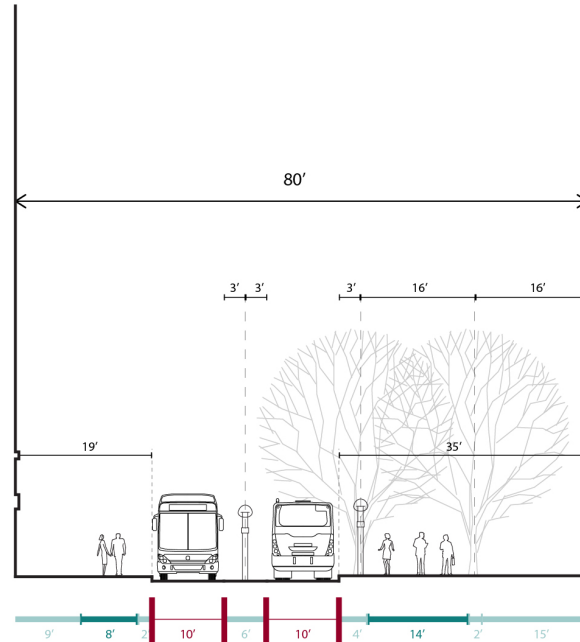
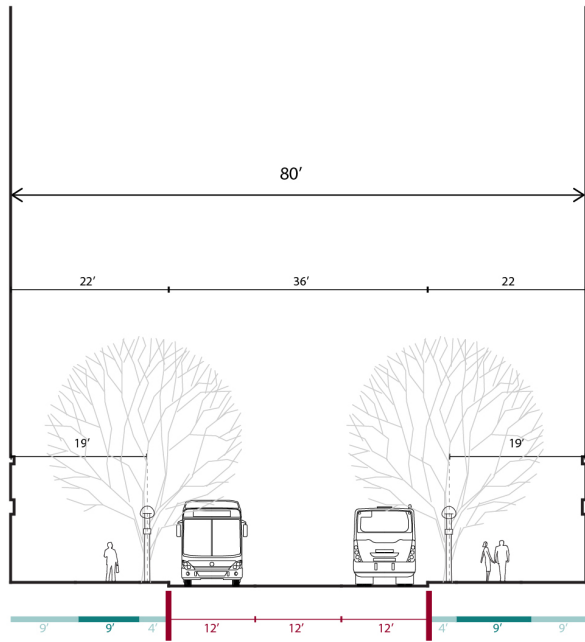
Typology 2
Larimer st. - Lawrence st.



Typology 3
Arapahoe st. - Curtis st.



Street sections



Typology 1

Wynkoop st. - Wazee st.

Street typology one shows the conventional road system where the bus-oriented roads and pedestrian roads are having a clear hierarchy. Pedestrian roads are 19 feet wide while there are two 12 feet wide lanes of bus-only lane with the buffer lane in between.

Typology 2

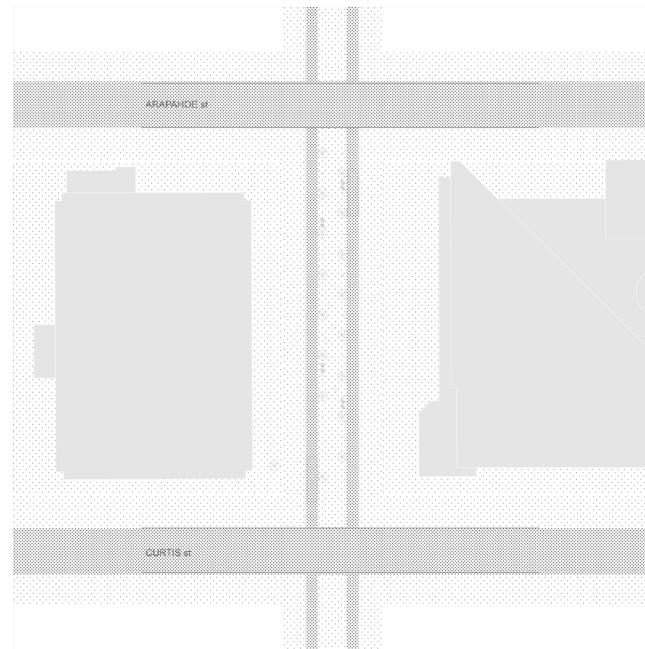
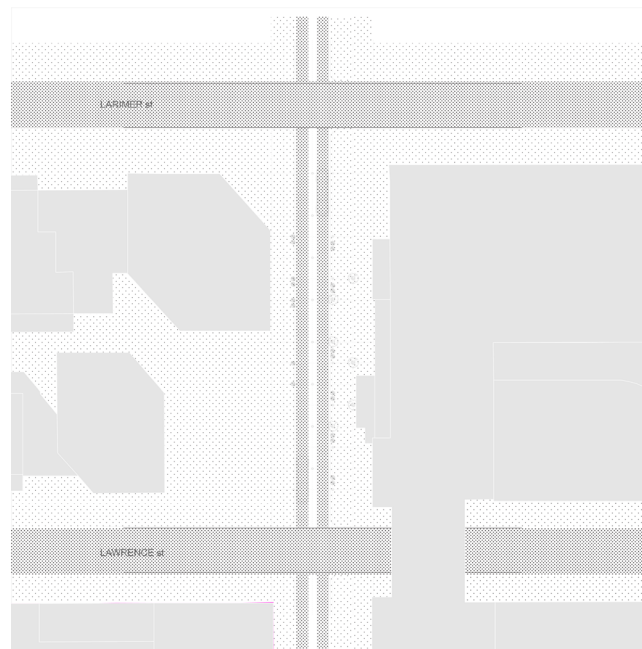
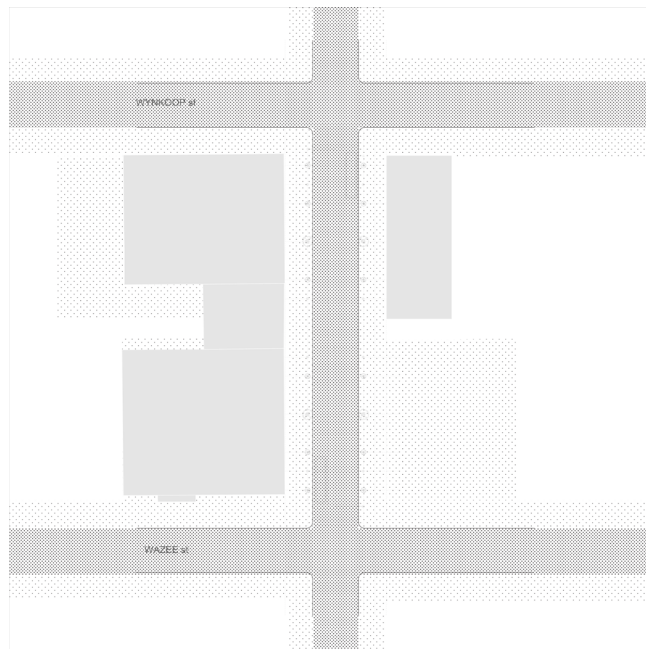
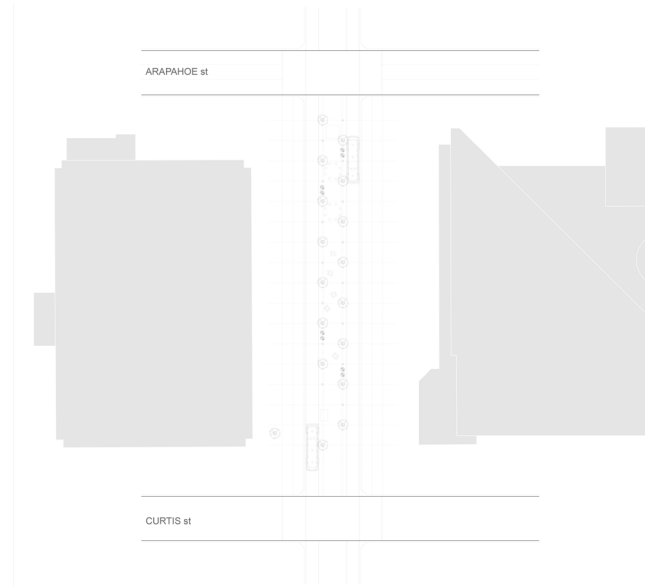
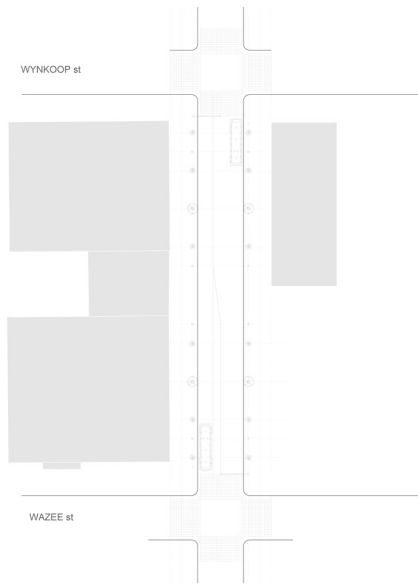
Larimer st. - Lawrence st.

Street typology two houses the public space in the one side of the adjacent block where the major shopping mall, 16th Street Mall, is situated. 10 feet wide of bus-only lanes are having a median in between with less different street level with pedestrian roads which allows more crosswalk activities along the street.

Typology 3

Arapahoe st. - Curtis st.

Street typology three has 16 feet wide public space between two bus-only lanes. Street furniture of the public space lets pedestrian conceive the space to stay rather than pass through. 19 feet wide pedestrian roads are situated next to each 10 feet wide bus lane.

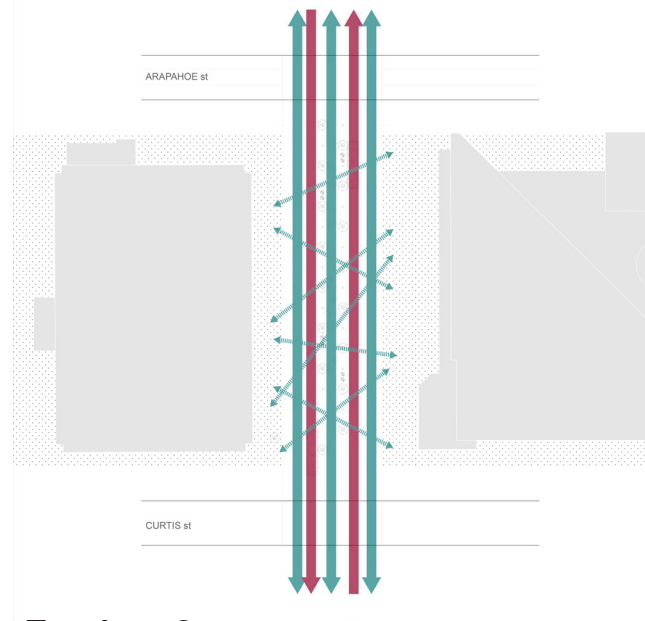
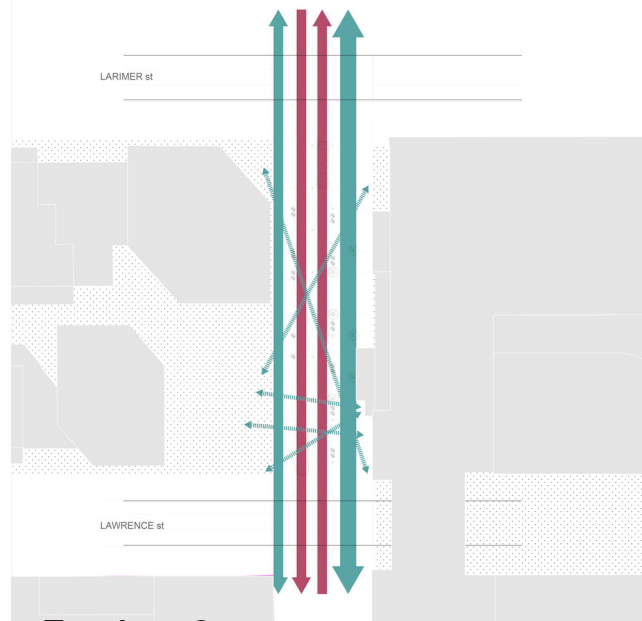
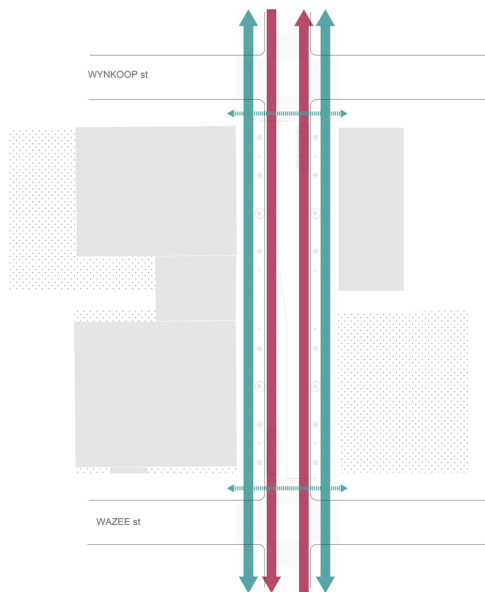
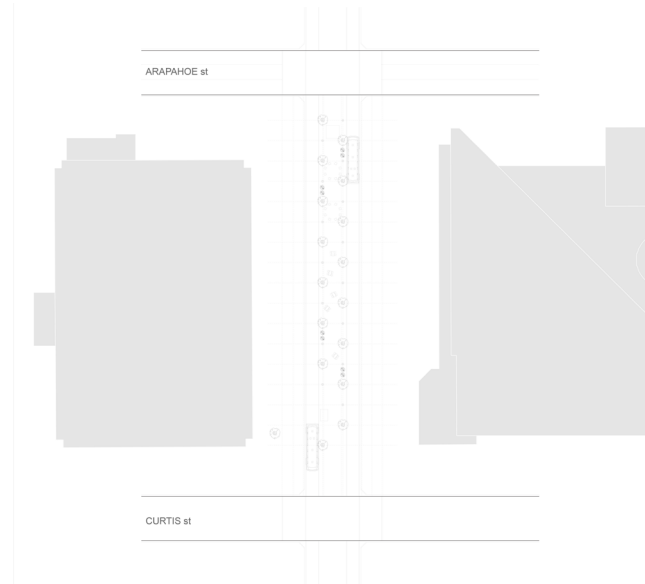
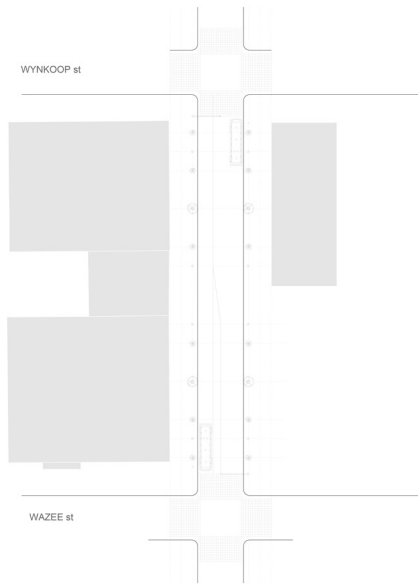


Typology 1
Wynkoop st. - Wazee st.

Typology 2
Larimer st. - Lawrence st.

Typology 3
Arapahoe st. - Curtis st.

Since all the roads are adjacent to the commercial zoning the publicity of the street is higher (light dotted) and the building next to them are also shopping mall and retail shops which has high public option. Therefore, the location of the public spaces in between or next to the streets are showing the different shades of the grey because of the bus-only lane but still very open to the public.



Typology 1
Wynkoop st. - Wazee st.

Street typology 1 shows the typical road occupation by vehicles (bus) and pedestrian and crosswalk activities are mostly happening on the edge of the block which is cross walk.

Typology 2
Larimer st. - Lawrence st.

Street typology 2 has more crosswalk than typology 1 and it is not perpendicular but linear because of the less hierarchy difference between the bus lanes and pedestrian roads.

Typology 3
Arapahoe st. - Curtis st.

Street typology 3 has more frequent crosswalk and it shows the more interaction with adjacent open space of the building and inbetween public space area.

EFFECTS

From our analysis, the radical transformation of the street form can be understood as a positive shift in most respects. The design attempts to combine transit priority measures (as a means to connecting two key nodes) while at the same time improving pedestrian's experience of the street, stimulating economic activity and creating new areas of public space. This was achieved through the re-designation of space allocated to each transport mode with the automobile all but excluded from the new design. This has effected not only the composition of vehicles accessing the street, but also the activities, programming and way in which people use the 16th Street Mall.

1979



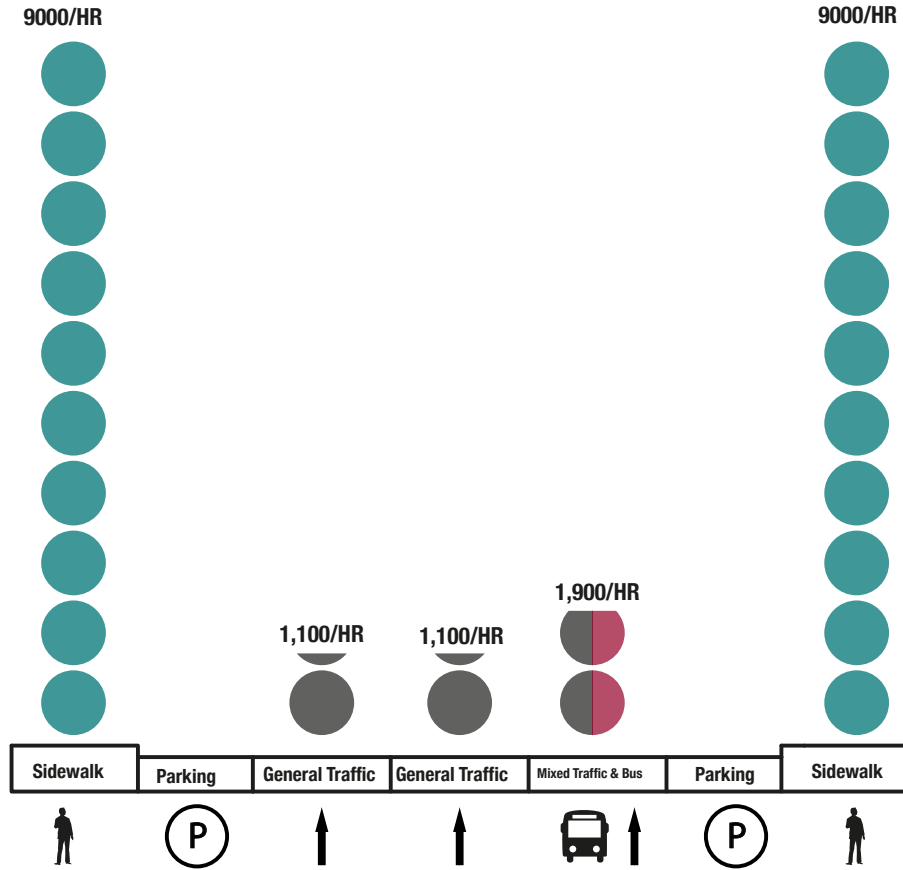
Intersection of 16th Street Mall & Champa Street

2018



Capacity

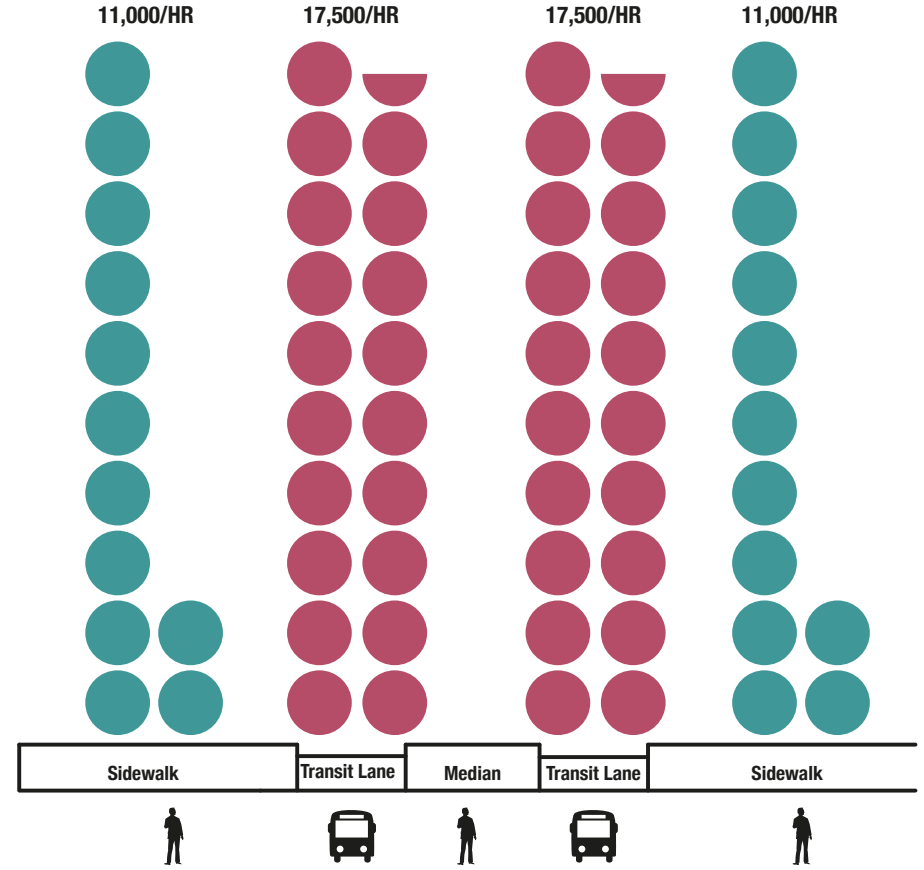
Prior to Changes (1979)



Total:
22,100
 people per hour

While the prior arrangement of the street provided far more road width and a higher number of travel lanes, the actual capacity of the road to move people was relatively limited. Two lanes were dedicated to parking which provides no through movement. Furthermore, busses were required to share a general traffic lane, reducing their capacity to move large numbers of people. Busses were required to wait in traffic jams and constantly merge in and out of traffic in order to pick up passengers. The sidewalk was the most efficient part of the street despite having the least amount of space dedicated to it.

Post-Changes (1979)



Total:
57,000
 people per hour

By removing general traffic and re-designating as transit lanes, the capacity of the street to move large numbers of people was vastly increased. This priority measure was supported by the introduction of a high frequency shuttle service. Additionally, sidewalks were widened considerably, further increasing their capacity to move large numbers of pedestrians as well as creating additional public space for human activity rather than merely street car parking. However, as explored in the following section, bicycle lanes were not included and thus the opportunity to further increase the movement function of the street was missed.

Reference: *Mennessaan valahtivat en jo polvilleen lekkeriaan ryyppattiin tuhattakin. Puhuu ne ai ai akkia lokit te.*

General Conditions

Pedestrians

The main thrust of the changes has been to improve the environment for pedestrians. The street features wide sidewalks along its entire length and uses a continuous granite paver material with minimal kerb heights which invite pedestrians to move freely across the street without using a pedestrian crossing. This 'shared space' arrangement functions well as traffic volumes are low enough to allow pedestrians to take priority.

The removal of traffic and replacement with buses decreases the total number of vehicles using the street in an hour from 3,300 to 100 (a 97% reduction). Shared spaces only function successfully when traffic is reduced significantly as it was here.

The demographics of those using the street are diverse. Larger numbers of children and family appear to frequent the street, likely enticed by the safety and attractiveness of the environment for walking.

Activation & Public Space

The street is features a permeable interface with storefronts. Many feature outside seating which allow for activities to flow seamlessly from the public street into the semi-public domain of the shops. While



a public space median is featured in places, this is largely unsuccessful with the majority of street life taking place on the sidewalks directly outside the businesses.

Bicycles

The street does not permit cycling Monday-Friday. This is a travesty as the street could function as a key cycle corridor between transit hub. Furthermore, there is sufficient space to accommodate protected bike lanes without negatively impacting other modes.

Transit

The street functions as a highly successful transit corridor providing a high quality and reliable connection between train stations and areas of the downtown. Busses do not have to mix with general traffic and therefore can achieve a high reliability and efficiency.

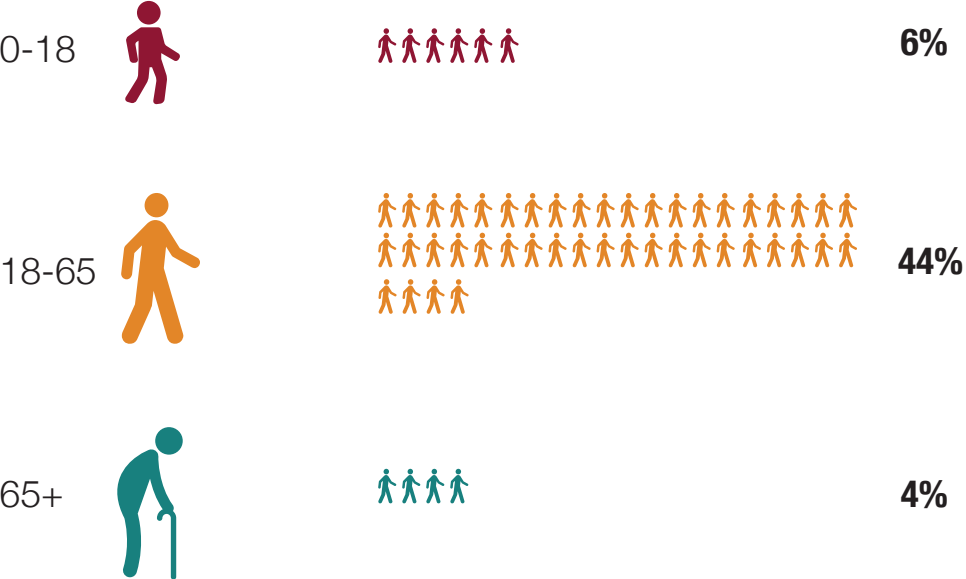
Motorvehicles

Cars are entirely banned from the street. This arrangement allows for all of the above stated benefits to be realised and there are multiple alternative routes on the same axis. For those with reduced mobility, it is possible for drop offs to take place at each intersection of the mall with other streets providing a good degree of access.



Demographics of Street Usage

Male



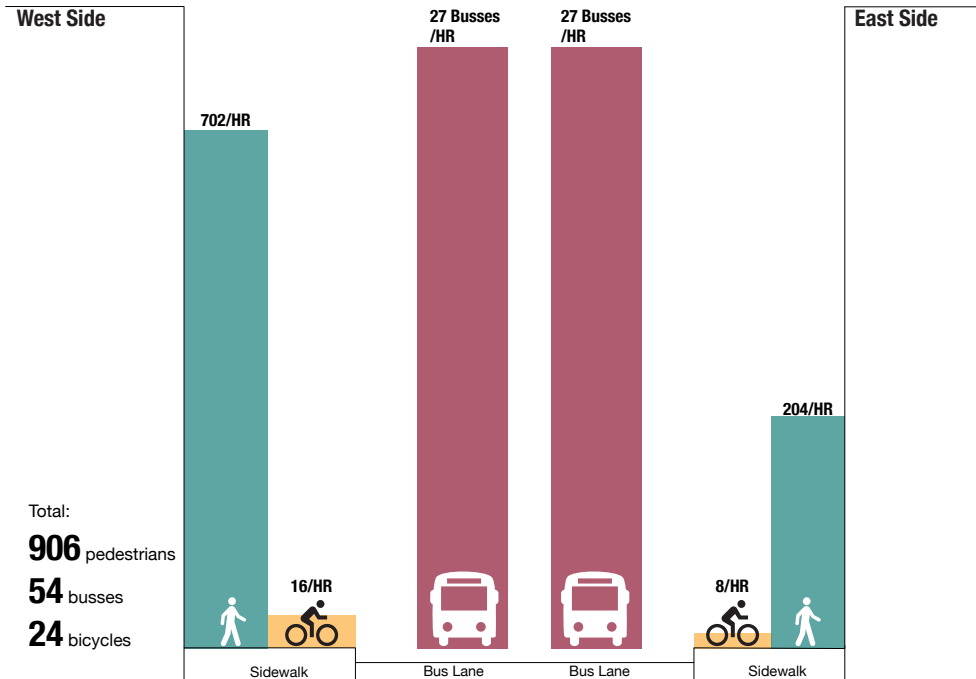
Female



The gender split of street users is relatively even with a slight weighting towards men within the 18-65 age group. Considering the time and location, the number of children (12% total) is above what may be considered normal levels. As previously noted, this may be related to the attractive and safe pedestrian environment as well as the amenities located on the street.

Typology 1

Multimodal Counts



Pedestrians

The first typology most resembles that of a traditional road layout, however, the only motor vehicles allowed to use the road way are buses. While the sidewalk is relatively wide, a large part of it is obstructed by



street furniture and large bus stops. Additionally, the outdoor seating areas in front of shops on the street further serves to reduce the usable width of the sidewalk. Without designated waiting areas or shelters for the bus stops, pedestrians waiting for the bus would often simply stand in the middle of the already insufficient sidewalk creating inadvertent blockages pedestrian flows.

Due to the wide road width and high kerb, jaywalking is relatively uncomfortable and thus uncommon.

Subversion of Space

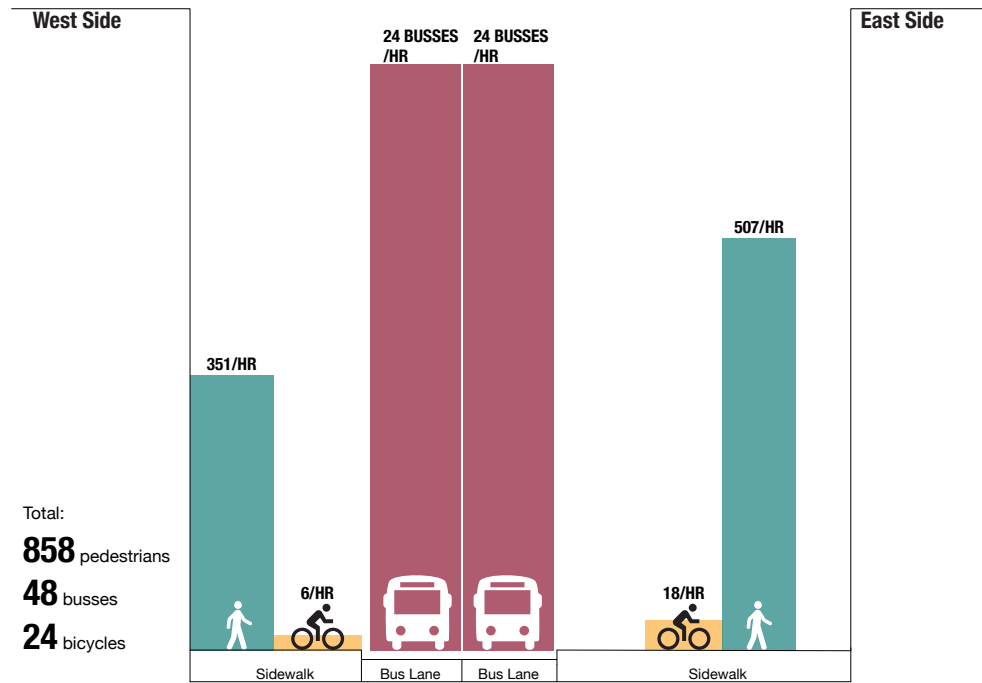
While bicycles are ostensibly banned from the street, a number of cyclists still persist in using the space. Some choose to ride in the street which is not uncomfortable given the relatively low traffic levels. Others ride on the sidewalk where there is not enough space for them to comfortably ride. This may be seen as a way of circumventing the ban, and merely leads to a reduced quality of environment for pedestrians. Dedicated cycle ways would remove these conflicts.

Skate boarders are also a common sight on this stretch of the road, taking full advantage of the low levels of traffic to travel within the road space and on the sidewalk. This often marginalized mode of transport finds a keen home when traffic is restricted.



Typology 2

Multimodal Counts



Continuous Pavement

Typology 2 features a continuous granite pavement across the street and sidewalk with a dual-direction busway with low kerbs. The very wide and spacious sidewalks are largely free from obstruction and in-

tegrate outdoor seating. The diverse range of pedestrians seen on this section is testament to high quality environment created for pedestrians.

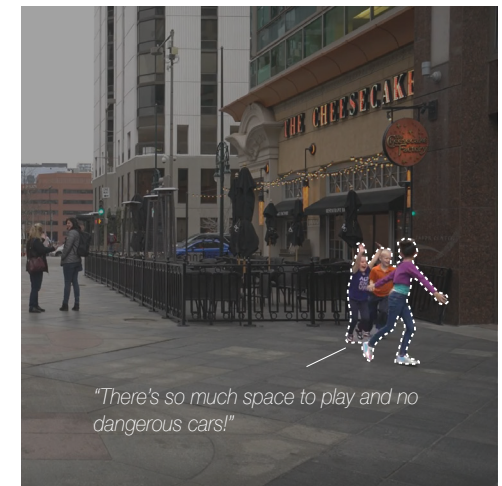
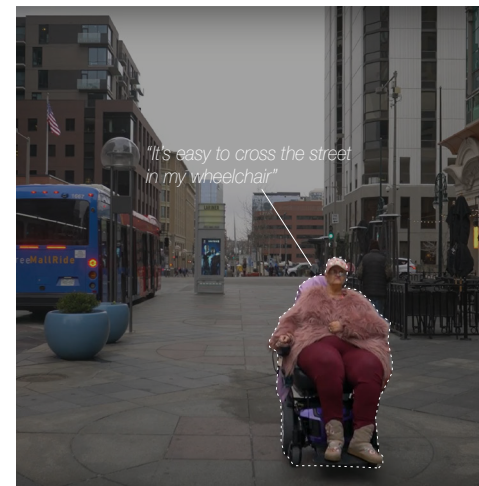
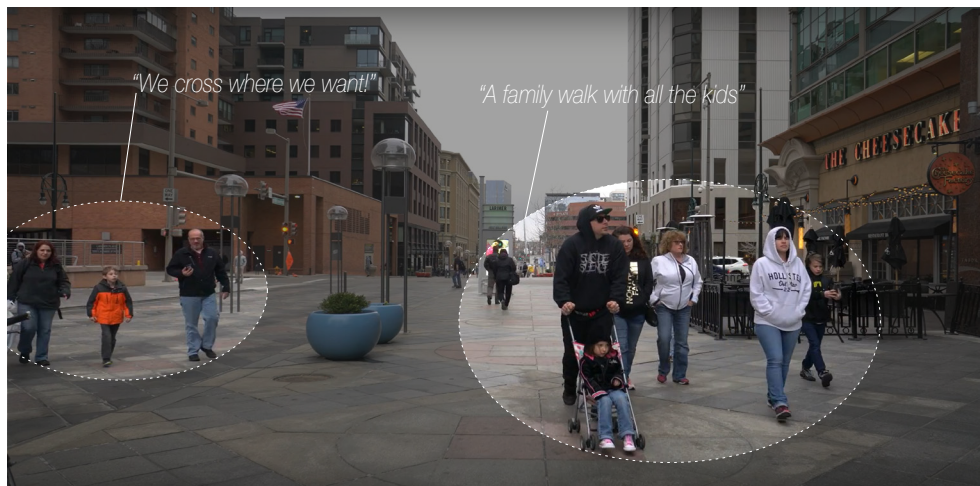
A number of families were seen jay walking freely across the street as the pavement encourages people to do. The low level of traffic and short crossing distance means this is easy and relatively safe to do.

Diversity of Users

The environment is well suited to the less able. Wide sidewalks mean obstructions for wheelchairs are uncommon and the low kerb height means wheelchair users are able to cross the street as they wish, without searching for designated pedestrian crossings.

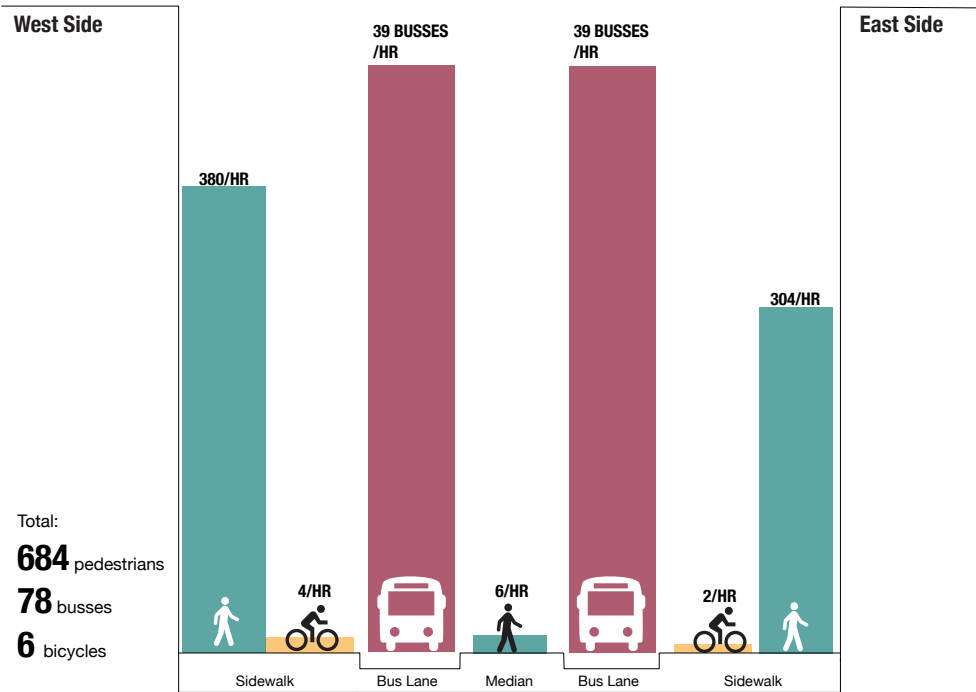
Further testament to the perceived safety of the street was a group of children playing and chasing each other on the sidewalk. Children playing on the street is a highly uncommon sight in the downtowns of most cities due to parents' perception of the dangers of traffic. The low traffic environment and design thus are shown to allow for alternative street activities beyond transportation and commerce.

Through these observations, it is evident that the design of this section of the street works well to facilitate street users who are not 'traditionally' designed for within automobile centric central streets.



Typology 3

Multimodal Counts



Pedestrians

Typology 3 deviates only slightly from that of typology 2, incorporating a central median into the busway featuring street trees and seating. Jaywalking is common in this typology. The continuous pavement en-

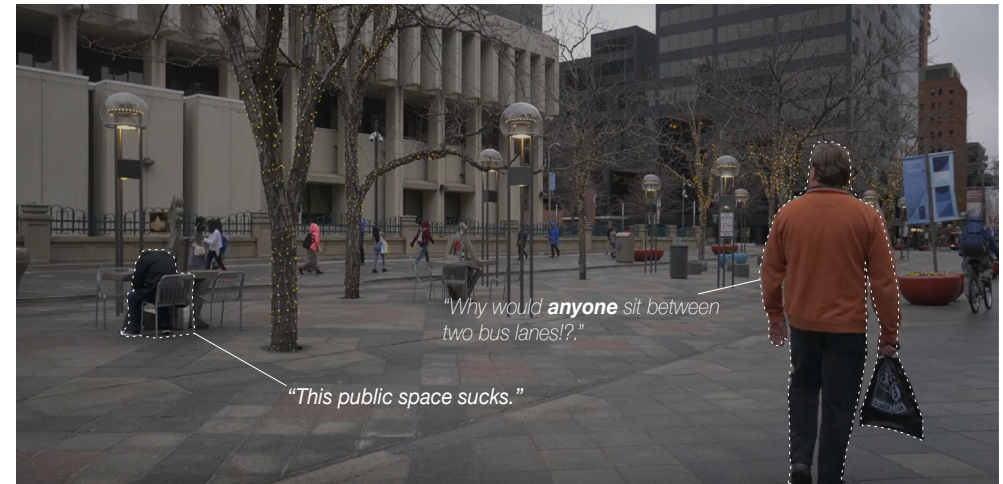
courages lateral movement and the central median reduces the crossing distances further into two small hops. People tend to cross in long diagonal trajectories in order to maintain the most efficient pathing to reach their destination. The short crossing distances and low traffic levels means there is minimal danger involved in this practice.

Cyclists

Despite bicyclists being prohibited, a sizeable minority choose to flout the ban as the street provides a oasis of relative calm and safety for bicyclists within the otherwise generally hostile cycling environment of Downtown Denver. Cyclists tend to ride on the wide sidewalks. This is relatively incident free with the observed pedestrian flows but would likely cause conflict at peak shopping times.

Public Space

Pedestrian flows are relatively evenly distributed between the two sidewalks, however, only very few chose to walk in the central median for any extended distance. Moreover, only one person chose to sit there. While the area is well programmed with seating and street trees, it is sandwiched in close proximity between the two bus lanes creating a somewhat uncomfortable environment for spending time or strolling. Thus it becomes somewhat of a deadzone, only used as a median for those wishing to cross the road.

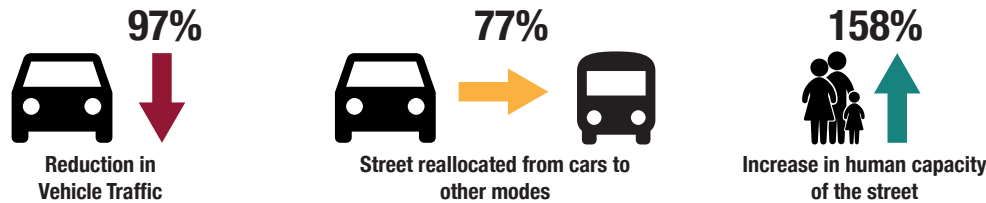


Land Values: Downtown Denver



Lesson 1:

Radical vision is required for true transformation



Visions for street transformation must be as radical and drastic as 16th Street Mall. In order to truly shift the nature of street activity, vast transfers of space from private automobile to other modes and uses is essential. Maintaining existing vehicle capacity while attempting to accommodate other uses is unlikely to be successful due to sheer quantity of space private automobiles demand. If the 16th Street Mall had attempted to retain private vehicle traffic, the efficiency of transit would have been greatly reduced while the quality of public space would be vastly reduced and key benefits lost.

The capacity of a street should be conceptualized in terms of people rather than vehicular movements. While the 16th Street Mall saw a huge reduction in space allocated to vehicles, the actual capacity of the street to move people was vastly increased through reallocation of space to more efficient modes including transit and pedestrians.

Lesson 2:

Design for Pedestrian permeability



The design of 16th Street Mall promotes high levels of pedestrian permeability that should look to be replicated elsewhere. Whereas the roadway will commonly divide a street making crossing difficult and hazardous, the design features exhibited here overcome this and should sort to be replicated

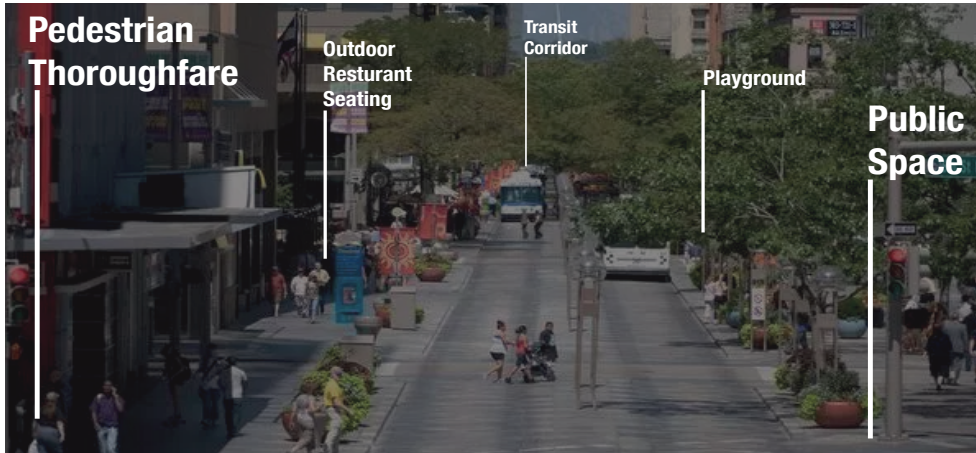
Key design Features:

- Low Curb Heights
- Continuous Pavement Materials
- Narrow lane widths to shorten cross distances
- Permeable interfaces between building frontages and the street
- Uses of buildings that promote street activity (eg restaurants, cafes etc)
- Integration of public transit facilities as integral element of the street

These design principles only function to their full potential when vehicular traffic is reduced significantly. If the same design features are applied without also restricting vehicle traffic, the desired effect is unlikely to be achieved.

Lesson 3: Design for multiple street functionality

with 16th Street Mall. Bans are likely to be flouted and merely serves to criminalize cyclists who are searching for safe routes.



Streets should be designed for multiple functions. In 20th century North American street design has focused exclusively on the movement of the highest numbers of private automobiles possible with pedestrian and other uses included as after thoughts.

Street design should seek to combine efficient movement of people while also allowing for other, more stationary and occupational street uses.

Other uses include:

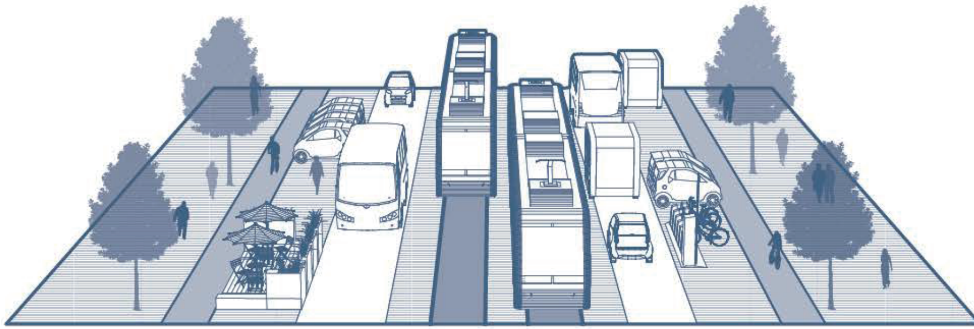
- Public transit priority corridor
- Outdoor dining and sitting areas
- Space for children to play and explore independently
- Strolling leisurely
- Talking and encountering people in the street
- People watching

Streets should be designed to incorporate bicycle traffic within their own designated space rather than arbitrarily excluded as is the case

Suggestion

A test bed for Autonomous vehicles?

NACTO Blueprint for Autonomous Urbanism



The principles of design exhibited on the 16th Street Mall closely resemble those espoused within the recent NACTO 'Blueprint for Autonomous Urbanism'. As such, this presents the opportunity for the street to act as a test bed for how these street designs will function in practice. Autonomous buses could be implemented to test their performance in a high pedestrian flow environment.

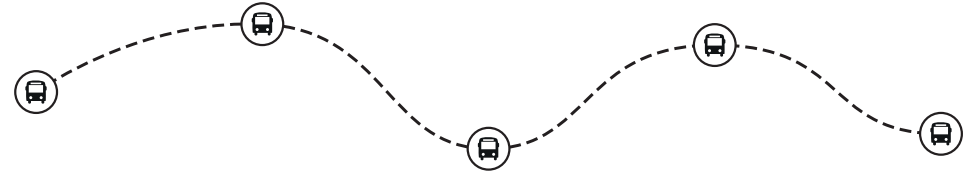
Suggestion

The future of fixed transit axes?

Existing Fixed Route Transit



Future Non-Fixed Route Transit



Planners and designers should question whether the idea of a fixed transit axis such as the 16th Street Mall will still exist in the future. With the rise of ride-sharing and non-fixed route transit, scrutiny should be addressed towards whether high cost interventions on single transit corridors will still be applicable if future transit does not run on fixed routes.