To access the Agenda and Backup Materials electronically, go to www.gjcity.org

PLANNING COMMISSION WORKSHOP AGENDA
HUMAN RESOURCES TRAINING ROOM
CITY HALL, 250 N 5TH STREET
THURSDAY, JUNE 8, 2023 - 12:00 PM

Attend virtually: bit.ly/GJPCW

Call to Order - 12:00 PM

Other Business

1. Transportation Engineering Design Standards (TEDS) Update

Adjournment

Grand Junction Planning Commission

Workshop Session

Item #1.

Meeting Date: June 8, 2023

Presented By: Rick Dorris, Trenton Prall, Public Works Director

Department: Community Development

Submitted By: David Thornton, Principal Planner

Information

SUBJECT:

Transportation Engineering Design Standards (TEDS) Update

RECOMMENDATION:

EXECUTIVE SUMMARY:

In July of 2022, the City hired Fehr and Peers to work on updating the City's Transportation Engineering Design Standards (TEDS) manual. This effort has occurred alongside the City's work with Fehr and Peers on the Pedestrian and Bicycle Plan and will incorporate changes reflecting community values for multimodal transportation and support implementation of the adopted Pedestrian and Bicycle Plan.

BACKGROUND OR DETAILED INFORMATION:

The Transportation and Engineering Design Standards (TEDS) Manual establishes requirements and provides guidance to the city and developers on how streets and multimodal transportation infrastructure are to be designed within Grand Junction. It includes guidance and requirements for preparing transportation impact statements (TIS), street design standards, access control, traffic signal design, street lighting, pavement, and pedestrian, bicycle, and transit facility design standards.

The TEDS Manual has not had a major update for almost 20 years ago. Some aspects of the Manual are out of date and not reflective of current community values or current design practices being applied within the city.

The TEDS Manual is being updated to incorporate the following general improvements:

- Reflect current community values for multimodal transportation (including for pedestrians, bicyclists, and transit users).
- Incorporate current state and national design standards.

- Improve the usability of the manual.
- Support implementation of the vision established in the recently adopted Pedestrian & Bicycle Plan.

SUGGESTED MOTION:

For Discussion Only

Attachments

1. TEDS_Manual_Update_Summary_Sheet
2. 20230531_Street-Sections
3. 29.01 Introduction 2023 2nd Draft Public
4. 29.04 Street Classification and Standards 2023 2nd Draft Public
5. 29.08 Transportation Impact Studies 2023 2nd Draft Public
6. 29.12 Access Management 2023 2nd Draft Public
7. 29.16 Access Design and Site Circulation 2nd Draft Public
8. 29.20 Local and Minor Collector Streets 2023 2nd Draft Public
9. 29.44 Traffic Signals and Construction Zones 2023 2nd Draft Public
10. 29.48 Transit Bicycle and Pedestrian Facilities 2023 2nd Draft Public
11. 29.64 Design Exceptions 2023 2nd Draft Public
12. 29.68 Alternate Street Standards 2023 2nd Draft Public
13. 29.28 Arterial and Collector Geometric Design 2023 2nd Draft Public
14. 29.32 Pavement and Truck Routes 2023 2nd Draft Public
15. 29.36 Street Lighting Utilities and Mailboxes 2023 2nd Draft Public
16. 29.40 Striping and Signing 2023 2nd Draft Public
17. TEDS SIG STNDRDS 2023
18. City of GJ Traffic Signal Specifications May 2023 Update

TEDS Manual Update

Informational Sheet

May 24, 2023

1. What is the TEDS Manual?

The TEDS (Transportation and Engineering Design Standards) Manual establishes requirements and provides guidance to the city and developers on how streets and multimodal transportation infrastructure are to be designed within Grand Junction. It includes guidance and requirements for preparing transportation impact statements (TIS), street design standards, access control, traffic signal design, street lighting, pavement, and pedestrian, bicycle, and transit facility design standards.

2. Why is the TEDS Manual Being Updated?

The TEDS Manual has not had a major update for almost 20 years ago. Some aspects of the Manual are out of date and not reflective of current community values or current design practices being applied within the city.

The TEDS Manual is being updated to incorporate the following general improvements:

- Reflect current community values for multimodal transportation (including for pedestrians, bicyclists, and transit users).
- Incorporate current state and national design standards.
- Improve the usability of the manual.
- Support implementation of the vision established in the recently adopted Pedestrian & Bicycle Plan.

3. What is the Process for Updating the TEDS Manual?

The project team kicked-off in late summer of 2022 and is aiming to finalize updates to TEDS in late summer 2023. The project is being guided by a Technical Advisory Committee (TAC), which has met four times over the course of the project at key milestones. The TAC is made up of representatives of different city departments, CDOT, Mesa County, the RTPO, neighboring jurisdictions, private developers, and transportation engineering consultants in the Valley that regularly use the TEDS Manual.

The process for updating the TEDS Manual has involved two major phases:

1) **TEDS Manual Assessment:** In fall of 2022 the team conducted a thorough assessment of the existing TEDS Manual to identify all the updates that are needed to achieve the project goals mentioned above. This included guidance from the TAC, and a survey that was sent to stakeholder agencies,

departments, and the broader development and transportation engineering community in Grand Junction.

2) **TEDS Manual Draft Updates:** Based on the outcomes of the TEDS Manual Assessment, the project team is updating the TEDS Manual. The updates are being done through an iterative process with city staff and the TAC and include two drafts prior to the final updates. The Second Draft was developed in May, 2023 and stakeholder comment is currently being solicited on this draft. Following feedback from meetings with stakeholders in June the TEDS Manual will be updated to a Final Draft in July and presented to City Council to be adopted by ordinance in late summer 2023.

4. What Major Updates are in the Revised Draft of the TEDS Manual?

The Second Draft of the TEDS Manual includes the following major updates:

- Reflect current design guidance from CDOT, AASHTO, ITE, NACTO, and other state and national sources.
- Update the standard street cross sections primarily to:
    - Incorporate low stress bicycle and pedestrian facilities in alignment with the Pedestrian and Bicycle Plan,
    - To reflect current city design practices, and
    - To be consistent with the current Fire Department Access standards.
- Include new requirements for transportation Impact Studies (TIS) to:
    - Document bicycle and pedestrian impacts, and
    - Require a Traffic Assessment for mid-size developments (generating 10 to 99 peak hour trips) in alignment with current CDOT practice to assess need for turn lanes, sight distance, and pedestrian and bicycle impacts.
- Add requirements for inter-parcel connectivity between developments to:
    - Mitigate traffic impacts on streets,
    - Improve mobility and access for people walking and biking to and through developments, and
    - To provide access to transit by providing more direct connections between developments and transit stops on the adjacent street network.
- Added a new requirement to establish a maximum block length of 700 feet for pedestrian access.
- Update traffic calming requirements on local streets to support slower design speeds.
- Removed the Fire Department Access Document and only reference it in TEDS.
- TEDS Exceptions are only allowed for alternative streets.
- Modified “effective” turn radii requirements to account for streets with bike lanes and on-street parking to encourage slower design turning speeds to mitigate intersection conflicts with pedestrians and bicyclists.
- Added illuminance requirements for bike and pedestrian facilities.

- Updated signing and striping requirements and signal design to match current city practice.
- Updated pedestrian and bicycle design standards to match the vision and guidance in the Pedestrian & Bicycle Plan and to reflect current national best practices.
- Added design guidance on pedestrian and bicycle crossings.
- Removed the chapter on transit design standards and instead reference the Mesa County *Transit Design Standards*.
- Removed the chapter on Private Streets, Shared Driveways, and Loop Lanes which is provided in the Zoning and Development Code.

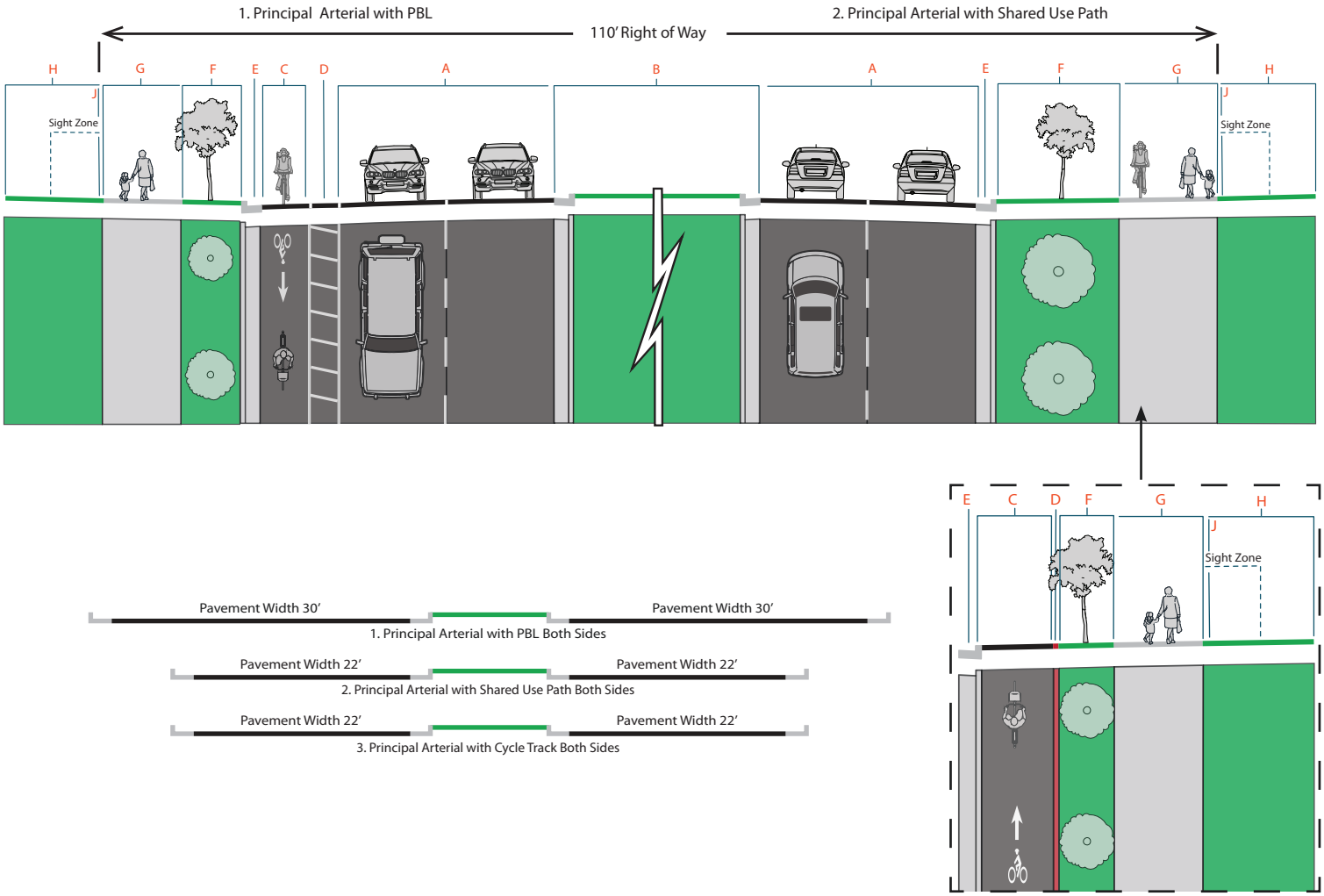
5. What are the Major Changes to the Standard Street Sections?

- Lane widths were updated to 11′ on arterial and collector streets.
- Sidewalk widths were updated to 6′ on local and collector streets with posted speeds <35 mph, and to 8′ on arterial and collector streets with posted speed >35 mph.
- Detached sidewalks are standard on all arterial and major collector streets and options for detached sidewalks are included on local and minor collector street standards.
- Low-stress bicycle facilities are included on all arterial and major collector street standards consistent with the Pedestrian and Bicycle Plan.
- Narrower street cross-section options are included for local streets that meet requirements in the Fire Department Access standards.
- The Multipurpose Easement was updated to 10′ on street sections with a detached sidewalk, which is consistent with existing practice on major arterial streets (14′ width was preserved on streets sections with attached sidewalks).
- The Rural streets section was removed.
- All streets are required to have a sidewalk on both sides of the street unless there is a public walkway on the other side of houses/businesses.
- A 5′ sight zone has been added behind the walk to the local street sections.
- Right-of-Way width was increased on the following street sections to accommodate pedestrian and bicycle infrastructure:
    - Minor Arterial – increases from 80′ to 100′
    - Major Collector – increases from 60′ to 78′ or 70′ depending on posted speed
    - Minor Collector/Commercial – increases from 52′ to 64′
    - Local Street – standard with attached sidewalk increases from 44′ to 46′ (other options are provided that vary in ROW width from 38′ to 63′).

6. What Input is the City Seeking from the Public/Stakeholders?

The City is seeking broad input from stakeholders and citizens on the recommended changes in the 2nd draft (May 2023). Information is posted on the City's website www.gjcity.org and at www.EngageGJ.org.

Principal Arterial



Principal Arterial ROW 110'										
	A	B	C		D	E	F	G	H	J
Type	Travel Lanes	Median/ Turn Lane	Bike Lane (On Street)	Bike Lane (Off Street)	Bike Buffer	Curb and Gutter	Sidewalk Buffer*	Sidewalk/ Shared Use Path	Multi-Purpose Easement	Frontage
1. Principal Arterial with PBL	11	17	5		3	2	6	8	10	.5
2. Principal Arterial with Shared Use Path	11	17			0	2	9.5	10	10	.5
3. Principal Arterial with Cycle Track	11	17		6.5	.5	2	7	8	10	.5

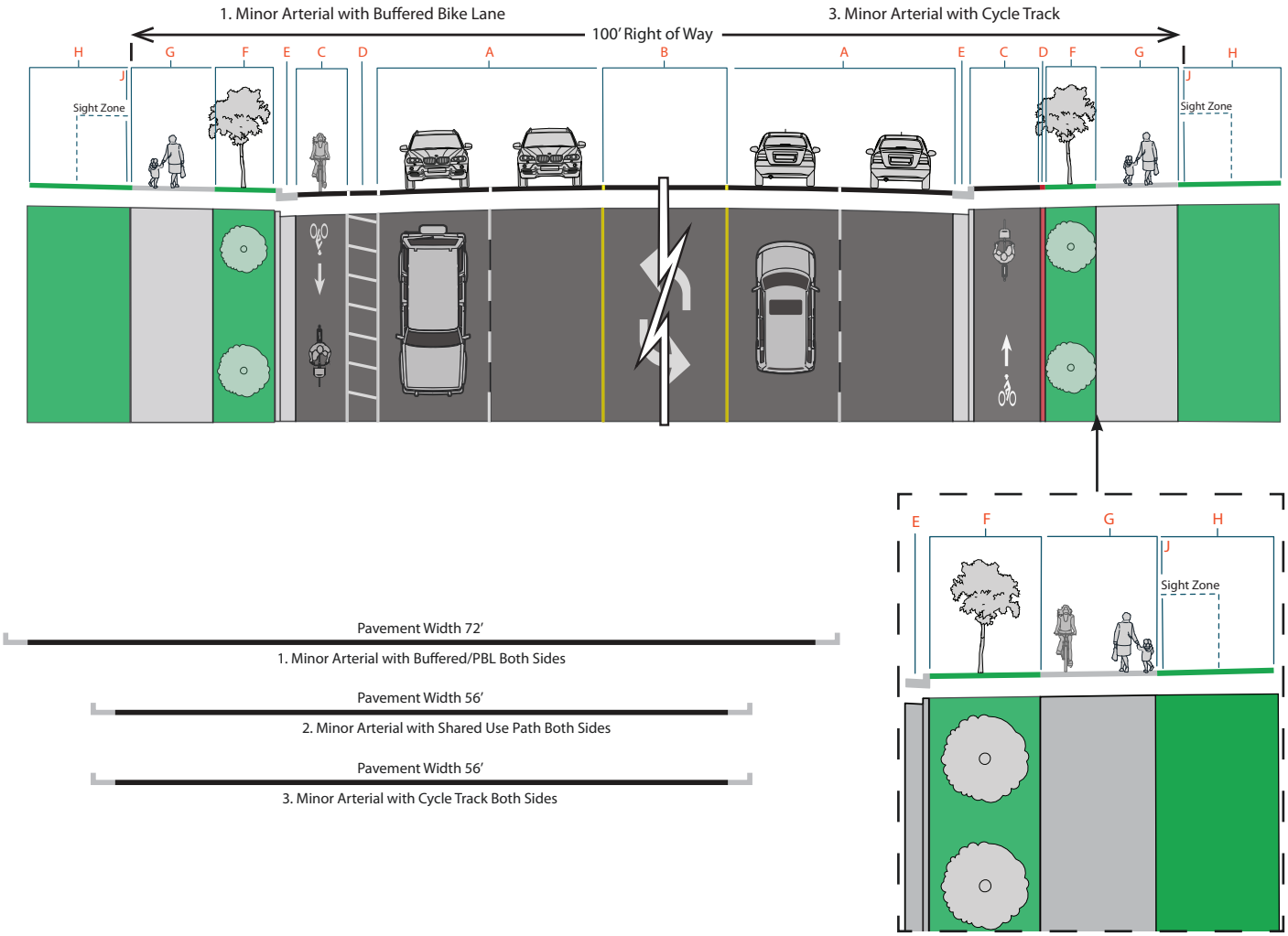
*The Sidewalk Buffer allows space for landscaping, street furniture (e.g. benches, bike, racks, etc.), and utility polls

Principal Arterial

Notes

- See Grand Junction Urbanized Area Functional Classification Map for principal arterial street designation.
- Vertical curbs, gutters and sidewalks are required on both sides of all arterial streets.
- Attached sidewalks may be approved where existing development precludes construction of detached sidewalks.
- All arterial streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC).
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City's Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.
- Vertical elements required in the buffer zone between the travel lane and bike lane to satisfy the condition of a protected bike lane (PBL) when speed is => 40 mph. Buffered bike lane (without vertical elements) may be acceptable when <40 mph.
- The standard design for a street with a shared use path includes a 10' path on both sides of the street. In situations where there are ROW constraints, higher bicycle demand on one side, or differing land uses on one side, an 8' sidewalk can be provided on one side with a 12' or 14' path on the other side.
- The standard design for a street with buffered bike lanes or a cycle track includes a one-way bikeway on both sides of the street. In some contexts where land use or other constraints dictate a two-way bikeway on one side of the street can be implemented. Refer to the NACTO Urban Bikeway Design Guide and the FHWA Separated Bike Lane Planning and Design Guide for special design considerations, particularly at driveways and intersections, when designing two-way protected bikeways.

Minor Arterial



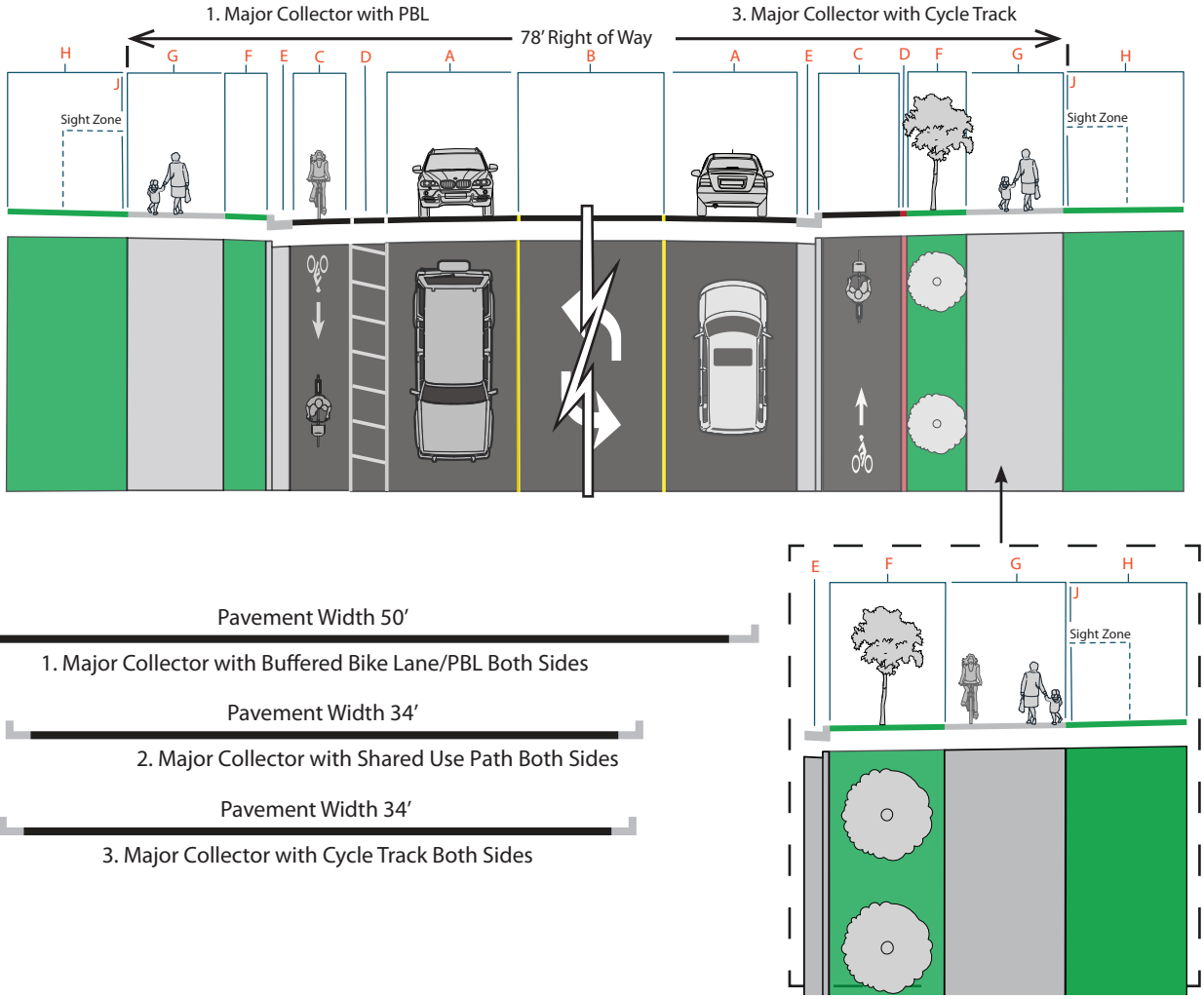
Minor Arterial ROW 100'											
		A	B	C		D	E	F	G	H	J
Type	# of Travel Lanes	Travel Lanes	Median/ Turn Lane	Bike Lane (On Street)	Bike Lane (Off Street)	Bike Buffer	Curb and Gutter	Sidewalk Buffer	Sidewalk/ Shared Use Path	Multi-Purpose Easement	Frontage
1. Minor Arterial with Buffered Bike Lane/ PBL	4	11	12	5		2	2	5.5	6	10	.5
2. Minor Arterial with Shared Use Path	4	11	12			0	2	9.5	10	10	.5
3. Minor Arterial with Cycle Track	4	11	12		6.5	.5	2	4.5	8	10	.5

Minor Arterial

Notes

- See Grand Junction Urbanized Area Functional Classification Map for minor arterial street designation.
- Vertical curbs, gutters and sidewalks are required on both sides of all arterial streets.
- All arterial streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC).
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City's Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.
- Vertical separators can be added to a buffered bike lane where additional cyclist protection is deemed necessary to achieve Level of Traffic Stress standards.
- Vertical elements required in the buffer zone between the travel lane and bike lane to satisfy the condition of a protected bike lane (PBL) when speed is => 40 mph. Buffered bike lane (without vertical elements) may be acceptable when <40 mph.
- The standard design for a street with a shared use path includes a 10' path on both sides of the street. In situations where there are ROW constraints, higher bicycle demand on one side, or differing land uses on one side, an 8' sidewalk can be provided on one side with a 12' or 14' path on the other side.
- The standard design for a street with buffered bike lanes or a cycle track includes a one-way bikeway on both sides of the street. In some contexts where land use or other constraints dictate a two-way bikeway on one side of the street can be implemented. Refer to the NACTO Urban Bikeway Design Guide and the FHWA Separated Bike Lane Planning and Design Guide for special design considerations, particularly at driveways and intersections, when designing two-way protected bikeways.
- When necessary, the two way left tun lane can be a raised median.

Major Collector 78’ ROW ≥35 MPH



Pavement Width 50’

1. Major Collector with Buffered Bike Lane/PBL Both Sides

Pavement Width 34’

2. Major Collector with Shared Use Path Both Sides

Pavement Width 34’

3. Major Collector with Cycle Track Both Sides

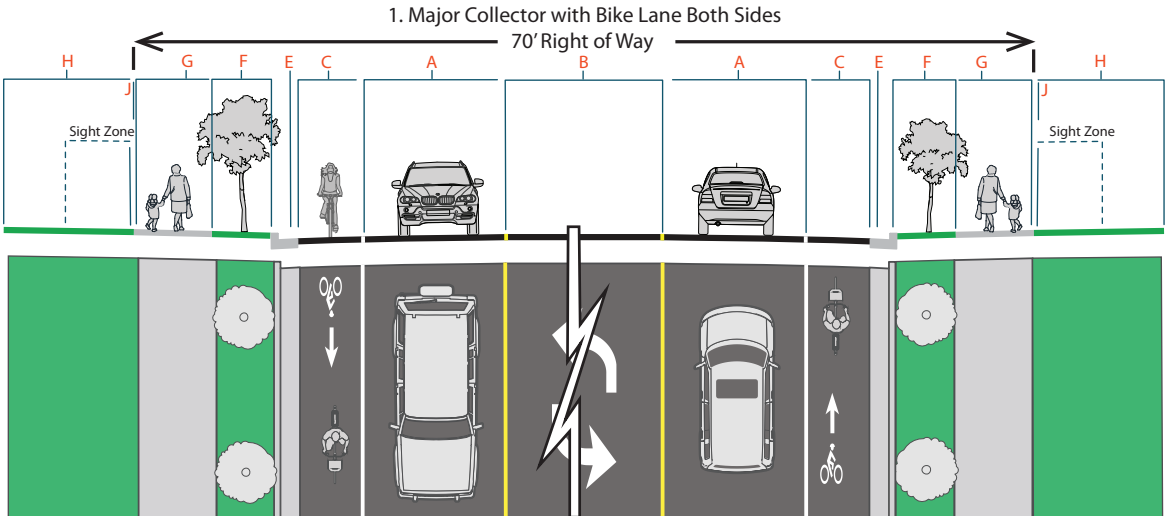
Major Collector ROW 78’ ≥35MPH										
	A	B	C		D	E	F	G	H	J
Type	Travel Lanes	Median/ Turn Lane	Bike Lane (On Street)	Bike Lane (Off Street)	Bike Buffer	Curb and Gutter	Sidewalk Buffer	Sidewalk/ Shared Use path	Multi-Purpose Easement	Frontage
1. Major Collector with Buffered Bike Lane/ PBL	11	12	5		3	2	3.5	8	10	.5
2. Major Collector with Shared Use Path	11	12	0		0	2	9.5	10	10	.5
3. Major Collector with Cycle Track	11	12		6.5	.5	2	4.5	8	10	.5

Major Collector 78’ ROW ≥35 MPH

Notes

- See Grand Junction Urbanized Area Functional Classification Map for collector street designation.
- Vertical curbs, gutters and sidewalks are required on both sides of all collector streets.
- Attached sidewalks may be approved where existing development precludes construction of detached sidewalks.
- All collector streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC).
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City’s Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.
- Vertical separators can be added to a buffered bike lane where additional cyclist protection is deemed necessary to achieve Level of Traffic Stress standards.
- Vertical elements required in the buffer zone between the travel lane and bike lane to satisfy the condition of a protected bike lane (PBL) when speed is => 40 mph. Buffered bike lane (without vertical elements) may be acceptable when <40 mph.
- Vertical separators would only be used between intersections.
- The standard design for a street with a shared use path includes a 10’ path on both sides of the street. In situations where there are ROW constraints, higher bicycle demand on one side, or differing land uses on one side, an 8’ sidewalk can be provided on one side with a 12’ or 14’ path on the other side.
- The standard design for a street with buffered bike lanes or a cycle track includes a one-way bikeway on both sides of the street. In some contexts where land use or other constraints dictate a two-way bikeway on one side of the street can be implemented. Refer to the NACTO Urban Bikeway Design Guide and the FHWA Separated Bike Lane Planning and Design Guide for special design considerations, particularly at driveways and intersections, when designing two-way protected bikeways.
- In segments of the street where there is lower left turn demand (at low volume intersections, low volume driveways, or where there are no driveways) the center turn lane can be removed and replaced with a painted buffer between the bike lane and the travel lane to provide additional comfort to bicyclists and/or the pavement width can be narrowed and the buffer between the sidewalk and curb widened.

Low Speed Major Collector 70’ ROW < 35MPH



Major Collector ROW 70’ < 35 MPH											
		A	B	C		D	E	F	G	H	J
Type	**Criteria**	**Travel Lanes**	**Median/ Turn Lane**	**Bike Lane (On Street)**	**Bike Lane (Off Street)**	**Bike Buffer**	**Curb and Gutter**	**Sidewalk Buffer**	**Sidewalk**	**Multi-Purpose Easement**	**Frontage**
1. Major Collector with Bike Lane Both Sides	<35 MPH	11	12	5		0	2	5	6	10	.5

1. Major Collector with Bike Lane Both Sides

Low Speed Major Collector 70’ ROW < 35MPH

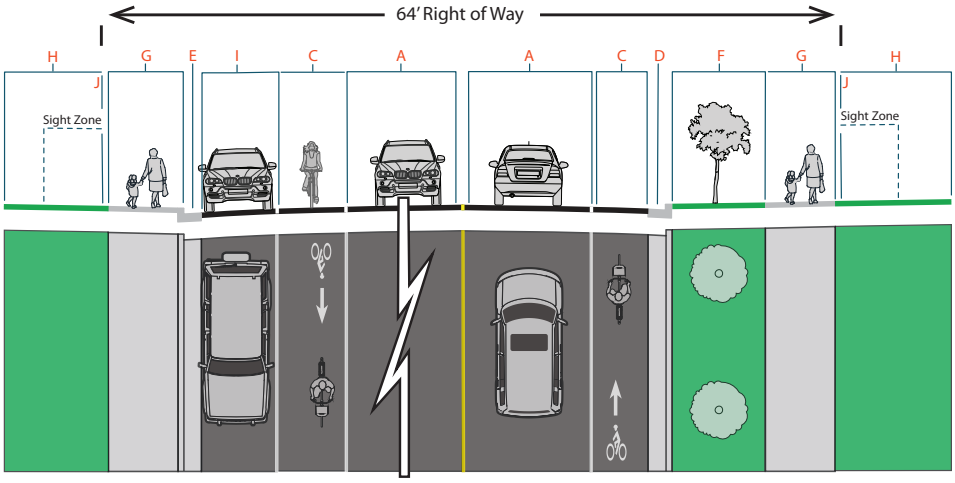
Notes

- See Grand Junction Urbanized Area Functional Classification Map for collector street designation.
- Vertical curbs, gutters and sidewalks are required on both sides of all collector streets.
- Attached sidewalks may be approved where existing development precludes construction of detached sidewalks.
- All collector streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC).
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City’s Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.
- In segments of the street where there is lower left turn demand (at low volume intersections, low volume driveways, or where there are no driveways) the center turn lane can be removed and replaced with a painted buffer between the bike lane and the travel lane to provide additional comfort to bicyclists and/or the pavement width can be narrowed and the buffer between the sidewalk and curb widened.
- If the Major Collector street corridor has a posted speed of 35 mph or higher within a mile of a particular location design may need to meet the standards of the Major Collector 78’ ROW.

Minor Collector

2. Minor Collector with Bike Lane and Parking and Attached Sidewalk

1. Minor Collector with Bike Lane and No Parking and Detached Sidewalk



Minor Collector ROW 64'

		A	B	C		D	E	F	G	H	I	J
Type	**Criteria**	**Travel Lanes**	**Median/ Turn Lane**	**Bike Lane (On Street)**	**Bike Lane (Off Street)**	**Bike Buffer**	**Curb and Gutter**	**Sidewalk Buffer**	**Sidewalk**	**Multi-Purpose Easement**	**Parking**	**Frontage**
1. Minor Collector with Bike Lane No Parking and Detached Sidewalk	≤30 MPH	11	0	5		0	2	7.5	6	10	0	.5
2. Minor Collector with Bike Lane with Parking and Attached Sidewalk	≤30 MPH	11	0	5		0	2	0	6	14	7.5	.5

Pavement Width 32'

1. Minor Collector with Bike Lane Both Sides (No Parking)

Pavement Width 47'

2. Minor Collector with Bike Lane and Parking on Both Sides

Minor Collector

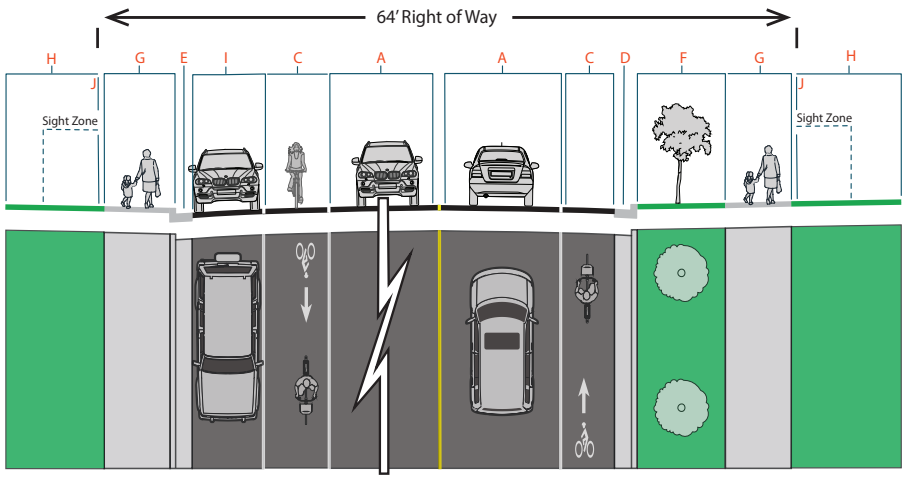
Notes

- If the street classification changes, efforts should be made maintain the facility type for the entire length of the corridor.
- See Grand Junction Urbanized Area Functional Classification Map for collector street designation.
- All collector streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC).
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City's Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- When a bike lane is adjacent to a parking lane, separation may be provided between the bike lane striping and parking boundary by marking the parking spaces to mitigate conflicts by bikers with the "door zone" of parked cars.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- On Street parking may be prohibited as required to provide left turn lanes at intersections.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.

Local Commercial

2. Local Commercial with Bike Lane and Parking and Detached Sidewalk

1. Local Commercial with Bike Lane and No Parking and Attached Sidewalk



Local Commercial ROW 64'										
	A	B	C		D	E	F	G	H	I	J
Type	Travel Lanes	Median/ Turn Lane	Bike Lane (On Street)	Bike Lane (Off Street)	Bike Buffer	Curb and Gutter	Sidewalk Buffer	Sidewalk	Multi-Purpose Easement	Parking	Frontage
1. Local Commercial with Bike Lane No Parking and Detached Sidewalk	11	See note	5		0	2	8	6	10	0	.5
2. Local Commercial with Bike Lane with Parking and Attached Sidewalk	11	See note	5		0	2	0	6	14	7	.5

Pavement Width 47'

1. Local Commercial with Bike Lane and Parking on Both Sides

Pavement Width 32'

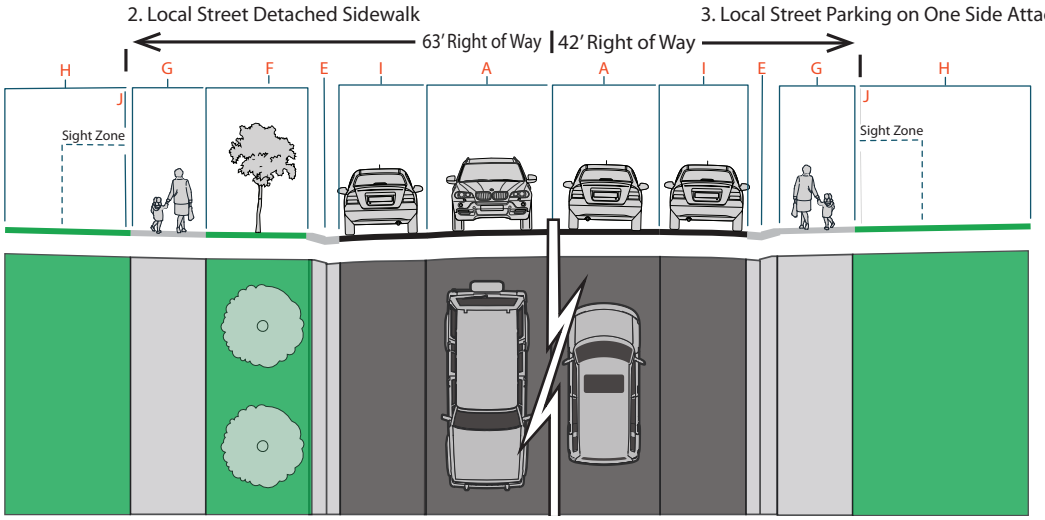
2. Local Commercial with Bike Lane Both Sides (No Parking)

Local Commercial

Notes

- See Grand Junction Urbanized Area Functional Classification Map for collector street designation
- All collector streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC. All pavement shall be designed in accordance with the AASHTO Guide for Design of Pavement Structures.
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City's Transportation Engineering Design Standards for Speed Change Lane Dimensions.
- See details of Multi-purpose Easement Adjacent to Right-of-Way in the standard contract documents.
- (On Street) parking may be prohibited as required to provide left turn lanes at intersections.
- For Sight Zone requirements refer to 29.28.150 of the TEDS Manual.
- Parking may be prohibited on streets exceeding TBD ADT, TBD speed, or based on other contextual factors.
- If turn lanes are warranted, they will be 11 feet in width for right turn lanes (exclusive of the gutter pan) and 12 feet for left turn lanes.

Local Street



Local Street ROW 38'-63'									
			A	E	F	G	H	I	J
Type	**Criteria**	**# of Travel Lanes**	**Travel Lanes**	**Drive Over Curb and Gutter**	**Sidewalk Buffer**	**Sidewalk**	**Multi-Purpose Easement**	**Parking**	**Frontage**
1. Local Street Attached Sidewalk	<1000 ADT	2	7	2.5	0	6	14	7	.5
2. Local Street Detached Sidewalk	<1000 ADT	2	7	3	8	6	10	7	.5
3. Local Street with Parking One Side Attached Sidewalk	<1000 ADT, ≤ 20 MPH	2	8.5	2.5	0	6	14	7	.5
4. Local Street with Parking One Side Cul-de-sac Attached Sidewalk	<1000 ADT, ≤ 20 MPH	2	10	2.5	0	6	14	7	.5
5. Local Street No Parking Attached Sidewalk	<1000 ADT, ≤ 20 MPH	2	10	2.5	0	6	14	0	.5
6. Local Industrial Street Attached Sidewalk		2	12	Vertical Curb 2	0	6	14	7	.5

ROW 46' Pavement Width 28'
1. Local Street Attached Sidewalk

ROW Width 63' Pavement Width 28'
2. Local Street Detached Sidewalk

ROW Width 42' Pavement Width 24'
3. Local Street Parking on One Side

ROW Width 45' Pavement Width 27'
4. Local Street Parking on One Side Cul-de-sac

ROW Width 38' Pavement Width 20'
5. Local Street No Parking

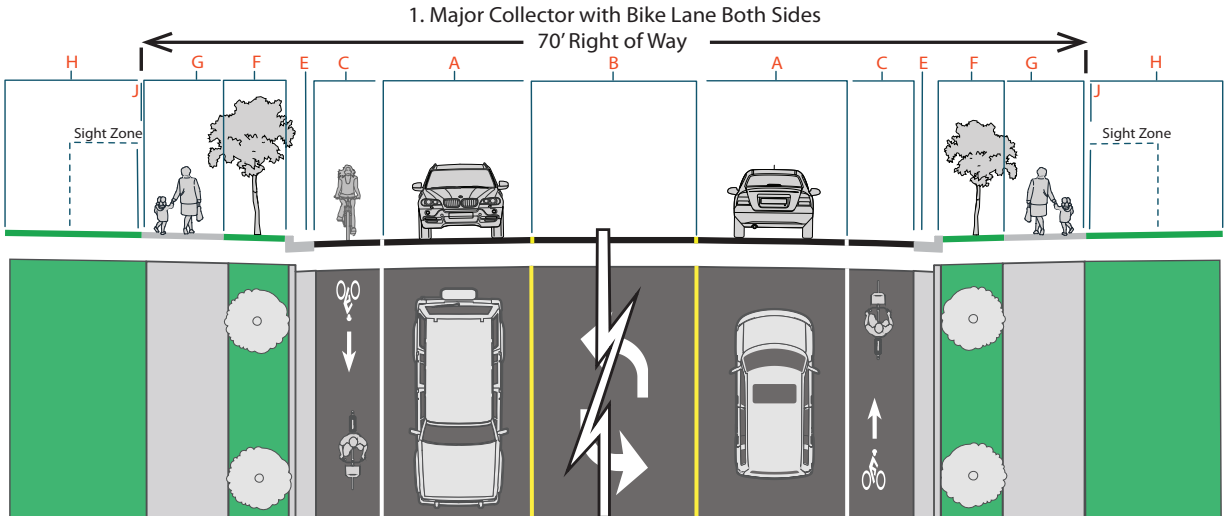
ROW Width 53' Pavement Width 38'
6. Local Industrial Street

Local Street

Notes

- A sidewalk can be provided on only one side of the street only if a sidewalk or path is located behind the houses/businesses on the side of the street without a sidewalk.
- If an attached sidewalk is included on a side of the street with no on-street parking the street must be designed for speeds of 20 mph or less and have less than 1,000 average vehicles per day.
- When parking is restricted, an off-lot parking plan (showing on-street and parking pods) is required. When density is R-4, 0.5 off lot parking spaces are required per unit, R-5 requires 1.0 spaces per unit, and R-8 requires 1.5 spaces per unit.
- When asphalt width is narrower than 28', a fire site plan is required demonstrating designated GJFD design apparatus can maneuver the site with on-street parking as shown in note 1.
- Drive over curb, gutter and sidewalk shall be installed only on urban residential streets with less than 1,000 A.D.T.
- Vertical curb and gutter can be used instead of drive over, but driveway cuts must be built with the subdivision and efforts should be made to maintain grade at sidewalks.
- Street sections can be changed to include detached sidewalks using the buffer in section 2. Right of way width will change accordingly.
- Except for the cal de sac, section 4, fire access shall come from two directions.

G Road



G Road ROW 70'									
		A	B	C	D	E	F	G	H
Type	**Criteria**	**Travel Lanes**	**Median/ Turn Lane**	**Bike Lane**	**Bike Buffer**	**Curb and Gutter**	**Sidewalk Buffer**	**Sidewalk**	**Muli-Purpose Easement**
Major Collector	<35 MPH	11	12	0	0	2	9.5	6	14
Major Collector with Bike Lane		11	12	4.5	0	2	5	6	14

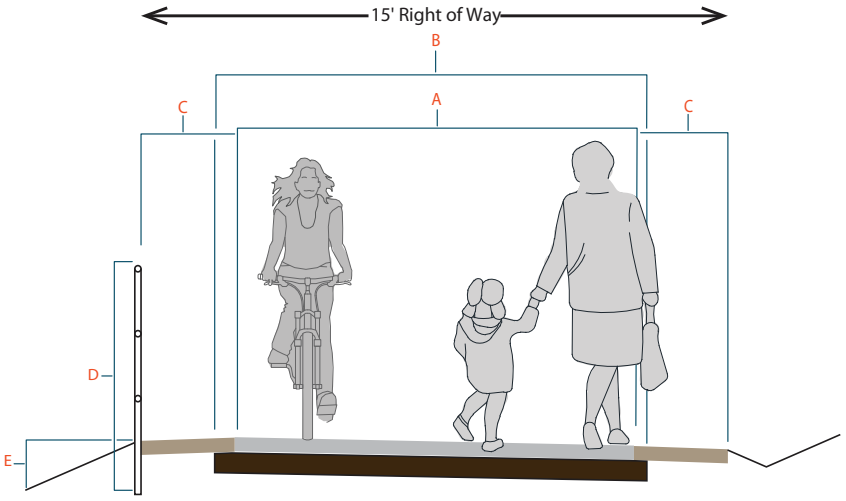
1. Major Collector with Bike Lane Both Sides

Place holder

Notes

- See Grand Junction Urbanized Area Functional Classification Map for collector street designation
- Vertical curbs, gutters and sidewalks are required on both sides of all collector streets
- Attached sidewalks may be approved where existing development precludes construction of detached sidewalks
- All collector streets shall be surfaced with Hot Bituminous Pavement (HBP) or Portland Cement Concrete (PCC. All pavement shall be designed in accordance with the AASHTO Guide for Design of Pavement Structures
- Additional right-of-way width will be required for construction of dedicated right-turn lanes. See chapters of the City's Transportation Engineering Design Standards for Speed Change Lane Dimensions.See page St-12 for Detail of Multi-purpose Easement Adjacent to Right-of-Way
- In Sight Zone no trees, shrubs, fences, structures, or other obstructions shall be over 30" in height (measured at the near edge of roadway). See notes page ST-14 for exceptions.

Two-Way Shared Use Off Street Path



Two-Way Shared Use Off Street Path					
		A	B	C	D
Type	**Criteria**	**Path**	**Subgrade**	**Aggregate**	**Railing**
Two Way Shared Use Path	Separate Right of Way	10	Compact top 6” of subgrad (to 95% AASHTO T-99)	2 4” Class 6 base course	42” high

Notes

- Off street paths shall be designed in accordance with the AASHTO “Guide for the Development of Bicycle Facilities” current edition.
- A minimum width of 8’ may be allowed were physical constraints preclude the standard width.
- Shared use path has a maximum slope of 2%.
- Class aggregate base course has a max slope of 6:1.
- Where slopes exceed 3:1 and F>2 a railing is required.
- Drainage should be designed for 2 year storm.
- If the path is along an Active Transportation Corridor or is near a high volume destination like a school or hospital, a 12 foot width may be required to meet demand and mitigate conflicts between bicyclists and pedestrians.
- Where possible paths should be located in the right of way, a path with a public easement, or in a public easement typically are located along industrial or commercial corridors.

29.01 INTRODUCTION

29.01.010 Forward

The standards contained herein regulate all transportation improvements within the public right-of-way, and all private work to be dedicated to the public, either as right-of-way or as an easement, and site circulation. The standards are to be treated as law. To that extent they are imposed to provide for coordinated, modern development with safe and efficient transportation facilities for the benefit of and to serve and protect users. The standards apply within the City limits and the Urban Development Boundary of Mesa County. The standards for transportation, engineering and design shall be known as TEDS.

All facilities and improvements within the public right-of-way shall be designed by or under the direct supervision of a registered professional engineer licensed to practice in the State of Colorado. All drawings, designs, sections, detail and supporting data submitted to the City or County for approval must bear the engineer's seal and signature and a statement that: *This design complies with the current TEDS manual dated _____*." All designs submitted shall be in accordance with the latest edition of the TEDS manual.

Some projects financed wholly or in part with state or federal funds are subject to the standards prescribed by agencies other than the City and County. Such standards may be more or less restrictive than the City of Grand Junction and Mesa County standards. The City and County shall require that the more restrictive standards shall be met.

The TEDS address frequent construction and development problems and questions. The standards by adoption and application ensure consistent transportation engineering design practices for new development and redevelopment of land in the City of Grand Junction and Mesa County. They are supplementary to the City and County Development Codes. Some of the material contained in this document has been drawn from standards of other cities and states and nationally established texts and publications.

The TEDS apply to new developments and as noted, limited and defined herein apply to existing improvements and infill development unless wholly constrained. Infill development in an urban area may be constrained by existing improvements, which if such condition exists shall require an affirmative waiver of TEDS in accordance with Chapter 14. The City and County may deviate from these standards only when and if deviation is shown to be warranted.

On Colorado Highways within the City of Grand Junction and urbanized Mesa County, the Colorado Department of Transportation (CDOT) Roadway Design Manual, the State

Access Code, and any corridor specific access control plan shall apply but only if more restrictive than TEDS.

If a proposed development within the Urban Development Boundary requires access to a County roadway or work will be performed in the County right-of-way approval from the County must first be granted.

29.01.020 Companion Documents and Software Recommended For Use with the Transportation Engineering Design Standards

Publications

Local:

City of Grand Junction *Zoning & Development Code*
City of Grand Junction *Standard Contract Documents*
City of Grand Junction Pedestrian & Bicycle Plan
City of Grand Junction Pedestrian Crossing Treatment Installation Guidelines

Mesa County *Design Standards*
Mesa County *Transit Design Standards and Guidelines*

State:

CDOT *Roadway Design Manual*
CDOT *State Highway Access Code*
CDOT *Pedestrian Crossing Installation Guide*

Federal:

Transportation Research Board *Highway Capacity Manual*
Federal Highway Administration *Roundabouts: An Informational Guide*
Federal Highway Administration *Manual on Uniform Traffic Control Devices*

Professional Organizations:

Institute of Transportation Engineers *Trip Generation*
AASHTO *A Policy on Geometric Design of Highways and Streets*
AASHTO *Guide for Bicycle Facilities*
AASHTO *Roadside Design Guide*
AASHTO *A Guide for Erecting Mailboxes on Highways*
NACTO *Urban Bikeway Design Guide*
NACTO *Designing for All Ages and Abilities*
NACTO *Don't Give Up at the Intersection*
FHWA *Separated Bicycle Lane Planning and Design Guide*

Colorado Asphalt Pavement Association *Guideline for the Design and Use of Asphalt Pavements for Colorado*

Software

Synchro or other software as approved by the city transportation engineer that aligns with methodologies from the latest Highway Capacity Manual (Signal Timing and Analysis)
SIDRA or other software as approved by the city transportation engineer (Roundabout Analysis)

AASHTO93 and M-E Design (Asphalt Pavement Design)

WinPAS from American Concrete Pavement Association

29.04 STREET CLASSIFICATION AND STANDARDS

29.04.010 Street Classifications and Standards

All streets have different functions. Some are to serve land uses directly while others are intended to move vehicles quickly and efficiently from one point to another. Ensuring that each street type can meet or maintain its function is crucial to the overall operation of the street system.

Major streets in the Grand Junction urbanized area are classified according to their function in the transportation network. These streets include Principal Arterials, Minor Arterials, Major Collectors, and Minor Collectors. All others are local streets. The functionally classified streets have been identified on a functional classification map that has been adopted by the City of Grand Junction and accepted by Mesa County.

Reference to the Street Classification Map in the Grand Junction Circulation Plan is made throughout the TEDS Manual. Different access controls and design standards apply to different roadway classifications. The purpose is to preserve or enhance safety and traffic flow. The Pedestrian and Bicycle Plan is also referenced throughout this manual for compliance with the adopted plan. Additionally, roadway segments with existing access management plans provide specific access control requirements on those roadways and should be referenced when applicable. These include:

- The Patterson Road Access Management Plan
- The Pear Park Plan
- Access Control Plan's on CDOT Highways
    - Clifton Access Control Plan
    - CO 340 Access Control Plan
    - US 50 Access Control Plan

The City Council and County Commission have adopted standard drawings and details for the construction of streets and location for utilities. These standards include minimum right-of-way and street width requirements, and include construction details for major and local streets. These will be referenced throughout the document. Local street and Minor Collector Street sections are located in Chapter 29.20. Major Collector and Arterial Street Sections are located in Chapter 29.28.

The adopted Street Classification Map in the Grand Junction Circulation Plan as well as the Street and Utility Standard drawings are available online and in various formats including AutoCAD Files.

29.08 TRANSPORTATION IMPACT STUDIES

29.08.010 Transportation Impact Study

The Transportation Impact Study (TIS) will assess the impacts of proposed development on the existing and planned street system. Comprehensive and coordinated transportation planning is critical to providing a balanced transportation system. The application of sound design principles for new streets, preserving street capacities in existing areas, ensuring smooth traffic flow, accommodating all transportation modes, and preserving or increasing safety are part of the TIS. To evaluate the impacts of development proposals on the transportation system, a professionally prepared TIS shall be required. This chapter provides standards for the preparation of a TIS. In addition, the following documents shall be referenced for more detailed information:

(a) Street Classification Map in the Grand Junction Circulation Plan

(b) Mesa County Functional Classification Map

(c) City Standard Contract Documents

(d) Pedestrian & Bicycle Plan

(e) Mesa County Transit Design Standards and Guidelines

(f) Corridor Guidelines

The primary responsibility for assessing the transportation impacts associated with a proposed development rests with the developer, and but not limited to the City, County, Colorado Department of Transportation (CDOT) or Regional Transportation Planning Office (RTPO) which operates Grand Valley Transit (GVT) serving in a review capacity.

29.08.020 Procedure

The following required steps describe the procedures required for the preparation and submittal of a TIS. This process can be altered slightly depending on the complexity of the project:

(a) General Meeting or Pre-Application Meeting

(b) Determination of Base Assumptions

(c) Submittal

(d) Review Agency Comments and Recommendations

29.08.030 General Meeting or Pre-Application Meeting

As a general rule, a TIS shall be required for all land use applications for new development in the City and as required by Mesa County Land Development Code. The requirement to prepare a TIS - or portions of a TIS - may be waived by the Transportation Engineer if the peak hour vehicle trip generation of the proposed project is less than 100 trips.

If the peak hour vehicle trip generation is estimated to be between 10 trips and 99 trips and the TIS requirement is waived by the Transportation Engineer, the applicant shall still complete a Traffic Assessment to determine if turn lanes are needed and if the proposed circulation serves pedestrians, bicyclists, and access to transit. A Traffic Assessment would include the following portions of a TIS: 1) Project Description, 2) Trip Generation, 3) Site Design and Circulation Evaluation, 4) Turn Lane Warrant Analysis, 5) Sight Distance Evaluation, and 6) Pedestrian and Bicycle Analysis.

If the applicant can demonstrate to the satisfaction of the Transportation Engineer that no other concerns exist with the transportation aspects of the proposed project, then a memo shall be prepared by the engineering consultant documenting the trip generation and safety improvements of the project and conclusions of the TIS.

The peak hour trip threshold of 100 is consistent with the Colorado Department of Transportation (CDOT) thresholds for requiring impact studies on state highways. The peak hour trip threshold of 10 – 99 for completing a Traffic Assessment is also consistent with CDOT thresholds on state highways. The methodology documented in the current edition of the *Institute of Transportation Engineers' (ITE) Trip Generation Manual* should be used to identify the peak hour vehicle trip generation rates for a project. The current edition of ITE *Trip Generation Manual* is adopted and incorporated by this reference.

The applicant shall provide, to the Development Engineer and the Transportation Engineer, information regarding:

(a) The project including type of land use (single family, townhomes, multi-family, office, retail, etc.) and size (number of dwelling units, square footage, etc.).

(b) The project site plan showing all proposed access locations and proposed land uses in relation to the accesses.

(c) Anticipated project completion date and project phasing.

(d) Any other information necessary or required to evaluate the project.

The appropriate agencies shall review the project information and provide comments regarding transportation issues including, but not necessarily limited to, accesses (locations/type), impacts on adjacent neighborhoods, the size of the study area and the study methodology.

29.08.040 Determination of Base Assumptions

The consultant preparing the TIS shall complete the Base Assumptions form. The Transportation Engineer will evaluate the TIS - Base Assumptions. The assumptions, once approved, shall confirm the base parameters and assumptions to be utilized by the traffic consultant in preparation of the TIS.

A Base Assumptions Form shall specify:

(a) Study Area Boundaries

(b) Study Years

(c) Future Traffic Growth Rates

(d) Study Intersections

(e) Time Period for Study

(f) Trip Generation Rates

(g) Trip Adjustment Factors

(h) Overall Trip Distribution

(i) Mode Split Assumptions

(j) Committed Roadway Improvements by other projects, CDOT, Grand Junction and Mesa County

(k) Other Relevant Transportation Impact Studies

(l) Areas Requiring Special Study

29.08.050 Pedestrian & Bicycle Analysis

As part of the Pedestrian and Bicycle Analysis the Transportation Engineer shall complete the Pedestrian & Bicycle Analysis Worksheet and document the existing conditions of adjacent pedestrian and bicycle infrastructure.

Documentation of the existing pedestrian and bicycle infrastructure should include the following areas near the development:

(a) Pedestrian and bicycle infrastructure adjacent to the proposed development.

(b) Pedestrian and bicycle infrastructure between the proposed development and the nearest adequate facilities if there are no or substandard pedestrian or bicycle facilities adjacent to the development.

(c) Pedestrian and bicycle infrastructure to destinations within a quarter mile of the development that will likely generate pedestrian or bicycle trips (such as grocery stores, transit stops, housing, employment centers, recreational facilities, services, and schools).

As part of this analysis the Engineer shall identify missing or substandard pedestrian and bicycle infrastructure by specifically noting the following conditions for each.

For pedestrian infrastructure:

(a) Pavement width

(b) Pavement condition

(c) Pavement material

(d) Whether the walkway is attached (directly adjacent to the street), detached (separated by a landscaped or hardscaped buffer), part of a multiuse trail independent of a street, or missing.

(e) Width of the buffer (between the sidewalk and the street) as applicable.

(f) Presence of obstructions in the walkway (such as street poles, etc.).

(g) Presence of pedestrian crossings and whether they are marked or unmarked, controlled (by a stop sign or signal) or uncontrolled.

(h) ADA compliance of pedestrian ramps at crossings.

(i) Number of conflicting driveways and lengths.

For bicycle infrastructure:

(a) Presence of a bicycle facility and type of facility (Bicycle facilities are defined by the Pedestrian and Bicycle Plan and described in section 29.48 Transit, Bicycle, and Pedestrian Facilities of the TEDS Manual.)

(b) Width of the bicycle facility and width of the buffer if applicable

The Pedestrian & Bicycle Plan shall be referenced and complied with for planned pedestrian and bicycle facilities within the study area boundaries. Pedestrian and bicycle standard widths and buffers by street type or context can be found in Chapter 29.20 for Local, Industrial, and Commercial Streets, and 29.28 for Collector and Arterial Streets, and Trails.

The analysis shall also discuss how pedestrians and bicyclists would access the proposed project to/from the adjacent neighborhood(s), and the need for special facilities to enhance pedestrian and bicycle connectivity.

The Pedestrian & Bicycle Analysis Worksheet will also identify existing pedestrian and bicycle facilities that may be impacted by the development and the extent of the impact, such as whether those facilities will result in an improvement, degradation, or no change to pedestrian and bicycle facilities. The form will also identify whether there is a proposed bicycle facility identified in the Pedestrian & Bicycle Plan on or adjacent to the proposed development and whether the development will impact the planned bicycle facility.

The form will also identify whether the proposed development is within an existing or planned shared micromobility zone as identified by the city. If so, the applicant should identify how the proposed development will include or accommodate storage space for shared micromobility devices. Similarly, the form will identify if the proposed development is within a overlay zone and whether the site plan is within compliance of the pedestrian and bicycle elements of the overlay zone.

29.08.060 Submittal

Copies of the TIS shall be submitted to the City Community Development or County Planning Department, as part of the required planning information. Revisions to the TIS shall be made as required if:

(a) Necessary to have a complete TIS; or

(b) When changes to the development necessitate additional revisions to the study. Electronic files of capacity analyses must be submitted with the TIS.

29.08.070 Review Agency Comments and Recommendations

The review agency or designee shall analyze, evaluate and/or review the TIS according to the adopted standards. Evaluative comments concerning the TIS shall be forwarded to the Project Planner. The Project Planner shall provide all review agency comments to the applicant. As a result of the engineering review the applicant may be required to:

(a) Perform and submit supplemental analyses and/or address specific transportation issues or;

(b) Prepare, perform, and submit a new study. Engineering review, shall to the extent practicable, cite references to this Manual, the Code, laws, rules, or regulation deficiencies in the TIS.

Review and evaluation of TISs are, and shall be, initially and principally based on local conditions and community expectations as articulated by local government and its officials. An example of such a local expectation is that eliminating existing left-turn phasing of a traffic signal at a nearby impacted intersection would not be a satisfactory solution to improving traffic level of service at that intersection.

If the TIS is based on assumptions that conflict with local conditions, and/or community expectations which may affect the usefulness or predictions proven by the TIS, the TIS will be rejected.

29.08.080 Transportation Impact Study Report Contents

A Colorado licensed professional engineer shall prepare the TIS. The engineer shall have experience in traffic and transportation engineering. A statement of qualifications must be included in the submitted study. Certification as a Professional Traffic Operations Engineer by the *Institute of Transportation Engineers* is preferred. Each TIS shall address:

(a) Project Description

(b) Existing Conditions

(c) Future Background Traffic Projections

(d) Project Traffic

(e) Total Traffic Projections

(f) Future Total Traffic Projections

(g) Site Circulation and Design Evaluation

(h) Transportation Impact Analysis

(i) Mitigation Measures

(j) Neighborhood Transportation Impact Analysis

(k) Conclusions

(l) Recommendations

(m) Any other information necessary or required to evaluate the project

29.08.090 Project Description

A description of the proposed project shall be prepared and include the type of land use and size of the proposed project, generally known as density and intensity. Intensity may be described in terms of floor area ratio or square footage of proposed development. Phasing plans shall be proposed, including the anticipated completion date. The proposed site plan shall be included; the site plan shall include a description of all proposed vehicular access locations, dimensions, and movements. The project description shall include how pedestrian and bicycle travel shall be accommodated. This shall include a discussion of types of sidewalks (attached/detached), pathways, and connections to local and perimeter destinations.

29.08.100 Existing Conditions

The TIS shall identify the existing transportation system conditions. Existing conditions shall include a description of the surrounding roadway network, bicycle facilities, and pedestrian facilities; an evaluation of the peak hour capacity and level of service at the study intersections and traffic crash history.

29.08.110 Description Of Existing Transportation System

The study description of the existing roadway network shall include, but not necessarily be limited to, the number of travel lanes, presence or lack of pedestrian and bicycle facilities, posted speed limits, and adjacent land use(s). Traffic and intersection data compiled by the City and/or County Engineering Departments may be available. All recent (within two years) average daily traffic data that is available for the roadway network shall be shown on a figure in the study. Intersection peak hour traffic data shall be no older than one year; if new counts are necessary this is the sole responsibility of the applicant. The applicant may, at the direction of the Transportation Engineer, be required to collect data at a shorter interval. All traffic count data shall be included in an appendix to the TIS.

The TIS shall describe the existing bicycle and pedestrian facilities and shall include any facilities directly adjacent to the project site and within one-quarter mile or as described in section The Pedestrian and Bicycle Analysis section. The Pedestrian & Bicycle Plan shall be referenced and complied with for planned pedestrian and bicycle facilities within the study area boundaries.

Bicycle facilities are defined by *the* Pedestrian and Bicycle Plan and described in section 29.48 Transit, Bicycle, and Pedestrian Facilities of the TEDS Manual.

Special attention shall be given to the bicycle and pedestrian connections to specific uses including but not limited to: schools, parks, employment centers, commercial areas, shopping, and adjacent land uses.

29.08.120 Capacity Analysis and Level of Service

The procedures set forth in the current edition of the *Highway Capacity Manual* (HCM) shall be used in analyzing the capacity and operational characteristics of vehicular, pedestrian and bicycle facilities.

HCM delay and queuing reports (such as Synchro or Sidra reports) shall be included in the appendices to the TIS report.

Roundabout analyses shall use SIDRA software or approved methodology. All worksheets shall be included in the appendices of the TIS report.

29.08.130 Future Traffic Projections

The future traffic projections shall be determined for each of the study years identified earlier as part of the base assumptions. Future traffic projections for the TIS analysis shall include:

(a) Planned System Improvements – Capital Projects

(b) Planned or in Process Development Projects

(c) Background Traffic Growth

A description of project-specific planned transportation system improvements identified in City, County or CDOT capital improvement plans shall be provided. This shall include, but not be limited to: signalization, intersection improvements, roadway widening, bicycle/pedestrian projects, and transit capital and operating/service improvements.

The future traffic analysis shall include known development projects that are within the study area and would impact the study intersections. Projects outside the study area currently being developed shall also be considered. Every project(s) and the cumulative effect shall be listed in the TIS and include location, size, and proposed land use.

The background traffic growth within the study area shall also be accounted for when determining future traffic projections. Background traffic growth is defined as the expected growth in traffic from regional changes to land use and the transportation network exclusive of the project. Growth factors suggested by the

consultant in the Base Assumptions form will be reviewed by the appropriate agency prior to use in the TIS.

The resulting future peak hour traffic projections at the study intersections shall be depicted on a figure in the TIS.

29.08.140 Project Traffic

(a) The transportation impacts of the project shall be generally determined based upon the following three-step process:

(1) Determination of Trip Generation

(2) Determination of Trip Distribution

(3) Assignment of Project Traffic

(b) **Trip Generation**.

The trips generated by the project shall be determined and provided in tabular form. The trip generation shall be determined for total build-out conditions and for any development phases. The trip generation table shall indicate the number of average daily trips and AM and PM peak hour trips and any other peak hour periods relevant to the development type.

The development of trip generation estimates for the project shall be based upon data from the current edition of the *Institute of Transportation Engineers' - Trip Generation Manual*. This includes using the selection process identified in the *Trip Generation Manual* to identify the appropriate land use code and trip generate rate. However, other data sources or trip generation rate studies may be utilized if the manual does not contain data for the type of project or other reliable data exists which better reflects the trip generation characteristics of the project. The use of other trip generation sources shall be discussed with the Transportation Engineer before being used, and if agreed, shall be memorialized in writing signed by the Transportation Engineer.

Adjustments to the standard trip generation of the proposed project may be made to account for internal site trips, pass-by trips, or other site specific/project specific characteristics of the proposed project. Adjustments for these characteristics shall be discussed with the City or County Transportation Engineer before use; in most cases the TIS shall follow guidelines set forth in documents such as the ITE *Trip Generation*

Manual. The adjusted trip generation for the proposed project shall be provided in tabular form or illustrated on figures.

Pass-by trip percentages represent the percent of expected trips generated from the site that would have traveled along the adjacent roadway network even if the land use did not exist. The percent of pass-by trips may be deducted from the expected trip generation from a proposed development of the corresponding land use. The ITE *Trip Generation Manual* should be used to identify any applicable pass-by trip percentages.

(c) **Trip Distribution**.

The trip distribution for the proposed project shall be identified in the TIS. The distribution pattern shall be based upon: the project's location within the urban area, the traffic model maintained by the MPO, existing traffic volume data, project marketing data, and engineering judgment. A figure showing the percentage of site traffic on each street shall be provided as part of the traffic study graphic material.

(d) **Trip Assignment**.

The project traffic shall be assigned to the roadway system according to the established trip distribution. The resulting project site generated traffic shall be depicted on figures for build-out conditions and any project phases. Daily and peak hour traffic volume information shall specifically be included.

29.08.150 Total Traffic Projections

The total traffic projections shall be determined for each of the study years identified in the base assumptions. The project-related traffic shall be added to the existing peak hour traffic. The resulting total traffic projections shall be depicted on a figure in the TIS. For each of the study years, the total traffic projections shall include the future traffic plus the project-generated traffic. The future total traffic projections shall be depicted on figures for each study year.

29.08.160 Site Design and Circulation Evaluation

The project shall be analyzed to determine if the proposed circulation serves pedestrians, bicyclists and vehicles. The site design shall be evaluated to determine if facilities for vehicles, pedestrians and bicycles meet design standards and/or Codes. The project shall comply with the adopted Pedestrian and Bicycle Plan.

The project shall be evaluated to determine if traffic flows are properly designed. Proper design shall minimize areas where motorists would tend to speed, minimize potential conflict areas between vehicles and pedestrians/bicyclists, and to establish circulation patterns that avoid unnecessary traffic congestion, cut-through traffic and conflict points. Adequate throat lengths for on-site stacking at exit points is required (see 29.16.100). At signalized driveways, the HCM 90th percentile worst lane queue model shall determine the necessary storage. Businesses with drive-thrus must conduct a queuing analysis for the drive-thru to demonstrate that the queue will not extend back onto the public street.

29.08.170 Transportation Impact Analysis

The TIS shall determine if the project creates any significant impacts at the study intersections and/or corridors within the study area boundaries. The peak hour capacity and level of service at each of the study intersections and /or corridors shall be evaluated for:

(a) Future Background Traffic Conditions for each Study Year and

(b) Total Existing Traffic Conditions and

(c) Future Total Traffic Conditions for each Study Year

The capacity and level of service analysis for each traffic scenario and each study year needs to include mode split assumptions, if any. The findings shall be shown in the TIS in tabular form or illustrated on figures.

29.08.180 Calculations for Capacity and Level of Service

HCM delays and queues shall be calculated for signalized intersections using the current version of the Highway Capacity Manual. Synchro is the preferred software, however additional software that that utilize the current HCM methodologies may be utilized with prior approval from the Transportation Engineer. The HCM delay and queues shall be calculated for the identified peak hours for existing conditions, the projected traffic with build-out of the project, or at completion of phases of larger projects. An appropriate 15-minute peak hour factor shall be used. The performance evaluation of signalized intersections shall include the following:

(a) Critical movements shall be identified and must meet or exceed the threshold requirement of 35 seconds of delay or less;

(b) No movements shall have an adverse effect on the coordinated progression of the street system as determined by an approved coordination model consistent with the methods of HCM;

(c) HCM 90th percentile worst lane queues shall be calculated and shall not obstruct upstream intersections or major driveways;

(d) The analysis of a signalized corridor must show a reasonable progression band, identified as a usable (unblocked) band for major traffic movements.

Unsignalized intersections shall be analyzed using the current Highway Capacity Manual methods. In the performance evaluation of stop controlled intersections, measures of effectiveness to consider include the delay, volume/capacity ratios for individual movements, average queue lengths and 95th-percentile queue lengths to make appropriate traffic control recommendations. The Highway Capacity Manual recognizes that the delay equation used in the capacity analysis procedure will predict Level of Service F for many urban intersections that allow minor-street left-turn movements, regardless of the volume of minor-street left-turning traffic. In recognition of this, the TIS should evaluate the results of the intersection capacity analysis in terms of all of the measures of effectiveness.

Roundabouts shall be analyzed using the current version of SIDRA or approved methodology.

29.08.190 Mitigation Measures

The TIS shall include feasible measures that would mitigate the project's vehicular traffic impacts. The mitigation measures shall be in addition to the required improvements necessary to preserve corridor and intersection capacity. The acceptable mitigation measure(s) shall minimize the demand for trips by single occupant vehicles and increase the use of alternative modes. Mitigation listed in order of priority includes:

(a) Transportation Demand Management Measures

(b) Traffic Signal Operation Improvements

(c) Street Widening and Other Physical Improvements

29.08.200 Transportation Demand Management (TDM) Measures

Transportation Demand Management measures are designed to facilitate the use of alternate transportation modes in order to decrease demand on the roadway system by single occupant vehicles. Example of TDM measures include:

(a) Vehicle trip reduction incentives and services offered by employers to encourage employees to utilize alternative modes of travel such as carpooling, vanpooling, riding public transit, bicycling, walking and telecommuting.

(b) Provision of a mix of land uses in close proximity, facilitating walking, bicycling or transit trips.

A detailed description of the proposed TDM measures and implementation plan shall be included in the TIS for any project seeking TDM-related trip reductions. If the proposed TDM program is acceptable to the Transportation Engineer, the applicant shall be allowed to reduce total project vehicle trips by an amount commensurate with applicable trip reduction policies.

The intersection capacity and level of service shall be calculated to reflect the application of the proposed mitigation measures; the calculation shall show that the project-related impacts have been reduced to an acceptable delay (see thresholds identified in 29.08.180) for all movements and transportation modes (vehicle, bicycles, pedestrians). The findings shall be shown in tabular form.

29.08.220 Traffic Signal Operational Improvements

Required traffic signal operational improvements may include upgrading signals with additional signal phases and/or signalization of an unsignalized intersection, addition of turn lanes and/or construction of a roundabout.

The need for new traffic signals shall be based on warrants established in the Manual on Uniform Traffic Control Devices, MUTCD. In determining the location of a new signal, traffic progression is of paramount importance. On arterial streets a spacing of one-half mile for all signalized intersections is necessary to achieve reasonable operating speed, capacity and optimum signal progression. Pedestrian movements shall be considered in the evaluation and adequate pedestrian clearance provided in the signal phasing assumptions.

The applicant shall submit an analysis addressing proposed access, proposed signals and capacity and level of service based on the City's operational practices. All assumptions shall be documented in the TIS. An approved traffic engineering analysis must be made to properly locate all proposed accesses that may require signalization. The roadway to be analyzed for signal progression shall be established by the City or County and shall include all existing and proposed signalized intersections.

(a) The progression pattern calculations must match the existing cycle length on the corridor under analysis.

(b) Signal phasing assumptions must relate to traffic volumes in the capacity analysis of individual intersections.

(c) Approved computerized progression analysis techniques must be of the type which utilize turning movement volume data and pedestrian clearance times in the development of timing plans.

(d) The green time allocated to the cross street shall be considered no less than the time which is required for a pedestrian to clear the main street using MUTCD standards.

(e) Existing timing and phasing data for City and/or County signals on the corridor(s) being analyzed will be provided to the consultant on written request.

(f) Elimination of or substantial changes to existing phases and/or timing will not be allowed without written approval of the Transportation Engineer.

(g) Existing signal operations shall be presumed to reflect the local conditions and community expectations as determined and directed by the Transportation Engineer.

(h) If optimum usable bandwidth, as that term is defined by the Transportation Engineer, would be reduced if a traffic signal were installed then the intersection shall remain unsignalized and turning movements shall be limited.

29.08.230 Street Widening and Other Physical Improvements

Mitigation measures that include street widening and other physical improvements must be physically feasible and must meet minimum standards and Code(s) for both on-site and off-site improvements.

29.08.250 Conclusions

The findings of the TIS shall be provided in a summary report.

29.08.260 Recommendations

The TIS should include an executive summary including recommendations. Recommended improvements/mitigation measures to achieve standards and safety improvements shall be stated. The recommendation section of the report shall describe the location, nature, and extent of proposed improvements. A sketch of each improvement shall be provided showing the length, width, and other pertinent geometric features of the proposed improvement.

TRANSPORTATION IMPACT STUDY
BASE ASSUMPTIONS

Project Information				
Project Name				
Project Location				
TIS Assumptions				
Study Area Boundaries	North:		South:	
	East:		West:	
Study Years				
Future Traffic Growth Rate				
Study Intersections	1.All Access Drives		2.	
	3.		4.	
	5.		6.	
	7.		8.	
Time Period For Study	AM PM Sat Noon			
Trip Generation Rates				
Trip Adjustment Factors	Pass by:		Captive Market:	
Overall Trip Distribution	North	South	East	West
Mode Split Assumptions				
Committed Roadway Improvements				
Other Traffic Studies				
Areas Requiring Special Study				

DATE:
TRANSPORTATION ENGINEER:

PEDESTRIAN & BICYCLE ANALYSIS WORKSHEET

IMPACTED PEDESTRIAN & BICYCLE FACILITIES

Question	Yes/No	If answered YES, please describe.	Identify mitigations (where applicable)
Does the proposed land use change existing pedestrian or bicycle facilities?			
Is the land use on or adjacent to a proposed bicycle facility identified in the Pedestrian & Bicycle Plan?			
Does the project conflict with a proposed bicycle facility identified in the Pedestrian & Bicycle Plan?			
Is the site within an existing or proposed shared micromobility zone? If so, does the site plan include dedicated space for storage of shared bicycles and scooters?			
Is the project within an overlay zone? If so does it comply with pedestrian and bicycle elements of the overlay zone?			

DATE:
TRANSPORTATION ENGINEER:

29.12 ACCESS MANAGEMENT

29.12.010 Access Management

Access management is a means to protect the safety, traffic operations, and the assigned functional purpose of the street system while considering the access needs of the various elements of the system. Access management addresses the problems of congestion, capacity loss, and accidents. Providing access to land development while simultaneously preserving the flow of traffic, bicycles, and pedestrians on the surrounding road system in terms of safety, capacity needs, and speed is the goal of access management. Access is defined as any driveway or other point of ingress/egress such as a driveway, alley, street, road, or highway that connects to the public street system.

The street system provides mobility to the traveling public. This travel may serve one of two distinct purposes. The first is to provide throughput, allowing travelers to move efficiently. The second is to provide direct access to properties. Arterial streets are traditionally designed to prioritize throughput for motor vehicles by intentionally limiting access. In contrast, local streets provide direct access to properties, but do not provide high throughput for motor vehicles. To accommodate throughput for motor vehicles on city streets, access on collectors and arterials must be intentionally managed.

However, limiting access on collector and arterial streets can also limit mobility of non-motorized and mass transit modes along those corridors. Therefore, the design of streets should consider the impacts to active transportation and transit users and how they may use the system differently. The Active Transportation Corridors defined in the Pedestrian and Bicycle Plan are along a mix of arterial, collector, and local streets, but are effectively the arterial street network for people walking and biking. Thus, travel for these users should be prioritized on these corridors. In some cases limiting access for motor vehicles can improve throughput for both motor vehicles and active transportation users, such as limiting driveways and turning movement conflicts along an arterial street. However, in other cases they may conflict. For example, long gaps in an arterial road without a traffic signal can improve throughput for motor vehicles along that corridor, but can decrease mobility for active transportation users trying to cross the street. Therefore, access control measures must be sensitive to the mobility needs of all modes of transportation.

The existing and future function of each street is critical in determining the number, location, and design of access points and access control. Access management extends beyond simply specifying the number and separation of driveways and access points. Included are roadway design, such as auxiliary lanes, medians, stopping sight distance, channelization, and land development issues such as sign standards, internal site circulation, driveway layout, and alternative travel modes.

Appropriate access management strikes a balance in preserving the functional integrity of the street and providing access. Speed, capacity, and safety are the significant reasons for instituting access management. With proper access management, the speed differential between vehicles can be minimized or separated and proper access management will reduce the number of conflict points, resulting in fewer accidents. When the traffic on the street system can travel safely and efficiently, capacity is preserved. Access management recognizes the interests of both landowners and roadway users in providing a transportation system that better meets the needs of all interests.

29.12.020 State Highways

Refer to the current edition of The State Highway Access Code. Under that code, all accesses constructed on a State Highway require an access permit approved by the State. The Access Code requires owners of land adjacent to a State Highway that is being developed or redeveloped to apply for an Access Permit for each access to the State Highway if the use of the property is being changed or the existing access modified. The definition of property change is included in Section 2.6 of the Code.

29.12.030 City or County Streets

Local jurisdictions approve the design, number, and location of access points. When changes in land use occur which result in changes in the type or nature of access operation, the access shall be approved with the development plans and constructed to meet current standards.

29.12.040 Backing Into the Right-of-Way

Driveways and parking pods that require backing maneuvers in a public street shall not be approved except on streets posted at 25 mph or less and with and an ADT of 2,000 vehicles or less. Exceptions may also be made in the downtown area, defined as the area between Pitkin Avenue to Grand Avenue, 1st Street to 8th Street.

Backing into alleys will be allowed from normal parking stalls, regardless of land use, under the following conditions:

(a) The parking is designed so the parking stall and aisle meet the requirements of section 21.06.090 of the Zoning and Development Code. The needed aisle width can include the existing alley.

(b) A maximum of four spaces in a row will be allowed, with a 5’ landscape area on each end of the spaces. This standard is designed for perpendicular parking spaces and a 50’ wide lot. Wider lots can create more spaces, up to

a maximum of 8 spaces without intermediate landscaping but the end landscaping is still required. Angle parking will be addressed on a case-by-case basis to achieve the intent of this standard.

29.12.050 Provision of Access

If a property has frontage on more than one street, access will be permitted only on those street frontages where design and safety standards can be met. The primary access shall be on the lower-order street or via an access easement. Refer to the current edition of the State Highway Access Code for access requirements off a state highway.

29.12.060 Restriction of Turning Movements

Turning movements may be limited where necessary for the safe and efficient movement of traffic, both on and off-site.

29.12.070 Number of Access Points and Joint Access

Each development applying for access to a collector or arterial street shall analyze its own internal circulation system and access points, as well as impacts to the surrounding properties and street system as part of the required TIS.

Cross-access connections and/or stub streets to abutting properties will be required between commercial and residential properties unless it can be shown that this won't facilitate better circulation or it creates safety hazards. The project site design shall include a circulation and access system that will safely and efficiently accommodate traffic from adjacent properties.

One access point per property ownership will be permitted, unless an approved site plan or TIS shows that additional access points are required to adequately handle driveway volumes and that the additional access points will not be detrimental to safety, traffic flow, and pedestrian and bicycle travel on adjacent public streets. Additional access points may also be allowed at the discretion of the director. Temporary access may be granted to accommodate phased development of a site. Temporary accesses are subject to removal, relocation, redesign or reconstruction after permanent approved access is constructed.

29.12.080 Cross-Access Corridors

Cross-access corridors shall be designed to provide common access and circulation among parcels, to assist in local traffic, pedestrian, and bicycle movement. Cross access should be designed to include the following elements:

(a) Sufficient separation between the public street and the cross-access corridor to allow storage and circulation to occur within the site.

(b) Sufficient width to accommodate **two-way travel** aisles designed to accommodate automobiles, service and delivery vehicles.

(c) Stub-outs to the abutting properties that will be tied in to provide cross-access.

(d) Linkage to other cross-access corridors in the area, if applicable.

(e) Sidewalks and/or trails to connect pedestrians and bicycles from existing facilities to, or through, the parcel to surrounding properties that will develop in the future and/or to existing facilities in a nearby location.

Wherever a cross-access corridor is designated on a subdivision plat, site plan or other development application, the property owner shall grant and record an easement allowing cross-access to and from the other properties in the area.

29.12.090 Stub Streets

A stub street is an existing or planned street that is or will be extended to the property line(s) of a development for the purpose of future extension onto adjacent property. A stub street may be for access and/or as a part of the comprehensive circulation system.

29.12.100 Abandoned Accesses

Existing driveways shall not be abandoned, relocated, altered, or reconstructed without a permit from the appropriate agency..

29.12.110 Exclusive Turn Lanes

Exclusive turn lanes are described in detail in the CDOT State Highway Access Code and in Chapter 29.28.

29.12.120 Field Access

Field access is defined as access used solely for agricultural purposes and traffic generation does not exceed one vehicle (two trip ends) per day when averaged over one calendar year. When an agricultural property changes to a new or more

intensive land use, all field accesses to the property shall be considered abandoned and access points for the new or more intensive use will be determined by the standards contained within this document.

29.12.130 Access Exceptions

Exceptions to these standards shall be allowed only as set forth in Chapter 29.64.

29.16 ACCESS DESIGN AND SITE CIRCULATION

29.16.010 Access and Site Design

Access is defined as any driveway or other point of ingress/egress such as a street, road, highway or driveway that connects to the public street system. This chapter defines the types of accesses, their locations, and geometric requirements.

Acceptable site design is achieved when three major elements – access location and design, site circulation and parking, building footprint and location – are integrated. Site circulation can directly affect the safety, traffic operations and the assigned functional purpose of the street system. Good site circulation is necessary to protect the integrity of the public streets as well as public safety within the site.

29.16.020 Access Locations

All entrances and exits to vehicular traffic areas shall be located and constructed to minimize traffic congestion on the public street system.

29.16.030 Spacing (Same Side of Street)

On local residential streets, single-family residential driveways on the same side of the street shall be located a minimum of 5 feet, measured from property line, to allow for maneuvering to occur without trespass. In locations where the 5 feet minimum spacing cannot be met due to limited lot frontage or other field constraint, the Development Engineer may permit a variance from the spacing standard.

On local commercial streets, driveways on the same side of the street shall be spaced a minimum of 50 feet, measured from edge of access to edge of access. On collector streets, driveways on the same side of the street shall be spaced a minimum of 150 feet apart. (see Driveway Spacing, Width, and Offset Requirements by Street Classification). On arterial streets where no other access to lower order streets is available, driveways on the same side of the street may be allowed to be spaced a minimum of 300 feet and may be restricted to right-in, right-out movements. No new residential driveways shall be allowed on arterial streets serving less than three units and when allowable driveways must be designed so vehicles are not backing into the street.

29.16.040 Offsets (Opposite Side of Street)

Where properties are not large enough to allow accesses on opposite sides of the street to be aligned, the center of accesses and intersections not in alignment shall

be offset a minimum of 50 feet on local commercial streets, measured from edge of access to edge of access, offset 150 feet or greater on all collector streets and minor arterial streets, and offset 300 feet or greater on all principal arterial streets (see Driveway Spacing, Width, and Offset Requirements by Street Classification). Greater distances may be required for left turn storage lanes. Shared accesses will be required wherever possible to minimize the number of access points along a street. Shared access provides for safer and more efficient operation of the flow of traffic on the street and shall minimally meet the above requirements.

29.16.050 Corner Clearance

Corner clearances are defined as the distance between the edge of a driveway (exclusive of the taper) and the edge of the nearest intersecting street. The clearance is necessary so that accesses do not interfere with street intersection operations and should provide drivers with adequate perception-reaction time to potential conflicts. On corner lots, the access location shall be on the street of lowest functional classification.

Minimum Corner Clearance (ft)
Measured from Flowline to Near Edge of Access

Street Classification Of Street Where Access Is Proposed	Clearance From Unsignalized Intersections	Clearance From Signalized Intersections	Single Family Residential Driveways
Local (≤ 300 ADT)	35’	150’	50’
Local (> 300 ADT)	50’	150’	50’
Collector	150’	150’	100’
Minor Arterial	150’ *	300’ *	N/A*
Major Arterial	300’ *	300’ *	N/A*

*May be restricted to right-in, right-out only access. Single family access to arterial streets is not acceptable practice and will be permitted only in extreme hardship cases.

29.16.060 Access Design

29.16.060 Types of Access

Generally, all new private property access shall be designed as curb cuts. Radii type curb returns with handicap ramps will be required for accesses when the peak hour right turn entering volume exceeds 20 vehicles in the peak hour. Auxiliary lanes shall be constructed when turn volumes meet the minimum criteria in the right turn warrant chart in section 29.28.170.

29.16.070 Design Vehicles

All accesses shall be designed to accommodate the turning characteristics of the largest vehicle that will most commonly utilize the proposed access. Most residential and small commercial driveways only need to accommodate passenger cars; other commercial or industrial developments will usually require at least one access that can accommodate the efficient entry or exit of larger vehicles.

29.16.080 Curb Radii

The radius at the flowline of gutter shall be at least 15 feet. The effective turn radius (which accounts for on-street bike lanes or parking if applicable) shall be 20 feet for multi-family residential access and 25 feet for commercial access. The effective radii for industrial uses or truck delivery accesses shall be individually designed for the type of truck that will frequently use the access, with a maximum required radius of 50'.

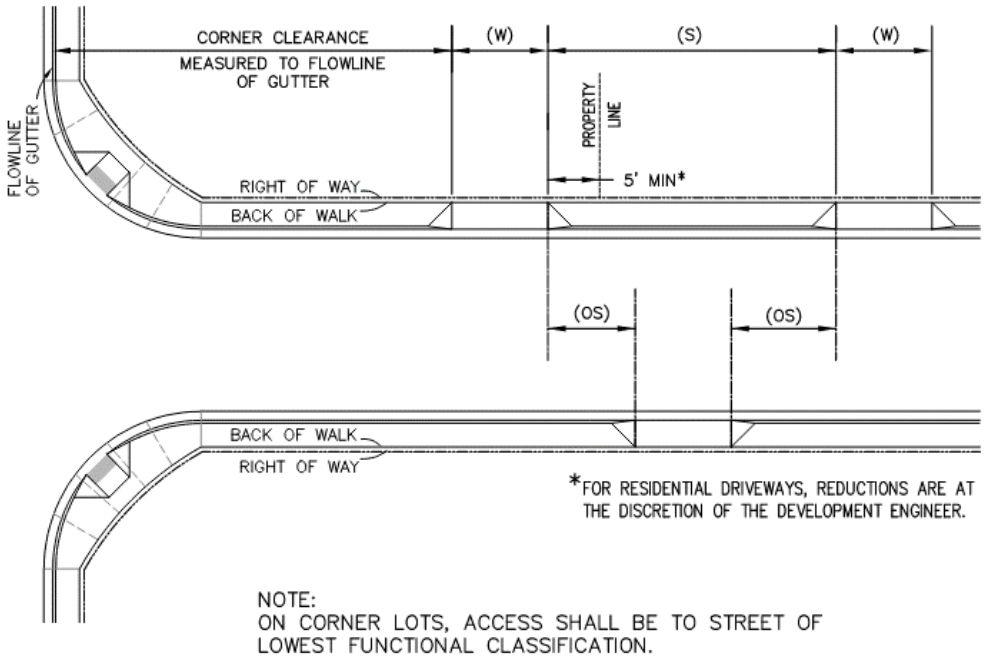
29.16.090 Driveway Width

Single-family residential driveway widths shall be between no more than 33 feet. All other access drive widths shall be between 25 feet and 36 feet. Multi-lane driveways shall be designed to accommodate a standard ingress lane of 16 feet and egress lanes of 12 feet.

Driveway Spacing, Width, and Offset Requirements by Street Classification

Street Classification (Land Use)	Driveway Spacing (S)	Driveway Width (W)	Offset (OS)
Local (Residential)	10' Min.	33' Max.	No Requirement
Local (Commercial and Industrial)	50' Min.	25' Min. 36' Max.	50' Min.*
Collector	150' Min.	25' Min. 36' Max.	150' Min.*
Minor Arterial	300' Min	25' Min. 36' Max.	150' Min.*
Principal Arterial	300' Min.	25' Min. 36' Max.	300' Min.*

* Greater offsets may be required for left turn storage lanes.



29.16.100 Throat Lengths and Vehicle Storage

Adequate vehicle storage capacity shall be provided for both inbound and outbound vehicles. Adequate storage facilitates the safe and efficient movement of vehicles between the street and the development.

The access throat shall be of sufficient length to prevent vehicles from spilling onto the public street system. Inbound vehicle storage areas shall be of sufficient size to ensure that vehicles will not obstruct the adjacent street, sidewalk, or circulation within the facility. The throat shall be of sufficient length to provide adequate storage of outbound vehicles without them interfering with on-site circulation. Outbound vehicle storage areas shall be provided to eliminate backup and delay of vehicles within the development. At signalized intersections, adequate storage for the outbound movement must be provided to enable vehicles to exit efficiently on green.

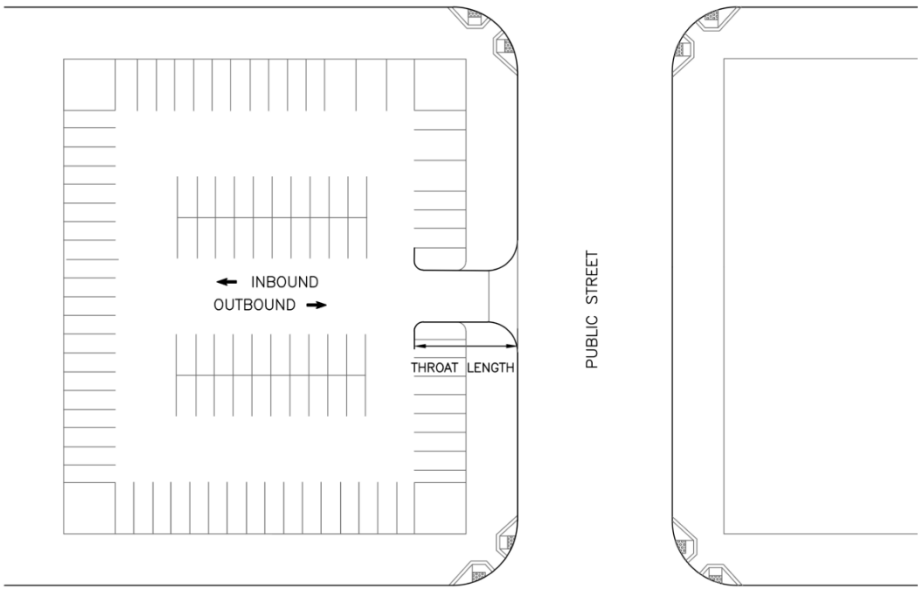
The requirements for vehicle storage (see On-Site Driveway Vehicle Storage Lengths) in parking lots and at drive-up type facilities are generally based on a

typical vehicle spacing of 20 feet, but may be increased where larger vehicles can be expected.

29.16.110 Accesses Serving Off-Street Parking Lots

On-site storage is measured from the flowline of the street to the first parking stall or aisle of a parking lot (see Throat Length Extents). Vehicle storage equivalent to or greater than the minimum distances shall be provided at accesses serving the site. The recommended distance for accesses with two approach lanes may be adjusted, subject to the TIS findings, roadway geometry, traffic volumes, and site layout.

Throat Length Extents



On-Site Driveway Vehicle Storage Lengths (feet)

Parking Spaces Per Exit Lane	Storage Length Required			
	Multi-Family Residential	Retail	Office	Industrial
0-25	25	25	25	25
25-200	25	50	25	50

201-400	25	75	100	150
401-600	50	150	200	More Lanes
601-700	100	200	More Lanes	More Lanes
> 700	200	More Lanes	More Lanes	More Lanes

Vehicle Storage Requirements for Drive-Up Facilities

Type of Facility	Vehicle Storage
Automated Tellers	4 spaces per machine
Drive-In Bank	3 spaces per 1,000 sf
Drive-In Restaurant	Identified through TIS
Automatic Car Wash	7 spaces per wash line
Self-Service Car Wash	2 spaces per wash line
Drive-In Theater	15% of the total parking capacity
Service Stations	1 space per nozzle + 1 space/island/direction
Drive-In Liquor Store	3 spaces per window[1]
Drive-In Dry Cleaners	2 spaces per window[1]

Adapted from Table 9-4, NCHRP 348 *Access Management Guidelines for Activity Centers*

[1]Measured from the pick-up window and includes the vehicle at the window.

29.16.120 Commercial Uses

The vehicle storage area that shall be provided for various drive-through commercial uses shall be:

(a) Based on a 20' length vehicle and a 12'wide lane.
(b) Separated from normal parking circulation aisles.
(c) Designed using the appropriate design vehicle turning template.

29.16.130 Grades

Access grades shall meet the same standard grades identified for intersections in Chapter 29.28.

29.16.140 Sight Distance

Adequate sight distance and sight zones shall be provided at all access intersections and internal street or drive aisle intersections within a development.

29.16.150 Channelization Islands

Commented [EM1]: Reference CDOT Chapter 9 as well?

Channelizing islands are discouraged. Use of medians to control turning movements will be required where physical conditions allow.

Channelized islands will only be allowed in situations where medians to control access are not feasible. If allowed, the islands shall not be smaller than 100 square feet and shall provide vertical curb and exposed colored aggregate or patterned concrete treatment. Patterns and color shall match those of any nearby islands or medians. Additional right-of-way or easement may be required to accommodate these designs. The ends of the islands shall typically be constructed with 2-foot flowline radii.

29.16.160 Pedestrians and Bicycles

Pedestrians and bicyclists are especially vulnerable to turning vehicles at access drives. The consolidation of access points benefits pedestrians and bicyclists by reducing the number of conflict points along the roadway. Access designs for pedestrian and bicycle facilities shall conform to Chapter 29.20 and Chapter 29.28 requirements and with the City Standard Details.

29.16.170 Transit

Where applicable, accesses shall be designed to accommodate busses or other transit vehicles in accordance with the Mesa County Transit Design Standards and Guidelines. These accommodations shall occur at shopping centers, malls, multifamily developments, or other mixed-use developments where transit vehicles may be frequent users of the on-site circulation system.

29.16.180 Emergency Vehicles

All accesses shall be designed to readily accommodate emergency vehicles that would ordinarily respond at the particular establishment (Refer to the current version of the Grand Junction Fire Department Access regulations based on the Uniform Fire Code).

29.16.190 Utilities and Lighting

Accesses shall be located to ensure that utility poles, electric boxes, and signs do not interfere with the visibility of the access or available sight distances. The design of site lighting shall maximize the visibility and location of the access.

29.16.210 Delivery and Service

Proposed development that includes truck loading/unloading shall provide adequate space for all truck operations. Adequate space minimally means that all truck operations be performed entirely on-site and off the public street system. Sufficient apron space shall be provided at all loading/unloading areas. Sufficient apron space is the area required for truck backing maneuvers. Delivery areas shall be separated from general traffic areas. Separation of delivery vehicle traffic from customer traffic shall occur entirely on-site. On-site roadways used by delivery vehicles shall be designed to accommodate the heavier payloads and turning characteristics of the largest vehicle expected to use the site.

29.16.220 Transit and Pedestrians

In larger mixed-use developments, multifamily developments, shopping centers, and malls, on-site roadways shall be designed to accommodate transit. This includes the design of pick-up/drop-off areas as well as the circulating roadways. Transit stops shall be located within a reasonable walking distance of the main building entrance while minimizing potential conflicts with circulating vehicles. Continuous pedestrian walkways and crossings that meet ADA standards and follow a direct (non-circuitous alignment) must be designed on-site and connected with each other and to the adjacent pedestrian network to reduce conflicts between pedestrians and vehicles and provide convenient access between the land uses and transit.

29.16.230 Inter-parcel Circulation

Inter-parcel circulation with shared access is required between adjacent commercial properties for vehicles, bicycles, and pedestrians. Inter-parcel circulation with shared access may be required between residential and commercial. This will be evaluated on a case-by-case basis to consider the context of the situation. This will reduce the number of curb cuts on public streets and will increase the safety and comfort for all modes of transportation on the adjacent street and capacity of the street system. Within larger development sites public streets may be required as part of a connected network to facilitate inter-parcel circulation of vehicles, pedestrians, and bicyclists.

29.16.240 Landscaping

Site landscaping requirements are detailed in the Zoning and Development Code. Landscaping at access points must meet the requirements for sight distance (see GJMC 29.28.140) and the sight zone (see GJMC 29.28.150). Landscaping islands shall also consider the same requirements.

29.20 LOCAL & MINOR COLLECTOR STREETS, LANDSCAPING & TRAFFIC CALMING

29.20.010 Street Standards

Geometric street standards have been developed to provide livability for residents, safety for both vehicular and pedestrian traffic and efficient movement. This chapter sets the minimum standards for geometric design of local and minor collectors streets that provide access to residential, commercial, and industrial land uses. These streets deserve special discussion because they are the most common streets built for development. Local streets are defined as streets whose primary function is to serve the abutting land use. Design criteria for both horizontal and vertical alignments are established in this chapter. Design criteria for major collector and higher classification streets are discussed in Chapter 29.28.

29.20.020 Local and Minor Collector Streets

Streets shall conform with the adopted Street Classification Map in the Grand Junction Circulation Plan. Minimally, the plan identifies locations where collector street connections are desired and identifies general alignments for local streets. Street layouts shall continue streets in adjoining subdivisions or their anticipated locations when adjoining property is not yet developed to provide interconnectivity.

29.20.030 Block and Lot Dimensions

Blocks shall not exceed 1,200 feet in length between intersections for motor vehicles (streets providing multiple access, not cul-de-sacs) and shall not exceed 700 feet in length for pedestrians (can be met by multiuse trails between lots or sidewalk along a street), except where topography, traffic, or other conditions require longer blocks. If a midblock cut-through pedestrian trail is included pedestrian bollard lights along the trail may be required in more urban areas. These are to be maintained by the HOA or private owner. No lots shall be divided by street, alley, or any other thoroughfare or property, or by City boundary lines.

29.20.040 Right of Way, Street Lane Widths, and Street Lengths

The required right-of-way width for a street is stated in the Street Sections. Additional widths may be required for needed through lanes, turn lanes, speed change lanes, and where it is necessary to accommodate slopes, irrigation crossings, drainage structures, and timing of adjacent development.

29.20.050 Cul-de-Sacs and Dead End Streets

No cul-de-sac shall be more than 750 feet long, measured from the center of the intersection to the center of the turnaround.

No more than 30 lots shall be located on a cul-de-sac street. All cul-de-sacs shall have a turnaround at the terminus point.

Surface drainage of a cul-de-sac shall be conveyed toward the intersecting street, if possible, and if not possible a drainage easement shall be provided leading out of the cul-de-sac.

Fire Department Access standards contain additional details to assist developers and designers in meeting the requirements of the fire department (Fire department Access B.2-5)

Unless the street meets all of the requirements for a cul-de-sac, no dead end streets shall be allowed except in cases where such streets are designed to connect with future streets on adjacent land. In that case, if any lots in the subdivision are dependent upon the dead end street for access, the plat shall include a temporary turnaround easement at the terminus of the street.

A single access street system shall be allowed for a maximum 100 dwelling units. The layout of the subdivision shall meet sections D104.3 and D107 of the International Fire Code. Before the 101st unit can be platted, a secondary access is required to be constructed or financially secured. This secondary access must be platted as public right-of-way and constructed to public street standards to the property line of the subdivision. A temporary turnaround shall be constructed if the stub street access is longer than 150 feet. For single or two-family residential developments that exceed 30 units, a separate and approved fire apparatus access road will be required.

29.20.060 Alignments

(a) Horizontal Alignment

Designs must conform to the pattern of thoroughfares designated in the Street Classification Map in the Grand Junction Circulation Plan. Proposed streets align with existing or platted streets with which they are to connect.

Local streets (if not ending in a cul-de-sac) shall extend to the property lines of the project. A temporary turn around area capable of supporting a fire truck (HS-20 loading) shall be required at the end of the street improvement if a cul-de-sac is not provided and the street is longer than 150' from the flowline of the intersecting

street,. Proposed streets with widths different from existing streets to which they are being connected must be transitioned using the pavement transition taper standards.

(b) Curve Radii

(1) All curve designs shall be based on the Horizontal Curve Design Criteria.

Horizontal Curve Design Criteria

Design Criteria	Local[1]		
	Hillside[2]	Residential	Industrial/ Commercial
Design Speed (mph)	20	25	30
Center[3] Line Radius (ft)	100	150	300
Horiz. Sight Dist. (ft)	150	200	200
Reverse Curve Tangent (ft)	0	0	0
Approach[4] Tangent at Intersections	50	75	100

1 These criteria are to be used without super-elevation.

2Hillside is defined as having grades of 10% or greater, as defined in section 21.06.010(f) of the City Zoning and Development code.

3 Radii shown are based on the street having a crown section with a pavement cross-slope of 2% on each side of the crown.

4 Where a curved road approaches an intersection, these tangent sections must be provided on the approach to the intersection to provide for adequate sight distance for traffic control devices at the intersection. The distance shall be measured from the flowline of the through street.

(2) Intersections shall meet the minimum effective turn radii at public street intersections (which accounts for on-street bike lanes or parking if applicable) and must meet a minimum curb return flowline radius of 15 feet.

Minimum Effective Turn Radii at Public Street Intersections

Through Street[2]	Intersecting Street				
	Arterial	Collector	Local Residential	Local Commercial	Local Industrial[1]
Local Residential	30’	25’	20’		
Local Commercial	30’	30’	20’	30’	30’
Local Industrial		30’		30’	30’

[1] Radii at intersections with industrial streets shall be designed on a case by case basis considering the turning requirements for the type of truck that will most commonly use the street.

[2] At signalized intersections where right turn channelization islands are provided or high truck and bus volumes may use the access, a larger flowline radius may be required.

[3] When bike lanes or parking are present consider a reduced flowline radii to match the effective flowline of the intersection, with a minimum flowline of 15’.

(c) Bulb Outs

If on street parking is present, steps should be taken to prevent vehicles from parking too close to the intersection. Bulbouts should be used to reduce the intersection width and prevent parking in the sight zone. This will result in shorter crossing distances for pedestrians, increased sight distance, and increased visibility of pedestrians especially for turning vehicles, which will increase pedestrian safety and comfort at intersections.

(d) Tangent Distance Between Curve

There is no minimum tangent distance between curves for residential or commercial street design.

(e) Superelevation

Superelevation is not allowed on residential street curves.

29.20.070 Vertical Alignment

(a) Grades

Design grades and vertical sight distance address drainage and/or safety concerns for vehicles and pedestrians. Grades of streets shall not be less than 0.5%, nor more than 8%. In hilly terrain (defined as having grades of 10% or greater, as defined in section 21.07.020 of the City Zoning and Development code), the maximum grade for local residential streets is 12% for a maximum distance of 500 feet.

(b) Grades at Intersections

At unsignalized intersections, the maximum grade in the intersection shall be 4%, and extends a minimum of 50 feet in each direction from flowline of the intersecting street. At signalized intersections, the maximum grade shall be 2% within the intersection and extend for 200 feet in each direction. When intersecting with State Highways, refer to Section 4 of the State Access Code.

To help keep the grade of gutters at a minimum of 0.5% a maximum allowable grade break of 1% is allowable in sags and 0.5% on crests.

29.20.080 Cross Section

(a) Street Cross Slopes

The typical cross slope is 2% crown to provide for adequate drainage to the pavement edge. The maximum cross slope shall not exceed 4%. The minimum cross slope shall be 1%. Typical sections are shown in the City Standard Details.

(b) Roadside Barrier and Bridge Rails

Roadside barriers shall be required in accordance with warrants, design criteria and standards for roadside barriers and bridge rails as defined in the most recent version of the AASHTO Roadside Design Guide, .

29.20.090 Stopping Sight Distance

Stopping sight distance is defined as the length of roadway ahead visible to the driver. The minimum stopping sight distance available on a roadway must be sufficiently long to enable a vehicle traveling at or near the roadway design speed to stop before reaching a stationary object in its path or react to a traffic control device such as a stop sign.

The appropriate stopping sight distance (see GJMC 29.28.140) shall be provided. The distances shown assume vehicles traveling on wet pavement on flat grades. Factors that take in to account the effect of grade on stopping sight distance shall be used in determining appropriate stopping sight distance where the grades are 3% or higher.

29.20.100 Bicycle Treatments

Bicycle facilities shall be provided in accordance with the adopted Pedestrian and Bicycle Plan. Provisions for bicycle facilities shall be in accordance with the current version of the AASHTO Guide for Development of Bicycle Facilities.

The standard cross-section of off-street multi-use trails is included. Refer to Chapter 29.48 for design guidance on bicycle facility types, and minimum adherence standards. Refer to the NACTO Urban Bikeway Design Guide and the FHWA Separated Bike Lane Planning and Design Guide for additional guidance on designing bikeway facilities identified in the Pedestrian and Bicycle Plan.

29.20.110 Intersections

There are two general types of intersections: unsignalized and signalized. Each of these shall have several different configurations and levels of traffic control. A roundabout is a form of an unsignalized intersection and is specifically discussed in GJMC 29.28.220 All intersection design shall conform to the guidelines set forth in AASHTO and the MUTCD.

29.20.120 Unsignalized Intersections

There are two appropriate levels of traffic control at unsignalized intersections: two-way stop controlled and all-way stop controlled. The appropriate use of each of these is discussed in the following sections.

(a) Two-way Stop Controlled Intersections

(1) Two-way stop controlled intersections shall be installed in new subdivisions.

(2) STOP signs shall be installed in accordance with the MUTCD.

(3) At intersections of two different types of roadways, a STOP sign shall be used on the minor street to stop the lesser flow of traffic. STOP signs will generally be used at all intersections that do not meet the all-way stop control or traffic signal warrants.

(b) All-way Stop Controlled Intersections

An all-way or "multi-way" stop installation shall be used only as warranted in Part II of the MUTCD**.**

` *29.20.130 Signalized Intersections*

Signals will not normally be considered for residential streets or commercial streets. Where signals may be warranted, the criteria in GJMC 29.28.130 shall be followed, and documented in a Transportation Impact Study (see Chapter 29.08).

29.20.140 Angles

Public streets shall intersect at 90° angles or as close to 90° as topography permits, in any event no less than 80°. Intersections on horizontal curves shall be avoided.

When an intersection is on a curve the center line of the intersection must be radial to the curve.

29.20.150 Grades

Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is 4% and extends a minimum of 50 feet in each direction from the outside edge of the traveled way of the intersecting street. At signalized intersections, the maximum grade is 2% within the intersection and extends 200 feet in each direction from the centerline of intersecting roadway. Grades above 4% will only be allowed on local and collector streets in areas with steep topography or other unusual circumstances that prevent a flatter grade, and must be documented as a design exception (see Chapter 29.64).

29.20.160 Spacing and Offsets

(a) Commercial Streets

Four legged intersections shall be spaced at least 300 feet apart from centerline to centerline. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet and be 150 feet from the nearest four legged intersection. If the left turn storage requirements for adjacent intersections overlap, the minimum spacing must be increased to provide adequate left turn storage in both directions. If exclusive turn lanes are required, the design shall conform to the criteria in GJMC 28.28.170.

(b) Local Residential Streets

Four legged intersections shall be spaced at least 300 feet apart from centerline to centerline. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet.

29.20.170 Intersection Sight Distance

Street intersections and private access to public streets shall be planned and located to provide as much sight distance as possible. At a minimum, there must be sufficient sight distance for the driver on the minor street or driveway to cross or turn onto the intersecting street. Minimum sight distance values are provided (see GJMC 29.28.140) for passenger cars turning left or right from a minor street. When grades are steeper than 3.0%, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, a) the 85th percentile speed, b) the posted speed if based on an engineering study, or c) in the case of a new facility, 80 percent of the design speed.

29.20.180 *Sight Zones*

Within the sight zone there shall be no sight obscuring sign, wall, fence, berming, or other object higher than 30 inches, or in the case of trees, no foliage lower than 8 feet (trees of any diameter may be planted as long as no foliage is lower then 8 feet). Vertical measurement shall be made from the flowline of the adjacent gutter or, if no gutter exists, from the edge of the nearest traveled way. Objects that may be located in the sight zones are items such as hydrants, utility poles, and traffic control devices. These shall be located to minimize visual obstruction.

29.20.190 Pedestrian Treatments

In order to provide pedestrian safety, comfort, and access, accommodations for pedestrians shall be designed into all intersections and in accordance with the Pedestrian and Bicycle Plan. This includes sidewalks, crosswalks, pedestrian refuge islands and accessible ramps. The design shall conform to the standards set forth by the Americans with Disabilities Act and meet the details specified in the City Standard Details.

29.20.200 Landscaping – Site Distance at Intersections

Any landscaping in the sight distance triangles at intersections shall be low growing, and shall meet the sight distance requirements in Section 29.20.180.

29.20.210 Traffic Calming

According to the Institute of Traffic Engineers (ITE), "Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users." This differs from standard traffic control devices such as stop signs, which are regulatory. Traffic calming strategies are engineered to be self-enforcing physical measures.

This section provides guidance for appropriate applications of traffic calming on the existing street system, as well as the application of traffic calming measures during the planning and design stages of new sub-divisions. Refer to ITE's Traffic Calming Measures for additional guidance on design and considerations of each traffic calming tool.

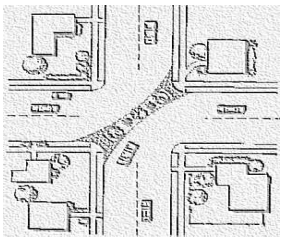
29.20.220 Methods to Divert Traffic from Residential Streets

Residents frequently complain that their residential street is being used by high speed and/or cut through traffic. One treatment of the traffic is the use of closures, diverters, and one-way treatments. Multiple treatments can be implemented on one street as part of a formal "Slow Streets Program" along with supporting signage such as "Local Traffic Only."

(a) Street Closure

Streets may be closed to give drivers no choice but to travel another route; residents are given access only. A street closure is the most drastic form of traffic calming and shall be carefully considered before implementation. Street closures can very often lead to traffic problems on nearby streets as drivers are re-routed to other routes. One of the benefits of this type of method of calming is a fully walkable neighborhood.

(b) Street Diverters



A street diverter can also be considered a partial street closure. With a diverter, traffic traveling in one direction is not given access to a street. This drawing shows the most common form of street diversion, where vehicles are allowed ingress and egress through single access points rather than from either direction. As with street closures, implementation of diverters may shift traffic to another street where access is not regulated. Street diverters should provide cut throughs for pedestrians and bicyclists.

(b) One-Way Streets

One-way streets may be effective in decreasing the number of vehicles traveling on a given roadway. Traffic patterns shall be assessed to determine the effects of a one-way street on a given circulation pattern. Although traffic volumes are generally decreased by one-way treatments, speeds can often increase as drivers are channelized through the street.

29.20.230 Methods to Slow Traffic on Residential Streets

Where speed is the recognized problem, the following methods can be effective in slowing existing traffic on residential and collector streets. These treatments are appropriate on streets where the block length is at least 600 feet. For blocks less than 600 feet traffic circles at the intersections are the preferred traffic calming tool.

(a) Chokers

Research has shown that traffic moves slower on more narrow roads. Chokers reduce the width of a street by narrowing the road at a 'choke point'. Depending on the road segment length, one or several chokers can be used.

(b) Medians

A median can be installed on a street where width tends to encourage speed. Medians narrow the lanes, reducing the comfort of the driver while driving at higher speeds. Median treatments are particularly effective with landscaping.

(c) Chicanes

A chicane is essentially half of a choker. A chicane is placed on one side of the road to narrow a lane of traffic. A chicane can be used singly but is usually placed as a series on both sides of the road.

29.20.240 Methods to Slow Traffic at Intersections

(a) Raised Intersections

Raised intersections are flat raised areas covering entire intersections, with ramps on all approaches and often with brick or other textured materials on the flat section.

(b) Realigned Intersections

Realigned intersections are changes in alignment that convert T-intersections with straight approaches into curving streets meeting at right angles – a straight shot along the top of the T becomes a turning movement.

(c) Traffic Circles

Traffic circles are set in the center of a three- way (driveways excluded) or four-way intersection to slow traffic coming from each direction. A traffic circle can be effective in creating a neighborhood gateway by providing a unique feature that can

be creatively landscaped. This includes mini traffic circles which can be applied as a retrofit to existing STOP controlled intersections.

(d) Other Methods

Other methods may be considered (such as hardened center lines) as approved by the jurisdiction.

29.28.250 Traffic Calming in New Developments

Long, wide streets with limited parking will generally increase speeds. As new developments occur, traffic calming can be planned as a feature of the neighborhood to keep vehicle travel speed low for maximum livability and safety of all street users. In large developments and developments that connect to existing residential streets, designs to control speeds and volumes are required. Design features such as curvilinear streets, T-intersections and entry treatments can reduce the need for traffic calming devices such as speed humps and chokers. Generally, horizontal calming measures will provide greater efficiency and livability in new developments.

The design speed of residential streets shall be 20 MPH. The design of local streets shall include positive traffic calming measures and devices. Such measures and devices shall be sufficient to minimize the ability of the average motorist to exceed 20 MPH.

29.20.260 Fire Department Access

The Grand Junction Fire Department responds to a multitude of emergencies in various types of buildings and occupancies. To provide effective fire-fighting operations, the Fire Department must be able to reach all structures by way of approved access. Thus, street design and access must meet the requirements established in the current version of the Grand Junction Fire Department Access document. The only potential exceptions to the requirements identified in that document that would be considered are modifications of the Alternative Street Designs (see Chapter 29.68) that are submitted and approved through a formal Design Exception Process (see Chapter 29.64).

29.44 TRAFFIC SIGNALS & CONSTRUCTION ZONES

ARTICLE I. GENERALLY

29.44.010 Installation/Relocation of Traffic Signals

New traffic signal installations and relocations of existing signal equipment may be required in the developer's public improvement agreement. New signals will be installed only when warranted as specified in the MUTCD and when the new signal will not have a detrimental effect on the traffic flow. The need for a traffic signal will be addressed in the TIS (see Chapter 29.08) and be designed in accordance with the criteria in GJMC 29.28.130.

The installation, modification or relocation of a traffic signal must follow the specifications defined in the *City of Grand Junction Traffic Signal Specifications* document.

29.44.020 Signal Design Plans

Signal design plans shall be submitted as part of the development plans. The design of the traffic signal shall follow the ITE *Manual of Traffic Signal Design* and the MUTCD standards. The signal design shall follow the Signal Specifications of the City.

Signal design plans shall contain all necessary information. Typical traffic signal installation and design details are included at the end of this chapter.

New signals or improvements to existing signals shall be required to install conduit for fiber optic cable and all necessary fiber optic equipment to connect to adjacent signals on streets as shown on the Signal Communications Plan.

29.44.030 Traffic Control Plans for Construction Zones

All maintenance of traffic plans for construction areas shall be submitted to and approved as part of the permitting process for work in the public right of way. All plans shall conform to the MUTCD and be prepared by a certified traffic worksite supervisor. On State Highways, the Colorado Department of Transportation shall approve work area traffic control signing and detour plans.

29.44.040 Signal Design Plans

Signal design plans shall contain all necessary information. Sample signal design drawings illustrating the proper information required are provided.

29.48 TRANSIT, BICYCLE, AND PEDESTRIAN FACILITIES

29.48.010 Planning and Implementation

Transit, bicycle, and pedestrian facilities are an integral part of the transportation system. This chapter establishes how to plan and implement these facilities. Transit, bicycle and pedestrian accommodations shall be addressed in transportation impact studies as discussed in Chapter 29.08. Additionally, the provision of transit, bicycle, or pedestrian facilities or easements for such facilities may be required as part of the development review process in order to facilitate multimodal circulation and access through or adjacent to the development consistent with the *Mesa County Transit Design Standards and Guidelines*, existing or planned transit routes, and the *Pedestrian and Bicycle Plan.* Section 29.16.230 provides requirements for inter-parcel circulation of walkways and bikeways to facilitate multimodal circulation.

29.48.020 Transit Facilities

All transit facilities shall conform to the latest version of the Mesa County Transit Design Standards and Guidelines. As part of the development review process, the city may require the developer to accommodate transit. Transit facilities could include provision of bus pads, sign posts, easement for benches and shelters, or easement for other transit facilities, such as a bus pullout.

29.48.030 Planning and Design Standards for Bicycles

Refer to the current version of the AASHTO *Guide for the Development of Bicycle Facilities*, as well as the *NACTO Urban Bikeway Design Guide*, and *FHWA Separated Bike Lane Planning and Design Guide* to address planning and design of bike facilities. NACTO also publishes two additional guides on designing low stress bike facilities: *Designing for All Ages and Abilities*, and *Don't Give Up At The Intersection*, which provides guidance on low-stress intersection design, and may be applicable when implementing bike facilities in Grand Junction..

The Grand Junction area has adopted a *Pedestrian and Bicycle Plan*. The plan shows the future bicycle network in Grand Junction by facility type, including off-street trails and on-street bikeways. The Plan gives guidance on design for bike facility types given the street context in order to eventually achieve a well-connected low-stress bicycle network throughout Grand Junction. All development shall comply with the current version of the Plan.

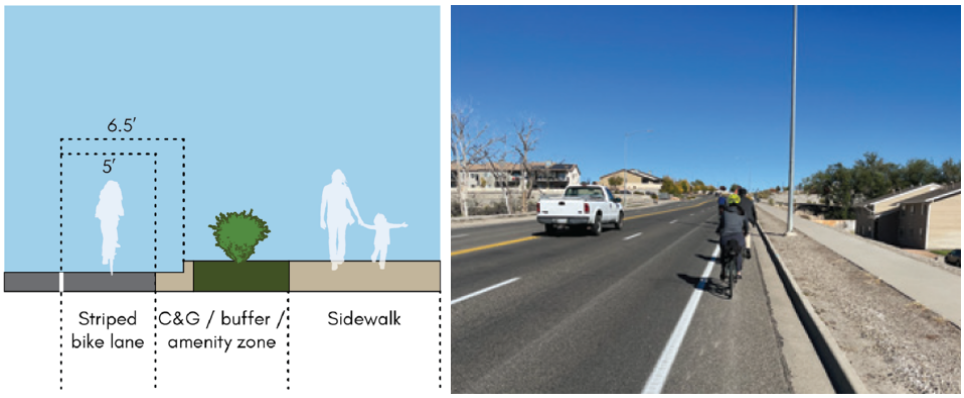
29.48.040 Facility Type

(a) The Pedestrian and Bicycle Plan identifies six bicycle facility types. They are:

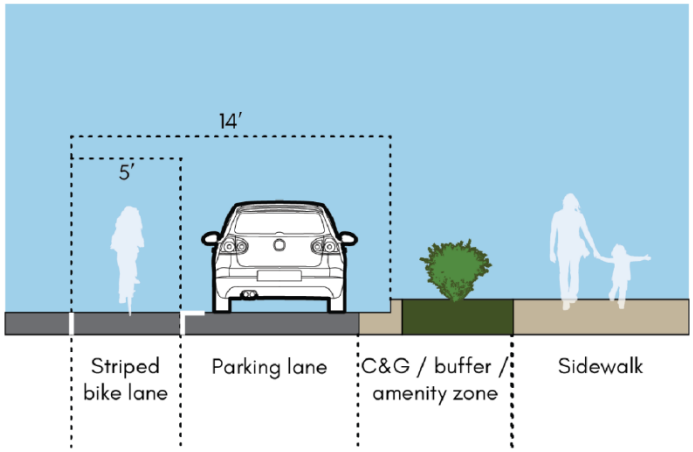
(1) **Bicycle Boulevard.** A street which is officially designated and marked [by signage and/or sharrow markings in the pavement] as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated. A bicycle boulevard may include other traffic calming features to mitigate the speed and volume of motor vehicle traffic on the street to create a more comfortable environment for bicyclists, such as curb extensions, mini roundabouts, speed humps, and traffic diverters. Generally, streets designated as bike boulevards should be designed for 15 to 20 mph, and the average daily traffic volume should not exceed 1,000 vehicles per day.

Mini roundabout on a Bicycle Boulevard

(2) **Bike Lane.** A portion of street, which has been designated (by pavement markings and signage) for use by bicyclists. The bike lane is typically 5 feet wide, measured from the lip of gutter pan when adjacent to the curb and is 6.5 feet wide when measured from the edge of the curb. When adjacent to a parking lane (and on the outside of the parking lane) the outside stripe of the bike lane is typically 14 feet from the edge of the curb (and a minimum of 12 feet from the edge of the curb). A buffer between the parking lane and the bike lane may also be implemented when there is a heightened "door zone" concern either through the use of a separate solid lane at least 18 inches from the bike lane or parking "Ts" to delineate parking spaces.



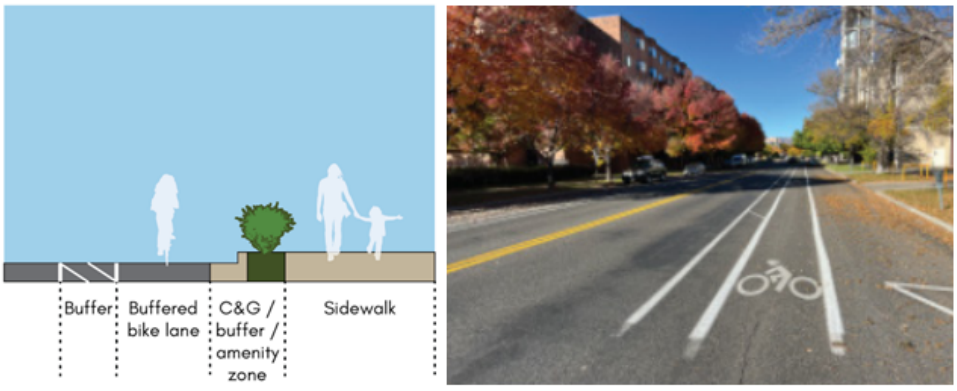
Bike lane adjacent to a curb



Bike lane adjacent to a parking lane

Example of a Parking "T" adjacent to a bike lane (source: NACTO)

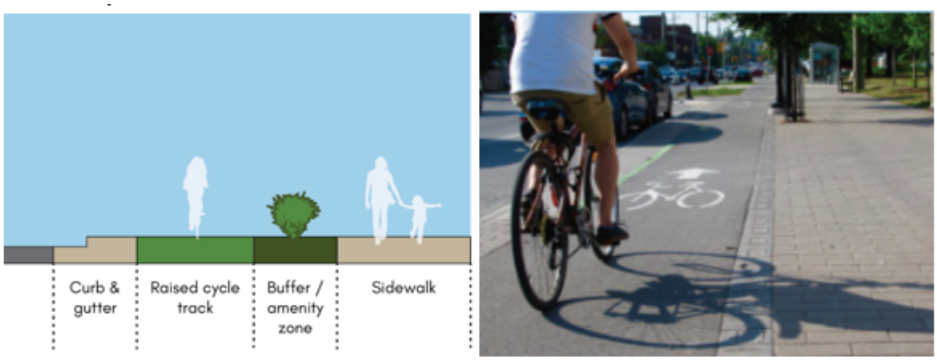
(3) **Buffered Bike Lane.** A portion of street, which has been designated (pavement markings and signage) for use by bicyclists with a painted buffer between a general purpose travel lane and the bike lane. The buffer width is typically 3 feet.



(4) **Protected Bike Lane**. A portion of street, which has been designated (by paint stripe, pavement markings, and signage) for use by bicyclists with a physical buffer between the general purpose travel lanes and the bike lane. The physical buffer may be delineator posts, planters, rigid bollards, a parking strip (parked cars), or a concrete barrier. The lane is typically 6.5 feet wide from the curb and the buffer is typically 3 feet.

(5) **Multiuse Trail.** A separate two-way trail or path from which motor vehicles are prohibited and which is for the shared use of bicycles and pedestrians. The trail is typically 10 feet wide when adjacent to a street and 12 feet wide when independent of a street. The width can be greater than 12 feet where bicycle and pedestrian demand warrants or conflicts between pedestrians and bicyclists are more frequent.

(6) **Raised Cycle Track**. A separate trail or path from which motor vehicles are prohibited, and raised from the general purpose travel lanes, and which is for the exclusive use of bicycles and other allowable micromobility devices (such as electric scooters). The trail is typically 6.5 feet wide or wider.



(b) The design standards for bike lanes and multiuse trails are contained in the AASHTO manual and additional design guidance for these facilities are contained in the NACTO Urban Bikeway Design Guide and FHWA Separated Bike Lane Planning and Design Guide. Typical widths and locations of bicycle facilities on the street are also provided in the street sections in Chapters 29.20 and 29.28. The list below are the minimum bicycle facility design standards to be provided:

(1) Uniformity in on-street facility design, signage, and pavement markings for bicyclist and motorist safety.

(2) Absolute minimum widths are 4 feet on an open shoulder and 5 feet against a curb or guardrail or next to a parking lane. Bike lanes must provide at a minimum 4 feet of width from lip of gutter when adjacent to the curb. When adjacent to a parking lane the outside painted line of the bike lane must be at least 12 feet from the edge of

the curb. Minimum widths should not be the default, but should only be applied in environments with constrained right-of-way. On most street segments, typical widths will be provided.

(3) Cross railroad tracks perpendicular to direction of bike travel with appropriate treatment to ensure smooth and safe crossings.

(4) On-street bicycle facilities shall provide bicycle-safe curb inlet grates.

(5) Avoid diagonal on-street parking on streets with a striped bike lane (unless the bike lane is between the parking lane and the curb).

(6) Implement bicycle detection at all traffic signal approaches with an existing or planned on-street bicycle facility at an actuated signal.

(7) Carry the bike lane through all intersections to the extent that is feasible.

29.48.045 Bicycle Intersection Treatments

Refer to the AASHTO *Guide for the Development of Bicycle Facilities*, as well as the *NACTO Urban Bikeway Design Guide*, and *Don't Give Up At The* Intersection for guidance on designing bicycle facilities through intersections. Effective treatments may include bike boxes, intersection crossing markings, two-stage turn queue boxes, median refuge islands, or other paint, signage, or vertical elements.

(a) **Multiuse Trail Crossings**. Where multiuse trails intersect driveways or side-street STOP controlled minor streets, multiuse paths should bend away so that they are set back from the major street. The total setback from the edge of the travel lane (or bike lane if present) to the edge of the multi-use path should be 15 to 25 feet (one vehicle length).

29.48.050 Pedestrian Facilities

Pedestrian facilities are required as a part of the street cross-section, as detailed in the City Standard Details and street cross section in Chapters 29.20 and 29.28. Additional guidance on pedestrian design is included in the Pedestrian and Bicycle Plan and reflected in the typical street cross sections. Detached paths that are constructed must conform to these details as well.

Environmental factors that contribute to the walking experience and therefore to the perceived level of service include:

(a) Comfort factors that include weather protection, climate control, transit shelters, and other pedestrian amenities.

(b) Convenience factors such as walking distances, pathway directness, grades, sidewalk ramps, directional signing, directory maps and other features that make pedestrian travel easy and uncomplicated.

(c) Safety that is provided by separation of pedestrians from vehicular traffic, or traffic control devices that can provide for time separation of pedestrian and vehicular traffic.

(d) Security features include lighting, open lines of sight, and the degree and type of street activity.

(e) Economy aspects related to user-costs associated with travel delays and inconvenience, and to the rental value and retail development as influenced by the pedestrian environment.

The quality of the pedestrian environment should be evaluated in three broad areas:

(a) Walking along the street – includes continuity, capacity, and comfort.

(b) Crossing the street – includes safety, sufficient space, delay, and route deviation.

(c) Some place to walk to – in terms of travel time on foot, destinations, and how much of an area can be reached within a reasonable time or distance.

The Pedestrian and Bicycle Plan includes pedestrian design recommendations for sidewalk and buffer widths in different street contexts to provide sufficient space and separation from traffic in order to achieve a high level of pedestrian comfort given the speed and volume of traffic. These recommendations are reflected in the typical street sections included in Chapters 29.20 and 29.28.

29.48.060 Pedestrian Intersection Treatments

All pedestrian crossings shall comply with the City Standard Details and be designed in accordance with the Americans with Disabilities Act, including accessible ramps, accessible push buttons when applicable, detectable surfaces, and other universal design features. Refer to the current edition of the Grand

Junction Pedestrian Crossing Treatment Installation Guidelines for guidance on applicability of pedestrian crossing treatments in different contexts, including at uncontrolled crossings. Refer to CDOT's Pedestrian Crossing Installation Guide for uncontrolled pedestrian crossings on state highways.

Potential pedestrian treatments at uncontrolled crossings may include:

(a) **Advance Warning Signing and Striping**. See Chapter 2C of the MUTCD for guidance on advance warning pedestrian crossing signs and Chapter 3B for yield line pavement markings.

(b) **High Visibility Marked Crosswalk.** According to FHWA high-visibility crosswalks use patterns such as bar pairs, continental, or ladder that are visible from farther distances to drivers and pedestrians. Additionally, consider using inlay or thermoplastic tape instead of paint for highly reflective markings.

(c) **Raised Crossings**. A raised mid-block crossing or raised intersection treatment may be installed as a treatment to slow vehicle traffic and function as an extension of the sidewalk to allow a pedestrian to cross the street at a constant grade. According to FHWA raised crossings are typically a candidate on 2-lane or 3-lan roads with speed limits of 30 mph or less and AADTs below 9,000.

(d) **Pedestrian Refuge Medians.** A pedestrian refuge median is a location in the middle of a pedestrian crossing where a pedestrian can take refuge, thereby separating their crossing into two steps and must include some type of raised median. Additional design guidance can be found in the Grand Junction Pedestrian Crossing Treatment Installation Guidelines.

(e) **Curb Extensions.** A roadway edge treatment where a curbline is bulged out toward the middle of the roadway to narrow the width of the street. Curb extensions are often used at the location of a pedestrian crosswalk to minimize the distance and time that a crossing pedestrian must be in the roadway and are typically implemented on streets with on-street parking. Curb extensions also increase visibility of pedestrians waiting to cross and are an effective means to slow vehicles, including slowing turning vehicles when implemented at intersections.

(f) **Rapid Rectangular Flashing Beacons (RRFB).** RRFBs are small rectangular yellow flashing lights that are deployed with pedestrian crossing warning signs. They are typically actuated by a pedestrian push button and flash for a predetermined amount of time, to allow a pedestrian to cross the roadway, before going dark. RRFBs are warning devices and

do not themselves create a legal requirement for a vehicle to stop when they are flashing. Guidance on the appropriate context for RRFBs are provided in the Grand Junction Pedestrian Crossing Treatment Installation Guidelines.

(g) **Pedestrian Hybrid Beacons (also known as HAWK beacons).** A pedestrian hybrid beacon is used to both warn and control traffic at a pedestrian crossing. It is actuated by a pedestrian push button, and uses a combination of circular yellow and red traffic signal displays to first warn motorists of a pedestrian that is about to cross the street, then require the motorist to stop for the pedestrian crossing, and then release the motorist to proceed once the pedestrian has cleared the crossing. The Beacon is a hybrid between a pedestrian traffic signal and a stop sign.

(h) **Traffic Signals.** Depending on factors defined in the Grand Junction Pedestrian Crossing Treatment Installation Guidelines, such as vehicle traffic volume, vehicle speed, and the number of lanes, or other contextual factors (such as pedestrian volume, crash history, or adjacent land use), it may be appropriate to signalize a pedestrian crossing.

29.64 DESIGN EXCEPTIONS

29.64.010 Design Exceptions

This manual establishes standards for the construction of transportation and infrastructure improvements in the City and within the Urban Development Boundary. There may be certain circumstances where those standards do not adequately meet the public's needs. The public needs, as defined by these standards, may conflict with constraints on the property or a new or innovative development proposal.

This chapter describes an exception process. It may be that an exception is a one-time event or it may be that the Manual will be revised to incorporate the exception.

The flowchart depicts the design exception process.

The burden in the development process shall be on the applicant to demonstrate that the proposed exception, if granted, will not result in a dangerous condition as determined by the City or County. No exception shall be allowed if the resulting design is dangerous or otherwise fails to meet the fundamental needs of the community. The fundamental needs of the community shall be determined by the City or County, but primarily are the provision of safe, efficient and effective transportation.

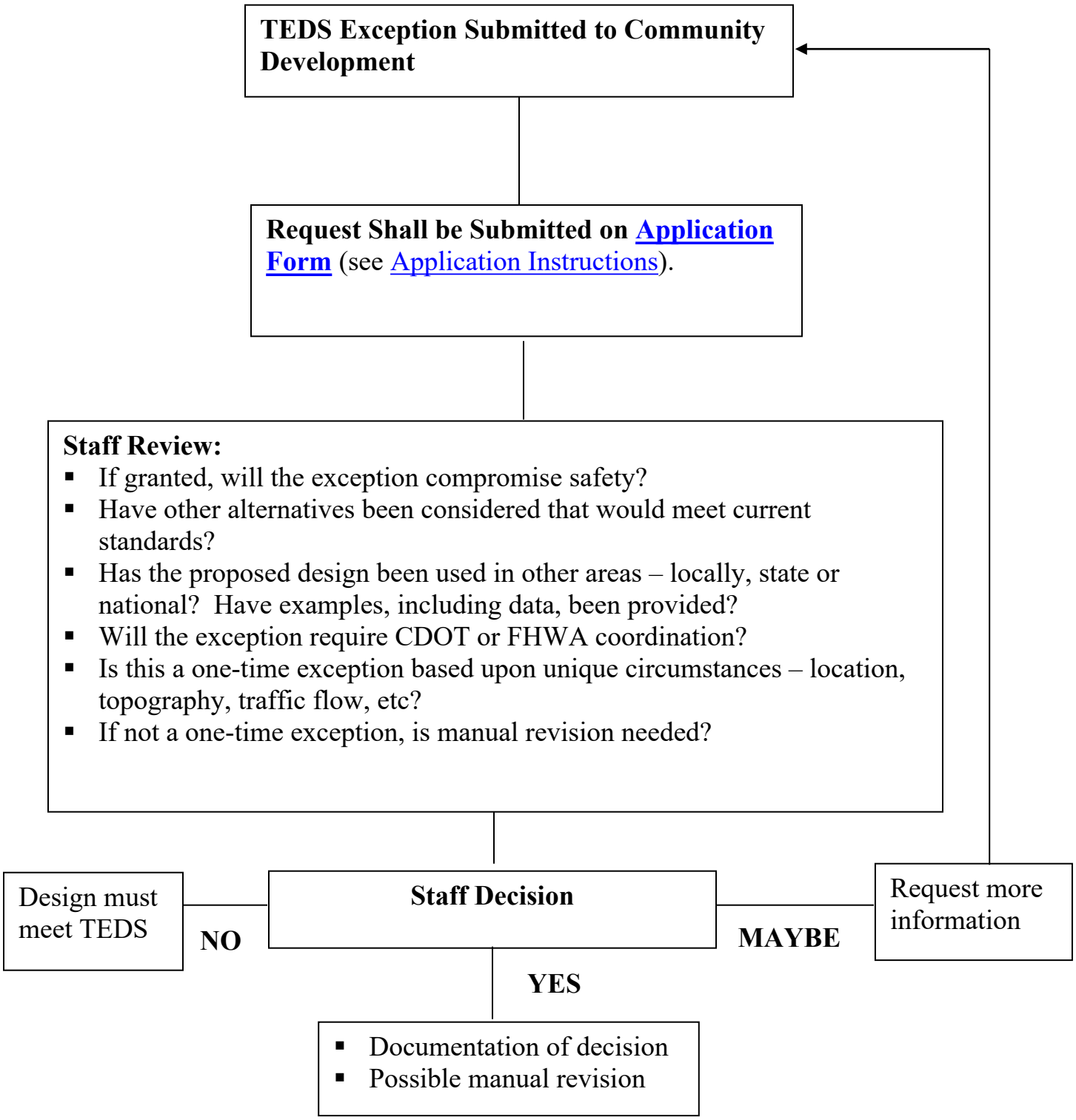
Any exceptions to the TEDS manual should be clearly proposed as early as possible in the project development and review process. Exceptions to TEDS should be identified no later than preliminary plan submittal.

If a design exception is to be a permanent modification to the TEDS Manual, it will be the responsibility of the City and County staff to update TEDS and disseminate the change to CDOT, other municipal or county departments and the development community.

When geometric standards or other design criteria are not specifically addressed in the City or County standards, then the latest editions of the following standards and criteria shall govern the design.

- Colorado *State Highway Access Code*
- CDOT *Roadway Design Manual*
- Institute of Transportation Engineers (ITE) *Traffic Engineering Handbook*
- American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets*

Design Exception Process



APPLICATION INSTRUCTIONS

Transportation Engineering Design Standards (TEDS) Exception Request

Submit the application and associated drawings, in electronic format, using the following instructions.

City File No.: _____ (To be filled in by City Staff)

Project: Fill in all lines in this section unless otherwise noted

Site Address: _____

Applicant: _____

Representative: _____

Date: _____

Parent Project:

Project Name: _____

City File No.: _____

1. Referenced chapter in TEDS and a brief description of the request(s)

Cite the section of TEDS for which the exception is being sought and briefly state what the request is. Examples are shown below:

Request #1 - Chapter 29.12.040 - Allow backing into the right of way

Request #2 - Chapter 29.20.060(b)- Reduce the centerline radius of a street

Request #3 - Chapter -.

2. Site Description

Describe the site in detail as necessary to explain the project and the TEDS exception request(s). Include a description of surrounding properties and access points when necessary. There should be plenty of detail in this section. Better to include too much than not enough.

Include pictures and drawings as necessary. NOTE: aerial pictures from the City's GIS system, including contours, can be copied and pasted into the document. www.gjcity.org

For each TEDS exception request, please complete A and B below

REQUEST #1

A. Description

Describe the request in detail using the applicable section(s) of the TEDS. Why should this request be granted? What does it do for the project? Describe problems created by not granting the TEDS exception; Why can't the TEDS requirement be met? Describe benefits created by granting the TEDS exception.

B. Exception Considerations

1. How will the exception affect safety?
   Do you believe the exception will compromise safety? If not, explain why and be specific.

2. Have other alternatives been considered that would meet the standard?
   Show as many alternatives as possible including those that meet TEDS. This is critical. Think out of the box. The committee will ask questions like "Can they buy an adjoining parcel and design it to meet TEDS requirements?"

   Include pictures and drawings.
   Any applications submitted without examples will be returned. Only in rare instances are there requests that don't have alternatives.

3. Has the proposed design been used in other areas?
   Describe how this request has been used in other areas; here or in other locales. Be sure to describe the advantages or disadvantages seen in these areas. Pictures and drawings would be helpful.

4. Will the exception require CDOT or FHWA coordination?
   "No" or "Yes" and a description of what the agency will be looking for.

5. Is this a one-time exception or a request to change the TEDS manual?
   Explain if this is a one-time exception or if you think the TEDS manual should be modified to allow this request permanently.

REQUEST #2 –**Provide complete information for each request as shown for REQUEST #1 above.**

APPLICATION

Transportation Engineering Design Standards (TEDS) Exception Request

City File No.: TED- (To be filled in by City Staff)

Project: _____

Site Address: _____

Applicant: _____

Representative: _____

Date: _____

Parent Project:

Project Name: _____

City File No.: _____

3. Referenced chapter in TEDS and a brief description of the request(s)

Request #1 -

Request #2 -

Request #3 -

4. Site Description

REQUEST #1 -

A. Description:

B. Exception Considerations

6. How will the exception affect safety?

7. Have other alternatives been considered that would meet the standard?

8. Has the proposed design been used in other areas?

9. Will the exception require CDOT or FHWA coordination?

10. Is this a one-time exception or a request to change the TEDS manual?

REQUEST #2 -

A. Description:

B. Exception Considerations

1. How will the exception affect safety?

2. Have other alternatives been considered that would meet the standard?

3. Has the proposed design been used in other areas?

4. Will the exception require CDOT or FHWA coordination?

5. Is this a one-time exception or a request to change the TEDS manual?

REQUEST #3 -

A. Description:

B. Exception Considerations

1. How will the exception affect safety?

2. Have other alternatives been considered that would meet the standard?

3. Has the proposed design been used in other areas?

4. Will the exception require CDOT or FHWA coordination?

5. Is this a one-time exception or a request to change the TEDS manual?

29.68 ALTERNATE RESISENTIAL STREET STANDARDS

29.68.010 Intent of Provisions

The intent of this chapter is to provide flexibility in the creation, approval and use of public street infrastructure that varies from the cross-sectional standards provided in Chapter 29.20, and to accommodate such proposals under administrative approval procedures. This resulting alternate street standard may be used to create neighborhood character, enhance visual appeal, and to accommodate unique topographical or site features. Further, implementation of these standards should result in "a better solution," allowing alterations to the standard street section that produce benefit to the community.

29.68.020 Performance Criteria

All public streets considered for alternate cross-sections shall meet certain minimum performance-based standards and meet all intent for function of a public right-of-way. Each proposal must be framed within the specific context of the use.

(a) **Horizontal Geometry.**

(1) The horizontal geometry of street and path layouts must meet TEDS requirements elsewhere herein. The design must accommodate large vehicles such as fire trucks, trash trucks and semi trucks at an appropriate level of service.

(2) A minimum pavement width of 20 feet, from flow line of gutter to flow line of gutter, is required for all streets. Path widths or pedestrian walkways shall meet minimum widths as required in the Standard Contract Documents for Construction by path classification.

(3) Horizontal curb radii must be 15 feet minimum for chicanes, parking bulb-outs and other similar features to maintain proper drainage (see GJMC 29.28.160).

(4) Intersection geometry is as required elsewhere herein.

(b) **Vertical Geometry.** The vertical geometry of street and path layouts must meet TEDS requirements elsewhere herein and ADA requirements.

(c) **Sight Distance.** The design must achieve all sight distance requirements listed elsewhere in TEDS.

(d) **Connectivity.**

(1) Minimum connectivity requirements remain unchanged, including pedestrian and bicycle connectivity. Provision of access to adjacent parcels is required. Additional inter- or intra-parcel connectivity may be necessary where reduced street width is considered.

(2) Example: One case where narrow streets and the concept of "queuing" are frequently and successfully used is in older downtown neighborhoods across the country. The streets typically have a grid layout, short block length, and possibly an alley, all providing a high-degree of connectivity, thus allowing a narrow street with fairly high density and high use of on-street parking to function satisfactorily.

(e) **Parking.**

(1) Adequate parking must be provided both on- and off-street. Zoning and development code minimums are required on-site. The on-street parking range is required at 0.5 to 1.5 on-street parking spaces per dwelling unit (see the Local Street Section Notes in Chapter 29.20). Higher density development will demand on-street parking in the upper end of that range.

(2) Clustering of on-street parking in pods is encouraged where full on-street parking is not provided. The provision of on-street parking shall consider availability of parking for long vehicles or vehicles with trailers.

(3) Adequate parking outside of the travel lane must be provided. On the other hand, excessive availability of parking contributes to higher speeds due to width of travel lane available as well as to increased construction and maintenance costs.

(f) **Pedestrian Facilities.**

(1) The design must provide adequate pedestrian facilities equal to or better than existing adopted street sections. Detached walk and additional walk width are encouraged.

(2) Sidewalk is required to create continuous pedestrian walkways parallel with the public roadway. Generally, if lots front both sides of the street, sidewalk will be required on both sides of the street.

(g) **Drainage.**

(1) Curb and gutter is generally considered necessary. However, in limited instances, other options may be considered. Examples include an inverted crown as typically used in concrete alley applications and areas where attached curb and gutter may not be practical due to certain soil conditions. In these cases, adequate

drainage facilities must be provided per the Stormwater Management Manual (GJMC Title 28). Alternate drainage facilities must not require additional maintenance effort above conventional facilities.

(2) Surface drainage at bulb-outs and chicanes is preferred along a continuous gutter without drain troughs or otherwise inaccessible sections of gutter.

(3) Narrower street sections will not carry the same amount of water as the standard street sections. Analysis of the street stormwater carrying capacity by use of the SWMM nomographs will not be permitted.

(h) **Surfacing and Construction Requirements.** Hard surfacing (Portland cement concrete or asphalt pavement) is required and shall meet the structural design requirements contained in Chapter 29.32 GJMC. Gravel surfacing is not allowed. Construction requirements are contained in the Standard Contract Documents.

(i) **Right-of-Way and Multi-Purpose Easements.**

(1) Right-of-way and infrastructure dimension and configuration must provide adequate room for all necessary public facilities including, but not limited to, storm drainage; water lines and meters; sanitary sewer lines; electrical, natural gas, cable, telephone supply lines, service lines, pedestals and appurtenances; traffic control signage; irrigation supply and drainage; cut or fill slopes; and other public utility lines and appurtenances.

(2) The standard 14-foot multi-purpose easement may be reduced in width if adequate space is shown to exist within the right-of-way. The standard multi-purpose easement width on streets with a buffer between the sidewalk and the curb is 10-feet.

(3) Right-of-way configuration must provide adequate access to public utilities. Fencing of easement areas is discouraged as it reduces access to utilities and improvements.

(j) **Private Streets, Shared Drives and Alleys.**

(1) Nothing in this section shall expressly prohibit the use of private streets and shared drives, as allowed elsewhere herein, to be used in conjunction with alternate standard streets.

(2) The use of alleys is likewise permitted and may be used in conjunction with alternate standard streets to achieve utility service delivery, alternate access to off-street parking or enhance connectivity.

(k) **Traffic Calming**. Traffic calming requirements are the same as required elsewhere herein. Elements of narrowed streets may be considered part of the traffic calming system.

(l) **Other Right-of-Way Elements.** All elements of the function of the right-of-way must be considered in the design process.

(1) Mail Receptacles. Streets shall include design elements necessary to meet USPS requirements for access to mail receptacles. Mail receptacles will not be permitted within sight distance triangles at intersections or located such that they interfere with the safe and normal function of the street. Parking shall be provided adjacent to the mail receptacle.

(2) Urban Trails. Where urban trails, primary school walk routes, bike lanes, or other non-motorized transportation routes are indicated on adopted City, school district, or other plans, these elements must be incorporated into the design. The design must meet all requirements of City, State and federal standards, including ADA.

29.68.030 Application

The process for an alternative street request is similar to the Design Exception Process depicted on the flowchart in Chapter 29.64. The applicant shall submit a written report requesting alteration of the standard as a part of a pre-application conference, preliminary plan or other application process. The applicant is encouraged to make this application as early in the process as feasible. The report and plan shall contain the following:

(a) A specific request for alteration of the standard, detailing elements of the standard that are altered and the proposed alternative.

(b) A narrative explaining the reasons for requesting the alteration and proposed benefits.

(c) A narrative, individually addressing each criterion in the performance criteria above.

(d) A site plan showing limits and extents of proposed alterations.

(e) A site plan indicating proposed density, approximate lot size and frontage, access locations, street network, and other pertinent elements. Approximate horizontal and vertical geometry may be required, dependent on topography or other site constraints.

(f) A parking plan demonstrating on-street and off-street parking to demonstrate conformance with parking standards listed above.

(g) A fire site plan demonstrating that a fire truck can negotiate the development with the proposed on-street parking from both directions.

29.68.040 Approval

The Director or his/her assigned representative(s) shall make a final determination of adequate conformance to these criteria, and have the authority to approve or reject each proposed alternative. Staff or agency members may provide comment or modification to the proposal. The Director may consult with or delegate review and approval authority to City Staff, outside review agencies, or outside consultants.

Where the proposed alternate may affect utility placement, approval of the Utility Coordinating Committee is required prior to the consideration by the Director or his designee.

Deviation from the standard street cross-sections may continue to be accomplished through a variance or a planned development procedure as permitted in the zoning and development code.

29.28 ARTERIAL AND MAJOR COLLECTOR GEOMETRIC DESIGN, INCLUDING ROUNDABOUTS

29.28.010 Geometric Standards

Geometric standards have been developed to provide adequate safety for the traveling public. This chapter sets the minimum standards for geometric design of streets classified as major collector and above, as shown on the Street Plan Functional Classification Map in the Grand Junction Circulation Plan. These streets are intended for higher traffic volumes and throughput than the local streets and minor collector streets discussed in Chapter 29.20. They function in transition from direct land use access to movement of traffic.

Roundabouts provide safety improvements, less delay than other forms of control, community enhancement and increased traffic circulation at some intersections. Roundabouts can efficiently handle many intersections with decreased delay and greater efficiency than traffic signals. This section defines the roundabout and provides a link to general design criteria.

29.28.020 Arterial and Collector Streets

(a) General Requirements. Major arterials shall be designed to provide a high degree of mobility and serve longer trips, implying a higher operating speed and level of service. These streets are designated on the Street Plan Functional Classification Map in the Grand Junction Circulation Plan.. Minor arterial streets interconnect with and augment the major arterial system. These streets accommodate trips of shorter lengths and may also serve more access functions than the major arterial streets.

(b) Collector streets provide both land access and movement within residential, commercial and industrial areas. Operating speeds are lower than arterial streets.

(c) Pedestrians and bicyclists are users of the street system and street design needs to include consideration for them. The adopted Pedestrian and Bicycle Plan shows existing and future pedestrian and bicycle facilities.

29.28.030 Right of Way, Street Lane Widths, and Street Lengths

The required right-of-way width for a street is indicated in the Street Sections. Additional widths may be required for needed through and turn lanes, and where it is necessary to accommodate slopes and drainage structures.

29.28.040 Alignments - Horizontal Alignment

Streets shall extend to the boundary lines of the land to be subdivided. Proposed streets with widths different from existing streets to which they are being connected must be transitioned using pavement transition taper standards.

All designs shall be based on the Horizontal Curve Design Criteria.

Horizontal Curve Design Criteria

Design Criteria	Major[1]	
	Collector	Arterial
Min. Design Speed (mph)	35	40
Min. Center[2] Line Radius (ft)	470	SEE[4]
Min. Horizontal Sight Distance (ft)	250	325
Min. Reverse Curve Tangent (ft)	200	200
Min. Approach[3] Tangent at Intersections	200	300

[1] These criteria are to be used without super-elevation.

[2] Radii shown are based on the street having a crown section with a pavement cross-slope of 2% on each side of the crown. For minimum radii required for other cross-slopes or where super-elevation is provided and approved, see Exhibit 3-40 in "A Policy on Geometric Design of Highways and Streets," AASHTO, 2001 Edition.

[3] Where a curved road approaches an intersection, these tangent sections must be provided on the approach to the intersection to provide for adequate sight distance for traffic control devices at the intersection.

[4] The maximum super-elevation rate allowed is e=6%. Where super-elevation is used, runoff lengths shall conform to Table 3-9 in "A Policy on Geometric Design of Highways and Streets," AASHTO, 2011 Edition or most current edition.

29.28.050 Alignment - Vertical Alignment - Grades

Grades, curve length and vertical sight distance shall be designed to ensure proper drainage, sight distance and safety for vehicles and pedestrians. Grades of streets shall not be less than 0.5%. The grade of a street may be reduced only when matching existing streets or property. Maximum street grades shall be 8%. For algebraic differences of 0.5% or less, grade breaks shall be required for adequate drainage.

Design Controls for Vertical Curves

Design Speed MPH	Stopping Sight Distance (feet)	Crest "K" Values	Sag "K" Values
20	115	7	17
25	155	12	26
30	200	19	37
35	250	29	49
40	305	44	64
45	360	61	79
50	425	84	96
55	495	114	115
60	570	151	136

From Exhibits 3-34, 3-35, and 3-36, AASHTO A Policy on Geometric Design of Highways and Streets, 2011

[1] All minimum stopping sight distances for vertical curves with crests must be shown on the construction plans. Sight distances are based on design speeds

29.28.060 Clearance of Structures

A minimum of 17.5 feet shall be provided for all overhead sign structures. The clearance shall be measured from the crown of the street to the lowest portion of the structure. A minimum vertical clearance of 16.5 feet for all other structures shall be provided on all arterial streets and designated truck routes. A minimum

clearance of 14.5 feet may be allowed on collector streets per CDOT 2018 Roadway Design Guide.

29.28.070 Stopping Sight Distance

Stopping sight distance is defined as the length of roadway ahead visible to the driver. The minimum stopping sight distance available on a roadway must be sufficiently long to enable a vehicle traveling at or near the roadway design speed to stop before reaching a stationary object in its path or react to a traffic control device such as a stop sign.

The appropriate stopping sight distance shall be provided. The distances shown assume vehicles traveling on wet pavement on flat grades. Factors that take in to account the effect of grade on stopping sight distance shall be used in determining appropriate stopping sight distance where the grades are 3% or higher.

Minimum Stopping Sight Distance

Design Speed (MPH)	Stopping Sight Distance (Ft.)
20	115
25	155
30	200
35	250
40	305
45	360
50	425
55	495
60	570

Based on Exhibit 5-3, AASHTO A Policy on Geometric Design of Streets and Highways, 2011

Effect of Grade on Stopping Sight Distance

Design Speed (MPH)	Downgrades			Upgrades		
	3%	6%	9%	3%	6%	9%
20	116	120	126	109	107	104
25	158	165	173	147	143	140

30	205	215	227	200	184	179
35	257	271	287	237	229	222
40	315	333	354	289	278	269
45	378	400	427	344	331	320
50	446	474	507	405	388	375
55	520	553	593	469	450	433
60	598	638	686	538	515	495

From Exhibit 3-2, AASHTO A Policy on Geometric Design for Highways and Streets, 2001

29.28.080 Cross Section

(a) Cross Slopes. The typical cross slope is 2% crown to provide for adequate drainage to the pavement edge. The maximum cross slope on the tangent sections shall not exceed 4%. The minimum cross slope shall be 1%.

(b) Super-elevation. Super-elevation shall be designed in accordance with the Horizontal Curve Design Criteria.

(c) Clear Zones. All roadways shall meet clear zone requirements as set forth in the current edition of the AASHTO Roadside Design Guide. Where under-improved streets are constructed (for example, a half-street construction), the minimum shoulder width shall be provided.

(d) Roadside Barrier and Bridge Rails. Roadside barriers shall be required in accordance with warrants, design criteria and standards for roadside barriers and bridge rails as defined in the current edition of the AASHTO Roadside Design Guide.

29.28.090 Tapers and Transitions- Road Width Transition Tapers

When constructing a roadway that will connect with an existing roadway of a different width, a transition taper is required. These ratios are not to be used in the design of exclusive turn lanes**.**

Minimum Road Width Transition Tapers

Design Speed (MPH)	Transition Run/Offset (Ft/Ft)
30 or less	15 / 1
35	20 / 1
40	25 / 1
45	45 / 1
50	50 / 1
55	55 / 1
60	60 / 1

Table based on Section 3B-8, MUTCD.

29.28.100 Bicycle Treatments

Bicycle facilities are required as shown on the Pedestrian and Bicycle Plan. Provisions for bicycle facilities and crossings shall be in accordance with the AASHTO Guide for Development of Bicycle Facilities. Refer to Chapter 28.48 for design guidance on bicycle facility types, and minimum adherence standards. Refer to the Pedestrian and Bicycle Plan for additional guidance on designing bikeway facilities and bikeway crossings.

29.28.110 Intersections

Generally, there are two types of intersections: unsignalized and signalized. Each of these may have several different configurations and levels of traffic control. A roundabout is a form of an unsignalized intersection and is specifically discussed in Section 6.3. All intersections shall conform to the guidelines set forth in AASHTO and the MUTCD. For streets with bicycle facilities, refer to Chapter 29.48 for additional guidance on bicycle intersection treatments.

29.28.120 Unsignalized Intersections

There are three acceptable levels of traffic control at unsignalized intersections: yield controlled, two-way stop controlled and all-way stop controlled. The appropriate use of each of these is discussed in the following sections.

(a) **Yield Controlled Intersections**. Yield controlled intersections will not generally be allowed, except at roundabouts.

(b) **Two-way Stop Controlled Intersections**. Stop signs shall be used in accordance with the MUTCD.

(c) **All-way Stop Controlled Intersections.** An all-way or "multi-way" stop installation shall be used only where the criteria of the MUTCD are met.

29.28.130 Signalized Intersections

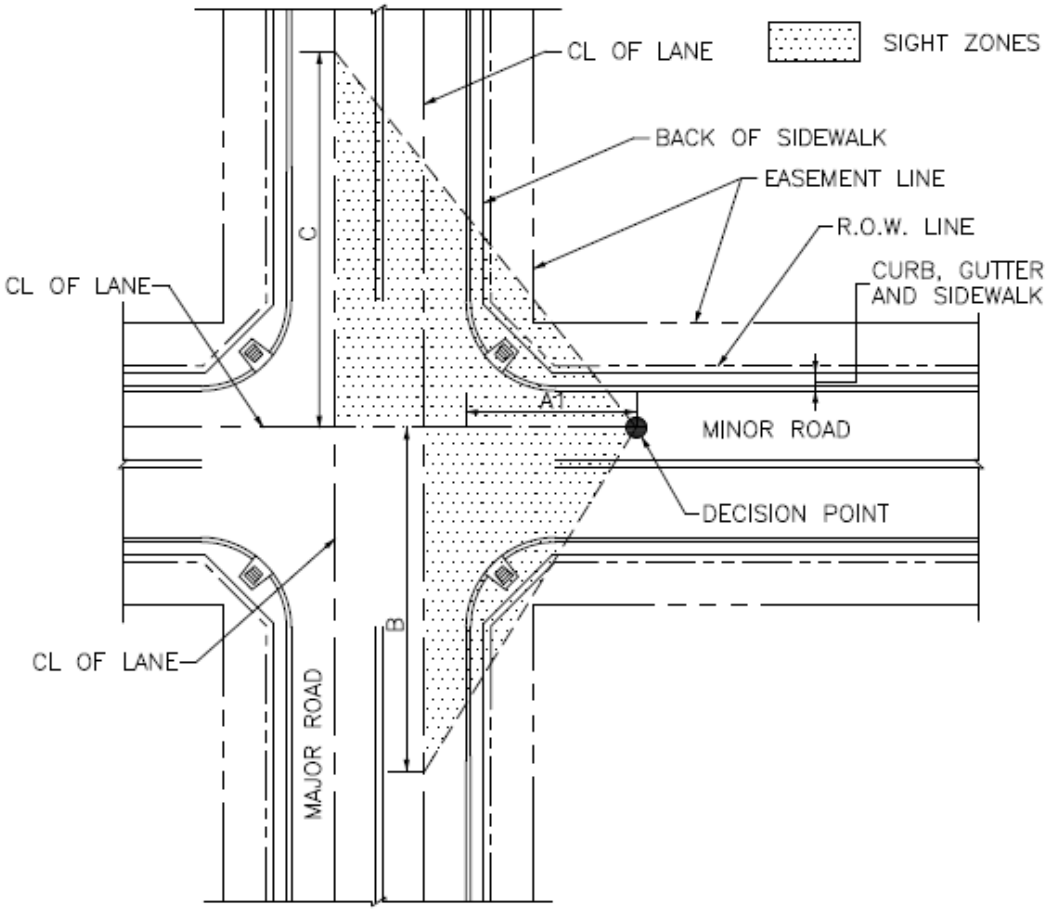
A signalized intersection shall only be installed after a careful analysis and engineering study of the roadway and traffic conditions at the intersection and on the corridor. When a signal is proposed on a corridor where signals are coordinated, the TIS (see Chapter 29.08) shall analyze the impacts to the progression of traffic on the corridor and on surrounding land uses. This analysis shall include the progression bandwidth, efficiency and level of service determinations, signal timing and phasing including pedestrian movements, and an analysis of the storage queue lengths for exclusive turn lanes. Signal installations shall meet the spacing criteria in Section 29.28.200. Traffic signal warrants and design criteria are thoroughly discussed in the MUTCD, Part IV.

29.28.140 Sight Distance

Street intersections and private access to public streets shall be planned and located to provide as much sight distance as possible. At a minimum, there must be sufficient sight distance for the driver on the minor street or driveway to cross or turn onto the intersecting street. Minimum sight distance values are provided for passenger cars turning left or right from a minor street. When grades are steeper than 3.0%, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, a) the 85th percentile speed, b) the speed limit if based on an engineering study, or c) in the case of a new facility, 80 percent of the design speed.

Minimum Sight Distance for Left and Right Turns onto Major Street by Passenger Cars at Stop-Controlled Intersections



APPROACH SPEED	B	C
15 MPH	145 FT	170 FT
20 MPH	195 FT	225 FT
25 MPH	240 FT	280 FT
30 MPH	290 FT	335 FT
35 MPH	335 FT	390 FT
40 MPH	385 FT	445 FT
45 MPH	430 FT	500 FT
50 MPH	480 FT	555 FT

*BASED ON AASHTO FIGURE 9–15

NOTES:

SIGHT ZONE SHOULD BE EVALUATED FOR ALL APPROACHES.

A1 IS 18' MEASURED FROM THE MAJOR ROAD LIP OF GUTTER. IN CONSTRAINED SCENARIOS, A1 MAY BE REDUCED TO A MINIMUM OF 14.5' WITH CITY APPROVAL.

DISTANCE B MAY BE UTILIZED WITH CITY APPROVAL, WHEN THE INTERSECTION CONTROL ONLY ALLOWS RIGHT TURNS OUT FROM THE MINOR LEG.

Factors for the Effect of Grade on Sight Distance

Approach Grade (%)	Design Speed (MPH)									
	15	20	25	30	35	40	45	50	55	60
-6	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.2	1.2	1.2
-5	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
-4	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.1
-3 to +3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
+4	1.0	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9
+5	1.0	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9
+6	1.0	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

Based on Exhibit 9-53, AASHTO A Policy on Geometric Design for Highways and Streets, 2001.

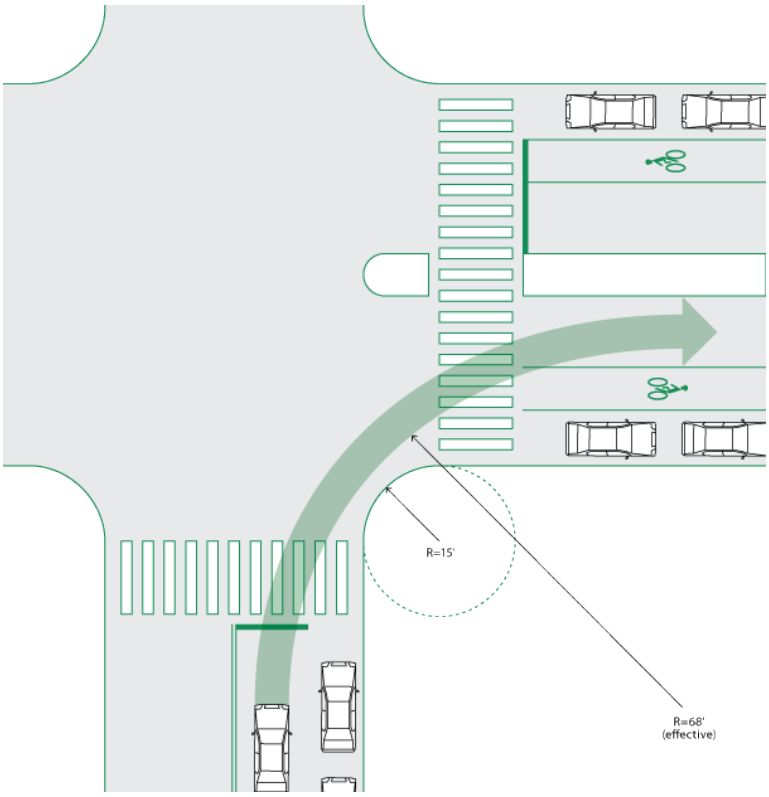
29.28.150 Sight Zones

Within the sight zone there shall be no sight obscuring sign, landscaping, wall, fence, berming, or other object higher than 30 inches, or in the case of trees, no foliage lower than 8 feet. Vertical measurement shall be made from the flowline of the adjacent gutter or, if no gutter exists, from the edge of the nearest traveled way. Objects that may be located in the sight zones are items such as hydrants, utility poles, and traffic control devices. These shall be located to minimize visual obstruction.

29.28.160 Intersection Radii

Minimum intersection effective radii must be maintained at public street intersections and a 15 foot minimum flowline radius is required to allow for proper drainage in situations where flowline radii is less than the effective radii. The "effective" radius is different than the flowline radius in that effective radius accounts for on-street parking or bike lanes which can cause the effective radius for a turning vehicle to be much larger than the flowline radius. An effective turn radius that is too large can encourage drivers to maintain a high speed while turning, which can compromise the comfort and safety of pedestrians crossing in the crosswalk. The NACTO Urban Street Design Guide recommends design corner radii to limit turning speeds to 15 mph to support a comfortable pedestrian

environment. Thus, when a bike lane or parking lane is present on one or both of the intersecting streets, either a bulbout (see 29.28.165) should be provided to maintain the desired effective radii or the flowline radius should be designed to be less than the minimum intersection effective radius in order to encourage slower turning vehicle speeds.



Example of "Effective" Turn Radius (source: NACTO Urban Street Design Guide)

Minimum Intersection Effective Radii

Through Street[2]	Intersecting Street				
	Arterial	Collector	Local Residential	Local Commercial	Local Industrial[1]
Arterial	35'	30'	30'	30'	30'
Collector	30'	30'	25'	30'	30'

[1] Radii at intersections with industrial streets shall be individually designed based on the turning requirements for the type of truck that will most commonly use the street.

[2] At signalized intersections where right turn channelization islands are provided or high truck and bus volumes may use the access, a larger flowline radius may be required.

[3] When bike lanes are present consider a reduced flowline radii to match the effective flowline of the intersection, with a minimum required flowline radius of 15 feet.

29.28.165 Bulb Outs

If on street parking is present, steps should be taken to prevent vehicles from parking too close to the intersection. Bulbouts should be used to reduce the intersection width and prevent parking in the sight zone. This will result in shorter crossing distances for pedestrians, increased sight distance, and increased visibility of pedestrians especially for turning vehicles, which will increase pedestrian safety and comfort at intersections.

29.28.170 Lane Requirements

Lane design through an intersection shall be consistent with the lane design of the streets forming the intersection.

(a) **Lane Widths.** Lane widths shall be consistent with the cross-sections as shown in the City Standard Street Details.

(b) **Exclusive Turn Lanes.**

(1) The purpose of an exclusive turn lane is to expedite the movement of through traffic, increase intersection capacity, permit the controlled movement of turning traffic, and promote the safety of all traffic. The provision of left-turn lanes is essential from both capacity and safety standpoints where left turns would otherwise share the use of a through lane. Right-turn lanes remove the speed differences in the main travel lanes, reducing the frequency and severity of rear-end collisions.

(2) Separate right turn lanes shall be required in accordance with the right turn warrant chart. Separate left turn lanes shall be required at all new signal locations and at unsignalized locations in accordance with the left turn warrant chart.

Warrants for Right Turn Lanes

Two Lane Roadways

Number of Peak Hour Turning Vehicles

DDHV (vph)	35 MPH or less	40 MPH	45 MPH	50 MPH	55 MPH
200				73	35
300			120	41	24
400	200	200	50	30	19

500	150	125	35	25	16
600	75	50	25	20	14
800	50	30	15	15	11
1000	25	25	15	11	9
1200	20	20	15	9	8

DDHV – Directional Design Hourly Volume; volume of vehicles in the design hour using the through lane adjacent to which the right lanes is to be constructed.

Warrants for Right Turn Lanes
Four Lane Roadways
Number of Peak Hour Turning Vehicles

DDHV (vph)	35 MPH or less	40 MPH	45 MPH	50 MPH	55 MPH
300					75
400			145	75	40
500			95	57	32
600	170	160	65	42	26
800	80	70	37	28	19
1200	50	25	20	18	14
1600	20	15	14	13	10
2000	15	10	9	9	8

DDHV – Directional Design Hourly Volume; volume of vehicles in the design hour using the through lane adjacent to which the right lanes is to be constructed.
Charts developed based on studies conducted by Kansas Department of Transportation and University of Nebraska

Warrants for Left Turn Lanes
Number of Peak Hour Turning Vehicles

DDHV	30-35 MPH	40 + MPH
100	30	14
200	15	12
300 +	12	12

(3) Construction of turn lanes on state highways shall be determined in accordance with the State Highway Access Code.

(4) Dual left turn lanes at signalized intersections shall be considered when the peak hour left turn volume exceeds 300 vehicles/hour. An analysis of the signal timing is required to measure the effects of the protected movement on the rest of the intersection movements. Intersection geometry shall allow for the operation of dual lefts. Permissive dual left turns are prohibited.

(c) **Left and Right Turn Lane Design**

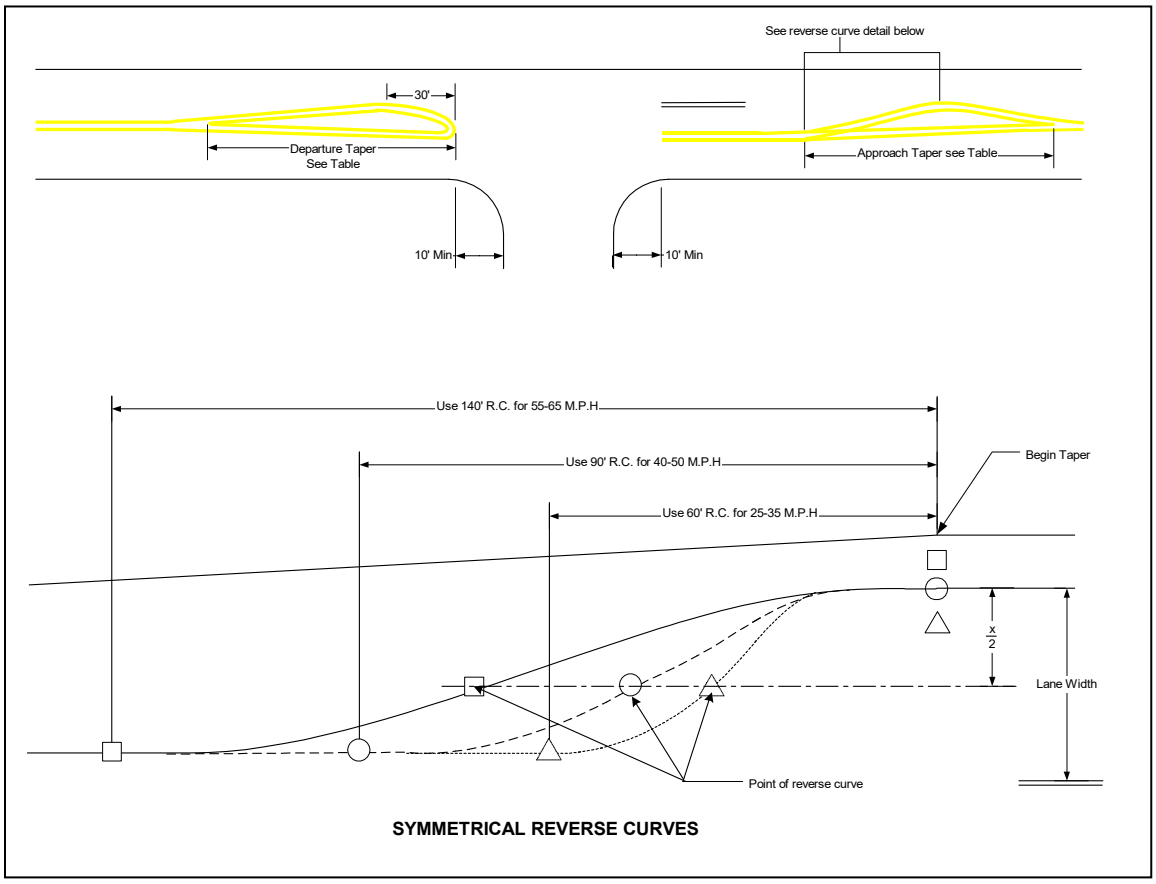
(1) The components of a left turn lane consist of a taper and the full width lane for storage as shown in the turn lane elements and design criteria. Turn lanes shall be 11' in width (not including the gutter pan) and two-way left turn lanes shall be 12' in width.

Minimum Left-Turn Tapers for Redirecting Through Lanes

Design Speed (MPH)	Tapers
25	10:1
30	15:1
35	20:1
40	30:1
45	45:1
50	50:1
55	55:1
60	60:1

Based on Table 4-9 CDOT Access Code
Use the same ratio for both approach and departure tapers.
Bay tapers shall be symmetrical reverse curves in accordance with the following:
Use 60' Reverse Curve for 25-35 MPH
Use 90' Reverse Curve for 40-50 MPH

Use 140’ Reverse Curve for 55-65 MPH



(2) Storage lengths for turn lanes at signalized intersections shall be determined based on a signal timing analysis that predicts the 90% queue length required for the turn lane. At unsignalized intersections, the turn lane storage will be determined in accordance with the storage length table. Tapers for right turn lanes shall be designed in accordance with the right-turn lane taper table. Use of the reverse curve is encouraged as part of the taper length to allow vehicles to decelerate in the full lane width. If used, the difference in length between the required taper and the reverse curve shall be added to the required storage length of the turn lane.

Minimum Storage Lengths for Unsignalized Turn Lanes

Turning VPH	≤60	100	200	300
Required Storage Length	50	100	175	250

Based on Table 9-7 CDOT Design Guide

Minimum Right-Turn Tapers

Design Speed (MPH)	Tapers
25	7.5:1
30	8:1
35	10:1
40	12:1
45	13.5:1
50	15:1
55	18.5:1
60	25:1

Excerpted from Table 4-6, CDOT Access Code

(3) Standards for State Highway right turn and left turn speed change lanes are found in the State Highway Access Code.

29.28.180 Angles

Proposed public streets must intersect at 90° angles or as close to 90° as topography permits (no less than 80°). Intersections on sharp horizontal curves shall be prohibited based on sight distance and viewing angle for the driver.

29.28.190 Grades

Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is 4% and extends a minimum of 50 feet in each direction from the outside edge of the traveled way of the intersecting street. At signalized intersections, the maximum grade is 2% within the intersection and extends 200 feet in each direction. Grades above 4% will only be allowed on local and collector streets in areas with steep topography or other unusual circumstances that prevent a flatter grade, and must be documented as a design exception (see Chapter 29.64).

29.28.200 Spacing and Offsets of Intersections

(a) **Minor Arterials and Major Collectors.** Signalized intersections shall be spaced no closer than 1/4 mile intervals. Unsignalized four legged intersections

must be spaced at least 300 feet apart. When T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet and be 150 feet from the nearest four legged intersection. If the left turn storage requirements for adjacent intersections overlap, the minimum spacing must be increased to provide adequate left turn storage in both directions. These spacing and offset requirements apply to intersecting streets on minor arterial and major collector streets. For spacing and offset requirements of driveways see GJMC 29.16.030 and 29.16.040.

29.28.210 Pedestrian Treatments

Accommodations for pedestrians must be designed into all intersections. Pedestrian accommodations include, but are not limited to sidewalks, crosswalks, pedestrian refuge islands, and accommodations for disabled pedestrians. Sidewalks are an integral part of urban streets and shall be included in the intersection design. Refer to the Bicycle and Pedestrian plan or city staff recommendations for detailed improvements at identified intersections. The City Standard Details shall be followed in designing and constructing pedestrian facilities. The intersection design shall conform to the standards set forth in the Americans with Disabilities Act. More information on the requirements can be found at http://www.access-board.gov/. Design of pedestrian facilities should also adhere to the latest guidance according to the U.S. Access Board's Public Right-of-Way Accessibility Guidelines (PROWAG). Where sidewalks are provided, accessible ramps must also be provided. Utility boxes, drainage inlets, signs, and other fixed objects shall not be located within the path defined by ramp. The ramp shall align with the sidewalk and must be located entirely within the marked crosswalk area.

(a) **Crosswalks.** Crosswalks shall be marked at signalized intersections and designed as part of the markings for the traffic signal. All crosswalk markings must conform to MUTCD standards. Crosswalks at un-signalized intersections or mid-block locations will only be considered when an engineering study is conducted in accordance with Institute of Traffic Engineers guidelines and indicates crosswalks would increase pedestrian safety. Refer to the current edition of the City's Pedestrian Crossing Treatment Installation Guidelines for guidance on applicability of pedestrian crossing treatments in different contexts, including at uncontrolled crossings. Refer to CDOT's Pedestrian Crossing Installation Guide for uncontrolled pedestrian crossings on state highways.

(b) **Pedestrian Refuge Islands.** Pedestrian refuge islands may be constructed where mid-block crosswalks are proposed. Islands should be 6' wide and 6' length

in advance and departing of crosswalk. All Islands must conform to the minimum standards established in the MUTCD, and must meet the design criteria for curbing and medians.

29.28.220 Roundabouts

(a) Design Criteria

A roundabout brings together conflicting traffic streams, allows the streams to safely merge and traverse the roundabout, and exit in the desired directions. The geometric elements of the roundabout provide guidance to drivers approaching, entering, and traveling through a roundabout.

Good roundabout design places a high priority on speed reduction and speed consistency. Low vehicle speed provides safety benefits including reduced numbers and severity of crashes; more time for entering drivers to judge, adjust speed for and enter a gap in circulating traffic; and safer merging. Roundabout intersections typically operate with lower vehicle delays than other intersection control types.

A capacity analysis of any proposed roundabout shall be conducted in accordance with Highway Capacity methods. The analysis shall include consideration for the largest motorized vehicle likely to use the intersection.

Roundabouts shall be designed in conformance with the guidelines set forth in the FHWA publication "Roundabouts: An Informational Guide".

(b) **Signing, Striping, and Pavement Markings**. All signing, striping, and pavement markings shall follow the MUTCD standards.

(c) **Lighting.** Adequate lighting is essential for drivers to perceive the general layout and operation of the intersection in time to make the appropriate maneuvers. A lighting plan will be required as part of the construction drawings for roundabouts.

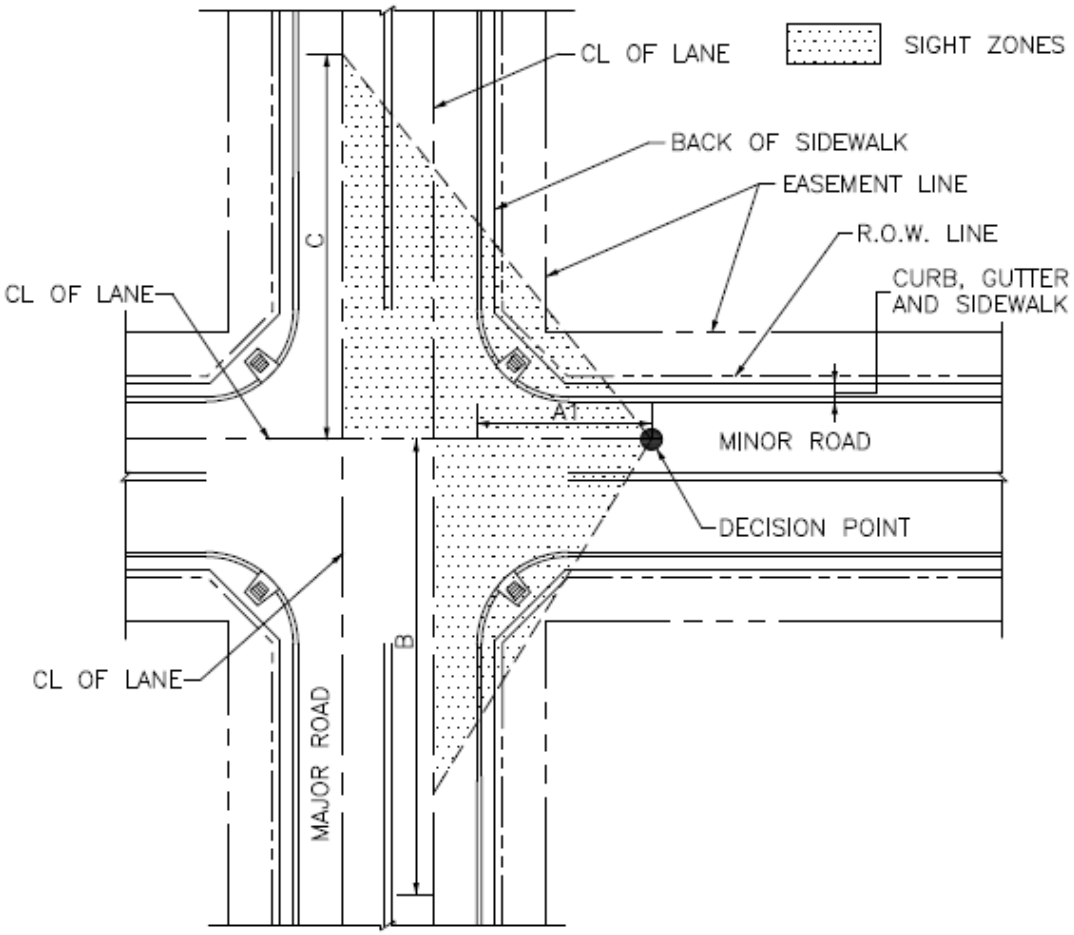
(d) **Landscaping.** Landscaping in the central island, the splitter islands and along the approaches is a benefit to both public safety and community enhancement. Landscaping shall follow these general principles:

(1) Make the central island more conspicuous;
(2) Improve the aesthetics of the area while complementing surrounding streetscaping as much as possible;
(3) Avoid obscuring the form of the roundabout or the signing to the driver;

(4) Maintain adequate sight distances;
(5) clearly indicate to the driver that they cannot pass straight through the intetrsection
(6) Discourage pedestrian movements through the center of the roundabout.

29.28.230 Landscaping – General Requirements

All new developments must provide landscapingthat meets the requirements of the City's Zoning and Development Code. Any landscaping in the sight distance triangles at intersections shall meet the sight distance requirements in the Sight Zones detail.



APPROACH SPEED	B	C
15 MPH	145 FT	170 FT
20 MPH	195 FT	225 FT
25 MPH	240 FT	280 FT
30 MPH	290 FT	335 FT
35 MPH	335 FT	390 FT
40 MPH	385 FT	445 FT
45 MPH	430 FT	500 FT
50 MPH	480 FT	555 FT

*BASED ON AASHTO FIGURE 9–15

NOTES:

SIGHT ZONE SHOULD BE EVALUATED FOR ALL APPROACHES.

A1 IS 18' MEASURED FROM THE MAJOR ROAD LIP OF GUTTER. IN CONSTRAINED SCENARIOS, A1 MAY BE REDUCED TO A MINIMUM OF 14.5' WITH CITY APPROVAL.

SIGHT ZONE DETAIL STOP CONTROLLED INTERSECTION

DEPARTMENT OF PUBLIC WORKS AND UTILITIES ENGINEERING AND TECHNICAL SERVICES DIVISIONS CITY OF GRAND JUNCTION, COLORADO	STANDARD STREET DETAIL	APPROVED: _____ REV: _____ DRAWN: _____	PAGE ST-XX

N:\Cadd\CITY-STD\DETAILS\STREET\ST-11.dwg 02/07/01 04:07:01 PM MST

29.32 PAVEMENTS & TRUCK ROUTES

29.32.010 Design Methods and Procedures

The following pavement design methods and procedures shall be followed to create a consistent pavement thickness design throughout the urban area.

This chapter references the Truck Route map developed for the urban area of the City and County (see Transportation Layer of the Online GIS Map). The truck route map must be consulted prior to beginning pavement design to assure that the design will accommodate anticipated truck loading.

29.32.010 Pavement Types

Pavement types which may be used for construction of City and County streets include Hot Mix Asphalt (HMA) and Portland Cement Concrete (PCC) pavements. The City and/or County shall approve in advance the type of pavement.

29.32.020 Design Input Variables

Parameters that must be evaluated in order to design an adequate pavement structure include subgrade soil properties, surface and sub-surface drainage, materials properties, environmental factors and traffic loading over the analysis period.

The minimum traffic analysis period to be used for the design of pavements for City streets is 30 years. Traffic growth rates vary depending upon the street classification, zoning location and other variables. Growth rates for most major streets are available from the Mesa County Regional Transportation Planning Organization, phone (970) 244-1830.

Traffic distribution by vehicle type shall be determined from, actual traffic counts and projections based on land uses and future build-out of area serviced by the road. Classification of vehicles derived from traffic counts are available for most major streets from the City of Grand Junction, Transportation Engineering Division, phone (970) 256-4110.

All other pavement design parameters including 18 kip equivalency factors, lane distribution factors, Resilient Modulus (M_R) conversion equations, drainage coefficients, reliability factors and serviceability indices shall be determined in accordance with the *Guideline for the Design and Use of Asphalt Pavements for Colorado Roadways* published by the Colorado Asphalt Pavement Association.

29.32.040 Pavement Design Procedures

(a) **Flexible Pavement Design Procedure**. Flexible pavement design includes asphalt concrete (AC) surfaces and surface treatments (ST). Flexible pavements shall be designed in accordance with the principles and procedures illustrated in the AASHTO Guide for Design of Pavement Structures (current edition). The computer software for the AASHTO guide is AASHTO Ware are DARWin in 3.1 Pavement Design and Analysis System. All use of flexible pavement should have a design life of at least 30 years. Perpetual pavements may be used where appropriate. Perpetual pavement design should follow the recommendations of CDOT M-E Pavement Design Manual 2021, 6.3.2.

(b) **Rigid Pavement Design Procedure**. Rigid pavement design includes plain jointed (JCP), jointed reinforced (JRCP) and continuously reinforced (CRCO) concrete pavements. Rigid pavements shall be designed in accordance with the principles and procedures illustrated in the AASHTO Guide for Design of Pavement Structures (latest edition). Approved software for design of rigid pavement includes AASHTOWare DARWin 3.1 and WinPAS developed by the American Concrete Pavement Association. All use of rigid payment should have a design life of at least 30 years.

29.32.050 Truck Routes

Primary and secondary trucks routes are shown on the Truck Route Map, additional information on truck routes can be found here.

29.36 STREET LIGHTING, UTILITIES AND MAILBOXES

29.36.010 Requirements

This chapter outlines the requirements for street lighting, including whether lighting is required, installation, maintenance responsibilities, and acceptable poles and luminaries. Utilities are discussed for their placement in the rights-of-way.

29.36.015 Telecommunication Facilities

Will add the City's Small Cell Infrastructure Standards

29.36.020 Street Lighting

Street lighting shall be installed on all new and existing public streets at the expense of the developer. Streetlights shall be designed, furnished and installed by the utility company responsible for supplying electrical power to the development or area. The location of all streetlights shall be shown on the traffic plan or street plan, or other design drawings as required by the City or County. All street lighting must conform to city ordinances on Dark Sky requirements.

29.36.030 Luminance Requirements

Street lighting shall provide average illuminance in accordance with Table 29.36-1.

Table 29.36-1
Average Maintained Illuminance (Foot Candles) on Public Streets

STREET CLASSIFICATION	AREA CLASSIFICATION		
	COMMERCIAL	INTERMEDIATE	RESIDENTIAL
Arterial	1.7	1.3	0.9
Collector	1.2	0.9	0.6
Local	0.9	0.7	*

*On local residential streets, a standard light shall be located at each street intersection, at or near the throat of each cul-de-sac, and at a maximum spacing of 250 feet measured along the centerline of the roadway. Additional lights may be required on horizontal curves at other locations.

29.36.040 Acceptable Poles and Luminaires

The standard streetlights are shown in Table 29.36-2.

Table 29.36-2
Standard Street Lights

STREET LIGHT STYLE	USED ON STREET CLASSIFICATION	WATTAGE	POLE COLOR
GE Salem Luminaire Full-Cutoff	Local Residential, Residential Collector	N/A	Black
Curvilinear Style Full-Cutoff "Hockey Puck"	Collectors, Arterials, Commercial	250-400	Black
Cobra Head Full-Cutoff – Flat Lens	Arterials (for existing overhead power), State Highways	100-400	Silver, Galvanized or existing wood pole

Height and wattage shall be determined by Utility Company in accordance with current IES standards. Where these standards conflict with existing lighting, design consideration will be given to consistency in the area.

Commented [EM1]: I don't believe these are made anymore. All street light styles need to conform with our franchise agreements with the utility companies

Commented [PP2R1]: City will provide guidance

29.36.050 Pedestrian and Bikeway Lighting

When required, lighting for detached public pedestrian and bikeway trails shall be designed, furnished and installed by the utility company responsible for supplying electrical power to the development or area. The lighting standard shall be the cutoff luminaire style that meets the illuminance requirements.

Lighting for pedestrian paths and bikeways should be considered in the following scenarios:

- Stairs and access ramps
- Pedestrian underpasses
- Conflict points along pathways

Lighting levels can be set based on the level of pedestrian activity in the area.

Conflict Type	Average Horizontal Illuminance (fc)	Average Vertical Illuminance	Horizontal Uniformity (avg:min)
Average illuminance with anticipated pedestrian activity	0.5	0.2	4
Average illuminance with	0.2	0.1	10

minimal pedestrian activity			

Best practice as laid out by CDOT should be followed through out the design process.

Pedestrian lighting is not considered in street light luminaire calculations. Attached sidewalk lighting is often provide by adjacent roadway lighting. On streets where there is a sidewalk only on one side lighting must be provided on that side of the roadway to illuminate the walkway. The need for pedestrian lighting should be considered as part of the lighting process whenever possible.

Pedestrian lighting is not normally required in residential subdivisions. Pedestrian lighting that is installed for decorative purposes shall be the responsibility of the homeowners' association or private developers for the cost of utilities and maintenance.

29.36.060 Breakaway Structures and Lateral Clearances

All fixed objects such as utility, street light poles, fire hydrants, telephone junction boxes, installed in the right-of-way shall be of the breakaway type meeting AASHTO construction specifications regardless of roadway classification. If breakaway type construction cannot be provided, a minimum of 10 feet horizontal clearance shall be provided between the flowline of the street (or the edge of the paved traveled way) and any new or relocated non-breakaway structure in excess of 4 inches in height. For local streets, a 5-foot lateral clearance is recommended. If sufficient right-of-way or easement is not available for the 10 foot clear zone, all installations must be placed "as near as practical" to the edge of the public right-of-way. This policy is applicable to all local and collector roadways roadways whose posted speed limit is in excess of 30 miles per hour and is intended to provide minimum standards for the purpose of protecting the public health, safety, and welfare. Dynamic performance for breakaway objects shall be evaluated in accordance with current AASHTO specifications. Arterial and major collector classifications should evaluate clear zone requirements per current AASHTO clear zone standards.

Commented [EM3]: I think a larger discussion is warranted here. Xcel has recently stated that they are not allowing breakaway poles. I think CDOT ran up against this issue on North Ave. - I will follow up with Kaity @ CDOT. Did Mark Bunnell provide any comments on this?

Commented [PP4R3]: Will update with direction from the city

29.36.070 Utilities

All utilities shall be placed in the roadway section as set forth in the City Standard Details.

29.36.080 Mailboxes - Location

(a) Mailboxes may be located within public rights-of-way so as not to obstruct pedestrian or vehicular traffic.

(b) In no case shall a mailbox obstruct a sidewalk, the traveled way of a roadway, the road shoulder, or impede maintenance activities associated with the facility. Mailboxes shall not be permitted within sidewalks, paths, or roadside ditches.

(c) On roads without a curb, the mailbox face shall be located a minimum of eight feet from the traveled way and adequate shoulder areas shall be provided for mail pickup and delivery.

(d) Streets with a curb and detached sidewalk: the mailbox face shall be located a minimum of 2 foot behind the curb face. Mailboxes must not pose an obstruction to the site zone. The mailbox should have a rear-facing door to facilitate mail removal without stepping into the street. Streets with attached sidewalk: the mailbox face shall be located a minimum of 2 foot behind back of walk.

(e) Group, gang mailboxes, or neighborhood box units shall not be placed in the area designated for sight distance or sight zone. Neighborhood mailboxes shall be considered a commercial location and must maintain the required driveway setback from intersections. Neighborhood mailboxes shall be shown on the utility composite and road plans. Group mailboxes should be placed a minimum of 2ft behind the sidewalk. Group mailboxes shall be illuminated by a streetlight.

29.36.090 Mailbox Construction Standards

Mailboxes erected on public right-of-way shall be of light sheet metal or plastic construction conforming to the requirements of the U.S. Postal Service. Construction of supports and details shall be in accordance with the current CDOT standards.

29.36.100 Mailbox Support Standards

(a) A single 4-inch x 4-inch square wooden post embedded no more than 36 inches into the ground; a single 4½ inch diameter wooden post embedded no more than 36 inches into the ground; a single metal post with a strength no greater than a 2-inch standard strength steel pipe (2 3/8" O. D.) and embedded no more than 24 inches into the ground will be acceptable as a mailbox support.

(b) A metal post shall not be fitted with an anchor plate, but it should have an anti-twist device that extends no more than 10 inches below the ground surface.

(c) Supports shall not be set in concrete unless the support design has been shown to be safe by crash tests when so installed.

(d) The post-to-box attachment details should be of sufficient strength to prevent the box from separating from the post top if a vehicle strikes the installation.

(e) No more than two mailboxes may be mounted on a support structure unless the support structure and mailbox arrangement have been shown to be safe by crash testing, or meet the requirements set forth in the above AASHTO guidelines.

(f) Mailbox support designs that differ from the AASHTO guidelines are subject to the exception process outlined in Chapter 14.

(g) Lightweight newspaper boxes may be mounted below the mailbox on the side of the mailbox support. Newspaper delivery boxes shall be of light sheet metal or plastic construction of minimum dimensions suitable for holding a newspaper.

Chapter 29.40 STRIPING AND SIGNING

29.40.010 Signs and Markings.

Signs and markings must communicate to the users a clear and definitive message. Signs and markings must conform to industry standards given in the MUTCD. Modifications to signing and striping on the Colorado State Highway System shall be submitted to the Colorado Department of Transportation for approval.

29.40.020 Signing and Striping Plan

Preparation of a detailed traffic control plan, showing the locations of all traffic control devices, is required as part of the development plans. A signing and striping plan is required for all public street improvements. The signing and striping plan must be clear and it must contain all relevant information. Example striping plans may be found in the CDOT M & S Standards.

29.40.030 Signing Specifications.

All roadway signs shall conform to the latest edition of the MUTCD and any Colorado supplement. See attached illustration for street name sign specifications.

29.40.040 Materials Specifications:

a) All signs shall be retroreflectorized sheeting on .125" thick tempered and anodized aluminum with radius corners. Letters and background shall faithfully reproduce their respective colors when illuminated at night.

b) All other signs:

1) Shall conform to MUTCD standard sign sizes

2) Shall be High Prismatic grade materials

c) Posts:

1) 12' length 3#/foot (min.) U channel posts shall be used for:

i. Single signs less than 7 sq. ft. wind loading area

ii. Double post mounting for signs 8 sq. ft. wind loading area

2) 14' length 3#/foot (min.) U channel posts shall be used for:

i. Warning sign assembly (2 signs) up to 9 sq. ft. wind loading area
ii. Single square or diamond shaped signs 9 sq. ft. wind loading area
iii. Double post mounting for all signs 10 - 16 sq. ft. wind loading area

3) 8' length 3#/foot (min.) U channel posts shall be used for:

i. End of road markers
ii. Object markers

4) All other signs use MUTCD lateral clearance specifications. *See 29.40.050 Installation Specifications: c) Lateral Clearance Restriction*

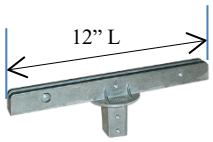
d) Fasteners:

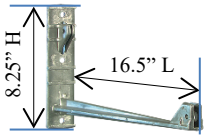
1) Street Name Signs:

i. 180-degree or 90-degree U-Channel Post Cap: cast aluminum 12" length & 5/16" set screws, attached to channel post with 1"x 5/16" bolts

ii. 90-degree cross cast aluminum 12" L x .875" D x .200" W with 5/16" set screws

1) Cantilever Wing Bracket: 16.5" L x 8.25" H x 2" W. For attaching to wood utility/light pole use 2" x 5/16" lag bolts and flat washer. *Two signs two brackets.*





2) All other Signs:

i. 3/8", grade 5 bolts with nylon lock nuts and flat washers. The bolt shall protrude beyond the lock nut by a full thread after assembly.

e) Street Name Sign Specifications: MUTCD Sign Code D3-1; D1-1; D1-2

1) Logo: All street name signs (D3-1) shall have the City Logo on the left side of the sign blank. D1-1 and D2-1 do not have logo. *Logo provided by the City of Grand Junction Traffic Department.*

2) **Color & Font:**

i. Sign blank is White High Prismatic Sheeting

ii. Background is 3M Blue 1175 C.

iii. Border is White ½“ thickness.

iv. Font is White FHWA Series C2000EX.

v. Font size on post mounted D3-1 & D1-1: 9” sign blank is 6” tall upper & lower case letters with 4” abbreviation.
Font size on post mounted D3-1 & D1-1: 12” sign blank is 8” tall upper & lower case letters with 6” abbreviation.
Font size on post mounted D1-2 18” sign blank is 6” tall upper & lower case letters with 4” abbreviation.

Font size on overhead 24” sign blank is 12” tall upper & lower case letters with 10” abbreviation.

3) **Sign Blank Size:**

i. Post mounted on local residential and collector streets: 9” X 24”-30”-36”-42”-48”-54”

ii. Post mounted on Arterials and Multi Lane Roads with speed limits greater than 40 MPH: 12” X 30”-36”-42”-48”-54”-60”

iii. Overhead signs 24 X 48” up to a maximum of 120” L

iv. Exceptions may be made on longer street names with approval from the Traffic Supervisor.

4) **Abbreviations:**

Avenue; Av	Boulevard; Blvd	Circle; Cir	Court; Ct	Drive; Dr
Road; Rd	Street; St	Way; Way	Run; Run	Trail; Trl

29.40.050 Installation Specifications

a) Minimum driven depth of post shall be 30 inches for all sign installation.

b) **Mounting Height Restrictions:** The mounting height is measured from the bottom of the sign to the top of the curb, or in the absence of curb, to the elevation of the near edge of the traveled way: See MUTCD Chapter 2A Figure 2A-2-C.

1) Street Name Signs (D3-1); Dead End Placard (W14-1a) & No Outlet Placard (W14-2a): 9ft min., 9.5ft max.

2) End of Road Markers: 4ft min., 5ft max.

3) All other signs: 7ft min., 7.5ft max.

c) **Lateral Clearance Restriction:** The near edge of sign shall not be less than 2 feet behind the face of curb or edge of sidewalk. Exceptions may be made on roads with a landscape strip with the approval of the Traffic Supervisor. On roads without curb, the

near edge of sign shall not be less than 6 feet from the shoulder or 12 feet from the travel way. See MUTCD Chapter 2A Figure 2A-2 & 2A-3

d) To maintain sign uniformity, no substitute or decorative materials will be allowed. The use of concrete for mount stabilization will not be allowed. If a stable mount cannot be achieved at the minimum driven depths, greater depths must be used in conjunction with longer posts. Minimum sign heights shall be maintained.

e) All signs (other than street name signs) shall be mounted on the wide, or open, side of the channel post. Care should be taken when tightening the bolts so as not to create a "dimple" in the aluminum sign.

f) At least two 'end of road' markers "OM4-2" signs shall be used where there is no alternate vehicular path. More than two markers may be required. Where a hazard exists such as an open ditch, the engineer may require permanent Type III Barricades to mark the roadway terminus. The design criteria for the permanent Type III barricade shall be the most recent Colorado Department of Transportation Standard Plan No. S-630-2

g) The developer shall bear all expenses for the fabrication and installation of permanent barricades and/or signs for implementing the approved project design (*i.e.* one way, no parking, dead end and private drive).

D3-1-D1-2 Examples

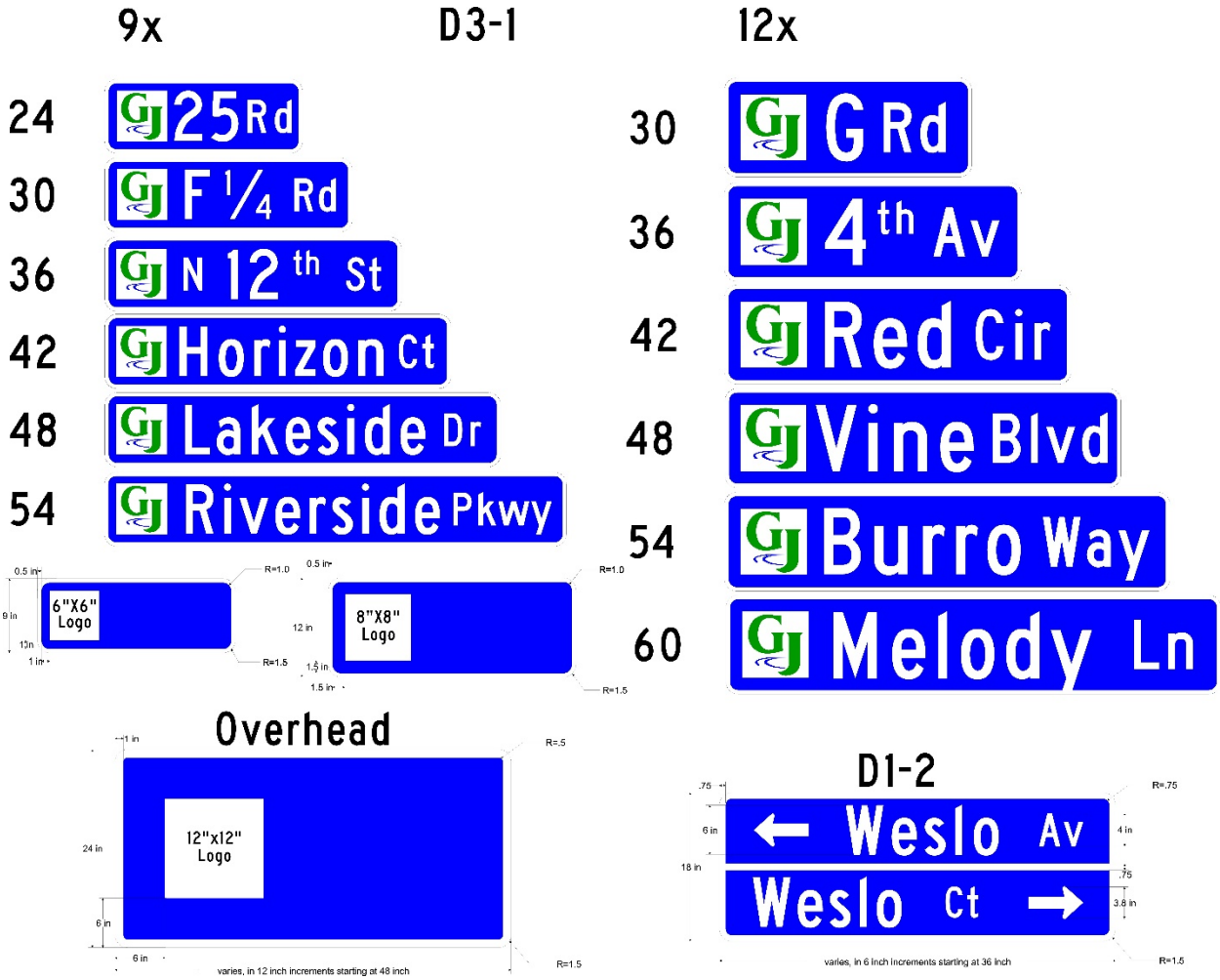
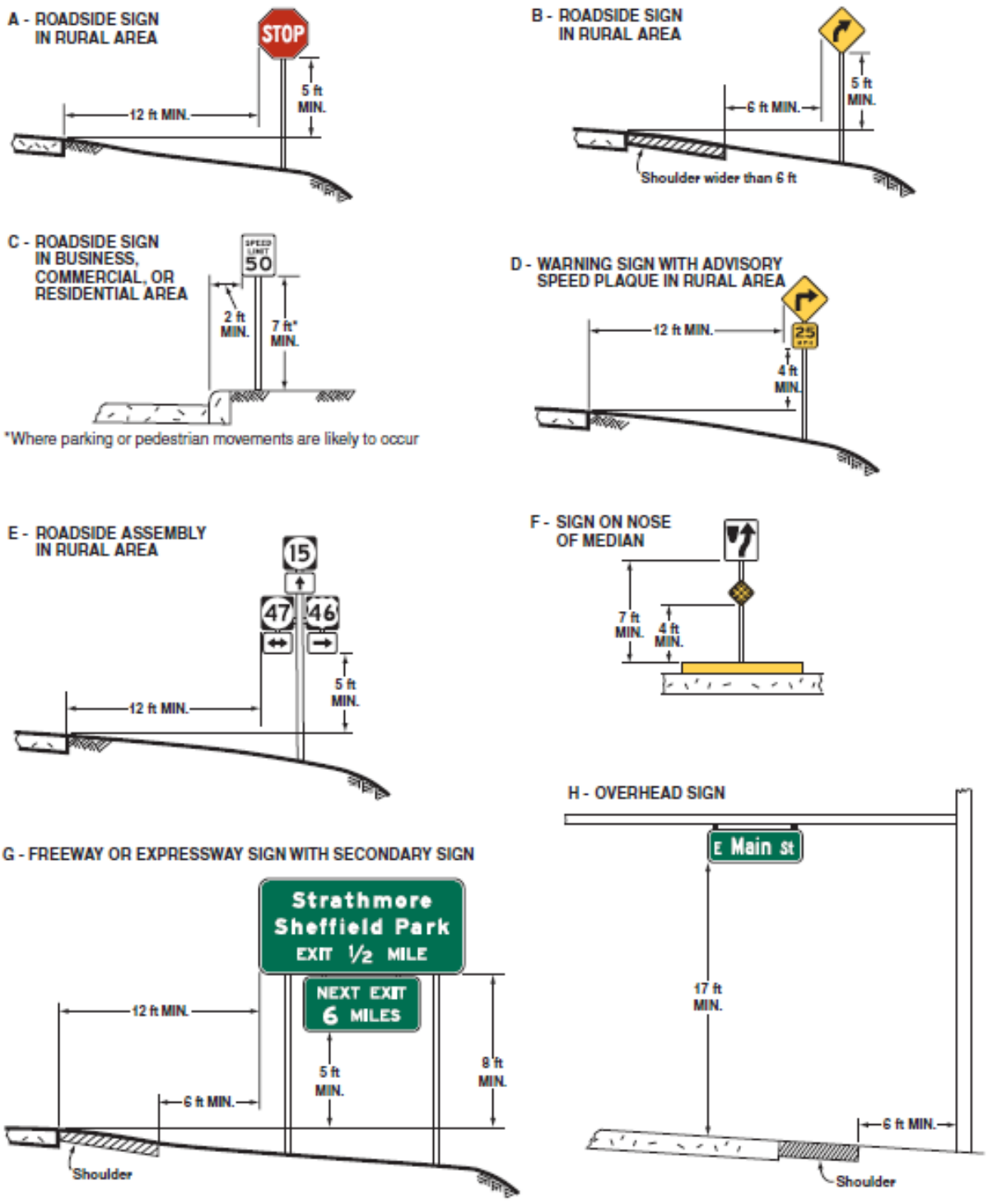
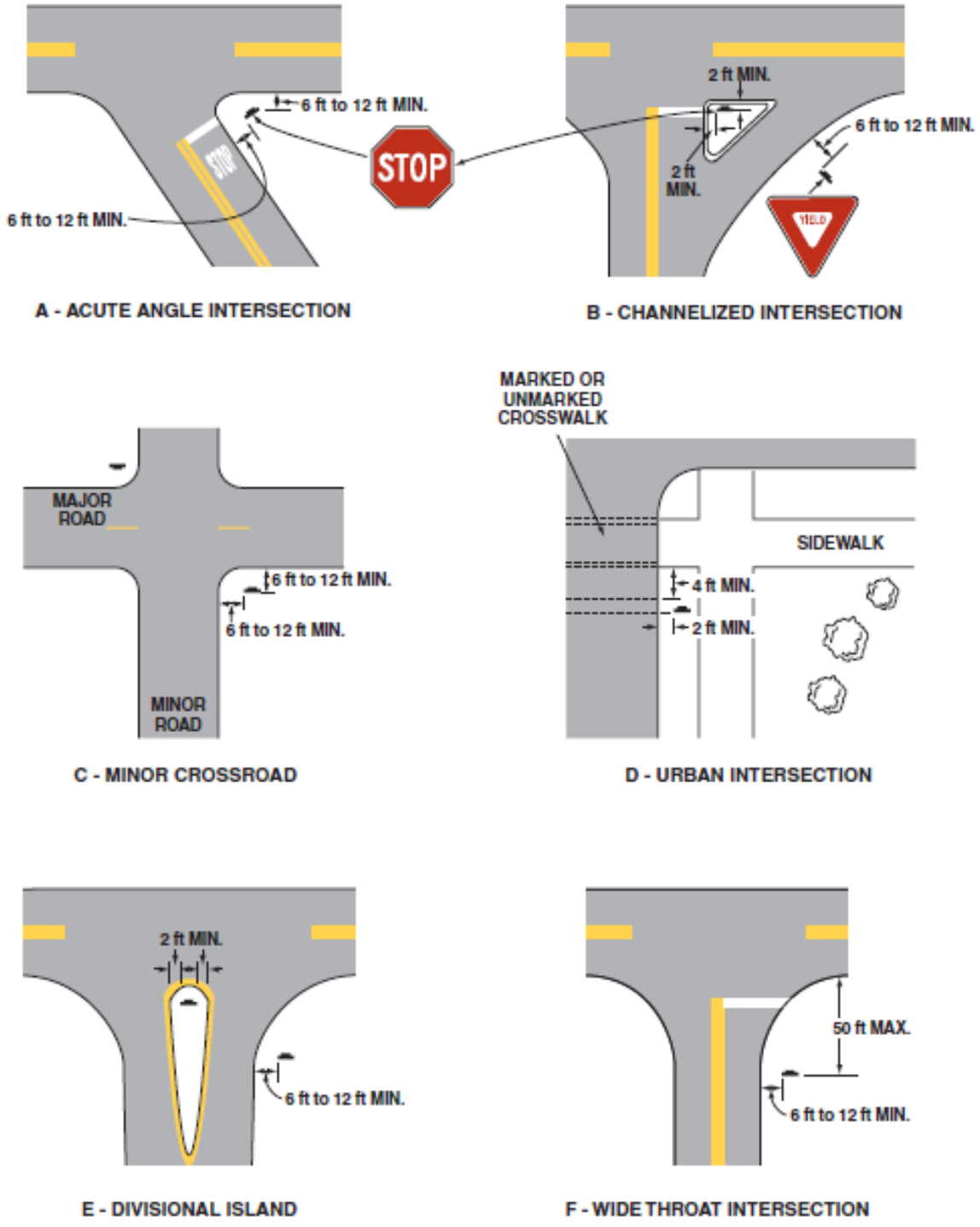


Figure 2A-2. Examples of Heights and Lateral Locations of Sign Installations



Note:
See Section 2A.19 for reduced lateral offset distances that may be used in areas where lateral offsets are limited, and in business, commercial, or residential areas where sidewalk width is limited or where existing poles are close to the curb.

Figure 2A-3. Examples of Locations for Some Typical Signs at Intersections



Note: Lateral offset is a minimum of 6 feet measured from the edge of the shoulder, or 12 feet measured from the edge of the traveled way. See Section 2A.19 for lower minimums that may be used in urban areas, or where lateral offset space is limited.

29.40.060 Striping Specifications

All striping shall conform to the latest edition of the MUTCD and any Colorado supplement.

All words, letter, symbol and arrow markings shall be installed in accordance with the design details in the Pavement Markings chapter of the latest edition of the "Standards Highway Signs and Markings" book adopted by the Federal Highway Administration.

a) Striping and Marking Materials.

1) All painted lines shall be applied at a minimum thickness of 15 mils, with 6-8 pounds of reflective glass beads applied per gallon of paint.

2) All permanent markings such as elongated arrows, stop lines, yield lines, crosswalks, preferential and bike lane markings must be an approved type thermoplastic material, applied a minimum of 125 mils thickness.

b) Colors. Markings shall be yellow, white, red, blue, black or purple. The colors for markings shall conform to the standard highway colors.

WHITE: Longitudinal lane lines, edge lines along the right side of the roadway or any ramp, transverse lines (except for cross-hatching markings in medians or safety zones separating opposing traffic flows or in left shoulders). Arrows, words and symbol markings (except the special interstate route shield symbol marking). Speed hump markings and parking space markings.

YELLOW: Centerlines separating lanes traveling in opposing directions. Edge lines along the left edge of a one-way roadway or one-way ramp. Cross-hatching markings in medians or safety zones separating opposing traffic flows or in left shoulders.

BLACK: Black in conjunction with one of the standard colors shall be a usable color where a light-colored pavement or concrete does not provide sufficient contrast with the markings. When used in combination with other colors, black is not considered a marking color, but only a contrast-enhancing system for the markings.

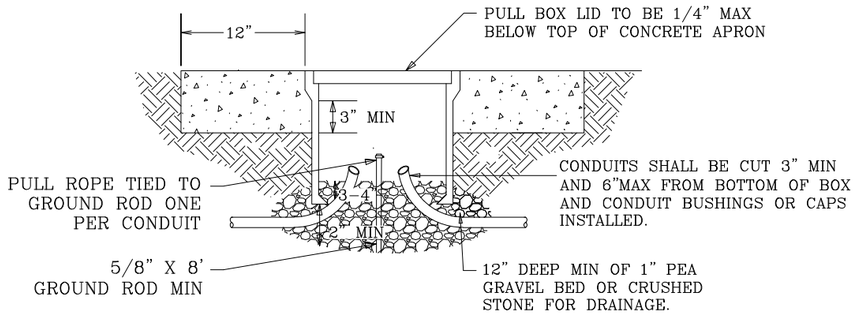
BLUE: Used for special markings that supplement white markings in a parking space specifically designated as reserved for the disabled. Blue raised pavement markers used to indicate the location of a fire hydrant adjacent to the road. Exception is for interstate route shield pavement markings, which is red, white, and blue.

RED: The only markings that are red are special raised pavement markers that are placed to be visible to "wrong-way" drivers. These special markers warn drives not to enter one-way roadways or one-way ramps in the wrong direction.

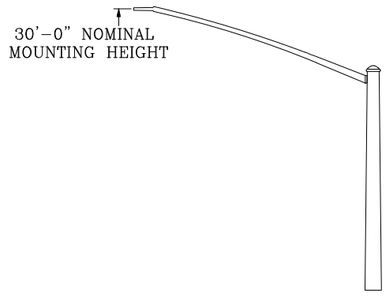
PURPLE: Shall supplement lane line or edge line markings for toll plaza approach lanes that are restricted to use only by vehicles with registered electronic toll collection accounts.

GREEN: Interim approval for bike lanes.

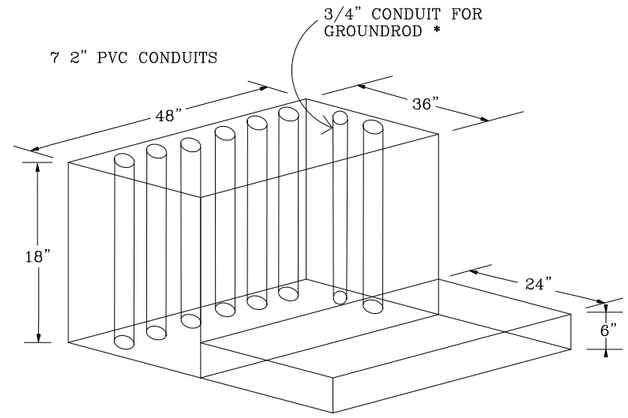
c) Re-Striping. When the removal of pavement markings is necessary for re-striping, the old markings must be ground off, sand-blasted or covered with a chip-seal. Covering the markings with black paint is prohibited.



PULL BOX DETAIL



LUMINAIRE EXTENSION

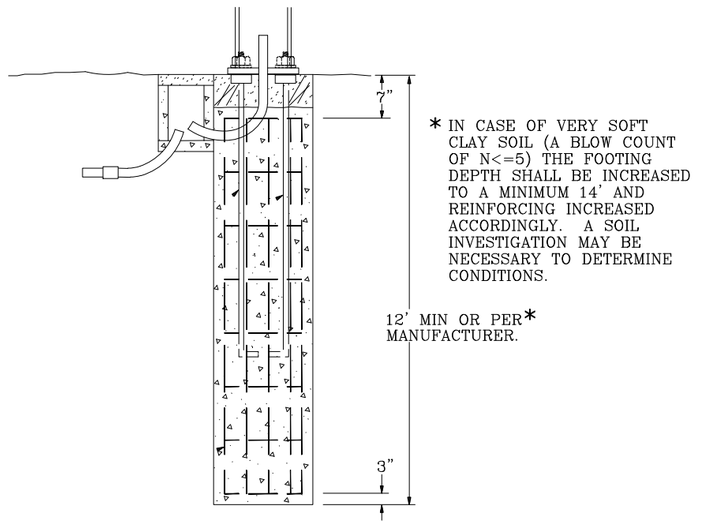


CONTROLLER CABINET FOUNDATION DETAIL

* INSTALL 5/8" SOLID COPPER GROUNDROD IN CABINET BASE
CONCRETE SHALL HAVE SMOOTH FINISH TOP

PULL BOX NOTES:

1. CONDUIT CENTERLINE SHALL BE ALIGNED TO TOP EDGE OF PULL BOX TO FACILITATE CABLE PULLING.
2. BED OF PEA GRAVEL OR CRUSHED STONE SHALL BE INCIDENTAL TO THE PULL BOX.
3. ALL PULL BOXES SHALL HAVE 12-INCH WIDE BY 6-INCH DEEP CONCRETE APRONS SLOPED AWAY FROM THE PULL BOX. THE COST OF APRON IS INCIDENTAL TO THE COST OF THE PULL BOX.
4. THE PULL BOX SHALL HAVE A DETACHABLE COVER WITH "GJ TRAFFIC", "GJ FIBER", OR "GJ COMM" PHYSICALLY IMPRESSED ON ITS TOP.
5. CONDUIT BEND NOTES:
   A. RADIUS MUST NOT BE LESS THAN 48" FOR CONDUIT CONTAINING FIBER
   B. SWEEP MUST NOT BE GREATER THAN 45 DEGREES
6. THE PULL BOXES SHALL HAVE THE WORDS "GJ TRAFFIC" OR "GJ COMM" CAST INTO THE SURFACE
7. ALL BORED CONDUITS SHOULD BE SWEPT DIRECTLY INTO PULL BOXES. NO PVC TRANSITIONS ALLOWED
8. REFER TO CDOT STANDARD PLAN NO. S-614-43 STANDARD SHEET NO. 6 OF 8 FOR STANDARD PULL BOXES AND NOTES



TRAFFIC SIGNAL POLE FOOTING

CITY OF GRAND JUNCTION
TRANSPORTATION ENGINEERING DIVISION

TYPICAL TRAFFIC SIGNAL INSTALLATION AND DESIGN DETAILS

DATE REVISED	DATE	TEDS CH. 29.44
	5/26/2023	SHEET 1 OF 3

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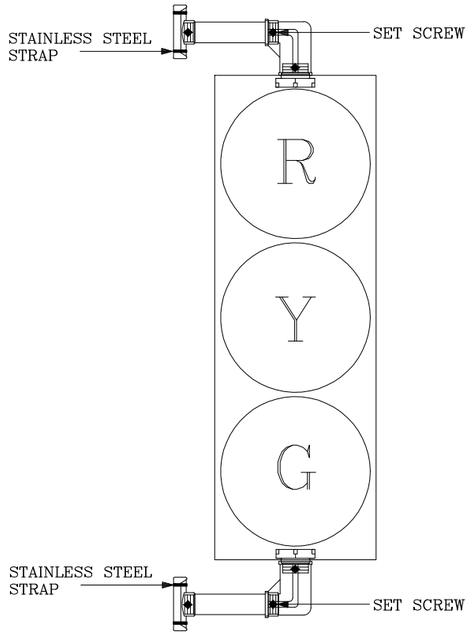
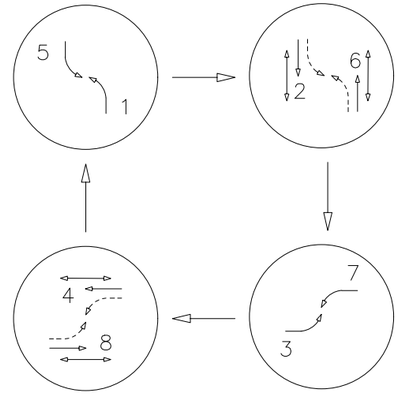
BILL OF MATERIALS

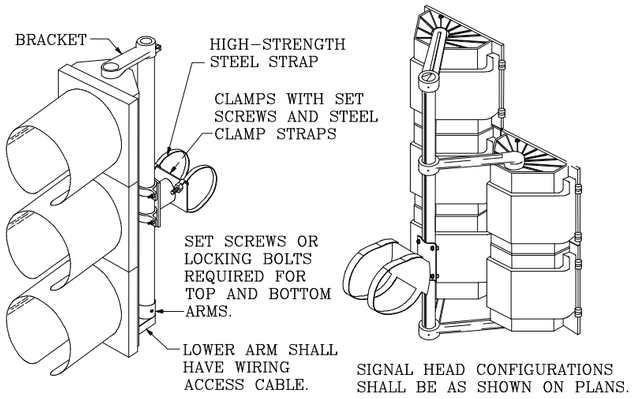
Item	Quan	Unit	Description
	4	EA	Mast Arm Pole (2 EA 35' L., 2 EA 40' L) with 2 EA Handicap Capable Pesestrain Push Buttons per Pole
	4	EA	Luminaire–15' L., 250 W. High Pressure Sodium
	20	EA	Traffic Signal Face, Black Polycarb, Tunnel Visor, with Black Aluminum Backplate (see Signal Face Detail)
	8	EA	Pedestrian Siganl Face, Black Polycarb, Countdown Type
	2	EA	Opticom Sensor, Two Directional, Model 722
	4	EA	Video Camera
	4	EA	Street Name Sign
	1000	EA	2" D. Conduit, Schedule 80 PVC
	50	EA	3" D. Conduit, Schedule 80 PVC
	1	EA	NEMA TS2 ATC Controller Cabinet w/UPS
	4	EA	Pull Box: 1 Large & 3 Small (unless noted otherwise)
	4	EA	Cabinet Module–Camera Interface
	1	EA	Cabinet Module–Model 754 Phase Selector
	1	EA	Cabinet Module–Power Source Interconnect
	520	LF	Wire–Video Coax Cable
	520	LF	Wire–Camera Power Cable
	400	LF	Wire–21 conductor, 14 GA., Stranded
	900	LF	Wire–7 conductor, 14 GA., Stranded
	400	LF	Wire–Push Button–2 pair, 18 GA., Shielded



SIDE OF POLE MOUNT BRACKETS (TYP)

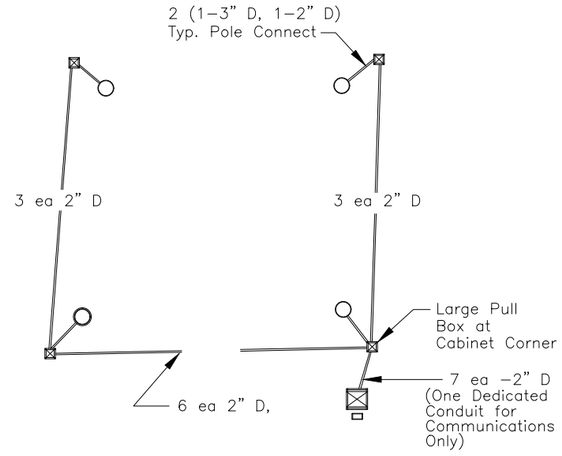


PHASING SEQUENCE



TRAFFIC SIGNAL MOUNTING BRACKET
(SKY–BRACKET OR APPROVED EQUAL)

Conduit Detail – Typical 2" D. Schedule 80 PVC
(Except as Noted)



CONDUIT DETAIL (TYP)

CITY OF GRAND JUNCTION
TRANSPORTATION ENGINEERING DIVISION

TYPICAL TRAFFIC SIGNAL INSTALLATION AND DESIGN DETAILS

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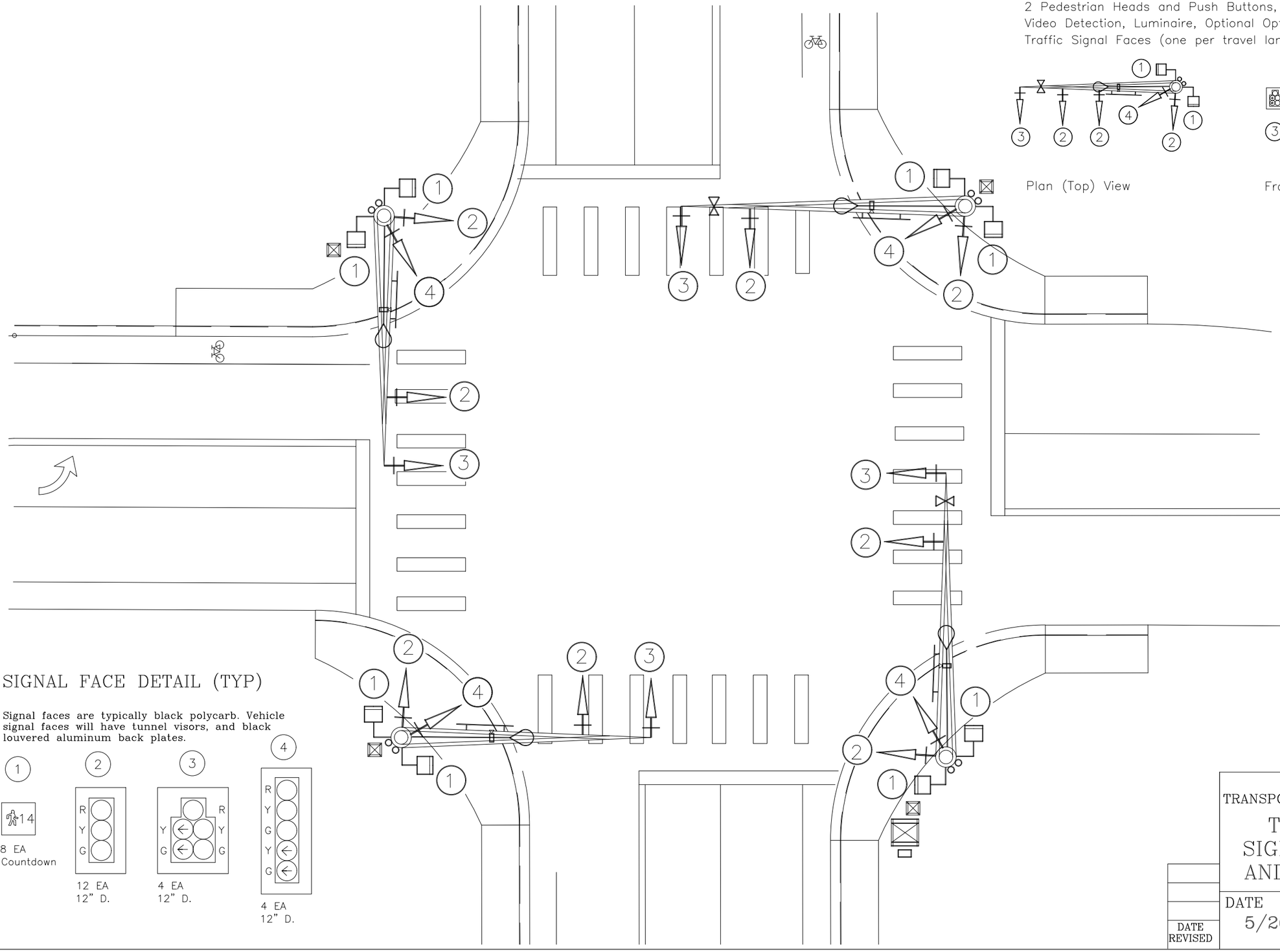
SHEET 2 OF 3

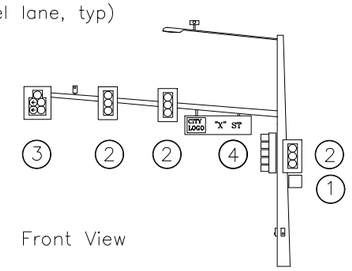
DETAIL ALL MASTARM LENGTHS



MASTARM ASSEMBLY (TYP)

2 Pedestrian Heads and Push Buttons, Street Name Signs, Video Detection, Luminaire, Optional Opticom Detector, and Traffic Signal Faces (one per travel lane, typ)

Plan (Top) View



Front View

SIGNAL FACE DETAIL (TYP)

Signal faces are typically black polycarb. Vehicle signal faces will have tunnel visors, and black louvered aluminum back plates.

8 EA
16" Countdown

12 EA
12" D.

4 EA
12" D.

4 EA
12" D.

CITY OF GRAND JUNCTION
TRANSPORTATION ENGINEERING DIVISION

TYPICAL TRAFFIC SIGNAL INSTALLATION AND DESIGN DETAILS

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SHEET 3 OF 3

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City of Grand Junction
Traffic Signal Specifications

General Requirements

The work specified in this section describes the installation of necessary material and equipment to complete traffic signals and/or other electrical systems as specified on the drawings, in the special contract provisions, or herein.

Traffic Control and Street Closure

The contractor shall be required to maintain access to all private drives throughout the period of construction. The contractor shall be required to erect and maintain all barricades, traffic control signs, cones, and other traffic control items necessary to provide proper traffic control during construction. The contractor shall submit three (3) copies of the traffic control plan to the City Transportation Engineer for approval 72 hours prior to beginning construction. At the completion of the project the contractor shall remove all barricades, traffic control signs, cones and other necessary construction traffic control items and return all areas or permanent traffic control devices damaged during construction to their original condition at no cost to the City. Traffic control signs and devices shall be in accordance with Part VI of the current version of the "Manual on Uniform Traffic Control Devices", (MUTCD), and as directed by the Engineer.

Testing

The City may at its option and cost retain the services of an independent testing lab to perform all testing consultation and to assist in the review of the work and equipment.

Intersection Power

The contractor shall notify the engineer two (2) weeks prior to the signal turn-on so that orders may be issued for power connection to the intersection on the specified turn-on date. Electrical power supply shall be separate from any other electrical service.

Equipment Salvage

All traffic signal equipment that is removed shall remain the property of the City. Such property is to be removed from the work site and returned by the contractor to the City of Grand Junction located at 333 West Ave Building D.

Existing Traffic Signals

When existing traffic signal installations are modified or completely rebuilt, the contractor shall avoid disturbing existing traffic signal equipment until the new or modified traffic signal system has been installed and put into operation. If the existing traffic signal equipment must be removed to accommodate the new construction, the contractor shall, with the engineer's approval and at the contractor's sole expense, install temporary overhead traffic signal equipment or an approved traffic signal trailer. The contractor shall at all times maintain a minimum of two (2) three-section (red, yellow, and green) traffic signal heads for each roadway approach in conformance with the MUTCD.

Signal Heads

Signal heads installed on standards or poles at new signal locations, which are not ready for actual electrical operation, **shall be bagged. This shall include pedestrian heads and**

pedestrian push buttons.

Field Location

All poles, control cabinets, pull box locations, and pole foundations shall be field located by the engineer. Traffic signal poles and mast arms shall not be ordered until field verification of pole foundations is complete.

Utilities

All utilities shall be shown on the plans to the extent that they can, based upon utility records, surface field indications and proposed installations. During the progress of the work, all utility locations and elevations will necessarily require field verification in cooperation with the affected companies and public agencies. The contractor shall be responsible for locating all valve boxes, manholes, etc., and insuring that they are properly protected and/or adjusted.

Notification of Work

The contractor shall work only on weekdays between the hours of 8:00 a.m. and 5:00 p.m. The contractor must receive written approval from the engineer to work at any other time.

Regulations and Code

All electrical equipment and material shall conform to the standards of the National Electrical Manufacturers Association (NEMA), Qwest Communications Company or the Colorado Department of Transportation, whichever is applicable. In addition to requirements of these specifications, the plans, the special contract provisions, all material, and work shall conform to the requirements of the National Electrical Code (hereinafter referred to as the "Code"), the Rules for Overhead Electrical Line Construction of the Public Utilities Commission, the Standards of the American Society for Testing Materials (ASTM), the American Standards Association (ASA), and any local ordinance which may apply. Wherever reference is made in these specifications or in the special contract provisions to the code, rules, or the standards mentioned above, the reference shall be construed to mean the code, rule, or standard that is in effect at the date of bidding.

Equipment List and Drawings

The contractor shall submit a list of equipment and material that he proposes to furnish within five days of the execution of the owner-contractor agreement. The submittal shall including all equipment and material as identified on the plans or in the specifications by the manufacturer's name which is necessary or customary in the trade to identify such equipment and material. The list shall be complete as to name of manufacturer, unit size, and material composition and shall be supplemented by such other data as may be required by the City Transportation Engineer.

The engineer or his designee prior to installation must make inspection or sampling of any materials, other than those already approved, according to the material specifications. If the contractor proposes a substitution of equipment called for in the plans or specifications, he shall provide additional information to prove the substitution item is of equal or superior quality. Any material and/or equipment installed by the contractor that is not in conformance with the City of Grand Junction specifications will be removed or changed at the contractor's expense. Upon completion of the work, the contractor shall submit an "as-built" or corrected plan showing, in detail, all construction changes including, but not limited to, wiring, cable, and location and depth

of conduit.

Excavating and Backfilling

Excavations for the installation of conduit, foundations, and other traffic signal items shall be performed in such a manner as to cause the least possible injury to the streets, sidewalks, and other improvements. Whenever possible, directional boring shall be used in place of trenching. The trenches shall not be excavated wider than necessary for the proper installation of the electrical appliances and foundations. Excavating shall not be performed until immediately before installation of conduit and other appliances. The material from the excavation shall be removed as the trenching progresses.

Trenches in existing or proposed roadways shall be backfilled with concrete or approved flow-fill material and caution tape. After backfilling, all trenches shall be kept well filled and maintained in a smooth and well-drained condition until permanent repairs are made.

Excavations in streets or highways shall be performed in such a manner that one (1) lane of traffic in each direction shall be open to public traffic. All lane closures shall be approved by engineer prior to closure. At the end of each day's work and any other time construction operations are suspended, all construction equipment and other obstructions shall be removed from that portion of the roadway open for use by public traffic. When excavations must remain open overnight, they shall be properly marked to warn motorists and/or pedestrians according to guidelines established in the "Manual on Uniform Traffic Control Devices for Streets and Highways" latest edition. The engineer may require the trench to be covered with steel plate so that the street remains open to traffic.

Removing and Replacing Improvements

The contractor shall at his sole expense replace or reconstruct sidewalks, curbs, gutters, rigid or flexible pavement, and any other City or privately owned property which is removed, broken, or damaged by him with material which conforms to current City standards and specifications. Whenever a part of a square or slab or existing concrete, sidewalk, or driveway is broken or damaged, the entire square or slab shall be removed and the concrete reconstructed as above specified.

The outline of all areas to be removed in Portland cement concrete sidewalks and in pavements shall be cut to a minimum depth of one-and-one-half inches (1-1/2") with an abrasive type saw prior to removing the sidewalk and pavement material. Cut for remainder of the required depth may be made by a method satisfactory to the engineer. Cuts shall be neat and true with no shatter outside the removal area.

Instructions and Wiring Diagrams

All equipment shall be provided with three sets of complete installation instructions, including a complete chart of field connections as well as containing service instructions, wiring diagrams, trouble-shooting procedures, etc. Each and every component used shall be clearly referenced in the service manual and its value, ratings and manufacturer part number shall be given.

Guarantee

The contractor shall include in his proposal all warrants and/or guarantees with respect to materials, parts, workmanship and performance of the product to be supplied. The minimum

guarantee period for the product shall be one (1) year from the date of final acceptance of the contract. The contractor shall attach to the bid a statement that all material to be supplied is either in exact accordance with the specifications or shall list in detail any and all deviations therefrom. The supplying of equipment that is not in accord with the specification and on which the contractor has indicated no exception shall be cause for rejection of the equipment and correction of the non-specification items entirely at the contractor's expense.

Underground Facilities

Foundations

A. All foundations shall be Portland cement concrete conforming to the applicable requirements of construction specifications of the City of Grand Junction, except as herein provided.
B. The bottom of concrete foundations shall rest on firm ground. Cast-in-place foundations shall be poured monolithically where practicable. The exposed portions shall be formed to present a neat appearance.
C. Forms shall be true to line and grade. Tops of foundations except as noted on plans, shall be finished to curb or sidewalk grade or as ordered by the engineer. Forms shall be rigid and securely braced in place and inspected prior to the pouring of concrete. Conduit ends and anchor bolts shall be placed in proper position and in a template until the concrete sets.
D. Anchor bolts shall conform to the specifications and each individual bolt shall have two (2) flat washers, and two (2) nuts. Shims or other similar devices for plumbing or raking will not be permitted.
E. Both forms and ground that will be in contact with the concrete shall be moistened before placing concrete. Forms shall not be removed until the concrete has thoroughly set.
F. All abandoned foundations shall be removed and disposed of by the contractor. All conduit runs associated with an abandoned foundation shall be extended or abandoned as called for on the plans. When a foundation is removed, the hole shall be backfilled in accordance with State of Colorado and City of Grand Junction standard practices.

Conduit

A. All cables and conductors not shown on the plans as aerial cable shall be installed in conduit unless installed in poles, pedestals, or mast arms. All metal conduits referred to in the specifications and shown on the plans shall be rigid and adequately galvanized. All PVC conduits will be of Schedule 80 or greater.
B. All trenches excavated in roadways, including new construction areas, shall be backfilled with concrete or State of Colorado approved flow fill, caution tape, and capped with six inches (6") of Grade E Asphaltic Pavement.
C. Following conduit schedule is in effect unless otherwise specified in the plans:

Run Type	Quantity	Size	Use
Street Crossings	1	2”	120 voltage
Street Crossings	2	2"	Low voltage
Street Crossings	2	2"	EXCEL use
Signal Pole	3	2"	Signal cables
Signal Pole	1	2"	EXCEL use
Controller Cabinet	3	2"	120 voltage
Controller Cabinet	1	2”	Excel use
Controller Cabinet	1	2"	Low voltage
Service Point	1	2"	EXCEL use
Fiber Optic Interconnect	1	2”	Communications
Ground Rod	1	5/8”	

D. The contractor, at his sole expense, may use larger conduit if desired. Where larger conduit is used, it shall be for the entire length of the run from outlet. No reducing couplings will be permitted underground.
E. The end of all metal conduit, existing or new, shall be well reamed to remove burrs and rough edges. Field cuts of existing or new conduit shall be made square and true, and the ends shall butt together for the full circumference thereof. Slip joints of running thread will not be permitted for coupling metal conduit. When a standard coupling cannot be used, an approved threaded union coupling shall be used. All couplings shall be screwed up until the ends of the metal conduits are brought together.
F. Where a "stub out" is called for on the plans, a sweeping ell shall be installed in the direction indicated and properly capped. The locations of ends of all conduits in structures or terminating at curbs shall be marked by a "Y" at least three inches (3") high cut into the face of the curb, gutter, or wall directly above the conduit.
G. Conduit bends, except factory bends, shall have a radius of not less than six (6) times the inside diameter of the conduit. Where factory bends are not used, conduit shall be bent without crimping or flattening, using the longest radius practicable.
H. Conduit shall be laid at a depth of not less than twenty-four inches (24") below the top of curb grade in sidewalk or grass areas and to a depth of not less than thirty inches (30") below the finished grade in all other areas. Conduit under railroad tracks shall be not less than forty-eight inches (48”) below the bottom of the tie.
I. Trench excavations for conduit shall be two inches (2") wider than the outside diameter of the conduit. Placing concrete or approved flow-fill up to the bottom surface of the existing or new roadway surface material shall accomplish backfilling of conduit trenches. The remaining portion of the excavation shall be backfilled with the same type of material used to construct the existing roadway surface.
J. Conduit shall always enter a foundation, pull box, or any other type structure from the direction of the run only.
K. Conduits terminating in a pole shall extend approximately six inches (6") vertically above the foundation.
L. All conduit runs that exceed ten feet (10') in length shall have a continuous nylon line pulled into the conduit along with the specified electrical cables and tracer wire #10 AWG. The line shall be firmly secured at each end of the conduit run with a minimum slack of three feet (3'). The purpose of this line is to be able to pull future electrical cable through the existing conduit runs. All nylon line shall be free of knots and “birds nest”.
M. Existing underground conduit to be incorporated into a new system shall be cleaned with a

mandrel or blown out with compressed air.

N. New conduit runs shown on the plans are for bidding purposes only and may be changed with approval of the engineer.

Underground Facilities - Pull Boxes

A. A pull box shall always be installed in combination with a steel strain pole and at all other locations shown on the plans and at such additional points as ordered by the engineer. The contractor may install, at his own expense, any additional pull box that he may desire to facilitate the work.
B. Pull boxes that are required shall be fabricated and installed in general conformance with the size and details shown on standard drawings.
C. Pull boxes shall be installed so that the covers are level with curb or sidewalk grade or level with the surrounding ground when no grade is established. The bottoms of all pull boxes shall be bedded in crushed rock. Conduit stub outs into pull boxes shall be no shorter than four inches (4”) from bedding grade. When installed in the concrete, two bolts on each side of the pull box 2” below the top shall be installed to adhere the box to the concrete.
D. When a new conduit run enters an existing pull box, the contractor shall remove the pull box or tunnel under the side at no less than eighteen inches (18") and enter from the direction of the run. No new conduit will be allowed to enter a new or existing pull box in any other manner than that shown on standard drawings.
E. For bored pipe, its preferable to have no PVC elbows entering pullboxes with bored pipe.

Underground Facilities - Conductor and Cable

A. Wiring shall conform to appropriate articles of the National Electric Code. Wiring within cabinets, junction boxes, etc., shall be neatly arranged and tagged/color coded per cable schedule.
B. Powdered soap stone, talc, or other approved lubricant shall be used in placing conductors in conduit.
C. A common neutral conductor, separate from the signal light circuit neutral, shall be used for all low-voltage circuits, including the detectors and pedestrian push-button circuits.
D. Splicing of cable will not be permitted in conduit, outside of signal heads, standards, foundations. All splicing should be done in the pole base, except where the main tie in at the signal cabinet pull box/cabinet corner.
E. In no case shall any shellac compounds be used. Wire nut type connectors shall be used on all splices made above ground level. A minimum of 18 inches of slack shall be left at each splice except within hand-holes where 24 inches shall be left.
F. When conductors and cables are pulled into the conduit, all ends of conductors and cables shall be taped to exclude moisture and shall be so kept until the splices are made or terminal appliances attached. Ends of spare conductors shall be taped and marked.
G. Cable shall be stranded. The gauge for IMSA cable is 14 or 12 stranded, and UF electrical is #12.
H. A small permanent tag on which the direction and phase is printed, in the order named, using the codes given in "**Cable Schedule**," shall be securely attached near the end of each conductor at each controller, standard, or pull box where conductors are separated. Where direction and phase are not clearly indicated by conductor insulation, additional tags shall be used.

Cable Schedule

Direction/Tag	Tape Color
NBLT	Red/Yellow
NB	Red
SBLT	Green/Yellow
SB	Green
EBLT	Orange/Yellow
EB	Orange
WBLT	Blue/Yellow
WB	Blue
Right Turn	Double Yellow with Corresponding Direction Color
Pedestrian	Brown

NOTE: This is a typical cable schedule and shall be used for the wiring of all signal installations. A new cable schedule will be noted on the plans at each intersection where different phasing and/or special equipment is required. It should be noted that a band of yellow is used to indicate a left turn and brown for a pedestrian movement. This is in addition to directional tape for the phase. For cable size and number of conductors see traffic signal material specifications and/or standard drawings.

I. Inboard and outboard heads, mounted on mast arms, are to be wired separately from head to base of pole or pull box.

Underground Utilities - Bonding and Grounding

A. Metallic cable sheaths, conduit, metal poles, and foundations shall be made mechanically and electrically secure to form a continuous system and shall be effectively grounded. Bonding and grounding jumpers shall be copper wire, No. 8 AWG, for all systems.
B. Bonding of standards shall be by means of a bonding wire attached to a bolt or a three-sixteenths inch (3/16") or larger bolt installed in the lower portion of the shaft.
C. At each pull box the ground electrode shall be a one-piece copper ground rod of five-eighths inch (5/8") diameter and eight feet (8') in length, driven into the ground so that the top is two inches (2") above the bottom of the pull box. The ground rod connector will be placed so that the bare copper wire, No. 8, can be pulled into a pole, foundation, or attached to the control cabinet ground buss.

Underground Utilities - Maintenance

The contractor shall have full maintenance responsibility of the traffic signal from the date of the written notification by the City Transportation Engineer to the final inspection and date of written approval of the work performed. **The contractor shall provide continuous maintenance and emergency service 24 hours each day during the time frame outlined above**. The Contractor shall provide and maintain a 24-hour a day continuous one number telephone answering service. All malfunctions of a controller and its accessory equipment shall be considered an emergency unless otherwise identified by the City. Equipment malfunctions and/or damage, which in the opinion of Grand Junction's Transportation Engineer or other authorized person, constitutes a serious hazard or inconvenience to the public shall be considered an emergency. Such malfunctions or damage may include, but not necessarily be limited to, situations where:

A. All indications are out including pushbuttons and pedestrian holds, for any one traffic movement;
B. Signal heads give conflicting indications to any intersection approach;
C. A signal has been knocked down;
D. An overhead red indication is out.

Contractor shall undertake each such emergency repair no later than one hour after Grand Junction notifies Contractor of the emergency.

Underground Maintenance - **Field Testing**
Prior to completion of the work, the contractor shall cause the following tests to be made on all traffic signals in the presence of the engineer or his designee.

A. Each circuit shall be tested for continuity.
B. Each circuit shall be tested for grounds.
C. A functional test shall be made in which it is demonstrated that each and every part of the system functions as specified or intended herein. The functional test for each traffic signal system shall consist of not less than fourteen (14) days of continuous, satisfactory operation commencing with full operation of all electrical facilities. During the fourteen-day period, the contractor will maintain the system or systems. The cost of any maintenance necessary, except electrical energy and maintenance due to damage by public traffic, shall be borne by the contractor and will be considered as included in the price paid for the contract item involved, and no additional compensation will be allowed.

Material Specifications

Material Specifications - Traffic Signal Indication Unit Specifications
All signal indication units shall be of the individual section, adjustable type, gloss black polycarbonate or approved equivalent.
A. Visors shall be detachable, twelve-inch (12") tunnel type, open at the bottom; be gloss black in color on the outside and flat black on the inside.

B. Lenses shall be in accordance with current Institute of Traffic Engineers Specifications.
.
C. Doors on the signal heads for the installation of LED and indications replacement or other maintenance shall not require use of any tool whatsoever to be opened. Doors shall be equipped with neoprene weatherproof gaskets to insure against infiltration of moisture, road film, and dust. Each three-color signal unit shall have the leads from all signal sections connected to a terminal board stamped with identifiable terminals. There shall be a terminal for color indication plus a common terminal where one lead from each indication shall terminate. The terminal board shall be mounted in the middle section and be properly insulated. All openings, top and bottom, shall be for one-half-inch (1/2") pipe or pipe mounting brackets. Gaskets shall be supplied for top and bottom openings.

Material Specifications - Pedestrian Signal Units
Sixteen-inch , one-way, ICC or equal pedestrian signal heads as specified on the plans. "Walk/Don't Walk" with countdown indications shall be symbolized and side by side. Visors, if

required, shall be egg crate type and heads shall be gloss black.

Material Specifications - Back plates

A. Where shown on the plans, black back plates shall be furnished and installed on signal faces. No background light shall show between the back plates and the signal face or between sections. All back plates are to be of aluminum or plastic construction and shall be the louvered type. Back plates shall provide a five-inch border for all 12-inch signal heads with 2-inch yellow reflective tape border.
B. Traffic signal heads requiring backboards shall be drilled for three-sixteenths-inch diameter by one-half-inch (3/16" x 1/2") pan head bolt with nut and lock washer. If the manufacturer fails to supply as described, it will then be the contractor's responsibility to do so. When installing backboards on the traffic signal head, the contractor will furnish three-sixteenths-inch (3/16") fender washers between bolt head and backboard.
C. The manufacturer will fabricate all backboards with a three-sixteenths-inch (3/16") washer on both sides of each rivet, which is used to hold each section of backboard together.

Material Specifications - Traffic Signal Lamps

A. All signal indications, for both vehicle and pedestrian signals, shall be LED and meet the requirements of the applicable CDOT specifications.

Electrical Cable

Electrical Cable - Signal Cable

14 AWG multi-conductor, stranded, copper wire manufactured to meet IMSA 19-1 specifications or approved equivalent. Each conductor in the cable will be individually insulated and rated at 600 volts. The number of conductors per cable will be specified in quantities and blueprints for the project in question.

Electrical Cable - Traffic Wire Specifications

20 conductor (Under Ground to each corner)

Green	Main St. Green
Orange	Main St. Amber
Red	Main St. Red
White	Through Traffic Common
Orange with Red tracer	Main St. Amber Arrow
Green with White tracer	Main St. Green Arrow
White with Black tracer	Turn Arrow Common
Blue	Main St. Walk
Black	Main St. Don't Walk
White with Red tracer	Pedestrian Common
Green with Black tracer	Side St. Green
Orange with Black tracer	Side St. Amber
Red with Black tracer	Side St. Red
Red with White tracer	Side St. Amber Arrow
Blue with Black tracer	Side St. Green Arrow

Blue with White tracer	Side St. Walk
Black with White tracer	Side St. Don't Walk
Black with Red tracer	Side St. Red Arrow (exclusive)
Blue with Red tracer	Spare
Red with Green tracer	Main St. Red Arrow (exclusive)

7 Conductor (Through Traffic Vehicular Heads)

Green	Green
Orange	Amber
Red	Red
White	Common
White with Black tracer	Spare
Blue	Spare
Black	Spare

7 Conductor (5 Section Turn Arrow Vehicular Heads)

Green	Green
Orange	Amber
Red	Red
White	Through Traffic Common
Blue	Green Turn Arrow
Black	Amber Turn Arrow
White with Black tracer	Turn Arrow Common

All spare wiring in Vehicular heads shall be kept at length, marked with black tape and coiled neatly in the amber lens housing.

7 Conductor (Pedestrian Heads)

Green	Main St. Walk
Red	Main St. Don't Walk
White	Main St. Ped. Common
Orange	Side St. Walk
Black	Side St. Don't Walk
White with Black tracer	Side St. Ped. Common

Directional color codes

Red	N/B
Orange	E/B
Green	S/B
Blue	W/B
Yellow	Left Turn

Brown	Ped

Pedestrian Push Button Wiring (2 Pair 18 AWG)

Black and White (Labeled Pair One (1))	Main Street
Black and Red (Labeled Pair Two (2))	Secondary Street

Electrical Cable - Interconnect Cable

General single mode fiber optic cable shall conform to the following general cable specifications and in accordance with the city's Signal Communications Plan:

A. Fiber complies with current EIA/TIA 455 and IEC 793 test methods for required attributes.
B. The cable is loose tube with a dry block to prevent water from seeping into the cable (no gel fillings shall be permitted).
C. All fiber optic cables intended to be installed in conduit are dielectric.
D. A minimum length of 1.8m on each end of the cable is accessible for on-reel testing.
E. Fiber has a D-LUX coating or approved equivalent to ensure color retention, minimize microbending losses and improve handling. The coating is mechanically strippable.

Electrical Cable - Pedestrian Push-Button Cable

Push-button wire shall be two pair quarter-inch diameter, shielded and jacketed cable. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation.

Electrical Cable - Ground

Single conductor, AWG No. 8, soft-drawn bare copper wire.

Electrical Cable - Optical Detector Lead-In Cable

The lead-in cable for the Emergency Vehicle Optical Detectors shall be 3M Type 138 or approved equal.

Vehicle Detectors

Vehicle Detectors - General

A. Detector units shall be card rack mounted plug-in type and operate from an external 24 VDC power supply. Detector units shall be in full compliance with the environmental and size requirements of NEMA standard TS1-Section 15 and meet the design, operation, electrical and functional performance requirements of both TS1 and TS2 specifications.
B. Each detector unit shall include four complete detector channels..
C. Each channel of the sensor unit shall automatically self-tune.

Vehicle Detectors - Vehicle Video Detection

Shall be current city specification or approved equal.

Vehicle Detectors - Emergency Vehicle Detectors

Optical Communication Detectors for emergency vehicle pre-emption shall be components of the 3M Opticom Priority Control System (Model 754 or as approved by the Engineer). All detectors shall be two-direction, two-channel. Detectors, phase selectors, harnesses, rack mount, and cabling shall be the manufacturer's latest make and model. No splicing of the lead-in cable shall be allowed.

Pedestrian Push Button Detectors

Push buttons shall be manufactured by Bulldog brand or approved equal.

A. Pedestrian push buttons shall be of the direct push-button contact type. They shall operate on a voltage not to exceed 18 volts AC. They shall be of tamper-proof design and equipped with a push-button instruction sign as shown in the Standard Details.
B. The assembly shall be weatherproof.
C. The housing shall be shaped to fit the curvature of the pole to which it is attached to provide a rigid installation. Saddles shall be provided to make a neat fit when required. Pedestrian signs shall be installed as shown on the Standard Details.

Traffic Signal Poles, Pedestals and Mast Arms

Traffic signal poles, pedestals, and mast arms shall be of the general configuration shown on standard drawings. All traffic signal poles and mast arms shall be designed to meet the requirements outlined in the current edition of "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals," published by AASHTO, for a wind velocity of 90 mph. Poles shall be galvanized. Poles shall be manufactured by Valmont or approved equal.

Controller Cabinet

A. All controllers and auxiliary equipment shall be housed in a factory wired, weatherproof, metal cabinet following **NEMA** specification **TS2 Type 1**. The cabinet shall have minimum interior dimensions, exclusive of stiffeners, shelf brackets, etc., of height - 46 inches, width - 29 inches, and depth - 15 inches.
B. The cabinet shall be constructed of 0.125 minimum thickness bare aluminum. Cabinets shall be braced internally or by folded seams in order to provide sufficient rigidity to withstand normal handling and transport to the field location without deforming.
C. The main door shall have a self locking, keyed, tumbler lock with two keys. Hinges shall be mounted on the cabinet in such a way that interchange-ability of doors is possible between cabinets of like size and manufacturer. Hinge pins shall be stainless steel. Doors shall have neoprene gaskets of sufficient thickness to provide a rain tight and dust tight seal. Secondary door (back door) shall have same design as the main door.
D. The engineer will provide, during the construction period, an additional external lock for the controller cabinet to maintain security of the controller cabinet.
E. A police or auxiliary door shall be provided. It shall be constructed so that no sharp edges

protrude from the main door and shall provide access to a panel with labeled switches for automatic to flashing operation and signal power on/off.

F. The cabinet shall be equipped with two thermostatically controlled, ball bearing fans with a capability of at least 100 cubic feet per minute. The thermostat shall be adjustable to turn on between 90 degrees Fahrenheit and 150^{o} degrees Fahrenheit and be so mounted as to be easily accessible for adjustment from the inside of the cabinet. An internally mounted lamp socket shall be provided with 150-watt capability and switched "on" only when the main door is open.
G. The cabinet shall have three shelves each capable of supporting 75 pounds. Shelves shall be supported on brackets, which provide for height adjustments. Each cabinet shall contain a 10 mil thick plastic envelope with side opening. It shall be a minimum size of 10" x 12" and be attached to the door by screws.
H. Assembly wiring - All cabinet wiring shall be neatly arranged and laced or enclosed in plastic tubing. No harness or wire shall be attached to any shelf rack or other point where movement of shelves or doors may damage it.
I. Terminal Facilities - Terminal facilities (load bays) shall be firmly attached in a position not less than 6 inches from the bottom of the cabinet so as to provide easy access and maximum convenience to the user.
J. Side mounted auxiliary panels should be firmly installed with the forward edge not more than 4 inches from the door sill and not less than 6 inches from the bottom of the cabinet in all cabinets.
K. The load bay and its associated equipment, harness, switches, etc., shall be grouped on removable panels. Each panel or group of receptacles and connecting cables shall be arranged to permit so that work can be performed on panel backs or cables.
L. A load switch bay and flash transfer capability is required for each phase. Load switches shall be provided for all the phases in the cabinet.
M. The load bay shall be protected by a main circuit breaker. A gas tube surge arrestor with MOV and a suitable radio interference filter shall be supplied. The arrestor shall be a three-electrode type with the following ratings:

1. Impulse Breakdown - less than 1,000 volts in less than .1 microseconds at 10 kV per microsecond.
2. Standby current - less than 1 milliamp ere.
3. StrikingVoltage - greater than 212 VDC.
4. Energy Capability - capable of withstanding pulses of peak current each of which will rise in 8 microseconds and fall in 20 micro-seconds to one-half the peak voltage at 3 minute intervals.
5. Peak Current Ratings shall be 20,000 amps. The MOV shall have ratings equal to or better than a General Electric type VI50LA20A. The RFI filter shall have a current rating equal to or greater than the main circuit breaker capacity.

N. Field terminals shall be screw types, capable of accommodating at least three number 12AWG wires. Engraving, silk screening or contrasting plastic labels shall permanently identify all terminals in the load bay. Terminal blocks shall be the barrier type and no live parts shall extend above the barrier.
O. A convenience construction grade duplex, fused at 15 amps shall be provided. It should be located in a position, which is convenient and safe for service personnel.
P. All AC power busses, switch or relay lugs and/or similar activity connection points which extend more than 1-1/2 inches from the panel are to be protected by insulation for safety. The locations of these items shall provide reasonable protection for service personnel.

Q. Signal power relays shall be mercury wetted, equal to or greater than circuit breaker capacity. Flash transfer relays shall be as manufactured by Midtex Model 136-62 T 3A1, 120 VAC, DPDT, 30 amp with Jones Plug base and dust cover or approved equal.
R. Flasher. The cabinet shall be equipped for flashing operation of signal lights with a 2-circuit solid state flasher in accordance with the latest NEMA specifications (15 amps per circuit). Flashing operation shall be set for flashing yellow on all main street approaches and red on all other approaches. Pedestrian and turn signals shall be extinguished during flashing operation. The flashing mechanism shall remain in operation during shutdown or removal of controller.
S. Load Switches. The cabinet shall be equipped with solid state load switching assemblies in accordance with the latest NEMA specification. Each load switch to be equipped with a 3 input LED indicator. Load switches shall contain 3 separate cube type solid state relays, which use a solid state switch which is capable of operations at 240 VAC and 25 amps when properly heat-shrinked but derated to 10 amps when used in load pack assembly.
T. Conflict Monitor. The cabinet shall have provision for conflict prevention in accordance with the latest NEMA TS2 specification. A conflicting display monitor unit that monitors all green, yellow and walk displays and detects absence of reds to cause flashing operation and stop timing if conflicting indications are detected shall provide conflict prevention. Removal of the monitor from the cabinet shall cause flashing operation. Conflict monitors shall be as manufactured by Eberly Designs, 12 LEP or approved equal.
U. Emergency Vehicle Preemption. The cabinet shall be equipped and wired with an Opticom Card rack mount for 3M Model 754 or approved equal. Detectors, phase selectors, harnesses, rack mount, and cabling shall be the manufacturer's latest make and model.

Actuated Controllers

A. **Compatibility** - THE LOCAL CONTROLLER AND CABINET SHALL BE 100 percent COMPATIBLE WITH THE CITY OF GRAND JUNCTION'S EXISTING COMPUTERIZED SIGNAL SYSTEM WHICH UTILIZES ECONOLITE EQUIPMENT.
B. Each controller shall have a removable data module.
C. Pre-emption. All actuated controllers shall be equipped to accommodate four E.V.P. inputs and one railroad preemption input.

Traffic Signing and Pavement Markings

General

The installation of all traffic control devices shall conform to the Manual on Uniform Traffic Control Devices and the Colorado Standard Specifications for Road and Bridge Construction, latest editions.

Traffic Control Devices on Public Property

The developer, at his own expense, will generally install all permanently fixed traffic signs. The developer must submit a signage plan for approval by the City Transportation Engineer. Traffic signs shall be placed to conform to the drawing details.

Traffic Control Devices on Private Property

A. Responsibility: All traffic control devices on private property; i.e., pavement markings,

regulatory signs, fire lane signs, and handicapped parking signs shall be installed and maintained by the property owner.

B. Placement: A signage and striping plan specifying the various types and combinations of traffic control devices shall be submitted to the City Transportation Engineer for approval.

Pavement Markings

The contractor shall submit a plan for all pavement markings to the City Transportation Engineer for approval prior to the beginning of the work. The pavement marking plan shall meet the requirements for such work as outlined in the Manual on Uniform Traffic Control Devices. The City Transportation Engineer must approve all pavement marking materials.

Traffic Control in Construction Areas

General

For any construction done on, in or to an existing City roadway and/or right-of-way or for the construction of a new City roadway, appropriate traffic control during construction shall be provided. For any such construction, a construction traffic control plan shall be prepared by the contractor and/or project engineer and shall be approved by the City Transportation Engineer prior to issuance of a street cut permit or public improvement construction permit.

Where a roadway does not currently exist, it is presumed that there is no motorist expectation of a travel route. Therefore, a construction traffic control plan for construction of a new roadway should strive to do two things: alert the motorist that this is a construction area, and alert the motorist that the road is not open to traffic. Construction traffic control plans shall also be prepared for construction occurring on existing City roadways where the motorist has an expectation of accessibility and shall be warned, advised, guided or regulated through any construction activity.

Time of Submittal

A construction traffic control plan shall be submitted to the City Transportation Engineer at the earliest with the submittal of final construction plans and at the latest with the application for a right-of-way or public improvement construction permit(s). All final construction plans submitted to the City of Grand Junction that entail construction on an existing City roadway or construction of a new City roadway must either:

A. Be accompanied by a construction traffic control plan.
B. Include a note stating a construction traffic control plan shall be submitted to the City of Grand Junction for approval before any permit for construction is issued. No right-of-way or public improvement construction permit shall be issued without the approved construction traffic control plan.

Scope of Construction Traffic Control Plan

For construction of new roadways, traffic control during construction should strive to keep the motorist from entering the facility. The primary means to accomplish this are by use of temporary barricades located in advance of the point where new construction joins old and appropriate signing. New roadways shall not be opened to general traffic, nor the construction traffic controls remove, without the approval of the Engineering Construction

Inspector and the City Transportation Engineer. One precondition of such an opening is that permanent signage and striping be in place.

Elements of Construction Traffic Control Plan

A. All construction traffic control plans shall contain the following information:
1. Name of contracting firm and, if different, the name of the firm responsible for traffic control devices.
2. Name and phone number(s) of 24-hour contact person responsible for traffic control devices.
3. Description of location of activity (roadway names, north arrow, etc.)

B. Projects identified as minor construction traffic control plans as determined by the City Traffic Engineer shall include, in addition to items listed in (A) above, either one of the following:
1. A neat sketch of the roadways and the proposed traffic control devices; or
2. A copy of a typical drawing of traffic device layout from an accepted source approved by the City's Transportation Engineer.

C. Projects identified as major construction traffic control plans as determined by the City Transportation Engineer shall include, in addition to items in (A) above, the following: The proposed traffic control devices specifically identified as to type and explicitly noted and dimensioned on as-builts, construction plan drawings or other detailed drawings.

Basis for Construction Traffic Control Plan

The Manual on Uniform Traffic Control Devices shall be the basis upon which the traffic control plan is designed in concert with proper, prudent and safe engineering practice. All necessary signing, striping, coning, barricading, flagging, etc. shall be shown on the plan. Other acceptable documents may be consulted or referenced, such as Traffic Control in Construction and Maintenance Work Zone (FHWA) and Flagging and Traffic Control Supervisor's Training Manual (CDOT).

Restriction, Regulations and Opportunities

In concept, City streets shall not be closed overnight and work shall not force road or lane closures before 8:30 a.m. or after 3:30 p.m. If exceptions to this are required, this shall be noted on the construction traffic control plan and shall be approved by the City Transportation Engineer. Travel-way width may be restricted. Minimum travel lane width in construction areas shall be ten feet (10'), but proper controls, including flagging, shall be indicated. Prohibition of on-street parking should be considered and noted where applicable.

All traffic control devices necessary to provide for public safety at the work site shall be furnished and maintained by the contractor at his own expense. If the contractor does not provide the approved traffic control devices, the City Transportation Engineer may install such devices, and the entire costs of such devices shall be borne by contractor. If the City is required to install the required traffic control devices due to negligence by the contractor, a minimum administrative charge of three hundred dollars ($300) will be assessed to the contractor.

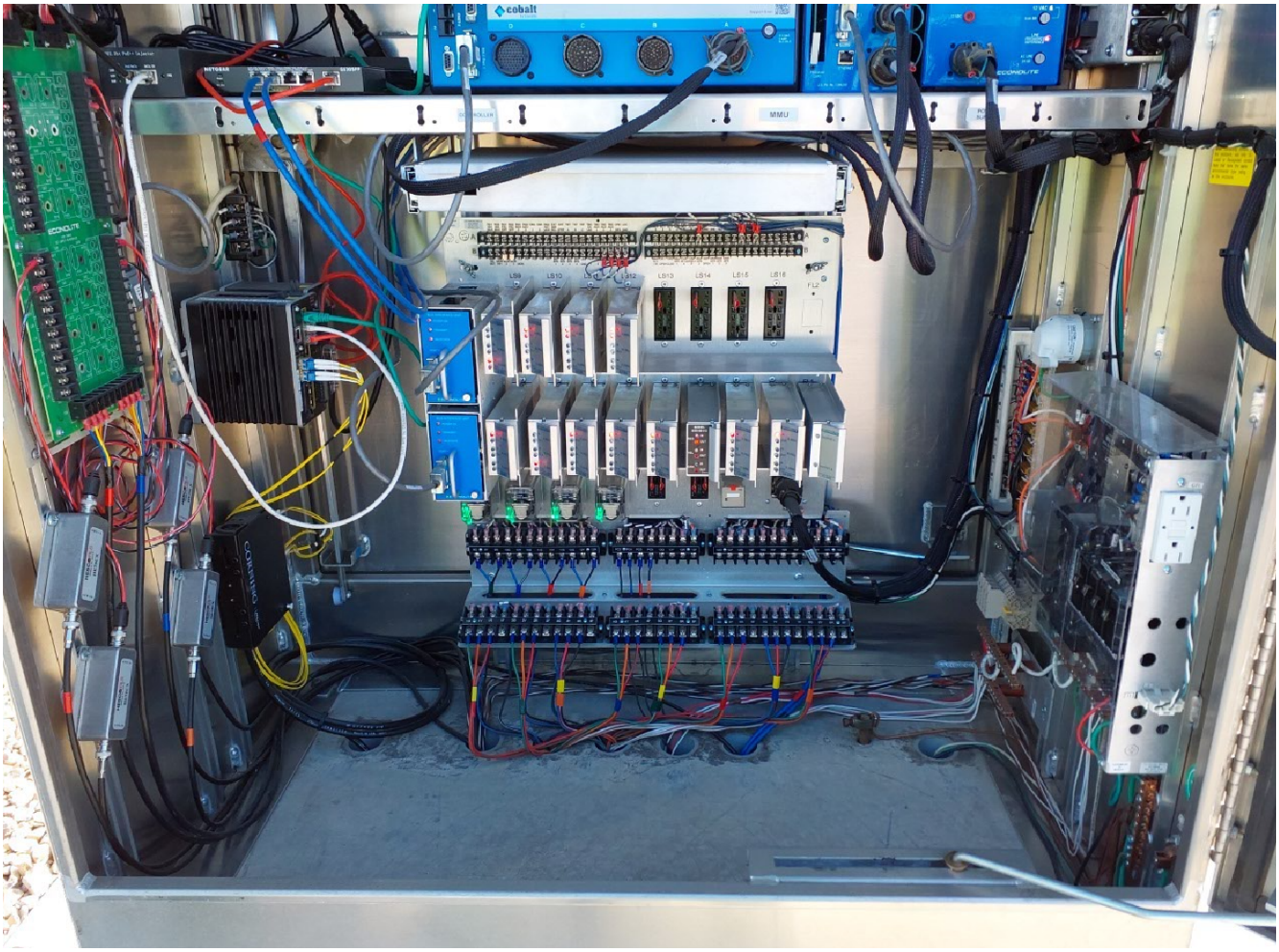
Approval

Staff of the City's Transportation Engineering Division should approve (sign and date) all

construction traffic control plans. In general, this responsibility rests with the Engineering Division Inspection Section. However, it is likely that most major plans will be referred to the Traffic Section for consideration. All complete road closures and all partial road closures (removing one or more travel lanes) that are proposed for overnight shall be approved by the City Transportation Engineer. One (1) copy of the approved plan shall remain with the Inspection Section for their verification that the traffic control plan has been adhered to in the field. One (1) copy shall be placed in the engineering project file. The contractor shall have one (1)approved copy of the traffic control plan on site at all times.

Modifications

Actual conditions in the field may necessitate modifications to the construction traffic control plan. Provided that the general intent of the original plan is satisfied, these modifications may occur without revision to the plan. The Engineering Construction Inspector shall be notified of any substantial changes and may refer these to the Transportation Engineering Division as needed for construction.



Cabinet wiring shall be neatly arranged and laced as shown above.