

# Mineral Avenue Corridor Assessment

By Aaron Heumann, PE, PTOE  
City of Littleton Transportation Engineering Manager

April 14, 2017

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## BACKGROUND

Mineral Avenue is the only east-west roadway that both extends through the City of Littleton, a south Denver suburb with a population of approximately 40,000 residents, and provides regional connectivity both west and east of Littleton. In addition, a paved regional trail connection extends along the north side of the corridor, which is a popular commuter and recreational facility for bicycles and pedestrians to access the nearby light rail station and continuous trail network. With residential and commercial land use access attempting to both cross the trail and access the wide six-lane, high-speed, heavily congested roadway, this corridor provides a multitude of conflicting interests.

As a result, the Mineral Avenue corridor is a vital asset to the city from the standpoint of providing vehicular connectivity and bicycle and pedestrian connectivity, as well as for providing access to the adjacent neighborhoods. For these reasons and based on the concerns expressed by the neighboring community, a corridor assessment was completed for the ½ mile segment of Mineral Avenue between Platte Canyon Road and Polo Ridge Drive.

## METHODOLOGY

In addition to improving the corridor, this study was identified as a city pilot project to develop a process by which city staff would work openly and cooperatively with the affected residents. This community engagement strategy utilized a series of community meetings infused at logical strategic steps of the corridor assessment to obtain additional feedback, to clarify and adjust the project goals based on preliminary findings, and to cooperatively identify potential solutions. A project webpage was also created on the city website to document every step of the assessment study and provide a source of reference for impacted and interested residents to review progress, ask question and provide input throughout the project.

The result of the study was the development of an implementation strategy that included phases of modifications to the corridor based on available funding and anticipated effectiveness of solutions, requiring agreement between city staff and residents.

## STUDY PROCESS

The first community meeting was held at the outset of the project in order to explain the purpose of the project to the residents, allow residents an opportunity to freely identify any and all issues and concerns within the corridor, and to establish a collaborative mission, goals and users of the corridor. The following ideals and principles were agreed upon by city staff and residents for consideration throughout the study and to be addressed by the ultimate recommendations and implementation strategy developed as a result of the project.

***Mission:*** provide a safe environment for all users of the Mineral Avenue corridor between Platte Canyon Road and Polo Ridge Drive.

- **Primary Goal:** evaluate the current level of safety and operations in order to improve the efficiency and safety for all users of the corridor.
- **Secondary Goal:** provide accessibility for the adjacent City of Littleton neighborhoods, while accommodating efficient flow for all users through the corridor.
- **Users:** pedestrians, bicyclists, transit operators, cars and service vehicles.

The portion of the Littleton community engaged to be involved in this study included the neighborhoods identified on the exhibit on the next page.

- Meadowbrook
- Polo Reserve – Polo Ridge Farms
- Polo Reserve – The Sanctuary
- Overlook at Platte Valley
- Pinnacle at Mountain Gate
- The Overlook Plateau
- Outlook (The Meadows at Platte Valley)
- Corridor Study Limits



These residents were solicited to identify the issues and concerns within the corridor, which included such topics as preventing cut-through traffic and U-turns at dangerous locations, reducing excessive speeding and queuing through intersections, and providing better sight lines and safer left turn movements. The appropriate information gathering to be obtained for addressing the objectives of the study was conjointly identified, prior to being obtained by the city. The extensive data collection effort for the corridor included:

- Past studies in the area.
- Documentation of the physical environment and constraints.
- Surrounding land use and proximal planning and development proposals.
- Two consecutive weeks of hourly vehicular volumes at multiple locations.
- Intersection turning movement and pedestrian/bicycle volumes during the morning and evening peak periods.
- Vehicle speeds at several locations and via a variety of means.
- Vehicle intersection delays and queuing for main street and side street left turn movements.
- The corridor accident history over the past 5½ years.
- The enforcement history by the local police of any moving violations over the previous 5½ year period.
- Transit and school bus daily activity.

The data was summarized and evaluated by city staff to conduct a full issues assessment based on the four primary concerns expressed by residents at the first community meeting. The main issues to be addressed according to the residents included:

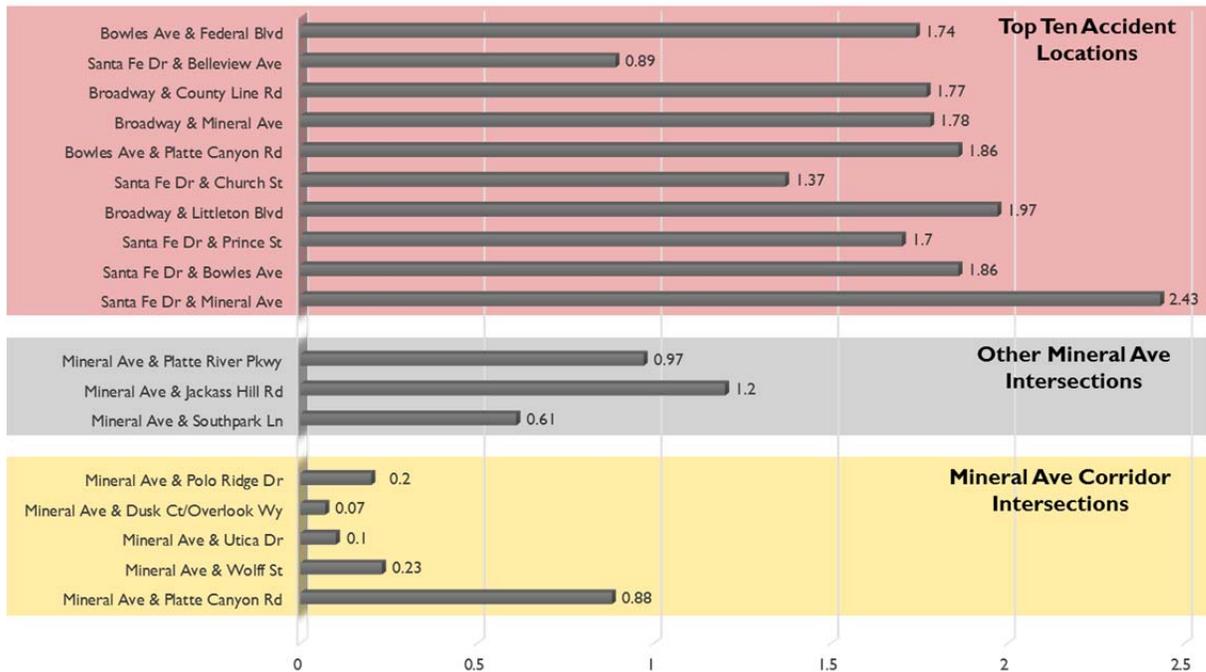
1. **Volume:** growing commuter traffic along Mineral Avenue and related to recent commercial development.
2. **Accidents:** growing number of accidents and severity of accidents along the corridor.
3. **Speed:** traffic travelling too fast creating unsafe conditions.
4. **Delay:** the growing Mineral Avenue volume making the ability to safely and timely make left turn movements into and out of the neighborhoods extremely difficult.

The assessment findings were presented to the residents at the second public meeting, including:

1. **Volume Concerns** – Based on historical daily traffic counts the commuter traffic on Mineral Avenue actually has remained relatively constant over the past five plus years. The feared significant increase in traffic as a result of the addition of the commercial development along

the corridor should not be of concern as turn movement counts showed substantially fewer trips to the area than anticipated.

- Accident Concerns** – The data history collected revealed the amount of accidents had remained relatively consistently low over the past five years. Furthermore, the severity of accidents did not appear to be of concern, as the accident history did not suggest any outlandish reporting of injuries or fatal accidents within the study area over the previous five plus years. Compared to other locations throughout the expanded area and city, the accident rates within the study area were considered extremely low. The exhibit below charts the relationship of accident rates (accidents per million vehicle miles per year) for the intersections within the study area (in yellow) with other locations along Mineral Avenue (in grey) and the highest accident locations in the city (in red).



- Speed Concerns** – In order to adequately and fully evaluate the speeds along Mineral Avenue, four methods of data collection were utilized, including: two weeks of tube counts, one day through the police speed trailer, several days of checks with the spot radar gun, several days of drive along observations. Consistently the results of the data collected reported reasonable vehicle speeds, with a vast majority of traffic travelling under 50 mph. This is not an uncommon finding for speeds along a corridor signed for 45 mph. Combined with the accident data reported previously in this study, the current corridor conditions were considered reasonably safe.
- Delay Concerns** – A comparison was conducted between the demand to move vehicles along Mineral Avenue and the number of vehicles accessing the side streets, as well as the actual delay of vehicles attempting to turn left onto and off of Mineral Avenue within the study area. The findings from this analysis demonstrated that the vast majority of the vehicles travelling in the corridor during the peak hours were through vehicles along Mineral Avenue and only a few (3% morning and 1% evening) were side street left turn movements. Meanwhile, only a few (2%) of the vehicles turning left along the Mineral Avenue corridor experienced delays typically considered unacceptable during peak hour conditions.

Despite the assessment findings that the problems along the corridor were perceived to be worse than the data indicated, the city recognized the need to address the general safety concerns of the residents and the inconsistency of the corridor within the study area compared to the roadway

segments immediately to the east and west. As a result, the second public meeting also utilized the data information and assessment to facilitate a full spectrum discussion of potential solutions with the residents, including such possibilities as alternative access locations, road diet techniques and raised crosswalks. The comprehensive list of suggestions by the residents were further evaluated by city staff and refined to distinguish practical solutions from non-viable proposals in order to develop a list of recommended improvements to the corridor.

The solutions considered viable were then further classified as improvements to one of three groupings:

1. **Mineral Avenue Modifications** – improvements directly to Mineral Avenue to address safety and accessibility, while considering the implications to roadway capacity, operations, vehicle conflicts and vehicle speeds.
2. **Platte Canyon Road Intersection Movements** – improvements to intersections along Platte Canyon Road, which runs perpendicular to Mineral Avenue but is accessible from the neighborhoods north and south of Mineral Avenue, in order to alleviate the traffic demands along the Mineral Avenue corridor. These changes also took into consideration implications to roadway capacity and operations, but also pedestrian crossings.
3. **Side Street Approach Improvements** – provisional revisions in the near term for more immediate impacts, as well as ultimate long term alterations to the neighborhood unsignalized roadway approaches to Mineral Avenue, focused on improving the safety of interactions between the neighborhood access vehicle conflict with pedestrian and bicycle trail users.

At the third and final public meeting, an implementation strategy was presented to the residents that clarified solutions that were deemed viable and identified a phasing plan based on cost estimates produced for the various improvements to the Mineral Avenue roadway, Platte Canyon Road intersections and the neighborhood access approaches to Mineral Avenue. The residents were encouraged to share their reactions to the plan and provide feedback regarding prioritizing improvements for the near term application and long-term implementation.

The results of the study findings were presented to City Council for approval of the implementation strategy and near term funding requirements. In addition, the successful experience of the community engagement process was also shared for application to future city projects.

## **IMPLEMENTATION STRATEGY**

The Mineral Avenue project plan was developed in collaboration with and with concurrence from the concerned and impacted residents adjacent to and with access to the corridor. The implementation strategy was comprised by identifying the viable recommended improvements, determining the expected costs associated to each component, and assigning the work to a phasing plan to accommodate the immediate implementation of some low cost but effective modifications until funding can be obtained for the higher cost long term alterations.

### Recommended Improvements

The first aspect of the implementation strategy required identification of feasible solutions for further development and dismissal of non-viable solutions. Some of the solutions determined to be non-viable included:

- The addition of a traffic signal within the corridor, which was not warranted and would likely increase the number and severity of accidents at the intersection.
- The use of a pedestrian signal to allow side street vehicles access to Mineral Avenue at certain times of the day, which was not the intent of the traffic control device.
- The addition of center left turn acceleration lanes in the center median, which would result in utility conflicts and a change in the character of the boulevard with minimal benefit.

- The reduction of the median noses to accommodate larger radius turns and quicker acceleration from the side streets onto Mineral Avenue, which was found to have constructability issues while degrading the integrity of the roadway.
- Providing a new access for the Meadowbrook neighborhood to Platte Canyon Road, which was not supported by the majority of the residents and found to be cost prohibitive due to grade differences and drainage issues.

With the remaining suggested improvements considered viable, a list of recommended modifications was fashioned and divided into three groupings.

1. **Mineral Avenue Modifications** – a variety of improvements were identified for the segment of Mineral Avenue between Platte Canyon Road and Polo Ridge Drive including:
  - Right turn acceleration/deceleration lane – convert the outside third lane for both eastbound and westbound Mineral Avenue from a ½ mile long through lane into a right turn lane to separate movements.
  - Narrowed lanes – reduce the Mineral Avenue eastbound and westbound lane widths to slow traffic and accommodate repurposing roadway width.
  - Widened center median – utilize the additional width from narrowing the lanes to increase the width of the Mineral Avenue center median by use of striping and delineators to accommodate two-stage left turn movements.
  - Reduced speed limit – along with the reduction from six through lanes to four through lanes, reduce the speed limit from 45 mph to 40 mph, which matches the segment of Mineral Avenue immediately to the west.
  - Specific U-turn locations – restrict U-turns at the commercial access and instead encourage U-turns to be made at the less active T-intersection one block to the east.
  - Deter vehicle queues from blocking intersections – the westbound Mineral Avenue queue of vehicles from the traffic signal at Platte Canyon Road often extend back through the intersection to the east during the afternoon peak hour, which could be deterred by “DO NOT BLOCK INTERSECTION” signs.
2. **Platte Canyon Road Movements** – improvements were identified for both the Mineral Avenue and Mineral Drive intersections along Platte Canyon Road in order to alleviate the traffic demands along the Mineral Avenue corridor, including:
  - Improvements to the Mineral Avenue intersection involving striping dual northbound and southbound left turn lanes, modifying the traffic signal by providing the appropriate turn signal indications and pedestrian indications, and a channelized northbound right turn lane.
  - Improvements to the Mineral Drive intersection comprised of striping and median modifications to allow all turn movements to the currently right-in/right-out only access.
3. **Side Street Improvements** – due to the uncertainty of funding but obvious need for improvements to the north side street approaches from the neighborhoods to Mineral Avenue at Wolff Street, Dusk Court and Polo Ridge Drive, both provisional (near term and more immediate) revisions and ultimate (long term) alterations were identified, including:
  - Provisional Revisions – low cost provisional revisions until the ultimate alterations can be funded and implemented.
    - Crosswalk striping – the addition of crosswalks both along the north side crossings of Mineral Avenue associated with the regional trail, but also for the south side crossings for safer pedestrian movements.
    - Trail signage – work with South Suburban Parks and Recreation to develop appropriate “Burma Shave” style of a series of signage along the trail in advance of the crossings along Mineral Avenue to make bicyclists aware of the

- approaching potential conflicts with vehicles.
- Blank out signs at Polo Ridge Drive pedestrian signal – the addition of a “NO LEFT TURN” blank out sign facing southbound left turning traffic and a “NO RIGHT TURN” blank out sign facing northbound right turning traffic on Polo Ridge Drive to prevent illegal turns during the pedestrian phase of the adjacent east side signal.
- Ultimate Alterations – long term more impactful improvements.
  - Curb extensions – narrowing the cross streets along the north side of Mineral Avenue by extending the curb will reduce the crossing distance for trail users.
  - Raised crosswalk – the addition of a pedestrian table for the crossing, set back from Mineral Avenue, will raise trail users up for added visibility and priority, while allowing vehicles to stop prior to the crosswalk and again after, before accessing Mineral Avenue.
  - Additional landscaping – in diverting the trail to the new set back crossing locations, landscaping will be necessary between the trail and the roadway to prevent trail users from bypassing the crossing.

### Phasing Plan

A three phase implementation strategy was identified for installing the improvements related to the Mineral Avenue corridor both immediately and long term.

**Phase 1** – The timing of the improvements associated with the first phase of implementation was envisioned to be and was installed in the fall of 2016. These lower cost items that were more easily implemented included:

- The side street provisional revisions previously identified including crosswalks, trail signage and blank out signs;
- Mineral Avenue lane reassignments including restriping to create right turn acceleration and deceleration lanes; narrower through lanes and a wider center refuge area to accommodate staged left turn movements; and signage for the right turn lanes, reduced speed limits, restricted U-turns, and queuing through intersection.

**Phase 2** – The only improvement included in this phase are the improvements to the Platte Canyon Road and Mineral Avenue intersection, which are anticipated to be included in the 2017 budget as capital improvement projects to occur in the summer of 2017. The proposed modifications to this intersection include:

- The restriping of the northbound and southbound approaches along Platte Canyon Road to allow dual left turn lanes, which would then be accompanied with the appropriate lane utilization signs and signal indications and equipment.
- The addition of a channelization island in the southeast corner to separate the northbound to eastbound right turn movement from the signal operations, requiring a new pedestal pole for relocated pedestrian indications and push buttons for a shorter crosswalk across the south leg of the intersection.

**Phase 3** – Due to the anticipated added expense of this work, the final improvements are not expected to occur until funding assistance can be identified. The final improvements consist of:

- The modifications to the Platte Canyon Road and Mineral Drive intersection to change the access from a right-in/right-out to also allow the southbound left in and westbound left out movements, which will require median work, striping and signage.

- The side street ultimate alterations for the southbound approaches from the neighborhood accesses to Mineral Avenue in the form of raised crosswalks, curb extensions and landscaping.

### Cost Estimates

A detailed preliminary cost estimate was developed for each of the recommended roadway improvements included in all three implementation phases. The following table summarizes the costs associated with the various modifications.

Phase	Project	Improvement	Cost
1A	Side Street Provisional Revisions	<ul style="list-style-type: none"> <li>• Crosswalk striping</li> <li>• Trail signage</li> <li>• Blank out signs on Polo Ridge Drive pedestrian signal</li> </ul>	\$11,000
1B	Mineral Avenue Lane Reassignment	<ul style="list-style-type: none"> <li>• Right turn acceleration/deceleration lane</li> <li>• Lane width narrowing</li> <li>• Center median widening</li> <li>• Speed limit change</li> <li>• Specific U-turn locations</li> <li>• Deter vehicle queues from blocking intersection</li> </ul>	\$35,000
2A	Platte Canyon Road/Mineral Avenue Intersection	<ul style="list-style-type: none"> <li>• Dual northbound and southbound left turn lanes</li> <li>• Traffic signal modifications</li> <li>• Channelized northbound right turn lane</li> </ul>	\$92,000
3A	Platte Canyon Road/Mineral Drive Intersection	<ul style="list-style-type: none"> <li>• Full movement access</li> </ul>	\$107,000
3B	Side Street Ultimate Alterations	<ul style="list-style-type: none"> <li>• Curb extensions</li> <li>• Raised crosswalks</li> <li>• Additional landscaping</li> </ul>	\$246,000
<b>Total</b>			<b>\$491,000</b>

### **PHASE 1 AFTER CONDITIONS**

To date, phase 1 of the implementation strategy has been completed with great satisfaction by the adjacent neighborhoods. The first phase was intended to identify low cost, immediate solutions that could facilitate a safer environment for all users of the corridor until funding could be obtained to implement additional more expensive reconstruction solutions. A variety of improvements were identified and implemented as part of phase 1.

These low cost modifications as part of the immediate implementation phase already have helped create a safer environment. While the change of the outside through lanes to right turn lanes would appear to reduce the capacity of the roadway section, because these third through lanes are essentially ½ mile auxiliary lanes, there has been minimal change in capacity. The modifications have improved the operations by separating movements along Mineral Avenue with the addition of the exclusive right turn lanes, through widening the center median for two-stage left turn movements, and by shifting the U-turns away from more congested intersections. The improvements have reduced the potential for vehicular conflicts by eliminating the outside through lanes and allowing two-stage left turn movements. Furthermore, vehicle speeds appear to be more manageable not only due to the reduced speed limit but from the perception by drivers as a result of the narrowed lanes.

Information gathering was conducted approximately 6 months after the implementation of the phase 1 improvements to evaluate the impact of the modifications on the corridor roadway operations. The after data collection comparison showed:

- **Roadway Volumes** – after condition counts were conducted at two locations along the corridor. The data showed a slight increase in the daily volumes along Mineral Avenue within the corridor compared to the before condition counts conducted one year prior.
- **Intersection Turn Movements** – after condition volumes were collected both at the main signalized intersection within the study corridor and at the commercial access expressed as a concern by the residents. The turn movements collected indicated a slight growth in volumes compared to the before counts.
- **Speeds** – after condition data was obtained for two locations within the corridor and compared to the speeds obtained prior to any of the roadway improvements. The results of the speed data comparison indicated slightly slower speeds in general within the corridor.
- **Delays** – the left turn movements in and out of the neighborhoods at one of the corridor unsignalized intersections were observed to compare the after conditions with the data obtained prior to any roadway improvements. The results indicated comparable delays for vehicles before the improvements to after.
- **Accidents** – the number of accidents within the study corridor over the 6 months since the phase 1 improvements were implemented was compared to the historical accident data previously reviewed as part of the study. The comparison showed that both the corridor as a whole and the individual intersections have reported a lower occurrence of accidents, with a lower incident of injury accidents.

Citizen input received since the phase 1 improvements were implemented has included all positive feedback from residents of all the neighborhoods involved in the project. Residents have specifically pointed out the following approvals of the modifications to date:

- The relocation of the U-turns away from the commercial access has improved operations at that location.
- The narrowing of lanes, introduction of the right turn acceleration/deceleration lanes and lowering of the speed limit has reduced speeds and made turning at the neighborhood accesses less stressful.
- The two-stage left turn movements have provided an alternative for those comfortable using the option to decrease delays.
- In general the corridor is less intimidating to access from the neighborhoods.

## CONCLUSIONS

The corridor appears to be functioning safer for bicyclists and pedestrians, has provided more alternatives for side street access to the corridor, and created safer turn movements from the corridor onto side streets, all the while with minimal impact to vehicle operations for the tens of thousands of commuters utilizing the corridor. City staff continues to move forward with phases 2 and 3 of the implementation strategy, which includes working with the local DOT to design modifications on an adjacent state highway that will further alleviate congestion and conflicts along the Mineral Avenue corridor, and instituting setback and raised crossings of the side streets to further enhance the regional trail connection, to benefit bicyclists and pedestrians, and to create safer vehicle-pedestrian and vehicle-vehicle interactions.

This project has demonstrated the benefits of good communication by interacting directly and often with the affected community and involving residents in the decision making process. The study has also shown that safety can be addressed while minimizing impacts to operations and congestion.