Title 29
TRANSPORTATION ENGINEERING DESIGN STANDARDS (TEDS)

Chapters:

Prior legislation – Resos. 111-01 and 86-03.

Chapter 29.01
INTRODUCTION

Sections:

29.01.010 Foreword.

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. 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 area of Mesa County as defined by the Persigo Agreement. 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 29.64 GJMC. 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, and the State Access Code shall apply but only if more restrictive than TEDS.

(Res. 39-04, 4-21-04)

29.01.020 Companion documents and software recommended for use with the Transportation Engineering Design Standards.

(a) **Publications.**

(1) Local.

(i) City of Grand Junction *Zoning and Development Code*.

(ii) City of Grand Junction *Standard Contract Documents*.

(iii) Mesa County *Road and Bridge Standards*.

(2) State.

(i) CDOT *Roadway Design Manual*.

(ii) CDOT *State Highway Access Code*.

(3) Federal.

(i) Transportation Research Board *Highway Capacity Manual*.

(ii) Federal Highway Administration *Roundabouts: An Informational Guide*.

(iii) Federal Highway Administration *Manual on Uniform Traffic Control Devices*.

(4) Professional Organizations.

(i) Institute of Transportation Engineers *Trip Generation*.

(ii) AASHTO *A Policy on Geometric Design of Highways and Streets*.

(iii) AASHTO *Guide for Bicycle Facilities*.

(iv) AASHTO *Roadside Design Guide*.

(v) AASHTO *A Guide for Erecting Mailboxes on Highways*.

(vi) APA *Bicycle Facility Planning*.

(vii) Colorado Asphalt Pavement Association *Guideline for the Design and Use of Asphalt Pavements for Colorado*.

(b) **Software.**

(1) *TEAPAC Signal2000* from Strong Concepts, Inc. (signal timing and analysis).

(2) *AaSIDRA* from Akcelik and Associates (roundabout analysis).

(3) *Darwin* from AASHTO (asphalt pavement design).

(4) *WinPAS* from American Concrete Pavement Association.

(Res. 39-04 (§ 1.0), 4-21-04)

Mesa County Urban Area (PDF)

Chapter 29.04
STREET CLASSIFICATIONS AND STANDARDS

Sections:

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 Grand Valley 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 Urban Trails Master Plan is also referenced throughout this manual for compliance with the adopted 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 following document.

The adopted Grand Valley Circulation Plan as well as the street and utility standard drawings are

available in various formats including AutoCAD Files on 3.5-inch or CD-ROM disks. These may be purchased at the administrative office of the Department of Public Works and Utilities, City Hall, 250 North Fifth Street, Grand Junction, Colorado, 81501.

(Res. 39-04 (§ 1.0), 4-21-04)

29.04.020 Access management plan.

(Res. 39-04 (§ 1.0), 4-21-04)

Functional Classification Map (PDF)

Chapter 29.08
TRANSPORTATION IMPACT STUDIES

Sections:

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) **Grand Valley Circulation Plan.**

(b) City standard details.

(c) **Urban Trails Master Plan.**

(d) Transit Design Standard Guidelines (Chapter 29.52 **GJMC).**

(e) 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, CDOT or RTPO serving in a review capacity.

(Res. 39-04 (§ 2.0), 4-21-04)

29.08.020 Procedure.

The following required steps describe the procedures required for the preparation and submittal of a TIS:

(a) General meeting or pre-application conference.

(b) Determination of base assumptions.

(c) **Submittal.**

(d) Review agency comments and recommendations.

(Res. 39-04 (§ 2.1), 4-21-04)

29.08.030 General meeting or pre-application conference.

(a) As a general rule, a TIS shall be required for all land use applications for new development in the City and as required by the 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 trip generation of the proposed project is less than 100 trips. 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 transportation consultant documenting the trip generation of the project and conclusions of the TIS.

(b) The 100 peak hour trip threshold is consistent with the Colorado Department of Transportation thresholds for requiring impact studies on State highways. The following are examples of developments that produce approximately 100 trips in the peak hour:

(1) One hundred single-family homes.

(2) Forty thousand square foot office building.

(3) Fast food restaurant.

(4) Twenty thousand square foot shopping center.

These thresholds are found in the Institute of Transportation Engineers' *Trip Generation*. The latest edition of *Trip Generation* is adopted and incorporated by this reference.

(c) At the pre-application meeting the applicant shall provide information regarding:

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

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

(3) Anticipated project completion date and project phasing.

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

(d) The appropriate agencies shall review the project information and provide comment 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.

(Res. 39-04 (§ 2.1.1), 4-21-04)

29.08.040 Determination of base assumptions.

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

(b) A base assumptions form shall specify:

(1) Study area boundaries;

(2) Period of study;

(3) Growth rates;

(4) Study intersections;

(5) Time periods for study;

(6) Trip generation rates;

(7) Trip adjustment factors;

(8) Overall trip distribution;

(9) Mode split assumptions;

(10) Committed roadway improvements by other projects, CDOT, Grand Junction and Mesa County;

(11) Other relevant transportation impact studies;

(12) Areas requiring special study.

Transportation Impact Study

Base Assumptions

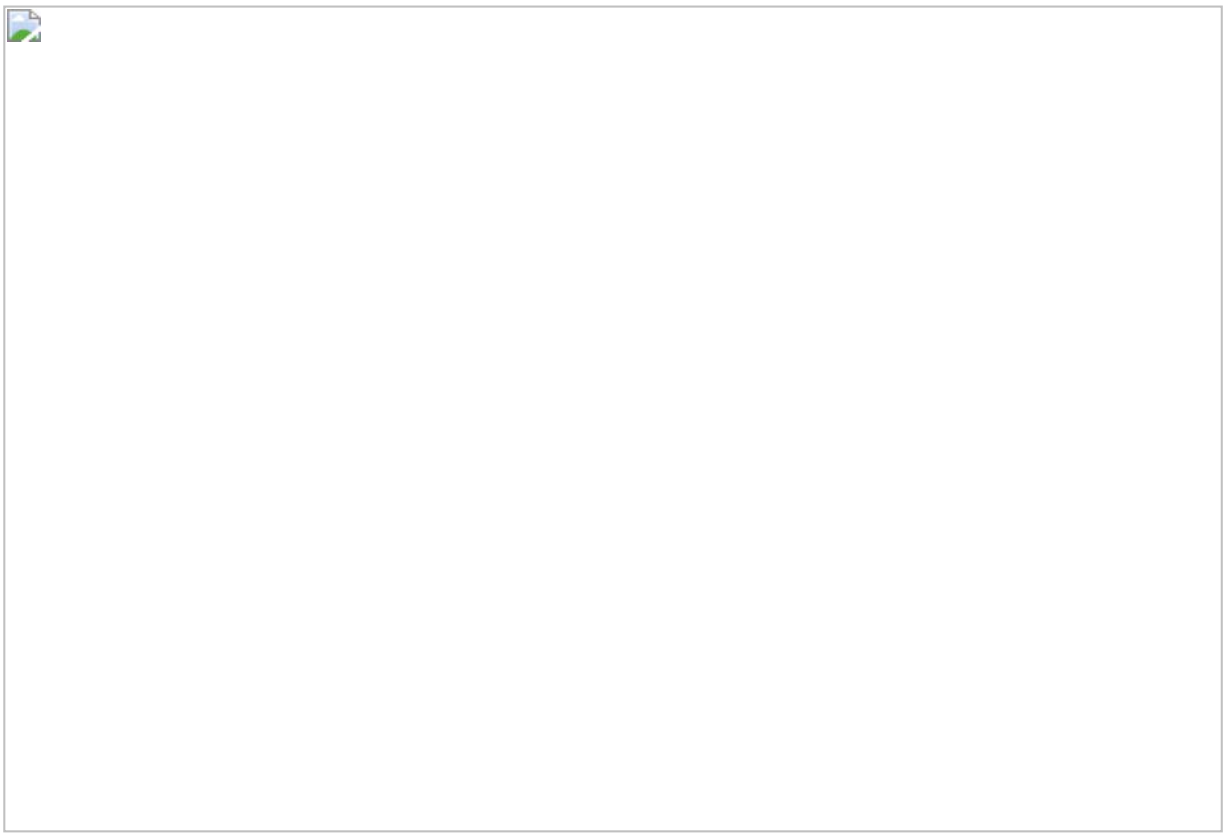
(Res. 39-04 (§ 2.1.2), 4-21-04)

29.08.050 Pedestrian analysis.

The Transportation Engineer shall complete the Pedestrian Analysis Worksheet. This form will be used to identify origin and destination pairs for analysis by the consultant of pedestrian quality of service measurements for directness, continuity, street crossings, visual interest/amenity, and security. Based upon the project's land use classification, consideration shall be given to the noted

destinations that are located within one-quarter mile of the project site. Destinations farther than one-quarter mile may be specified, for example a school walking area boundary.

Pedestrian Analysis Worksheet



(Res. 39-04 (§ 2.1.3), 4-21-04)

29.08.060 Submittal.
Copies of the TIS shall be delivered to the appropriate City or County Community Development Department, to be submitted as part of the required planning information. Revisions to the TIS shall be made as required if the revisions are necessary to have a complete TIS or where changes to the site's access necessitate additional revisions to the study. Electronic files of capacity analyses must be submitted with the TIS.

(Res. 39-04 (§ 2.1.4), 4-21-04)

29.08.070 Review agency comments and recommendations.
The review agency or designee shall analyze, evaluate and/or review 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 perform and submit supplemental analyses of and/or address specific transportation issues or prepare, perform and submit a new study. Engineering review shall, to the extent practicable, cite by reference to this manual, the code, laws, rules or regulations 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 signal operations will not be optimized by eliminating existing left-turn phasing.

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

(Res. 39-04 (§ 2.1.5), 4-21-04)

29.08.080 Transportation impact study report contents.

A Colorado licensed professional engineer shall prepare the TIS. The engineer shall have experience in the area of 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.

(Res. 39-04 (§ 2.2), 4-21-04)

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 all proposed vehicular access locations, dimensions and movements shall be described. The project description shall include a description of 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.

(Res. 39-04 (§ 2.2.1), 4-21-04)

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 quality of service at the study

intersections and traffic accident history.

(Res. 39-04 (§ 2.2.2), 4-21-04)

29.08.110 Description of existing transportation system.

(a) 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.

(b) 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 GJMC 29.08.050, Pedestrian analysis. The Urban Trails Master Plan shall be referenced and complied with for planned pedestrian and bicycle facilities within the study area boundaries.

(c) Bicycle facilities are defined by AASHTO *Guide for Bicycle Facilities* as:

(1) *Bicycle route* means a street which is officially designated and marked (by signage) as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated.

(2) *Bike lane* means a portion of street which has been designated (by paint stripe, pavement markings, and signage) for use by bicyclists.

(3) *Bike path* means a separate trail or path from which motor vehicles are prohibited and which is for the exclusive use of bicycles or the shared use of bicycles and pedestrians.

(d) 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.

(Res. 39-04 (§ 2.2.3), 4-21-04)

29.08.120 Capacity analysis and quality of service.

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

(b) HCM delay and queuing worksheets shall be included in the appendices to the TIS report.

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

(Res. 39-04 (§ 2.2.4), 4-21-04)

29.08.130 Future traffic projections.

(a) 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:

(1) Planned system improvements – capital projects;

(2) Planned or in process development projects;

(3) Background traffic growth.

(b) 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.

(c) 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.

(d) The background traffic growth within the study area shall also be accounted for when determining future traffic projections. Growth factors suggested by the consultant in the base assumptions form will be reviewed by the appropriate agency prior to use in the TIS.

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

(Res. 39-04 (§ 2.2.5), 4-21-04)

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.**

(1) 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 peak hour trips.

(2) The development of trip generation estimates for the project shall be based upon data from the latest edition of the Institute of Transportation Engineers *Trip Generation*. 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.

(3) 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*. The adjusted trip generation for the proposed project shall be provided in tabular form or illustrated on

figures.

Allowable Pass-by Factors

LAND USE	PASS-BY COMPONENT
Bank/S & L	15.0%
Regional Shopping Center	20.0%
Grocery Store/Community Shopping	30.0%
Hardware Store	10.0%
Strip Commercial	20.0%
Neighborhood/Convenience Center	60.0%
Fast Food Restaurant	45.0%
Gas Station	55.0%

(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.

(Res. 39-04 (§ 2.2.5), 4-21-04)

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.

(Res. 39-04 (§ 2.2.6), 4-21-04)

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 Urban Trails Master 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. At signalized driveways, the HCM ninetieth percentile worst lane queue model shall determine the necessary storage.

(Res. 39-04 (§ 2.2.7), 4-21-04)

29.08.170 Transportation impact analysis.

(a) 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 quality of service at each of the study intersections and/or corridors shall be evaluated for:

(1) Future background traffic conditions for each study year; and

(2) Total existing traffic conditions; and

(3) Future total traffic conditions for each study year.

(b) The capacity and quality 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.

(Res. 39-04 (§ 2.2.8), 4-21-04)

29.08.180 Calculations for capacity and quality of service.

(a) HCM delays and queues shall be calculated for signalized intersections using the latest version of the Highway Capacity Manual. The City of Grand Junction uses the TEAPAC signal analysis software and requires its usage and methodologies for design and analysis of signal timing. 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:

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

(2) 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;

(3) HCM ninetieth percentile worst lane queues shall be calculated and shall not obstruct upstream intersections or major driveways;

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

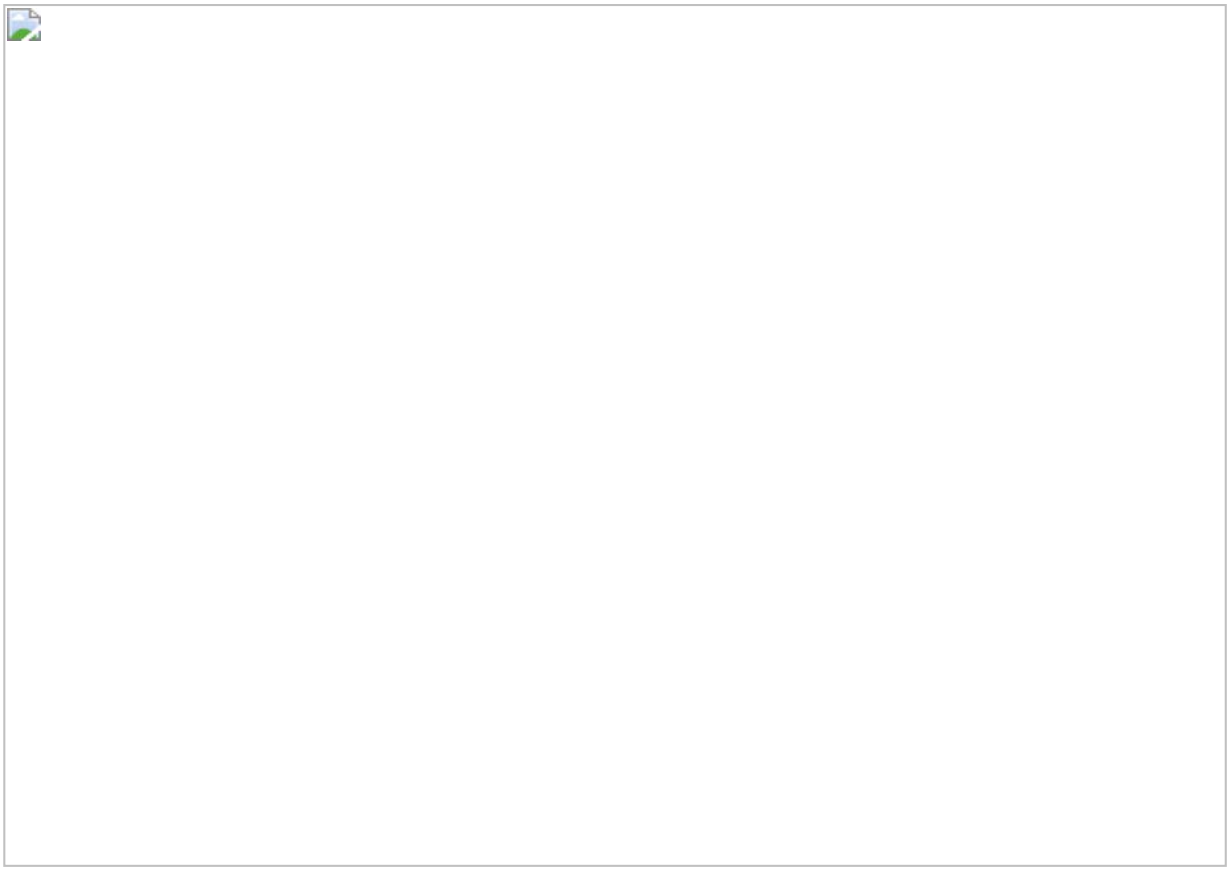
(b) Unsignalized intersections shall be analyzed using the latest Highway Capacity Manual methods. In the performance evaluation of stop controlled intersections, measures of effectiveness to consider include the delay, volume/capacity ratios for individual movements, average queue lengths and ninety-fifth 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 quality 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.

(c) Roundabouts shall be analyzed using the latest version of SIDRA or approved methodology.

(d) Street segment capacities shall be calculated using the following tables. The highest directional peak hour volume shall be used to calculate the segment quality of service.

	Area Type			
Functional Classification	**CBD**	**CBD Fringe**	**Residential**	**Rural**
	Vehicles per Lane per Hour			
Principal Arterial	600	700	850	1,000
Minor Arterial	550	650	750	850
Three-Lane Collector	500	600	700	800
Two-Lane Collector	450	550	650	600

Quality of Service	Volume to Capacity Ratio
A/B	0.00 – 0.90
C	0.91 – 1.00
D	1.01 – 1.10
E	1.11 – 1.20
F	Over 1.20



(Res. 39-04 (§ 2.2.8.1), 4-21-04)

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) Transit capacity and access improvements;

(c) Traffic signal operation improvements;

(d) Street widening and other physical improvements.

(Res. 39-04 (§ 2.2.9), 4-21-04)

29.08.200 Transportation demand management (TDM) measures.

(a) 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. Examples of TDM measures include:

(1) 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.

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

(b) 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.

(c) The intersection capacity and quality 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 for all movements and transportation modes (vehicle, bicycles, pedestrians). The findings shall be shown in tabular form.

(Res. 39-04 (§ 2.2.9.1), 4-21-04)

29.08.210 Transit capacity and access improvements.

Projects seeking transit credit shall document the proposed transit capacity credit and related reduction in total project vehicle trips. Examples of transit credits may include:

(a) Contributions of equipment or funds to increase the capacity of existing transit systems;

(b) Transit shuttles provided by applicant (e.g., bus, taxicab, van);

(c) Contributions toward transit stations or centers.

(Res. 39-04 (§ 2.2.9.2), 4-21-04)

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 cycle split assumptions.

The applicant shall submit an analysis addressing proposed access, proposed signals and capacity and quality 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 use a cycle length at least as long as current signal timing on the corridor under analysis.

(b) Cycle split 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 changing cycle splits 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.

(Res. 39-04 (§ 2.2.9.3), 4-21-04)

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.

(Res. 39-04 (§ 2.2.9.4), 4-21-04)

29.08.240 Neighborhood transportation impact analysis.
(a) The TIS shall analyze the project impacts on adjacent residential areas. The need for this study shall be identified as part of the base assumptions. If it is determined that a neighborhood TIS is required the following procedure shall be followed:

The applicant shall examine existing transportation conditions within the defined neighborhood. This shall follow the same procedure as set forth for the TIS. Daily and peak hour traffic volumes shall be collected for the local streets to be included in the analysis. Furthermore, the applicant shall:

(1) Determine project-generated traffic for all modes within the neighborhood and show on

a figure in the TIS.

(2) Determine total traffic projections for the streets in the study area.

(3) Determine if the impacts created by the proposed project are significant to the residential streets.

(4) Develop measures, including but not limited to traffic calming techniques to mitigate impacts.

(b) The neighborhood TIS 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.

(Res. 39-04 (§ 2.2.10), 4-21-04)

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

(Res. 39-04 (§ 2.2.11), 4-21-04)

29.08.260 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.

(Res. 39-04 (§ 2.2.12), 4-21-04)

Chapter 29.12
ACCESS MANAGEMENT

Sections:

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 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 serves two distinct purposes. The first is to provide mobility to the traveling public. The second is to provide direct access to properties. These two purposes may conflict such that multiple access points along a road restrict both the speed and capacity at which vehicles may travel. A properly designed system provides a balance such that certain streets, such as principal arterial highways, have a greater emphasis on facilitating mobility while other streets, such as local streets, can have a greater role in providing direct access to properties.

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.

(Res. 39-04 (§ 3.0), 4-21-04)

29.12.020 State highways.
The State Highway Access Code 2, CCR 601-1, was amended. The most current document is: State of Colorado State Highway Access Code, Volume 2, Code of Colorado Regulations 601-1. 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.

(Res. 39-04 (§ 3.1), 4-21-04)

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.

(Res. 39-04 (§ 3.2), 4-21-04)

29.12.040 Backing into the right-of-way.
Driveways, parking or loading areas that require backing maneuvers in a public street shall not be approved except for single-family or duplex residential uses on local streets. Exceptions may also be made in the downtown area, defined as the area between Pitkin Avenue to Grand Avenue, First Street to Eighth 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 in GJMC 29.16.230. The needed aisle width can include the existing alley.

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

(Res. 39-04 (§ 3.2.1), 4-21-04)

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. Additional access points may be allowed based on traffic safety as determined by a TIS as described in Chapter 29.08 GJMC.

(Res. 39-04 (§ 3.2.2), 4-21-04)

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.

(Res. 39-04 (§ 3.2.3), 4-21-04)

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 easements or stub streets to abutting properties may be required when it is determined that such abutting properties may be unable to meet access spacing standards. The project site design shall include a circulation and access system that will safely and efficiently accommodate traffic from adjacent properties. The site plan shall include the site frontage for a minimum distance of 200 feet from the site property boundaries.

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 and traffic flow on adjacent public streets. 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.

(Res. 39-04 (§ 3.2.4), 4-21-04)

29.12.080 Cross-access corridors.

Cross-access corridors shall be designed to provide common access and circulation among parcels, in order to assist in local traffic 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.

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.

(Res. 39-04 (§ 3.2.5), 4-21-04)

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.

(Res. 39-04 (§ 3.2.6), 4-21-04)

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

(Res. 39-04 (§ 3.2.7), 4-21-04)

29.12.110 Exclusive turn lanes.
Exclusive turn lanes are described in detail in the CDOT Access Management Code and in Chapter 29.28 GJMC.

(Res. 39-04 (§ 3.2.8), 4-21-04)

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.

(Res. 39-04 (§ 3.2.9), 4-21-04)

29.12.130 Access exceptions.
Exceptions to these standards shall be allowed only as set forth in Chapter 29.64 GJMC.

(Res. 39-04 (§ 3.3), 4-21-04)

Chapter 29.16
ACCESS DESIGN AND SITE CIRCULATION

Sections:

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 access, 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.

(Res. 39-04 (§ 4.0), 4-21-04)

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.

(Res. 39-04 (§ 4.1), 4-21-04)

29.16.030 Spacing.

On local residential streets, single-family residential driveways shall be spaced a minimum of five feet measured from the property line to allow for maneuvering to occur without trespass. In locations where the five-foot 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 and industrial streets, driveways shall be spaced a minimum of 50 feet, measured from edge of access to edge of access. On collector streets, driveways shall be spaced a minimum of 150 feet apart. On arterial streets where no other access to lower order streets is available, commercial driveways may be allowed where 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.

(Res. 39-04 (§ 4.1.1), 4-21-04)

29.16.040 Offsets.

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, offset 150 feet or greater on all collector streets and offset 300 feet or greater on all arterial streets. Greater distances may be required for left-turn storage lanes. Shared accesses shall be encouraged 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 meet the above requirements.

(Res. 39-04 (§ 4.1.2), 4-21-04)

29.16.050 Corner clearance.

"Corner clearances" are defined as the distance between a driveway and 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 avoid 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	Clearance from Unsignalized Intersections	Clearance from Signalized Intersections	Single-Family Residential Driveways
Local	50′	150′	50′
Collector	150′	150′	100′
Minor Arterial	150′ *	300′ *	100′ *
Major Arterial	300′ *	300′ *	150′ *

*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.

(Res. 39-04 (§ 4.1.3), 4-21-04)

29.16.060 Access design – 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.

(Res. 39-04 (§ 4.2.1), 4-21-04)

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.

(Res. 39-04 (§ 4.2.2), 4-21-04)

29.16.080 Curb radii.

The radius at the flowline of gutter shall be 20 feet for multifamily residential access and 25 feet for commercial access. 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 feet.

(Res. 39-04 (§ 4.2.3), 4-21-04)

29.16.090 Driveway width.

Single-family residential driveway widths shall be between 12 feet and 33 feet. All other access drive widths shall be between 28 feet and 40 feet. Multi-lane driveways shall be designed to accommodate a standard ingress lane of 16 feet and egress lanes of 12 feet.

(Res. 39-04 (§ 4.2.4), 4-21-04)

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 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.

(Res. 39-04 (§ 4.2.5), 4-21-04)

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. 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.

On-Site Driveway Vehicle Storage Lengths (Feet)

Parking Spaces per Exit Lane	Storage Length Required			
	Multifamily Residential	Retail	Office	Industrial
0 – 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	6 spaces per window
Drive-In Restaurant	10 spaces per window[1]
Automatic Car Wash	10 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]

[1]Measured from the pick-up window.

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

(Res. 39-04 (§ 4.2.5.1), 4-21-04)

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-foot length vehicle and a 12-foot-wide lane.

(b) Separated from normal parking circulation aisles.

(c) Designed using the appropriate design vehicle turning template.

(Res. 39-04 (§ 4.2.5.2), 4-21-04)

29.16.130 Grades.
Access grades shall meet the City Standard Contract Documents.

(Res. 39-04 (§ 4.2.6), 4-21-04)

29.16.140 Sight distance.
Adequate sight distance and sight zones shall be provided at all access intersections.

(Res. 39-04 (§ 4.2.7), 4-21-04)

29.16.150 Channelization islands.
Channelizing islands may be incorporated into the access design for purposes of limiting movements into or out of accesses. Use of medians to control turning movements is preferred and will be required where physical conditions allow.

When allowed, the islands shall not be smaller than 100 square feet and shall provide vertical curb and colored exposed 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 two-foot flowline radii.

(Res. 39-04 (§ 4.2.8), 4-21-04)

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 29.28 GJMC requirements and with the City Standard Details.

(Res. 39-04 (§ 4.2.9), 4-21-04)

29.16.170 Transit.
Where applicable, accesses shall be designed to accommodate buses or other transit vehicles in

accordance with Chapter 29.48 GJMC. These accommodations shall occur at shopping centers, malls, or other mixed use developments where transit vehicles may be frequent users of the on-site circulation system.

(Res. 39-04 (§ 4.2.10), 4-21-04)

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 Chapter 29.24 GJMC, Fire Department Access, regulations based on the Uniform Fire Code).

(Res. 39-04 (§ 4.2.11), 4-21-04)

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.

(Res. 39-04 (§ 4.2.12), 4-21-04)

29.16.200 Site circulation.
On-site circulation shall be given the same attention as is given to the design of public street systems. Poor site design and circulation is detrimental to both the public investment in the street system and the private investment in the property. Access locations, building location, site circulation, and parking are highly interrelated as each one has a dramatic effect on the others. The design of the on-site circulation system shall be an integral part of the overall site and access design process.

(Res. 39-04 (§ 4.3), 4-21-04)

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 means 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.

(Res. 39-04 (§ 4.3.3), 4-21-04)

29.16.220 Transit and pedestrians.
In larger mixed use 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. Adequate pedestrian facilities must be designed on-site to reduce conflicts between pedestrians and vehicles.

(Res. 39-04 (§ 4.3.4), 4-21-04)

29.16.230 Inter-parcel circulation.
Where practical and where reasonable walking distances can be provided, inter-parcel circulation with shared access shall be implemented. This will reduce the number of curb cuts on public streets and will increase the safety and capacity of the street system.

(Res. 39-04 (§ 4.3.5), 4-21-04)

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 and the sight zone. Landscaping islands shall also consider the same requirements.

(Res. 39-04 (§ 4.3.6), 4-21-04)

Chapter 29.20
RESIDENTIAL AND COMMERCIAL STREETS, LANDSCAPING AND TRAFFIC CALMING

Sections:

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 residential streets and commercial streets. These streets deserve special discussion because they are the most common streets built for development. “Local residential streets” and “commercial 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 collector and higher classification streets are discussed in Chapter 29.28 GJMC.

(Res. 39-04 (§ 5.0), 4-21-04)

29.20.020 Residential and commercial streets.
Streets shall conform with the adopted Grand Valley Circulation Plan. Minimally, the plan identifies locations where collector street connections are desired and identifies general alignments for residential streets. Street layouts shall continue streets in adjoining subdivisions or their

anticipated locations when adjoining property is not yet developed to provide interconnectivity.

(Res. 39-04 (§ 5.1), 4-21-04)

29.20.030 Block and lot dimensions.

Blocks shall not exceed 1,200 feet in length between intersections (streets providing multiple access, not cul-de-sacs) except where topography, traffic, or other conditions require longer blocks.

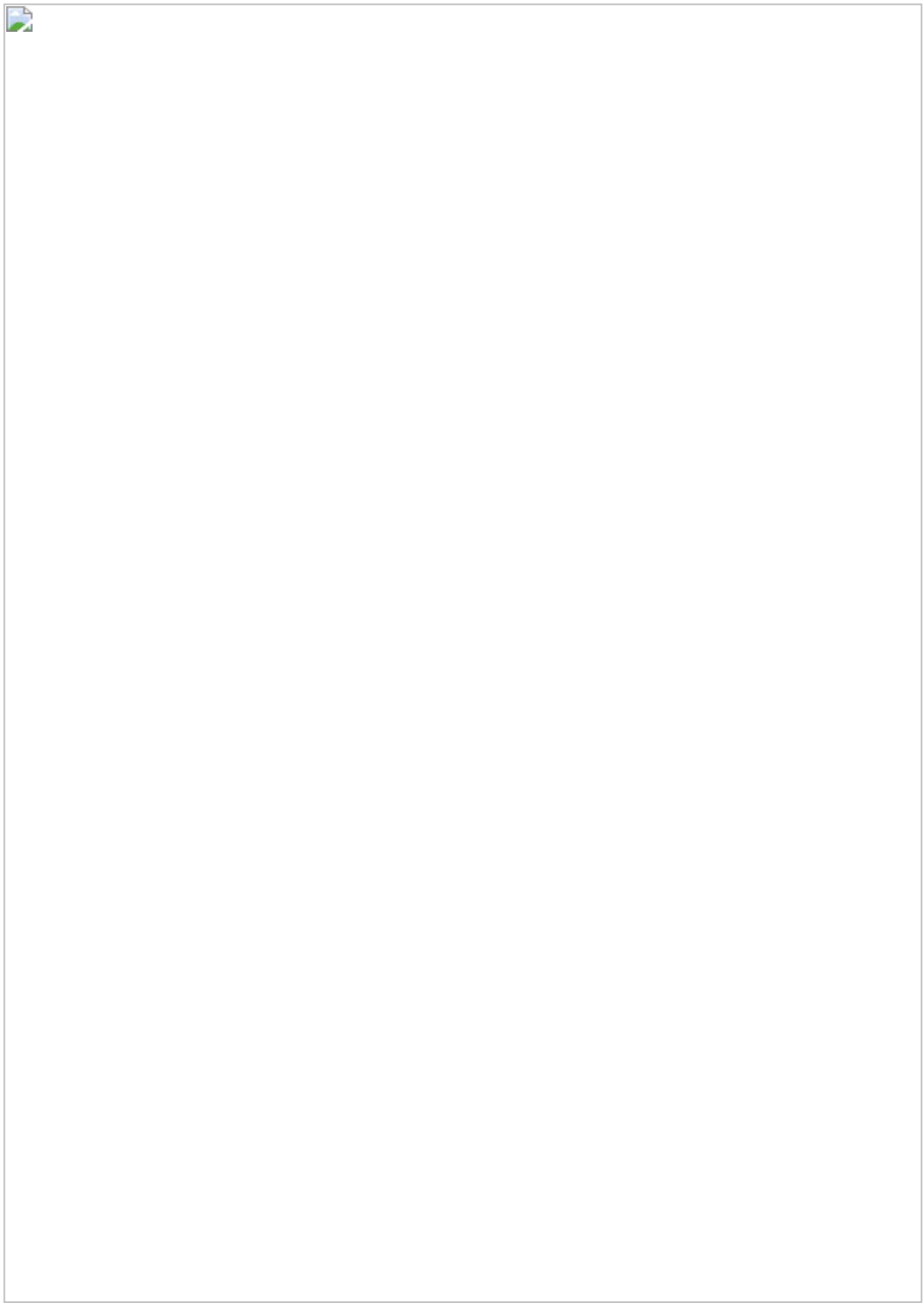
No lots shall be divided by street, alley, or any other thoroughfare or property, or by City boundary lines.

(Res. 39-04 (§ 5.1.1), 4-21-04)

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 City Standard Details. Additional widths may be required for needed through lanes, turn lanes, speed change lanes, and where it is necessary to accommodate slopes, irrigation crossings and drainage structures.

(a) **Urban Residential Collector.**



(b) **Urban Residential Street.**

(c) **Commercial Street Section.**

(d) **Industrial Street Section.**

(e) **Rural Roadway.**

(f) **Two-Way Shared Use Off-Street Path on Separate Right-of-Way.**

(g) **Cul-De-Sac Turnaround – Residential Court.**

(h) **Cul-De-Sac Turnaround – Minimum Dimensions – Commercial/Industrial Court.**

(Res. 39-04 (§ 5.1.2), 4-21-04)

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.

Single access street systems shall be allowed for a maximum of 100 dwelling units. The layout of the subdivision shall meet sections D104.3 and D107 of the International Fire Code. A future secondary access is required to 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.

(Res. 39-04 (§ 5.1.3), 4-21-04)

29.20.060 Alignments.

(a) **Horizontal Alignment.** Designs must conform to the pattern of thoroughfares designated in the Grand Valley 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 boundary lines of the project. A temporary turnaround area paved with asphalt surfacing shall be required at the end of the street improvement if a cul-de-sac is not provided. 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 superelevation.

[2] Hillside is defined as having grades of 10 percent or greater, as defined in GJMC 21.07.020.

[3] Radii shown are based on the street having a crown section with a pavement cross-slope of two percent 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 minimum flowline radii at public street intersections.

Minimum Intersection Flowline Radii

Through Street[2]	Intersecting Street				
	Arterial	Collector	Local Residential	Local Commercial	Local Industrial[1]
Local Residential	Not Allowed	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.

(c) **Tangent Distance Between Curve.** There is no minimum tangent distance between curves for residential or commercial street design.

(d) **Superelevation.** Superelevation is not allowed on residential street curves.

(Res. 39-04 (§ 5.1.4), 4-21-04)

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 percent, nor more than eight percent. In hilly terrain (defined as having grades of 10 percent or greater, as defined in GJMC 21.07.020), the maximum grade for local residential streets is 12 percent for a maximum distance of 500 feet.

(b) At unsignalized intersections, the maximum grade in the intersection shall be four percent, and extends a minimum of 50 feet in each direction from flowline of the intersecting street. At signalized intersections, the maximum grade shall be two percent 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.

(Res. 39-04 (§ 5.1.5), 4-21-04)

29.20.080 Cross section.

(a) **Street Cross Slopes.** The typical cross slope is two percent crown to provide for adequate drainage to the pavement edge. The maximum cross slope shall not exceed four percent. The minimum cross slope shall be one percent. 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 AASHTO Roadside Design Guide, 1989 Edition or latest.

(Res. 39-04 (§ 5.1.6), 4-21-04)

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

(Res. 39-04 (§ 5.1.7), 4-21-04)

29.20.100 Bicycle treatments.
Bicycle facilities shall be provided in accordance with the adopted Urban Trails Master Plan. Provisions for bicycle facilities shall be in accordance with the AASHTO Guide for Development of New Bicycle Facilities 1999.

The standard cross-section of off-street bicycle paths is shown in the City Standard Details.

(Res. 39-04 (§ 5.1.8), 4-21-04)

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.

(Res. 39-04 (§ 5.2), 4-21-04)

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.

(Res. 39-04 (§ 5.2.1), 4-21-04)

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.

(Res. 39-04 (§ 5.2.2), 4-21-04)

29.20.140 Angles.
Public streets shall intersect at 90-degree angles or as close to 90 degrees as topography

permits, in any event no less than 80 degrees. Intersections on horizontal curves shall be avoided.

(Res. 39-04 (§ 5.2.3), 4-21-04)

29.20.150 Grades.
Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is four percent 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 two percent within the intersection and extends 200 feet in each direction. Grades above four percent 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.

(Res. 39-04 (§ 5.2.4), 4-21-04)

29.20.160 Spacing and offsets.
(a) **Commercial Streets.** Four-legged intersections shall be spaced at least 150 feet apart. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 100 feet and be 100 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 29.28.170(b).

(b) **Local Residential Streets.** Four-legged intersections shall be spaced at least 300 feet apart. Where T-intersections are used, the centerlines of streets not in alignment shall be offset a minimum of 150 feet.

(Res. 39-04 (§ 5.2.5), 4-21-04)

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 for passenger cars turning left or right from a minor street. When grades are steeper than three percent, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, (a) the eighty-fifth 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.

(Res. 39-04 (§ 5.2.6), 4-21-04)

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 eight 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.

(Res. 39-04 (§ 5.2.6.1), 4-21-04)

29.20.190 Pedestrian treatments.
In order to provide pedestrian safety, accommodations for pedestrians shall be designed into all intersections where pedestrians are expected to be present. This includes sidewalks, crosswalks,

pedestrian refuge islands and accessible ramps. The design shall meet the details specified in the City Standard Details.

(Res. 39-04 (§ 5.2.7), 4-21-04)

29.20.200 Landscaping – Sight distance at intersections.
Any landscaping in the sight distance triangles at intersections shall be low growing, and shall meet the sight distance requirements in GJMC 29.20.180.

(Res. 39-04 (§ 5.3), 4-21-04)

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.

GJMC 29.20.210 through 29.20.250 provide 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 subdivisions.

(Res. 39-04 (§ 5.4), 4-21-04)

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.

(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.

(c) **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.

(Res. 39-04 (§ 5.4.1), 4-21-04)

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:

(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.

(d) **Speed Humps/Speed Tables.** Speed humps or tables are vertical measures to slow traffic. Rather than speed bumps, speed humps are designed to unobtrusively get vehicles to slow down. While a speed bump jolts a vehicle at any speed, a speed hump allows the vehicle to travel the speed limit with little effect.

(Res. 39-04 (§ 5.4.2), 4-21-04)

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 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.

(Res. 39-04 (§ 5.4.3), 4-21-04)

29.20.250 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 25 miles per hour. 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 25 miles per hour.

In general, traffic calming devices shall be required on new local streets with straight sections of street in excess of 300 feet in length or streets that connect to existing local street networks.

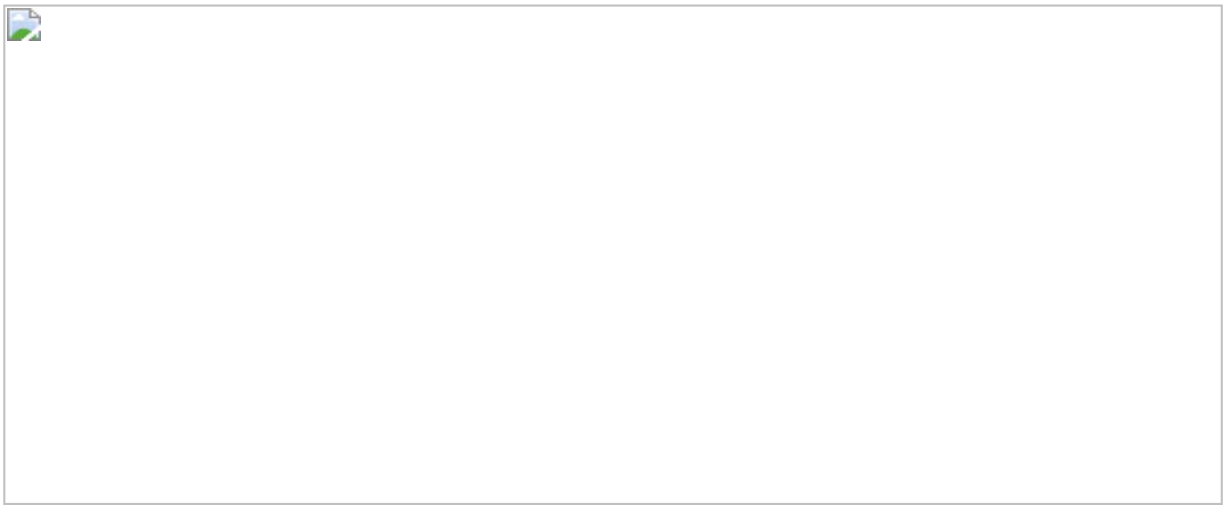
(Res. 39-04 (§ 5.4.4), 4-21-04)

Chapter 29.24
FIRE DEPARTMENT ACCESS

Sections:

29.24.010 Background.
The Fire Department is required to respond to a multitude of emergencies in various types of buildings and occupancies. These include single-family dwellings, apartment buildings, shopping malls, business complexes, industrial complexes, hospitals, and nursing homes. To provide effective fire fighting operations, the Fire Department must be able to reach all structures by way of approved access roadways, streets, or driveways.

This directive shall assist developers and designers in meeting the requirements for Fire Department access, by defining terms and listing minimum design standards considered necessary for effective fire fighting operations.



(Res. 39-04, 4-21-04)

29.24.020 Administrative interpretation – Defined terms.

Fire Department access means an approved route that is always available for use by fire trucks and is designed to meet fire equipment load requirements. Except for loop lanes, shared driveways, and private driveways, all access routes must be at least 20 feet wide. When a dead-end access route exceeds 150 feet in length, an approved turnaround area must be provided.

Public street access means a Fire Department access route on a public right-of-way. Public street access routes must comply with the City or County road design standards and also must comply with the Uniform Fire Code.

Private street access means a Fire Department access route on private land. Private street access routes must comply with the Uniform Fire Code.

Grades. Street grades shall comply with City or County design standards for both public and private street access routes. Maximum grade shall not exceed eight percent.

Grades on turnaround areas. Maximum grades on turnaround areas shall not exceed four percent.

Height. All Fire Department access routes shall have at least 13 feet, six inches of vertical clearance for the entire required width.

Looped lane means a Fire Department access route in a public right-of-way, consisting of a looped road that must be at least 16 feet wide. Looped lanes may be approved for residential subdivisions and must be designed to approved standards (see design pages).

Private driveway means a driveway designed for the use of occupants of no more than two single-family dwelling units or one two-family dwelling unit. If the dwelling units are located more than 100 feet from an approved Fire Department access route, the private driveway must meet our minimum design standards, which are: access routes must be at least 12 feet wide; grades do not exceed City/County grade requirements; adequate turnarounds provided if over 150 feet long; width to be increased if sharp curves are included; constructed with an all-weather surface and able to support the weight of a fire truck.

Shared driveway means a Fire Department access route on private property, serving three or more single-family units. A shared driveway must be at least 16 feet wide and be designed to approved standards (see design pages).

Residential cul-de-sac, commercial/industrial cul-de-sac means an approved turnaround area for public rights-of-way or private property, designed to Fire Department standards (see design pages).

Tee turnaround, alternative turnarounds means an approved turnaround area for private property designed to Fire Department standards (see design pages).

(Res. 39-04, 4-21-04)

29.24.030 Access guidelines.

The following guidelines represent the Fire Department's efforts to maintain consistency concerning Fire Department emergency access. It is the Department's responsibility to ensure adequate access for Fire Department emergency responders. The City therefore reserves the right to require modifications to established requirements if, in its opinion, the access cannot be provided or may be compromised.

(a) **Type of Surface.** All access roadways shall be finished by application of an all-weather driving surface of hot mix asphaltic concrete or concrete pavement over a flexible base capable of supporting a design wheel load of 18,000 pounds (GVW 80,000 pounds minimum; H-20 loading). The roadway design must be prepared and certified by an engineer registered by the State of Colorado. Any required Fire Department access within 100 feet of any building must meet the same wheel-loading criteria. All required access roadways must be properly maintained and kept clear for emergency use at all times.

Any alternatives to these specifications must be reviewed and approved by the Grand Junction Fire Department prior to construction.

(b) **Two Points of Access.** Providing two points of fire apparatus access has the following benefits:

(1) If one access route is blocked, emergency responders have a second route to the property.

(2) If an emergency requires evacuation of an area, the public will have an alternative exit route should one route be blocked by the emergency incident.

When two points of access are required, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses. The Grand Junction Fire Department does not allow the second access point limited to use by emergency responders only. The second access must always be available for public use in case the other access is blocked.

(c) **Commercial and Industrial Developments.**

(1) Buildings or facilities exceeding 30 feet or three stories in height shall have at least two means of fire apparatus access.

(2) Buildings or facilities having a gross building area of more than 62,000 square feet shall have at least two means of fire apparatus access. If the buildings or facilities are provided with an approved automatic fire sprinkler system, the gross building area can be increased to 124,000 square feet with one access road.

(d) **Multifamily Residential Developments.**

(1) Multifamily residential projects having more than 100 dwelling units shall be provided with at least two means of fire apparatus access.

(2) Multifamily residential projects of up to 200 dwelling units, which are provided with an approved fire sprinkler system, may have one means of fire apparatus access.

(e) **One- or Two-Family Residential Developments.**

(1) Developments where the number of dwelling units exceeds 30 shall be provided with separate and approved fire apparatus access roads.

(2) Developments where the number of dwelling units is 60 or less may be served by a single fire apparatus access road, provided all dwelling units are provided with approved residential fire sprinkler systems.

(Res. 39-04, 4-21-04)

29.24.040 Aerial apparatus roadway width.
Fire apparatus access roadways shall have a minimum unobstructed width of 26 feet in the immediate vicinity of any building or portion of building more than 30 feet in height. At least one of the required access routes meeting this condition shall be located within a minimum of 15 feet and a maximum of 30 feet from the building, and shall be positioned parallel to one entire side of the building.

(Res. 39-04, 4-21-04)

29.24.050 Maintenance of access roads.
Maintenance of the required access shall be considered during the planning stages and installation of Fire Department access roadways, fire hydrants, or connections. This includes the potential growth of trees and/or other vegetation over the years.

(Res. 39-04, 4-21-04)

29.24.060 Divided entryway.
A divided entryway can present a challenge to emergency vehicles. The required width of the driveable surface in a divided entryway is based on the width of the entryway and that of the street fronting it.

(a) If the street fronting the divided entryway is 28 feet wide, each lane of the entryway must be at least 15 feet wide.

(b) If the street fronting the divided entryway is 34 feet wide, the entryway lanes may be less than 15 feet wide, but cannot be less than 12 feet wide.

(c) For fronting streets wider than 34 feet, entryway lanes must be at least 12 feet wide.

(Res. 39-04, 4-21-04)

29.24.070 No parking signage.
For access routes less than 28 feet wide and for fire apparatus turnaround areas, vehicle parking is not allowed. “No Parking” signs are required. An approved design for the signage is shown in the Transportation Engineering Design Standards (TEDS), available from the City of Grand Junction Department of Public Works.

(a) For access routes 16 to 22 feet wide, “No Parking” signs are required along both sides of the route.

(b) For access routes 22 to 28 feet wide, “No Parking” signs are required along one side of the route.

(c) For hammerhead tees and alternative turnarounds, “No Parking” signs are required along both sides of the area.

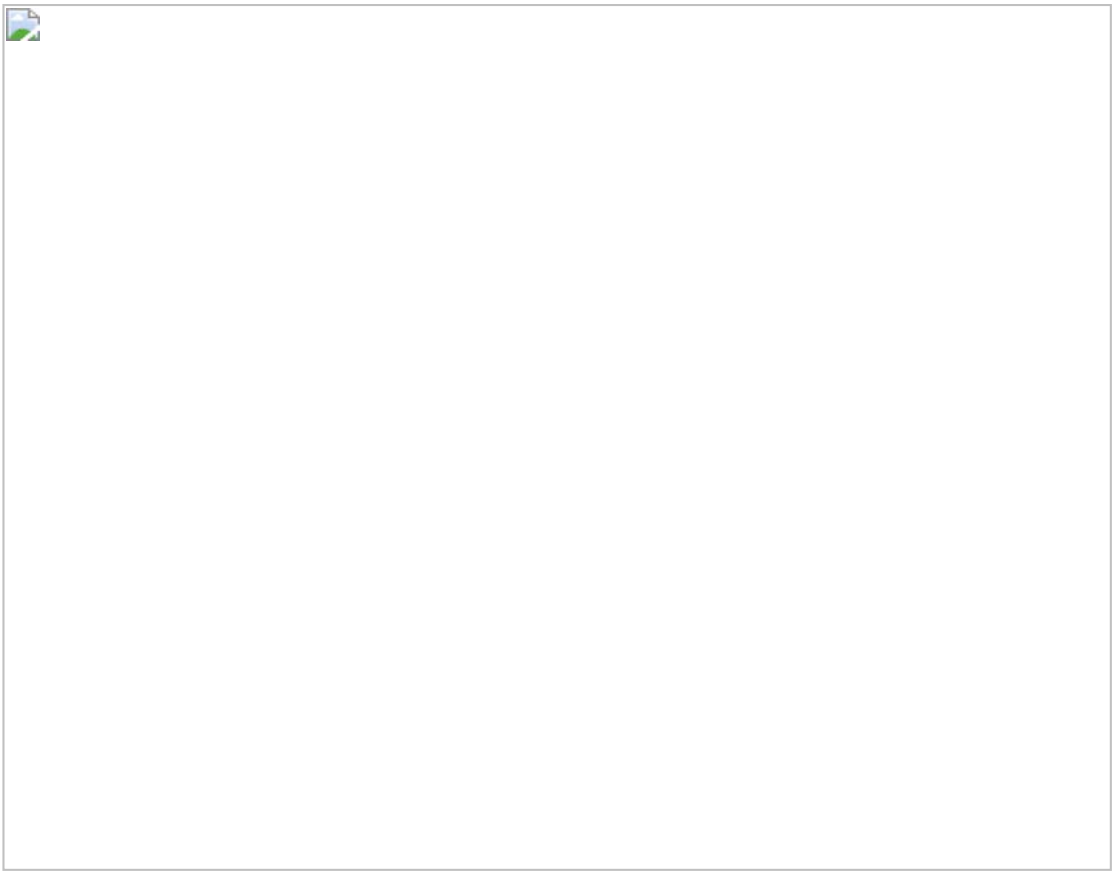
(d) For cul-de-sacs, “No Parking” signs should be placed along the outside of the turnaround area.

(Res. 39-04, 4-21-04)

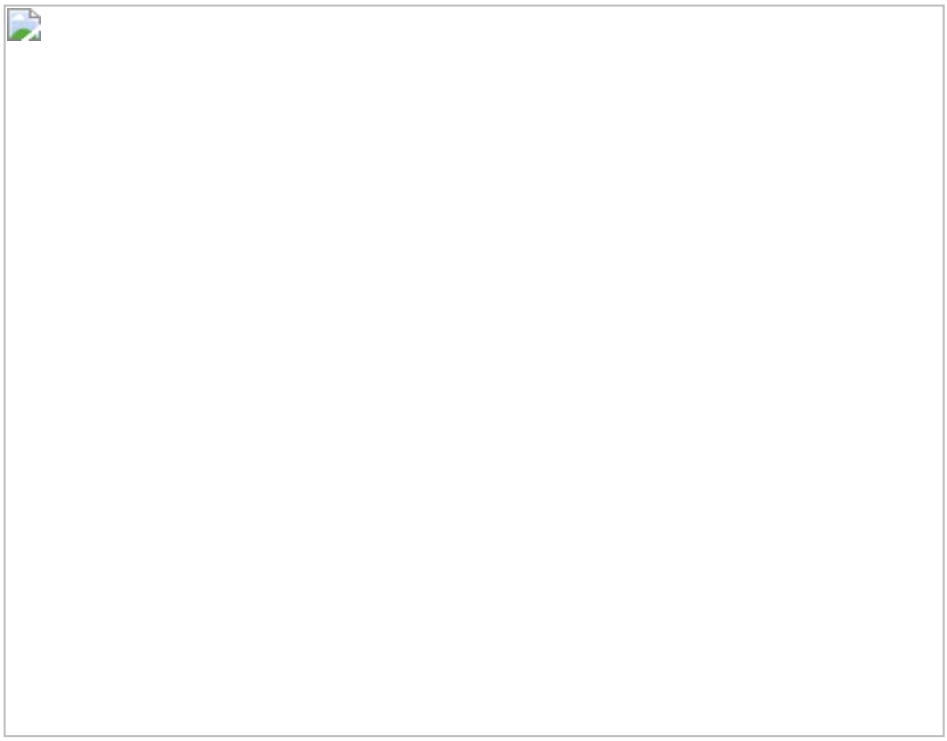
29.24.080 Design standards.

The following pages give examples of Grand Junction Fire Department approved roadway, turnaround, and turning radius specifications. The last of these pages may be photocopied onto a transparency as a template for Fire Department turn radius requirements. This is the template used by the Fire Prevention Bureau when reviewing plans to determine proper access and is based on the actual size of the Grand Junction Fire Department fire fighting apparatus.

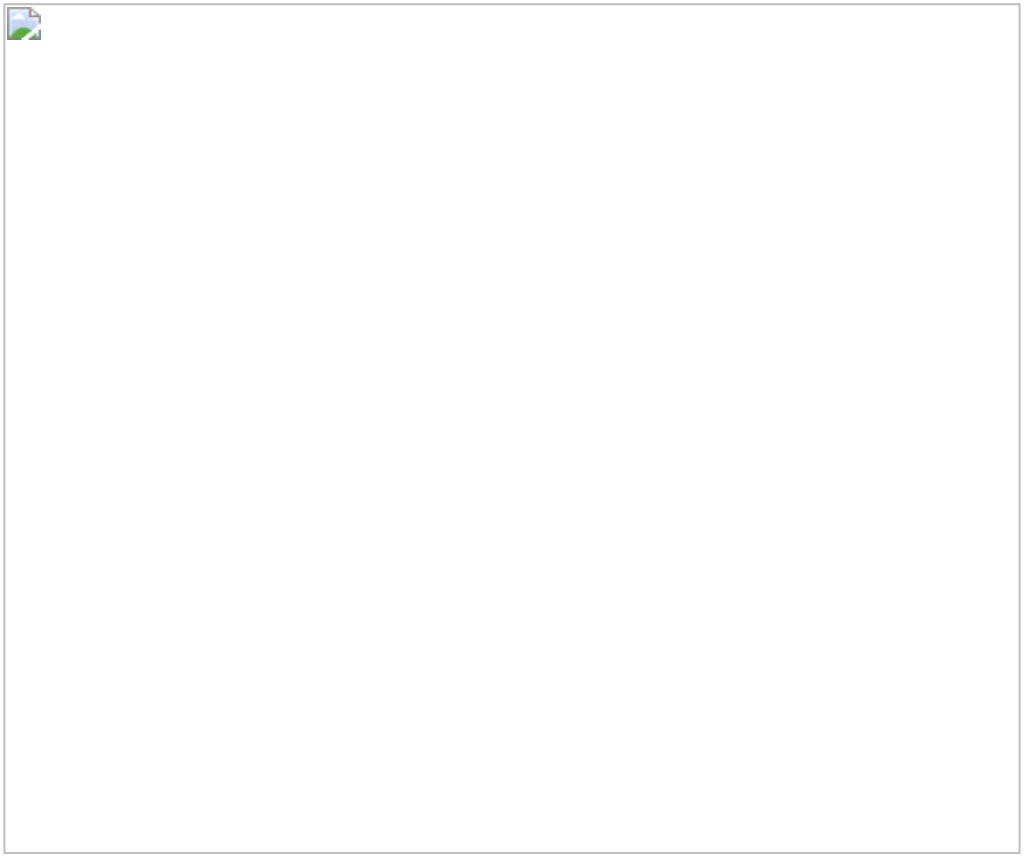
Hammerhead Tee Turnaround



Alternative Tee Turnaround



Alternative Turnaround

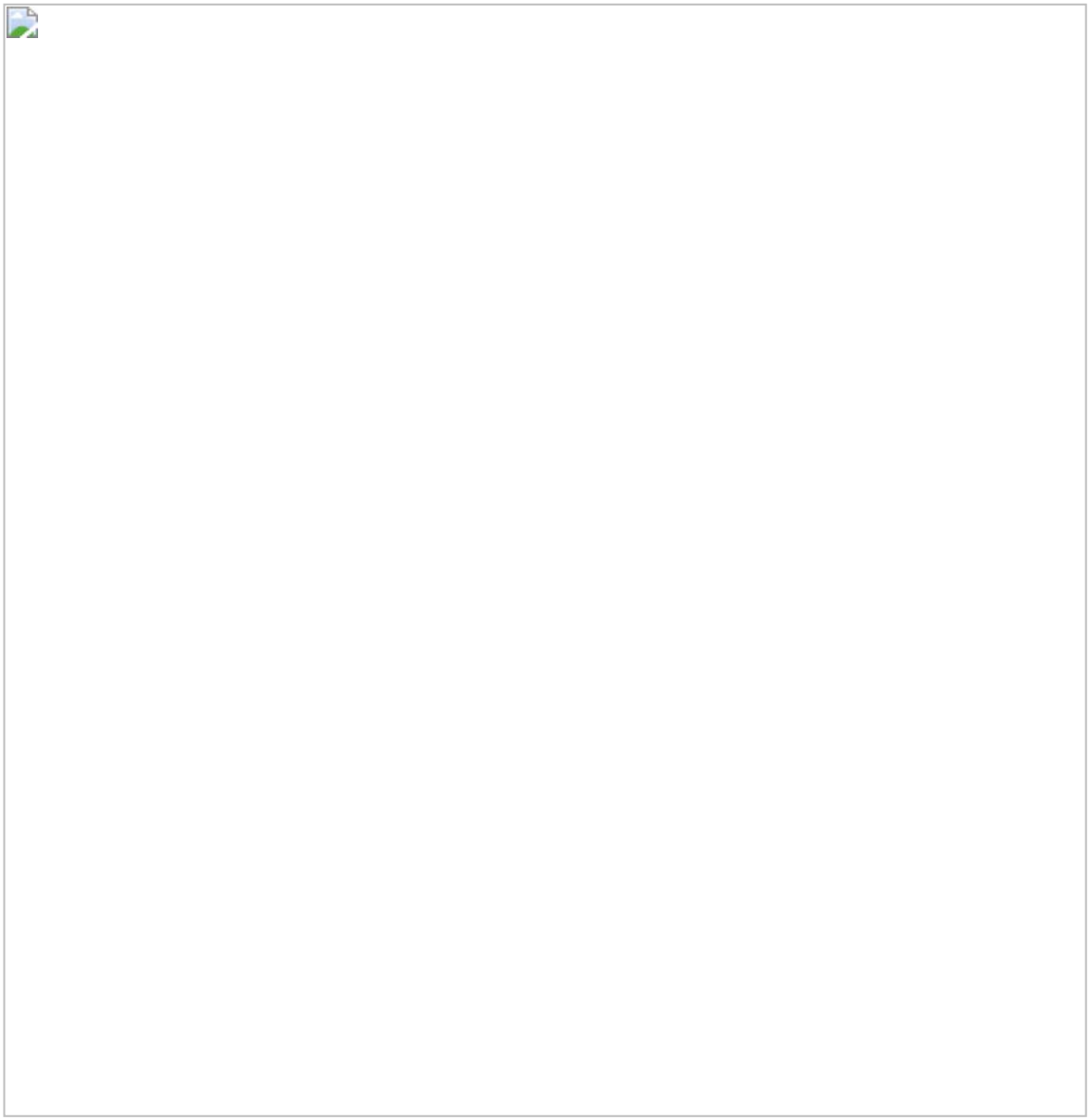


(Res. 39-04, 4-21-04)

29.24.090 Other fire department turnarounds and clearances.

(a) **Turnouts for Fire Hydrants.** For emergency access routes less than 22 feet wide, where fire hydrants are required along the route, a turnout area for fire trucks is required. The width of the access road must be at least 20 feet in the area of the turnout. This turnout area is required so that when a fire truck utilizes the fire hydrant in an emergency, the access route will still be available for use by other emergency vehicles.

(b) **Intermediate Turnaround Areas.** In cases where a single point of access exceeds 600 feet in length, intermediate turnaround areas are required. The width of the access road must be at least 28 feet in the area of the turnaround. These areas allow emergency vehicles to turn around without having to drive to the end of a long dead-end road. The intermediate turnarounds must be provided at a maximum interval of every 500 feet.



(Res. 39-04, 4-21-04)

29.24.100 Looped lane standards.

(a) Not more than seven single-family residences obtain access from the fire loop lane;

(b) The 16-foot-wide fire loop lane shall consist of an all-weather clear surface;

(c) No curve on any portion of the flow line of the fire loop lane shall have an inside radius of

less than 33 feet and an outside radius of less than 48 feet. “Flow line” means the area between the curbs or equivalent if curbs are not present.

(d) No portion of the fire loop lane shall extend more than 250 feet from the abutting street right-of-way.

(e) A minimum of four parking spaces shall be constructed at the end of the fire loop lane, as indicated on the diagram.

(f) The fire loop lane and parking stalls, as indicated on the diagram, are dedicated to and maintained by the City;

(g) Two-way traffic is allowed;

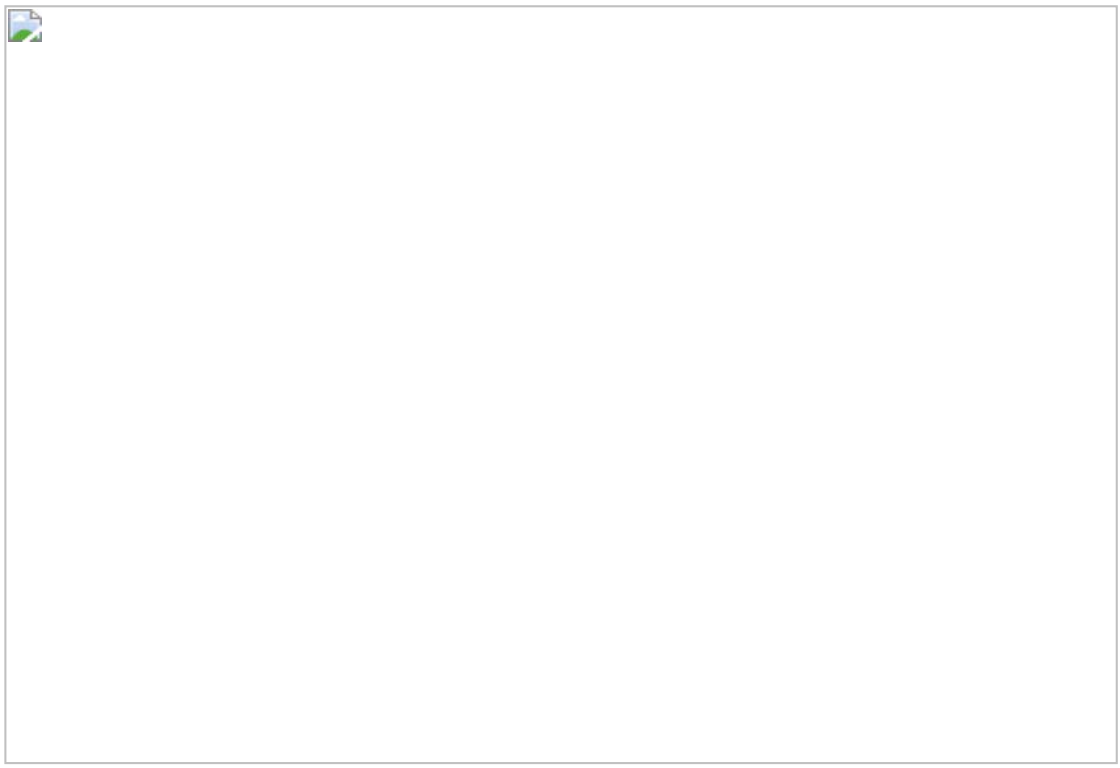
(h) “No parking” signs and markings, as required by the City, are installed and maintained so that no parking is allowed between the curbs on any traveled portion of the fire loop lane;

(i) Corner lots that front the fire loop lane and the abutting street shall be required to only obtain access from the fire loop lane;

(j) No garage or carport built on a lot obtaining access from the fire loop lane shall be constructed any portion of which is closer than 30 feet from any portion of the fire loop lane;

(k) Each residence obtaining access from the fire loop lane shall provide and maintain four parking spaces between the garage or carport and the fire loop lane; and

(l) The fire loop lane shall only connect to a street where on-street parking exists now and is expected to remain, according to the City Engineer, based on such factors as the City capital program and any adopted street plans.



(Res. 39-04, 4-21-04)

29.24.110 Shared driveway standards.

(a) A shared driveway shall be owned and maintained by the owners of the parcels or lots which abut the shared driveway;

(b) Not more than four single-family lots shall abut or touch any portion of the shared driveway and no more than four single-family units may access a shared driveway;

(c) A shared driveway shall be least 16 feet wide and not longer than 150 feet;

(d) No parking is allowed on the shared driveway;

(e) Each lot abutting a shared driveway must provide four on-site parking spaces;

(f) Each lot abutting a shared driveway must access off the shared driveway unless varied at time of subdivision approval; and

(g) A shared driveway may be used only where it intersects a street where on-street parking exists and is expected to remain, according to the City Engineer, based on such factors as the City capital program and any adopted street plans.

(Res. 39-04, 4-21-04)

Chapter 29.28
ARTERIAL AND COLLECTOR GEOMETRIC DESIGN, INCLUDING ROUNDABOUTS

Sections:

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 collector and above, as shown on the Grand Valley Circulation Plan. These streets are intended for higher volumes and faster traffic than the residential streets discussed in Chapter 29.20 GJMC. 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 chapter defines the modern roundabout and provides a link to general design criteria.

(Res. 39-04 (§ 6.0), 4-21-04)

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 Grand Valley 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 Urban Trails Master Plan shows existing and future pedestrian and bicycle facilities.

(Res. 39-04 (§ 6.1), 4-21-04)

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 City Standard Street Details. Additional widths may be required for needed through and turn lanes, and where it is necessary to accommodate slopes and drainage structures.

(a) **Principal Arterial (No On-Street Parking).**

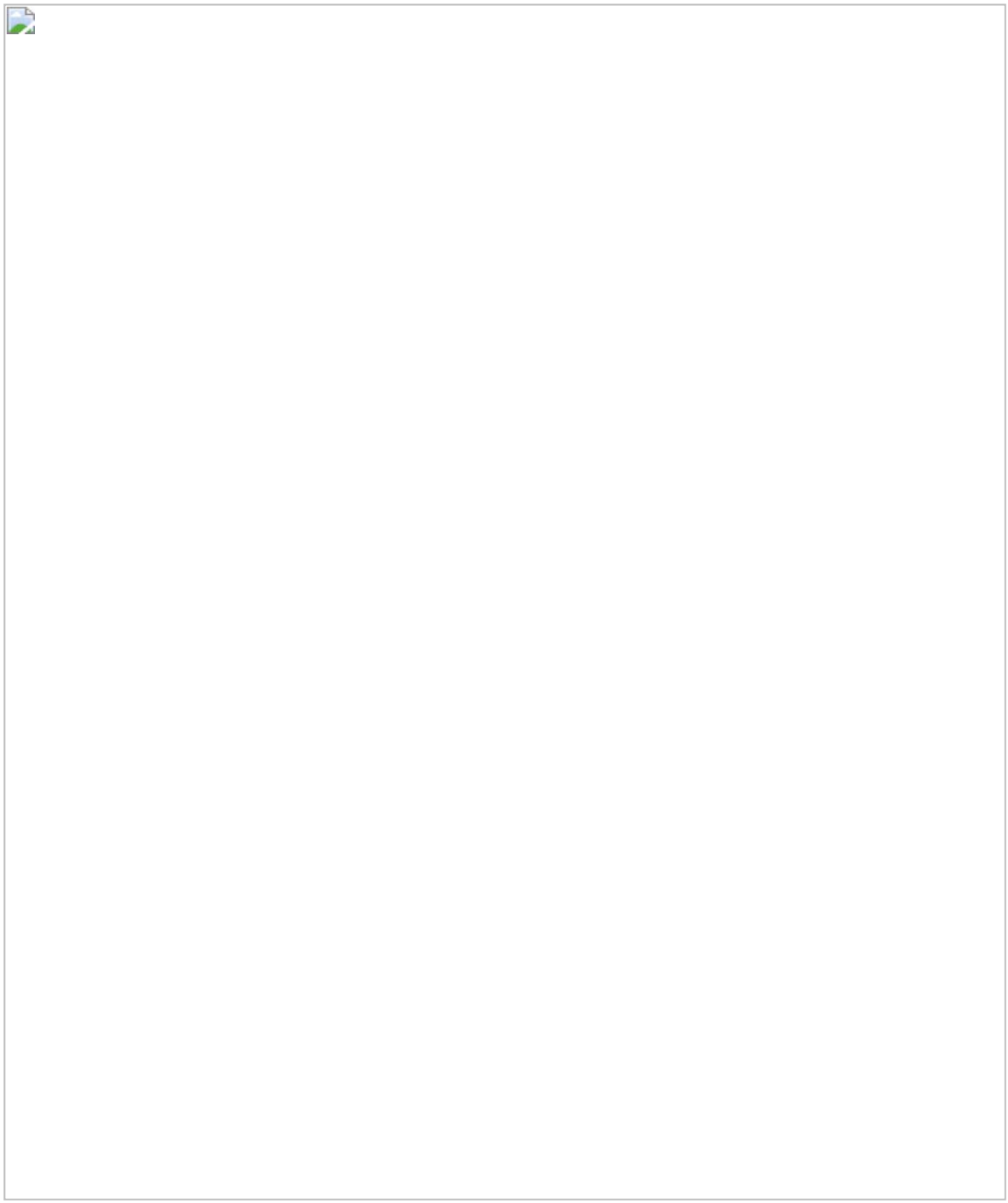
(b) **Minor Arterial (No On-Street Parking).**

(c) **Collector (No On-Street Parking).**

(d) **D 1/2 Road Section (No On-Street Parking).**

(e) **D Road Section (No On-Street Parking).**

(f) **G Road Sections.**



(Res. 39-04 (§ 6.1.1), 4-21-04)

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 superelevation.

[2] Radii shown are based on the street having a crown section with a pavement cross-slope of two percent on each side of the crown. For minimum radii required for other cross-slopes or where superelevation 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 superelevation rate allowed is e = six percent. Where superelevation is used, runoff lengths shall conform to Exhibit 3-41 in "A Policy on Geometric Design of Highways and Streets," AASHTO, 2001 Edition.

(Res. 39-04 (§ 6.1.2), 4-21-04)

29.28.050 Alignments – 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 percent. The grade of a street may be reduced only when matching existing streets or property. Maximum street grades shall be eight percent. For algebraic differences of 0.5 percent 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 3-76 and 3-79, AASHTO, "A Policy on Geometric Design of Highways and Streets," 2001.

[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.

(Res. 39-04 (§ 6.1.3.1), 4-21-04)

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 feet for all other structures shall be provided on all arterial streets and designated truck routes. A minimum clearance of 14 feet may be allowed on collector streets.

(Res. 39-04 (§ 6.1.3.2), 4-21-04)

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 into account the effect of grade on stopping sight distance shall be used in determining appropriate stopping sight distance where the grades are three percent 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 3-1, AASHTO, “A Policy on Geometric Design of Streets and Highways,” 2001.

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.

(Res. 39-04 (§ 6.1.3.3), 4-21-04)

29.28.080 Cross section.

(a) **Cross Slopes.** The typical cross slope is two percent crown to provide for adequate drainage to the pavement edge. The maximum cross slope on the tangent sections shall not exceed four percent. The minimum cross slope shall be one percent.

(b) **Superelevation.** Superelevation shall be designed in accordance with the horizontal curve design criteria (GJMC 29.28.040).

(c) **Clear Zones.** All roadways shall meet clear zone requirements as set forth in AASHTO Roadside Design Guide, 1989 Edition. 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 AASHTO Roadside Design Guide, 1989 Edition or latest.

(Res. 39-04 (§ 6.1.4), 4-21-04)

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.

(Res. 39-04 (§ 6.1.5), 4-21-04)

29.28.100 Bicycle treatments.

Bicycle facilities are required as shown on the Urban Trails Master Plan. Provisions for bicycle facilities shall be in accordance with the AASHTO Guide for Development of New Bicycle Facilities 1999.

(Res. 39-04 (§ 6.1.6), 4-21-04)

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 GJMC 29.28.220. All intersections shall conform to the guidelines set forth in AASHTO and the MUTCD.

(Res. 39-04 (§ 6.2), 4-21-04)

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 subsections.

(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.

(Res. 39-04 (§ 6.2.1), 4-21-04)

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 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 GJMC 29.28.200. Traffic signal warrants and design criteria are thoroughly discussed in the MUTCD, Part IV.

(Res. 39-04 (§ 6.2.2), 4-21-04)

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 three percent, adjustment factors must be applied.

The operating speed on each approach is assumed to be, in order of desirability, (a) the eighty-fifth 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

Major Street Speed	Minimum Sight Distance
20 MPH	200′
25 MPH	275′
30 MPH	350′
35 MPH	400′

40 MPH	500′
45 MPH	550′
50 MPH	600′
55 MPH	700′

Table based on Table 11-15 of the ITE Traffic Engineering Handbook, 5th Edition.

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.

(Res. 39-04 (§ 6.2.3), 4-21-04)

29.28.150 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 eight 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.

(Res. 39-04 (§ 6.2.3.1), 4-21-04)

29.28.160 Intersection radii.

Minimum intersection radii must be maintained at public street intersections.

Minimum Intersection Flowline 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.

(Res. 39-04 (§ 6.2.4), 4-21-04)

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
1,000	25	25	15	11	9
1,200	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 lane 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

1,200	50	25	20	18	14
1,600	20	15	14	13	10
2,000	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 lane 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 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 12 feet 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.

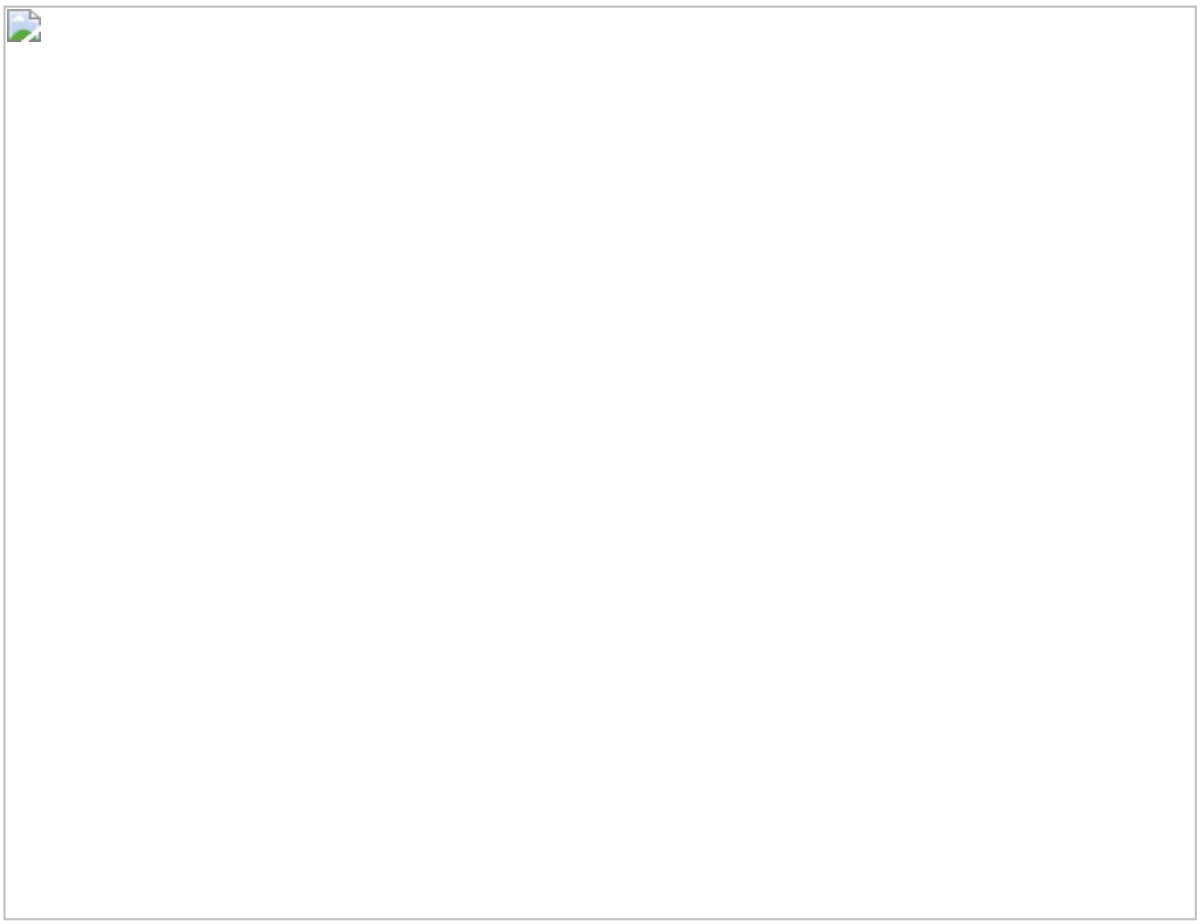
(2) Use the same ratio for both approach and departure tapers.

(3) Bay tapers shall be symmetrical reverse curves in accordance with the following:

(i) Use 60-foot reverse curve for 25 to 35 miles per hour.

(ii) Use 90-foot reverse curve for 40 to 50 miles per hour.

(iii) Use 140-foot reverse curve for 55 to 65 miles per hour.



(4) Storage lengths for turn lanes at signalized intersections shall be determined based on a signal timing analysis that predicts the 90 percent 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.

(5) Standards for State highway right-turn and left-turn speed change lanes are found in the State Access Code.

(Res. 39-04 (§ 6.2.5), 4-21-04)

29.28.180 Angles.

Proposed public streets must intersect at 90-degree angles or as close to 90 degrees as topography permits (no less than 80 degrees). Intersections on sharp horizontal curves shall be prohibited.

(Res. 39-04 (§ 6.2.6), 4-21-04)

29.28.190 Grades.

Intersections shall be on grades as flat as practical. At unsignalized intersections, the maximum allowable grade in the intersections is four percent 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 two percent within the intersection and extends 200 feet in each direction. Grades above four percent 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.

(Res. 39-04 (§ 6.2.7), 4-21-04)

29.28.200 Spacing and offsets.

(a) **Principal Arterials.** Signalized intersections shall be spaced at one-half mile intervals. Unsignalized intersections must be T-intersections spaced at least 600 feet apart, measured centerline to centerline. Unsignalized four-legged intersections may be allowed on arterial streets; provided, that the design of the intersection precludes left turns onto and through movements across the arterial. If the overlap of left-turn storage requirements for two T-intersections exceeds 600 feet, the minimum spacing must be increased to provide adequate left-turn storage in both directions.

(b) **Minor Arterials and Collectors.** Signalized intersections shall be spaced at one-quarter 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.

(Res. 39-04 (§ 6.2.8), 4-21-04)

29.28.210 Pedestrian treatments.

Accommodations for pedestrians shall 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. 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/. 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 unsignalized 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.

(b) **Pedestrian Refuge Islands.** Pedestrian refuge islands may be constructed where mid-block crosswalks are proposed. Islands must conform to the minimum standards established in the MUTCD, and must meet the design criteria for curbing and medians.

(Res. 39-04 (§ 6.2.9), 4-21-04)

29.28.220 Roundabouts.

(a) **Design Criteria.**

(1) 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.

(2) 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.

(3) 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.

(4) Roundabouts shall be designed in conformance with the guidelines set forth in the FHWA publication “Roundabouts: An Informational Guide.” The guide can also be found at http://www.tfhrc.gov.

(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 intersection;

(6) Discourage pedestrian movements through the center of the roundabout.

(Res. 39-04 (§ 6.3), 4-21-04)

29.28.230 Landscaping – General requirements.

All new developments must provide landscaping meeting the requirements of the City's zoning and development code, GJMC 21.06.040, and the County's Land Development Code, Chapter 7. Any landscaping in the sight distance triangles at intersections shall meet the sight distance requirements in the sight zones detail.

(Res. 39-04 (§ 6.4), 4-21-04)

Chapter 29.32
PAVEMENTS AND TRUCK ROUTES

Sections:

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. The truck route map must be consulted prior to beginning pavement design to assure that the design will accommodate anticipated truck loading.

(Res. 39-04 (§ 7.0), 4-21-04)

29.32.020 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.

(Res. 39-04 (§ 7.1), 4-21-04)

29.32.030 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. The minimum growth rate to be used for traffic projections on major streets is 2.2 percent per year.

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.

(Res. 39-04 (§ 7.2), 4-21-04)

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 (latest edition). The computer software for the AASHTO guide is AASHTOWare DARWin 3.1 Pavement Design and Analysis System.

(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.

(Res. 39-04 (§ 7.3), 4-21-04)

29.32.050 Truck routes.
Primary and secondary trucks routes are shown on the truck route map.

(Res. 39-04 (§ 7.4), 4-21-04)

Truck Route Map (PDF)

Chapter 29.36
STREET LIGHTING, UTILITIES AND MAILBOXES

Sections:

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.

(Res. 39-04 (§ 8.0), 4-21-04)

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.

(Res. 39-04 (§ 8.1), 4-21-04)

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.

(Res. 39-04 (§ 8.1.1), 4-21-04)

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 Semi-Cutoff	Local Residential, Residential Collector	100	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, wattage and spacing 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.

(Res. 39-04 (§ 8.1.2), 4-21-04)

29.36.050 Pedestrian and bikeway lighting.

(a) 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 with 70-watt lamp.

(b) Pedestrian lighting is not considered in street light luminaire calculations.

(c) 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 for the cost of utilities and maintenance.

(Res. 39-04 (§ 8.1.3), 4-21-04)

29.36.060 Breakaway structures and lateral clearances.

All fixed objects such as utility, street light poles, fire hydrants, and telephone junction boxes installed in the right-of-way shall be of the breakaway type meeting AASHTO construction specifications. 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 four inches in height. For local streets, a five-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 arterial and major collector 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.

(Res. 39-04 (§ 8.1.4), 4-21-04)

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

(Res. 39-04 (§ 8.2), 4-21-04)

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 one foot behind the curb face. 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 one 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.

(Res. 39-04 (§ 8.3.1), 4-21-04)

29.36.090 Mailboxes – 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 AASHTO “A Guide For Erecting Mailboxes on Highways,” 1984.

(Res. 39-04 (§ 8.3.2), 4-21-04)

29.36.100 Mailbox support standards.
(a) A single four-inch by four-inch square wooden post embedded no more than 36 inches into the ground; a single four-and-one-half-inch diameter wooden post embedded no more than 36 inches into the ground; a single metal post with a strength no greater than a two-inch standard strength steel pipe (two-and-three-eighths-inch 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 29.64 **GJMC.**

(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.

(Res. 39-04 (§ 8.3.2.1), 4-21-04)

Chapter 29.40
STRIPING AND SIGNING

Sections:

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.

(Res. 39-04 (§ 9.0), 4-21-04)

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.

(Res. 39-04 (§ 9.1), 4-21-04)

29.40.030 Signing specifications.
All roadway signs shall conform to the latest edition of the MUTCD and any Colorado supplement. See GJMC 29.40.040(d)(2) for street name specifications.

(Res. 39-04 (§ 9.2), 4-21-04)

29.40.040 Materials specifications.
(a) All signs shall be reflectorized sheeting on 0.080-inch-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 intensity grade materials.

(c) **Posts.**

(1) Twelve-foot length 3#/foot (minimum) U channel posts shall be used for:

(i) Single signs less than seven square feet wind loading area;

(ii) Double post mounting for signs eight square feet wind loading area.

(2) Fourteen-foot length 3#/foot (minimum) U channel posts shall be used for:

(i) Warning sign assembly (two signs) up to nine square feet wind loading area;

(ii) Single square or diamond shaped signs nine square feet wind loading area;

(iii) Double post mounting for all signs 10 to 16 square feet wind loading area.

(3) Eight-foot length 3#/foot (minimum) U channel posts shall be used for:

(i) End of road markers;

(ii) Object markers.

(d) **Fasteners.**

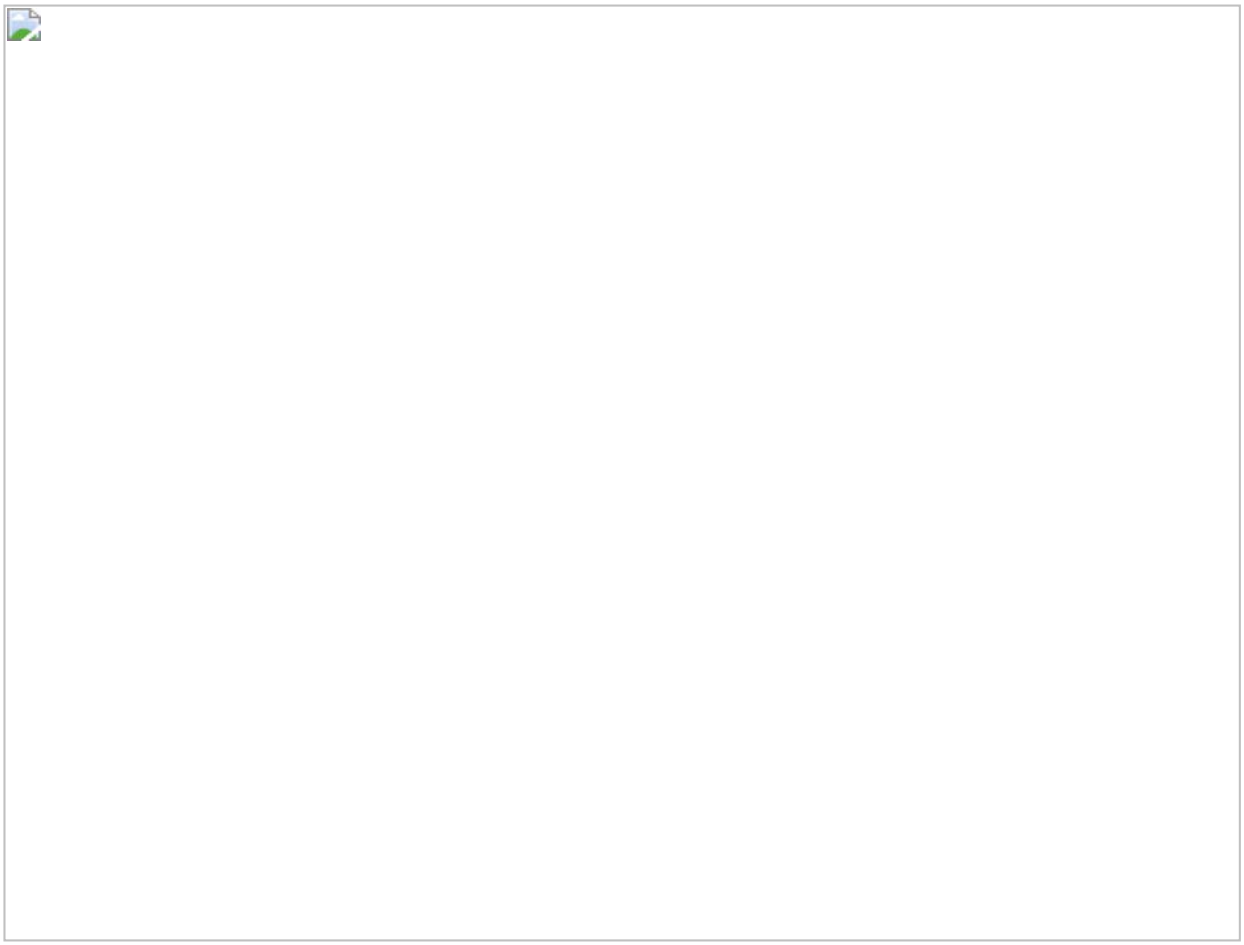
(1) Street Name Signs.

(i) Post caps: cast aluminum with 12-inch slots and five-sixteenths-inch set screws, attached to channel post with one-inch by five-sixteenths-inch bolts;

(ii) 90 cross piece: cast aluminum with 12-inch slots and five-sixteenths-inch set screws.

(2) All Other Signs.

(i) Three-eighths-inch grade 5 bolts with nylon lock nuts and flat washers. The bolt shall protrude beyond the lock nut by a full thread after assembly.



(Res. 39-04 (§ 9.2.1), 4-21-04)

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 near edge of pavement elevation:

(1) Street name signs: nine-foot minimum, 9.5-foot maximum.

(2) End of road markers: four-foot minimum, five-foot maximum.

(3) All other signs: seven-foot minimum, 7.5-foot maximum.

(c) **Lateral Clearance Restriction.** The near edge of sign shall not be less than two feet behind the face of curb. On roads without curb, the near edge of sign shall not be less than six feet from the shoulder or 12 feet from the travel way.

(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 consisting of nine red reflectors, each with a minimum

dimension of three inches, mounted symmetrically on an 18-inch diamond black panel 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 which may be used to mark the roadway terminus. The design criteria for the permanent Type III barricade shall be the Colorado Department of Transportation Standard Plan No. S-630-2, dated November 1, 1992.

(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).

(Res. 39-04 (§ 9.2.2), 4-21-04)

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

(a) **Striping and Marking Materials.** All painted lines shall be applied at a minimum thickness of 15 mils, with six to eight pounds of reflective glass beads applied per gallon of paint.

All permanent markings such as elongated arrows, stop lines, crosswalks, preferential and bike lane markings must be an approved type thermoplastic material, applied a minimum of 120 mils thickness. All letters, arrows and symbols shall be in conformance with the “Standard Alphabets for Highway Signs and Pavement Markings” adopted by the Federal Highway Administration.

(b) **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.

(Res. 39-04 (§ 9.3), 4-21-04)

Chapter 29.44
TRAFFIC SIGNALS AND CONSTRUCTION ZONES

Sections:

Article I. Generally

Article II. Traffic Signal Specifications

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 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 Traffic Signal Specifications (Article II of this chapter).

(Res. 39-04 (§ 10.1), 4-21-04)

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.

(Res. 39-04 (§ 10.2), 4-21-04)

29.44.030 Easements.
At proposed signalized private accesses, the first 50 feet of a private driveway approach as measured from the flowline of the cross street shall be dedicated as a permanent easement to provide for traffic signal loop detector placement and maintenance.

(Res. 39-04 (§ 10.3), 4-21-04)

29.44.040 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.

(Res. 39-04 (§ 10.4), 4-21-04)

29.44.050 Signal design plans.
Signal design plans shall contain all necessary information. Sample signal design drawings illustrating the proper information required are listed below:

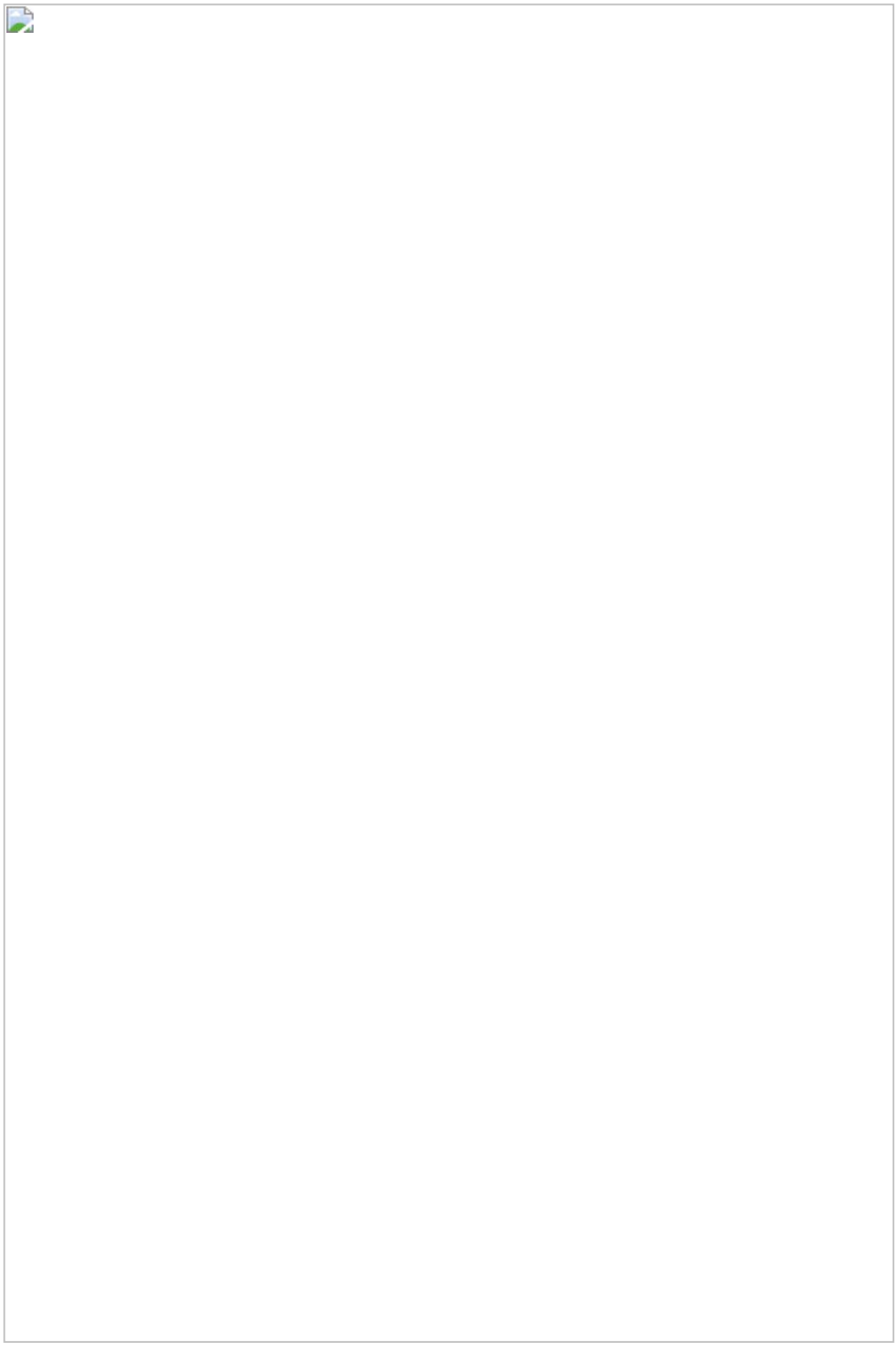
(a) Control Cabinet Foundation Detail, Pull Boxes, Pedestal Pole Installation, Pedestal Pole Footing.

(b) **Traffic Signal Pole Details.**

(c) **Mastarm Assembly, Signal Face Detail, Conduit Detail, Phasing Sequence.**

(d) **Loop Installation Detail.**

(e) **Example of Typical Installation.**



(Res. 39-04, 4-21-04)

Fiber Optic Project Detail (PDF)

Article II. Traffic Signal Specifications

29.44.060 General requirements.

The work specified in this article 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.

(Res. 39-04, 4-21-04)

29.44.070 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 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 "Manual on Uniform Traffic Control Devices for Streets and Highways," (MUTCD) Millennium Edition, dated June 14, 2001, published by the Federal Highway Administration, and as directed by the Engineer.

(Res. 39-04, 4-21-04)

29.44.080 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.

(Res. 39-04, 4-21-04)

29.44.090 Intersection power.
The contractor shall notify the engineer two 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.

(Res. 39-04, 4-21-04)

29.44.100 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 2551 River Road.

(Res. 39-04, 4-21-04)

29.44.110 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. The contractor shall at all times maintain a minimum of two three-section (red, yellow, and green) traffic signal heads for each roadway approach in conformance with the MUTCD.

(Res. 39-04, 4-21-04)

29.44.120 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.

(Res. 39-04, 4-21-04)

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

(Res. 39-04, 4-21-04)

29.44.140 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 ensuring that they are properly protected and/or adjusted.

(Res. 39-04, 4-21-04)

29.44.150 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.

(Res. 39-04, 4-21-04)

29.44.160 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.

(Res. 39-04, 4-21-04)

29.44.170 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 include 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.

(Res. 39-04, 4-21-04)

29.44.180 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. 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 lane of traffic in each direction shall be open to public traffic. All lane closures shall be approved by the 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.

(Res. 39-04, 4-21-04)

29.44.190 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 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.

(Res. 39-04, 4-21-04)

29.44.200 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 a manual for the controller, 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.

(Res. 39-04, 4-21-04)

29.44.210 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 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.

(Res. 39-04, 4-21-04)

29.44.220 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 flat washers, and two 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.

(Res. 39-04, 4-21-04)

29.44.230 Underground facilities – 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 mastarms. 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, and capped with six inches 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	3″	120 voltage
Street Crossings	1	2″	Low voltage
Street Crossings	1	2″	EXCEL use
Signal Pole	1	3″	Signal cables
Signal Pole	1	2″	EXCEL use

Controller Cabinet	2	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

(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 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 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 24 inches below the top of curb grade in sidewalk or grass areas and to a depth of not less than 30 inches below the finished grade in all other areas. Conduit under railroad tracks shall be not less than 48 inches below the bottom of the tie.

(i) Trench excavations for conduit shall be two inches 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 vertically above the foundation.

(l) All conduit runs that exceed 10 feet in length shall have a continuous nylon line pulled into the conduit along with the specified electrical cables. The line shall be firmly secured at each end of the conduit run with a minimum slack of three feet. 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.

(Res. 39-04, 4-21-04)

29.44.240 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 from bedding grade. When installed in the concrete, two bolts on each side of the pull box two inches 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 18 inches 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.

(Res. 39-04, 4-21-04)

29.44.250 Underground facilities – Detector loop wire installation.

(a) Each individual detector loop is to be terminated as specified on the construction drawing, without splicing, to this termination point. Any required series or parallel connections are to be at the termination point.

(b) All loops shall have a tag attached to the leading clockwise lead of the loop. This tag shall be marked to indicate the relative location of the loop. This marking shall correspond directly to the loop designations on the intersection drawing provided in the contract.

(c) Detector loop roadway slots shall be cut in asphalt that has a six-inch minimum depth and sealed one-fourth inch below the surface level of the roadway with 3M sealer or approved equal.

(d) Loop lead ins shall run to pull box on side of walk designated on plans. Leads shall not be placed in valve box in roadway unless approved by engineer.

(Res. 39-04, 4-21-04)

29.44.260 Underground facilities – Conductor and cable.

(a) Wiring shall conform to appropriate articles of the National Electrical 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 or pull boxes. All splicing shall be done in the pole base, except for loop wires and 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. Detector loop lead in splices in underground systems shall be waterproofed with 3M splice kits or City approved equivalent. 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.

(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
Illuminated Street Signs	White
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 mastarms, are to be wired separately from head to base of pole or pull box.

(Res. 39-04, 4-21-04)

29.44.270 Underground facilities – 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 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 diameter and eight feet in length, driven into the ground so that the top is two inches 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.

(Res. 39-04, 4-21-04)

29.44.280 Underground facilities – 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 bulbs and lenses, 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.

(Res. 39-04, 4-21-04)

29.44.290 Underground facilities – 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 14 days of continuous, satisfactory operation commencing with full operation of all electrical facilities. During the 14-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.

(Res. 39-04, 4-21-04)

29.44.300 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, 12-inch tunnel type, open at the bottom; be gloss black in color on the outside and flat black on the inside.

(b) Reflectors shall be a single piece of silvered glass or specular aluminum with an anodic coating. Reflectors shall conform to ITE standards.

(c) Lenses shall be in accordance with Institute of Traffic Engineers Specifications.

(d) Sockets shall be fixed focus.

(e) Doors on the signal heads for the installation of lamps and lens replacement or other maintenance shall not require use of any tool whatsoever to be opened. Doors and lenses shall be equipped with neoprene weatherproof gaskets to ensure against infiltration of moisture, road film, and dust. Each three color signal unit shall have the socket 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 socket 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 pipe or pipe mounting brackets. Gaskets shall be supplied for top and bottom openings.

(Res. 39-04, 4-21-04)

29.44.310 Material specifications – Pedestrian signal units.
Sixteen-inch, one way, ICC or equal pedestrian signal heads as specified on the plans. "Walk/Don't Walk" indications shall be symbolized and side by side. Visors shall be egg crate type and heads shall be gloss black. When countdown timers are required they shall be manufactured by Tassimco Technologies.

(Res. 39-04, 4-21-04)

29.44.320 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.

(b) Traffic signal heads requiring backboards shall be drilled for three-sixteenths-inch diameter by one-half-inch 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 fender washers between bolt head and backboard.

(c) The manufacturer will fabricate all backboards with a three-sixteenths-inch washer on both sides of each rivet, which is used to hold each section of backboard together.

(Res. 39-04, 4-21-04)

29.44.330 Material specifications – Traffic signal lamps.
All signal indications, for both vehicle and pedestrian signals, shall be LED and meet the requirements of the applicable CDOT specifications.

(Res. 39-04, 4-21-04)

29.44.340 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.

(Res. 39-04, 4-21-04)

29.44.350 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. Pedestrian Common
Orange	Side St. Walk
Black	Side St. Don't Walk
White with Black tracer	Side St. Pedestrian Common

Loop Lead-In Wire: 18 Gauge 3 Pair Shielded

Black/White	Through Traffic
Black/Red	Turning Traffic
Black/Green	Spare

Directional Color Codes

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

Pedestrian Push Button Wiring (2 Pair 18 AWG)

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

Illuminated Street Sign Wiring (12 AWG (UL) Type UF with Ground)

Black	AC Positive
White	AC Negative
Bare	Green (Ground)

(Res. 39-04, 4-21-04)

29.44.360 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 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.

(Res. 39-04, 4-21-04)

29.44.370 Electrical cable – Loop wire.
Detect-A-Duct Cable consisting of single conductor No. 14 stranded THHN with an outer protective sleeve.

(Res. 39-04, 4-21-04)

29.44.380 Electrical cable – Pedestrian push button cable.
Push-button wire shall be two conductor quarter-inch diameter, shielded and jacketed cable. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation.

(Res. 39-04, 4-21-04)

29.44.390 Electrical cable – Loop lead in cable.
Detector loop lead in cable shall be a six-conductor quarter-inch diameter, shielded and jacketed cable. Conductors shall be AWG No. 18 stranded copper with polypropylene insulation. The conductors shall be twisted at least six turns per foot. Color rotation shall be black and red, black and white, black and green. The interior of the cable shall be filled with an amorphous material that prevents water penetration. Aluminized polyester shielding shall be applied around the conductors to prevent electromagnetic interference. The cable jacket shall consist of black or gray high-density polyethylene. The jacket shall not be degraded by prolonged exposure to typical pavement runoff components. The cable shall be suitable for operation at temperatures of minus 60 degrees Celsius to plus 80 degrees Celsius.

(Res. 39-04, 4-21-04)

29.44.400 Electrical cable – Illuminated street name signs wire.
Shall be UL Type UF 12-2 with ground 600 volt sunlight resistant grade romex.

(Res. 39-04, 4-21-04)

29.44.410 Electrical cable – Ground.
Single conductor, AWG No. 8, soft drawn bare copper wire.

(Res. 39-04, 4-21-04)

29.44.420 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.

(Res. 39-04, 4-21-04)

29.44.430 Vehicle detectors – General.
(a) Detectors shall be 3-M Canoga or approved equivalent.

(b) This specification defines the minimum design operational and performance requirements for multiple channel, digital self-tuning inductive loop detectors. 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.

(c) The front panel shall include an erasable, write-on channel identification area and clearly indicated switch operating position. I.D. area one centimeter square per channel minimum.

(d) All component part and test points shall be clearly identified by permanent marking of circuit referenced on the P.C. board. Integrated circuit devices having 16 or more leads shall be socket mounted to facilitate repair and maintenance of units. Detectors supplied to this specification shall be warranted by the supplier to be free of defects in materials and workmanship for a period of five years from date of shipment from manufacturer.

(e) Each detector unit shall include two or four complete detector channels. Each channel shall sequentially energize its loop inputs to eliminate crosstalk (mutual coupling) between large, very closely spaced adjacent loops connected to the same unit. The sequential time sharing and digital processing of loop inductance data shall be accomplished on a single LSI microcircuit per unit for maximum reliability. The method of measuring shall be crystal reference digital period counting, multi-channel scanning. Only one channel input per unit shall be active at any point in time.

(1) Sequential scanning shall fully prevent crosstalk between channels of a detector connected to closely spaced or overlapped loops for directional detection.

(2) Sequential scanning shall allow two detection channels to operate with full performance using a common home run cable.

(3) Sequential scanning shall allow two or more detection channels to be connected to a single detection amplifier with full operating performance, including separate mode and sensitivity selection capability on each channel.

(f) Each channel of the sensor unit shall automatically self-tune to any loop and lead in inductance from 20 to 2,500 micro henries within two seconds with full sensitivity after application or interruption of supply voltage. Units shall also track changes in loop/lead in electrical characteristics, as might reasonably be expected to occur in undamaged loops, properly installed in sound pavements, without producing false indications or changes in sensitivity.

(g) Each detector unit shall be provided with a loop test switch position to verify loop system integrity and reduce maintenance costs. The “open loop test” position shall indicate a previous fault via the front panel indicator. The memory shall remain intact and can be queried repeatedly. Existing detections shall not be reset and the memory shall only be reset by power interruption as by removing and re-inserting the plug-in detector units.

(h) Each channel shall include a 16-position push-type wheel switch to allow selection of eight pulse sensitivities, seven presence levels and a “Reset” and an “Off” position. Each detector unit shall include eight sensitivity selections in 2:1 steps that can be correlated to the relationship of the number of turns of wire in a loop versus the sensitivity required to detect a specified vehicle. The selections shall be designed to allow detection of licensable vehicles in loops of two or more turns electrically in series, parallel or series/parallel configuration in nonreinforced or reinforced pavements with lead in/homerun combinations from 50 feet to 1,000 feet. The number of turns in a loop, electrical configuration of multiple loops and pavement type will dictate the sensitivity required for proper, predictable detection.

(i) If specified, channel presence time shall be modified if delay or extension time is selected. The timing switch shall select delay or extension or “Off,” if no timing is desired. Internal DIP switches shall provide for selection of “Delay” time of zero to 31 seconds in one-second increments and “Extension” time of zero to seven and three-quarters seconds in quarter-second increments.

(j) Presence indicators shall be wide angle, high brightness type LEDs suitable for sunlight visibility. When timing is selected and a channel is active that channel’s indicator shall flash at four Hz during delay and at 16 Hz during extension to indicate timing is in progress. Further, the timing shall be aborted when the vehicle is no longer present and/or the channel control input shall become inactive. The delay timer shall be reset when a vehicle leaves the loop prior to time out and shall abort when the control input becomes inactive. The extension timer shall operate and reset when a vehicle leaves the loop and be aborted when the control input becomes inactive. Each timer (delay and extension) shall be provided with buffer circuitry to enable or disable the timer based on an external input (green gate) signal. Circuit shall be designed for AC or DC input control on AC powered units and for DC control on DC powered units.

(k) Each detector unit shall utilize a ΔL = (Delta L) thresholding technique to provide a more constant, predictable vehicle detection sensitivity with series added inductance, i.e., many loops connected in series and/or long lead in/homeruns will generally require the same sensitivity setting as would be required for a single loop with short lead in, to simplify setup.

(l) Each channel shall automatically recover from intermittent opens or multiple shorts to ground. Each channel shall tolerate and continue to operate with no change with a single point short to ground on the loop or lead in system. Each channel shall provide a continuous, non resettable (fail safe) output and indication in response to an open loop/open lead in system. The open loop indication and output shall not be resettable as long as the open exists, except that they shall be defeated when the channel “Off” position is selected.

(m) Extended features shall include: two serial ports (front panel RS232 and Edge connector Xmit/Recve), TS1 and TS2 compatible from manual or software switch, micro loop occupancy detection, traffic counting capable to include long-loop presence count from 15 minute to infinite intervals all accessible from either serial interface, dual detect and fault LED indicators per channel, external inputs to control timing functions and enable remote reset, extended diagnostics, programming and live status available via serial interface utilizing Windows compatible software.

(Res. 39-04, 4-21-04)

29.44.440 Vehicle detectors – Vehicle video detection.
Shall be Iteris video detection equipment or approved equal.

(Res. 39-04, 4-21-04)

29.44.450 Vehicle detectors – Emergency vehicle detectors.
Optical communication detectors for emergency vehicle preemption 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.

(Res. 39-04, 4-21-04)

29.44.460 Pedestrian push button detectors – General.
Push buttons shall be manufactured by Alinco Electric Sales 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.

(Res. 39-04, 4-21-04)

29.44.470 Illuminated street name signs – General.
Lighted street name signs shall be manufactured by NuArt or approved equal.

(a) Signs shall have a city logo on the left side.

(b) The background shall be blue.

(c) Lettering to be white uppercase and lowercase font.

(d) Photo cell mounts shall be on the bottom of illuminated street name sign frame.

(e) One-half-inch black wire loom shall be used to cover romex drip loop coming from sign into mastarm.

(Res. 39-04, 4-21-04)

29.44.480 Traffic signal poles, pedestals and mastarms.
Traffic signal poles, pedestals, and mastarms shall be of the general configuration shown on standard drawings. All traffic signal poles and mastarms shall be designed to meet the requirements outlined in the 1985 edition of "Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Traffic Signals," published by AASHTO, for a wind velocity of 90 miles per hour. Poles shall be galvanized. Poles shall be manufactured by Valmont or approved equal.

(Res. 39-04, 4-21-04)

29.44.490 Controller cabinet – General.
(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 manufacture. 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 fans shall be mounted in a weatherproof housing attached to the top of the cabinet. The thermostat shall be adjustable to turn on between 90 degrees Fahrenheit and 150 degrees Fahrenheit and be so mounted as to be easily accessible for adjustment from the front of the cabinet. An internally mounted incandescent lamp socket shall be provided with 150-watt capability and switched “on” only when the main door is open.

(g) The cabinet shall have two 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 inches by 12 inches 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 six 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 four inches from the door sill and not less than six 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 0.1 microseconds at 10 kV per microsecond.

(2) Standby current: less than one milliamp ere.

(3) Striking voltage: greater than 212 VDC.

(4) Energy capability: capable of withstanding pulses of peak current each of which will rise in eight microseconds and fall in 20 microseconds to one-half the peak voltage at three-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 one and one-half 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 two-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 three input LED indicator. Load switches shall contain three 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.

(Res. 39-04, 4-21-04)

29.44.500 Actuated controllers – General.

(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, or necessary modifications of the software and hardware shall be included to make both systems fully compatible.

(b) An actuated controller shall be completely solid state, electronic device capable of selecting and timing traffic movements. It shall provide timing and load switch control of each major vehicular phase, including concurrent associated pedestrian movements. The controller shall conform to the latest NEMA specifications and shall provide for complete and full operation of eight phases from within either a TS1 or TS2 type 1 cabinet.

(c) The controller shall have all electronic components easily accessible and arranged in

functional groupings on the printed circuit boards. Printed circuit boards shall be designed to facilitate identification of components for maintenance purposes. Printed circuit design shall be of NEMA specification quality and designed so that the components may be removed and replaced without permanent damage to the board or track.

(d) Timing shall be adjustable on the controller face by keyboard programming. A security code or other means shall be provided to prevent unauthorized or accidental entry.

(e) Timing shall be readable from a display that is sufficient to make certain that all register positions can be easily and definitely recalled. Every keyboard controller shall have an easily followed legend silk screened on the face of the controller or on a metal or plastic card or placard which is securely attached by screws or rivets.

(f) All circuitry components shall be available on the open market and the original manufacturer's part number shall be shown on the parts list.

(g) Overlap programming shall be provided by NEMA standard overlap board and/or keyboard.

(h) An entry mode to any single phase parameter of a keyboard controller shall not affect any other parameter or the same parameter on another phase, unless programmed by specific keyboard instructions, such as "copy" sequences or other prescribed methods of rapid program entry.

(i) Every controller supplied shall be the manufacturer's latest, first line production model tested and delivered by a domestic manufacturer who is regularly engaged in the construction of such equipment.

(j) Each controller shall be supplied with a complete set of operational and service manuals, wiring schematics and parts layout up to a maximum of 10 sets per order. Any controller for which these documents are not available is not a production model within the meaning of these specifications.

(k) Each controller shall have a removable data module.

(l) **Preemption.** All actuated controllers shall be equipped to accommodate four E.V.P. inputs and one railroad preemption input.

(Res. 39-04, 4-21-04)

29.44.510 Actuated controllers – Coordination unit.

(a) The coordination unit shall be an internal function within each local controller and shall meet, as a minimum, the following functional requirements.

(b) The coordinator shall provide for at least four cycle lengths adjustable from 30 to 255 seconds, three offsets adjustable from zero to 99 percent with offset correction by dwelling in coordinated phase or smooth transition, and four splits per cycle.

(c) Standard NEMA functions shall be used to control the intersection timing.

(d) The coordinator shall be capable of changing the controller's phase sequence upon command and telemetry failure.

(e) The coordinator shall be capable of setting the intersection free by loss of system sync, cycle/offset false commands, free command and telemetry failure.

(f) The coordinator shall be capable of setting the intersection into a flashing operation in accordance with the Manual on Uniform Traffic Control Devices, latest edition.

(g) The coordinator shall be capable to operate with telemetry module without additional hardware or software.

(h) Time base coordination mode shall be provided as a backup with all standard coordination features available. At least two seven-day programs shall be available with 50 additional holiday programs in the event of a master controller or communications failure. Time base standby mode shall be programmable for an entire year with automatic daylight savings and leap year changes.

(Res. 39-04, 4-21-04)

29.44.520 System telemetry.

(a) Telemetry equipment shall be an internal plug-in module to a local controller with easy access for removal. Master controller or stand alone chassis may contain standard plug-in module. Each telemetry unit shall be capable of transmitting data to and from local controller, local detectors and system detectors (eight per intersection). A provision shall be made to reject invalid messages. The system command shall be transferred each second to maintain time sync.

(b) The telemetry equipment shall be designed so that all communications among intersections in one system can be accomplished over no more than two pairs of hard wire interconnect or leased phone lines. Dedicated pairs from the master to each local intersection are not permitted.

(Res. 39-04, 4-21-04)

29.44.530 On-street master – General.

(a) **Cabinet Assembly.** The master controller shall be wired into a cabinet assembly that also includes a local intersection equipment configuration. The cabinet shall be wired complete with master connecting cables in accordance with applicable portions of the local controller cabinet specifications. The incoming power service and interconnect terminals shall be adequately equipped with surge arrestors to protect against high-energy transients.

(b) **Incoming Sensor Data.** The master shall have the ability to receive output data from at least eight sensors from each local intersection. It shall be possible to assign at least 32 of the incoming sensors to internal computational channels for pattern selection analysis.

(c) **Traffic Pattern Selection.** The program in effect shall be selected on a priority basis with the following priority arrangements:

(1) Manual entry from keyboard;

(2) External command from a master;

(3) Time of day/day of week schedule;

(4) Traffic responsive based on sampling sensor analysis.

(d) The master shall select one of six different cycle lengths or “free” operation based on inbound or outbound volume levels. It shall be possible to program segments in the volume range levels to change to the next higher or lower cycle lengths.

(e) The master shall be able to select any of five different offset plans per cycle. Offset plans shall be chosen based on the differential between inbound and outbound volume levels. The five offset plans shall be designated as follows:

(1) Heavy inbound;

(2) Inbound;

(3) Average;

(4) Outbound;

(5) Heavy outbound.

(f) When balanced flow occurs, the master shall select the average offset plan. When the volume in one direction exceeds the volume in the other direction by the programmed amount, a standard preferential offset shall be implemented. If the volume differential exceeds a second (higher) programmed amount, a heavy preferential offset must be implemented. It shall also be possible to reserve the heavy preferential offset plans for special pattern implementation only. Programmable settings must be provided for both entering and leaving each offset.

(g) Split plan selection shall be identical to offset plan selection except that arterial traffic volume levels must be compared to side street volume levels. Three different split plans shall be provided:

(1) Heavy arterial;

(2) Average;

(3) Heavy side street.

(h) The master shall call for the average split plan during normal conditions. If the arterial volume exceeds the side street volume by the programmed amount, the heavy arterial split shall be selected. In the same manner, if side street volume exceeds arterial volume by a programmed amount, the heavy side street split shall be called.

(i) **Crossing Artery Synchronization.** The master controller shall have capability to coordinate with a separate master controller of the crossing artery through the common intersection for both systems.

(j) **System Diagnostics.** Diagnostic tests shall be performed on system detectors, telemetry communications and intersection operation.

(k) Sampling sensors shall be monitored for absence of calls or constant calls. If a sensor fails, it shall be automatically disconnected from the calculations for traffic responsive plan selection. If normal sensor operation resumes, the sensor shall be automatically reinstated.

(l) Telemetry communications diagnostics shall monitor readbacks for no response condition including local telemetry and telemetry channels.

(m) Intersection diagnostics shall be available to display intersection status condition. All fault conditions shall be reported and logged.

(n) **Count Storage.** The master shall have the ability to tabulate and store 15-minute count data from up to 32 different sensors. The data shall be available for automatic transfer to the central office facility upon request.

(o) The selection of the sensors to be counted in any 24-hour period shall be completely programmable from the central office computer.

(p) **Miscellaneous Data Storage.** The master shall store all of the following data:

(1) The time of day and location of all sampling sensor failures. If normal operation resumes, this time shall also be recorded.

(2) The time of day, location and mode of all local intersection failures. The time that normal operation resumes must also be recorded.

(3) The time and mode of all pattern changes. Changes due to external override must be distinguished from normal pattern changes.

(4) The average volume or occupancy level for each 15-minute period for all computational channels.

(q) It shall be possible to transmit any of the data listed above to the central office computer automatically or upon demand.

(r) **Downloading Local Coordination Settings.** It shall be possible to download any local intersection coordination setting (offset, force off or permissive period) from the master via the unit's keyboard.

(s) **Display.** During normal operation, the timing pattern in effect shall be displayed on the front panel, including the cycle, offset plan and split plans selected. Also, the unit shall indicate how the timing plan was selected through normal volume calculations, by an occupancy channel or by manual or central computer override. The master shall also indicate when the time of day mode is in effect and show whether this mode was selected manually or because of sensor failures.

(t) **External Override.** The master controller shall have appropriate inputs to externally select any timing pattern and override the pattern selected through traffic analysis.

(u) **Telemetry.** The master shall include a telemetry module for two-way communications between the master and local controllers. The equipment shall be compatible with the telemetry equipment specified for the local controllers.

(Res. 39-04, 4-21-04)

29.44.540 Traffic signing and pavement markings.

(a) **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 edition.

(b) **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.

(c) **Traffic Control Devices on Private Property.**

(1) 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.

(2) 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.

(d) **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.

(Res. 39-04, 4-21-04)

29.44.550 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.

(Res. 39-04, 4-21-04)

29.44.560 Traffic control in construction areas – 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.

(Res. 39-04, 4-21-04)

29.44.570 Traffic control in construction areas – 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 removed, 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.

(Res. 39-04, 4-21-04)

29.44.580 Traffic control in construction areas – 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 subsection (a) of this section, 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 subsection (a) of this section, 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.

(Res. 39-04, 4-21-04)

29.44.590 Traffic control in construction areas – 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).

(Res. 39-04, 4-21-04)

29.44.600 Traffic control in construction areas – 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 10 feet, 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 $300.00 will be assessed to the contractor.

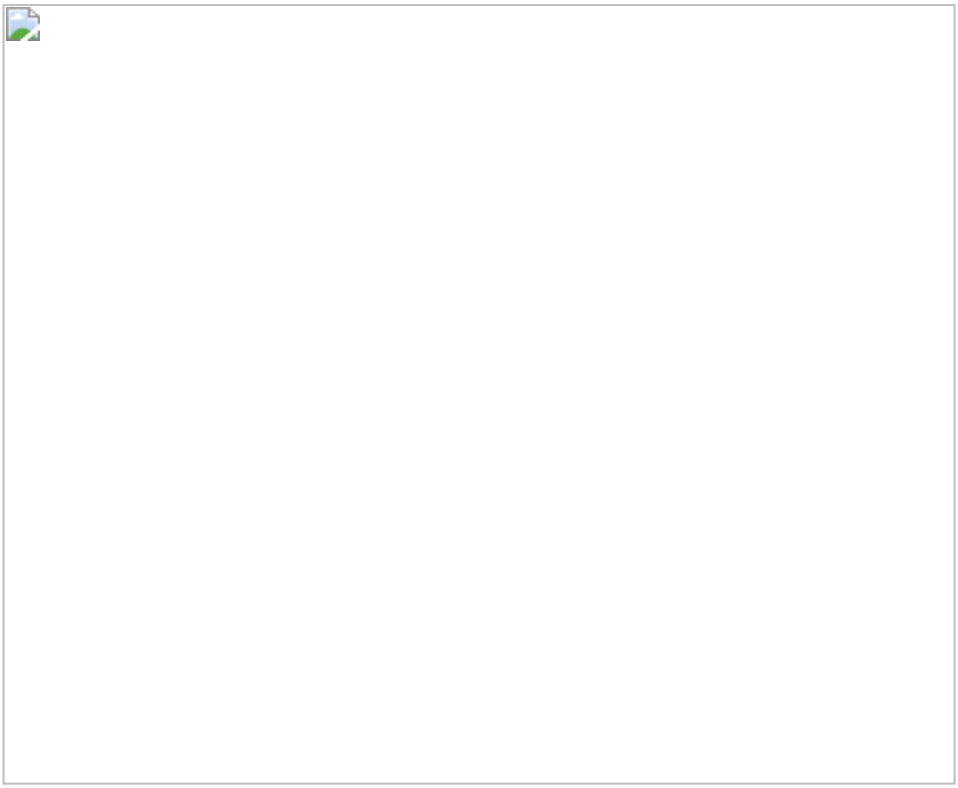
(Res. 39-04, 4-21-04)

29.44.610 Traffic control in construction areas – 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 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 copy shall be placed in the engineering project file. The contractor shall have one approved copy of the traffic control plan on-site at all times.

(Res. 39-04, 4-21-04)

29.44.620 Traffic control in construction areas – 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.



(Res. 39-04, 4-21-04)

Chapter 29.48
TRANSIT, BICYCLE AND PEDESTRIAN FACILITIES

Sections:

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 GJMC.

(Res. 39-04 (§ 11.0), 4-21-04)

29.48.020 Transit facilities.
All transit facilities shall conform to the Transit Design Standards and Guidelines for all Development in Mesa County. As part of the development review process, all new development shall accommodate transit in the overall development process.

(Res. 39-04 (§ 11.1), 4-21-04)

29.48.030 Planning and design standards for bicycles.
The AASHTO publishes The Guide for the Development of Bicycle Facilities, 1999, to address planning and implementation of bike facilities. Additionally, the American Planning Association publishes a guide entitled “Bicycle Facility Planning” to guide the planning process.

The Grand Junction area has adopted an Urban Trails Master Plan. The plan shows existing and future paths, off-road routes and on-street routes. All development shall comply with the plan.

(Res. 39-04 (§ 11.2), 4-21-04)

29.48.040 Facility type.
(a) AASHTO has developed three major classes of facilities that are used by bicyclists. They are:

(1) A *shared use path* which is a separate multi-use bike trail that has an alignment separate from automobile traffic that is typically 12 feet wide or more.

(2) A *bike lane* facility which is a striped bike lane on a street. The lane is typically four feet wide.

(3) A *signed shared roadway* facility which is an on-street bike route that is designated by signage alone.

(b) The design standards for these different facilities are contained in the AASHTO manual; however, the list below is a list of the minimum bicycle facility design standards to be provided:

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

(2) Bicycle lanes as one-way in same direction of travel as vehicles, and marked as such. For shared use paths, refer to AASHTO for the proper buffering.

(3) Six feet or greater shoulder width on rural roads. Minimum widths are four feet on an open shoulder and five feet against a curb or guardrail.

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

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

(6) Avoid diagonal on-street parking.

(7) Implement bike sensitive traffic detector loops where possible.

(Res. 39-04 (§ 11.2.1), 4-21-04)

29.48.050 Pedestrian facilities.
(a) Pedestrian facilities are required as a part of the street cross-section, as detailed in the City

Standard Details. Detached paths that are constructed must conform to these details as well.

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

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

(2) 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.

(3) 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.

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

(5) 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.

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

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

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

(3) 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.

(Res. 39-04 (§ 11.3), 4-21-04)

Urban Trail Master Plan (PDF)

Chapter 29.52
TRANSIT DESIGN STANDARDS AND GUIDELINES

Sections:

29.52.010 Objectives and transit service area.

These guidelines describe the recommended methodology for the location and design of transit stops and other transit facilities within the Grand Valley Transit service area. A number of specific elements are included – guides to the location and design of stops, proper placement of amenities at stops, and general guidelines for other transit facilities.

Although the process of location and designing bus stops would appear fairly simple to the casual observer, creating a design with optimal transit facilities requires the consideration of many factors. The ideal arrangement of bus stops from the transit user's point of view includes frequent stops in the travel lane of the roadway and sidewalk or trail connections to the user's destination. However, from the perspective of the other users of the roadway, the ideal arrangement for bus

stops is infrequent stops placed in turnouts out of the travel lane. These guidelines seek a balance of the needs of all roadway users.

Improved pedestrian systems connected to transit stops will make using the transit system safer and more enjoyable. Appropriately located turnouts will enhance user safety while minimizing delay to traffic. As barriers to transit use are removed, the system will become easier for all residents to use.

(Res. 39-04, 4-21-04)

GVTmap (PDF)

29.52.020 Transit stop location and type.
Decisions regarding bus stop frequency, location and length call for careful analysis of passenger service requirements, the type of service provided and the interaction of stopped buses with general traffic flow. Achieving a balance of convenience to both the transit passenger and the auto user is a prime objective.

(a) **Stop Spacing and Location.** The proper location of a transit stop requires a site investigation of the stop(s) under consideration; no standard type of stop can be recommended for all locations. An inventory of land uses within a quarter-mile corridor of the road under consideration should be developed, noting uses that serve as major trip producers and attractions. The bus stop location flow chart outlines the sequence of decisions for locating a transit stop. The administrative regulation details the process for requesting changes to stops.

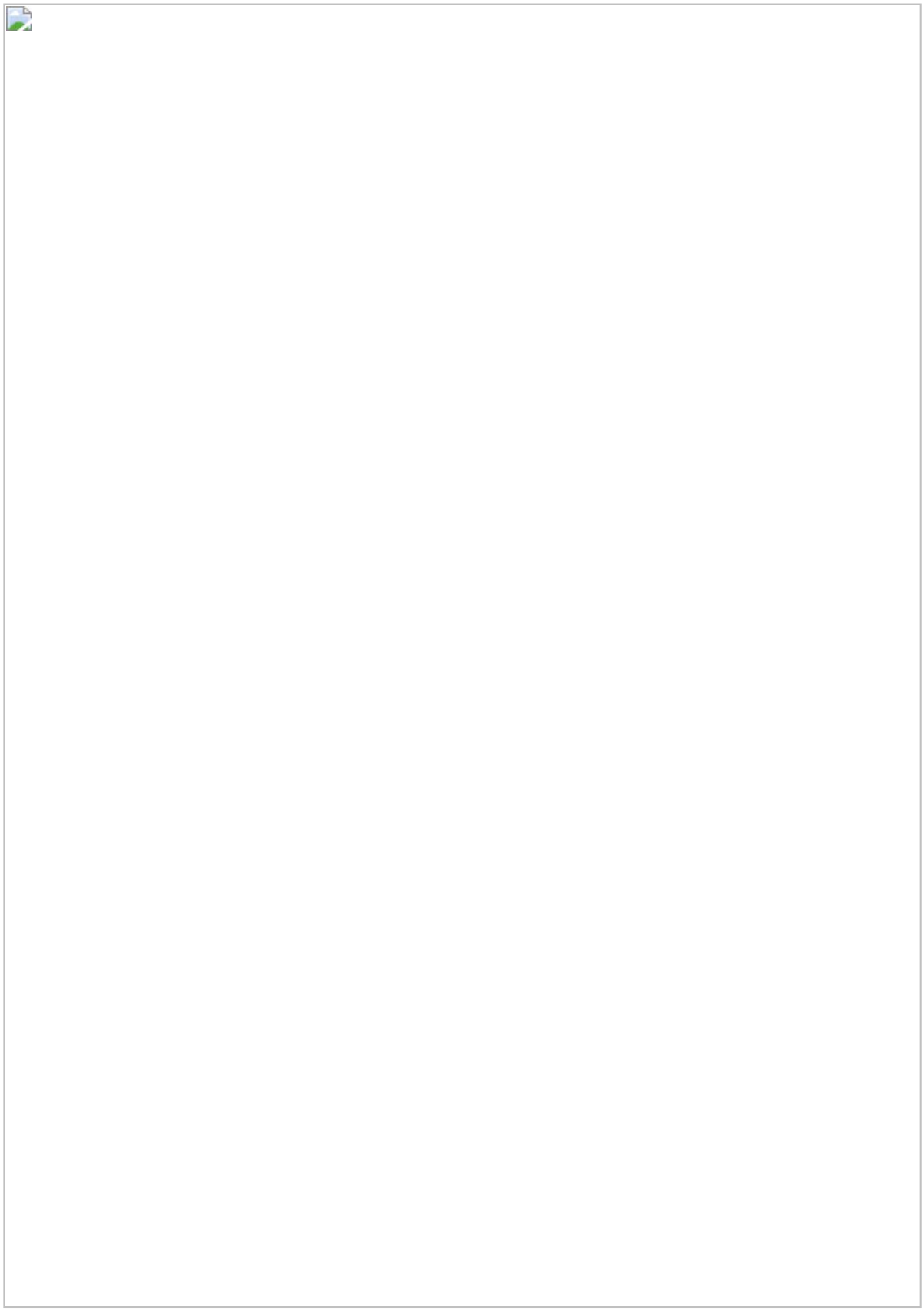
(b) **Stops at Major Generators.** Stops should be located within a short walk from schools, major retail malls, office buildings and multi-unit apartments. These stops provide access to the transit system for uses that generally produce numerous transit riders. Bus stops should be located to balance good rider access with pedestrian safety. Stop locations should minimize the potential for jaywalking while minimizing rider walking distance and avoiding unnecessary crosswalk movements.

(c) **Stops at Signalized Intersections.** Stops at the far-side of signalized intersections can operate conveniently for both auto and transit users. Buses can use the gaps in the traffic stream created by the signal to pick up and discharge passengers and to reenter traffic.

(d) **Intermediate Stops.** Transit industry standards suggest that most riders will not want to walk more than one-quarter mile to a bus stop. Stops for areas of low to moderate passenger demand should be preliminarily established by applying the one-quarter mile criteria. Bus stop spacing should be related to ridership density; stops should be closer together in the major commercial districts and farther apart in the outlying areas. Ideally, stops should be as far apart as possible without adversely affecting passenger convenience. Recommended ranges for bus stop spacing are as follows:

Major Commercial Areas	500 – 800 feet
Urban	700 – 1,000 feet
Suburban	1,000 – 1,500 feet

In suburban areas, consideration should be given to how far a person must walk to get to the street with bus service. Stops on both sides of a two-way street should be paired up whenever possible to provide passengers with boarding and alighting points near one another.



(e) **Refining Transit Stop Locations.** In general, stops should be located after (far-side of) an intersection to facilitate bus and traffic operations. However, far-side stops are occasionally impractical or conflict with existing development.

Specific attributes of potential transit stops must be reviewed. Sight distance is critical. Transit drivers need to be able to see to the rear sufficiently to safely re-enter traffic, following vehicles

need to see the stopped bus in time to safely stop or merge left, and vehicles on side streets or driveways need to be able to see oncoming traffic.

(1) Far-side transit stops are recommended under the following conditions:

(i) At intersections controlled by signals, stop or yield signs.

(ii) The traffic is heavier on the approach side than on the departure side of an intersection.

(iii) The intersecting street is a one-way street with traffic moving from left to right when viewed as one approaches the intersection.

(iv) At intersections where heavy left or right turns occur.

(v) At intersections where the bus route and heavy traffic movements diverge.

(2) Advantages of far-side stops:

(i) Reduced conflicts between right-turning vehicles and stopped buses.

(ii) Additional intersection capacity is provided by making the approach curb lane available for traffic.

(iii) Sight-distance deficiencies created by buses stopped near-side of the intersection are eliminated.

(iv) Shorter maneuvering distances for the buses to enter and leave moving traffic are required.

(v) Increased ease and speed for bus re-entering the traffic stream during heavy traffic, as a result of platooning of traffic at signalized intersections.

(3) Disadvantages of far-side stops:

(i) Intersections may be blocked if other vehicles park illegally in the stop, obstructing buses and causing traffic to back up across the intersection.

(ii) A bus at a far-side stop obscures sight distance to the right of a driver entering the intersection from the right.

(iii) Where the bus stop is too short for multiple buses stopping at the same time, the overflow will obstruct the cross street.

(4) Near-side stops are recommended under the following conditions:

(i) Traffic is heavier on the departure side than on the approach side of the intersection.

(ii) The cross street is a one-way street where traffic flows from right to left.

(iii) Where the transit route turns right, a near-side stop should be established before the turn.

(iv) At intersections controlled by signals, stop or yield signs when transit operations are more critical than traffic or parking.

(5) Advantages of near-side stops:

(i) Create a minimum of interference at locations where traffic is heavier on the far-side of an intersection.

(ii) Passengers generally board buses closer to a crosswalk, minimizing walking distance.

(6) Disadvantages of near-side stops:

(i) Heavy vehicular right turns can cause conflicts, especially where a vehicle makes a right turn from the left of a stopped bus.

(ii) Buses often obscure stop signs, traffic signals, or other control devices, as well as pedestrians crossing in front of the bus.

(iii) The sight distance of a driver entering an intersection is diminished from the right.

(iv) The bus re-entering traffic flow after stopping often must wait through several cycles.

(v) Lengthy separate right-turn lanes cause the bus stops to be located too far from the intersection.

(7) Mid-block stops are recommended under the following conditions:

(i) Traffic or street characteristics prohibit a near or far-side stop at an intersection.

(ii) Large transit passenger generators exist and heavy ridership makes the location desirable.

(iii) Blocks are exceptionally long and allow adequate distance for the bus to merge into a left-turn lane if required.

(iv) A median island exists in the roadway.

(8) Advantages of mid-block stops:

(i) Buses create a minimum of interference with sight distance for both vehicles and pedestrians.

(ii) Waiting passengers assemble at less crowded sections of the sidewalk.

(9) Disadvantages of mid-block stops:

(i) The removal of curbside parking may be required.

(ii) Patrons from a cross-street may have to walk farther to board the bus.

(iii) Pedestrian jaywalking is more prevalent, resulting in increased friction, congestion and potential accidents.

(f) On-Street or Off-Street? The decision to place a bus stop off-street in a turnout should be made carefully. The decisions will affect the ability of the roadway and transit to move people safely and quickly. The bus stop type flow chart depicts the decision-making process.

(Res. 39-04, 4-21-04)

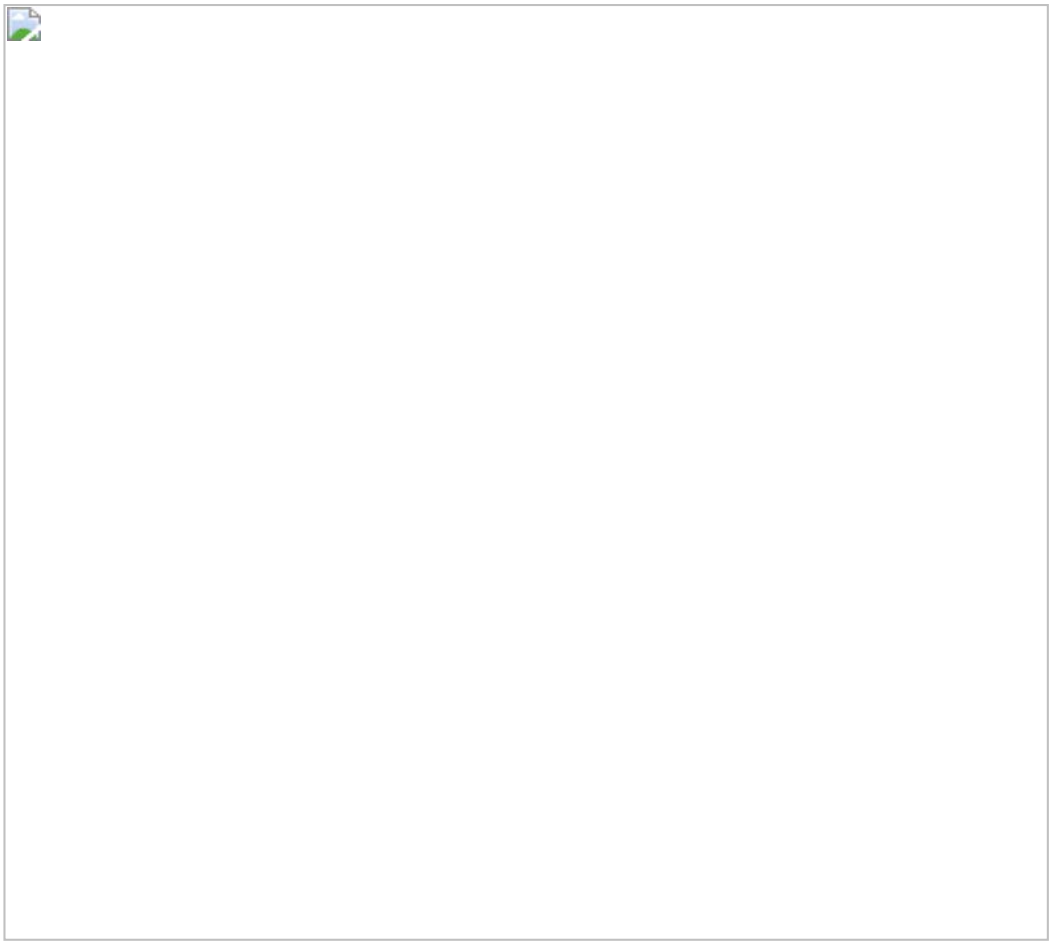
29.52.030 Transit stop design.

Transit stops serve as interface points between sidewalk/trail systems, street networks and transit routes. Consequently, transit stop designs should provide access, temporary and permanent storage capacity and through traffic bypass capacity.

(a) **On-Street Stops.** On-street stops need to be located minimum distances from intersections and driveways to avoid conflicts. On streets with on-street parking, the parking must be removed to allow for the stop and is a consideration in siting stops. Figure 29.52.030.A shows the minimum distances from intersections for stops.

Figure 29.52.030.A

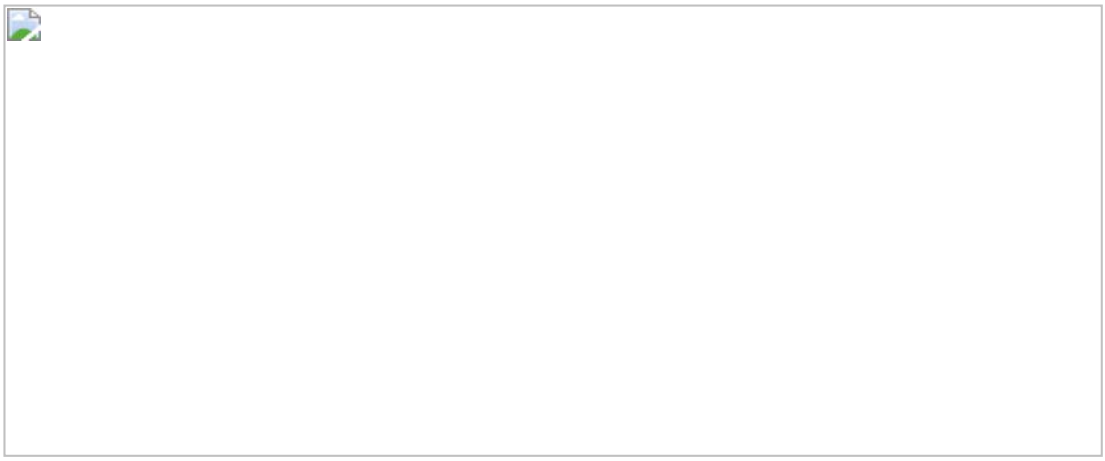
On-Street Transit Stops



(b) **Off-Street Turnouts.** Off-street turnouts allow buses to pull out of the traffic stream. The geometric layout is shown in Figure 29.52.030.B. Turnouts should not be located where there are potential rear sight distance problems. The desirable surface material for turnouts is concrete pavement. If asphalt pavement is used, the pavement design must be structurally sufficient for the shear forces created by buses turning into and out of the turnout.

Figure 29.52.030.B

Off-Street Transit Turnout – Grand Valley Transit



(c) **Facility Access.** Transit stops shall be connected with an accessible route to all streets, sidewalks and/or trails within the site boundary. The site boundary is defined by the beginning and end of the transit stop, the adjacent street and the right-of-way line for the street segment. Where a transit stop serves as a transfer point, the site boundary and an accessible route shall extend to the connecting route bus stops. Where a bus stop is the closest stop to an intersection, major generator or other private development, it is necessary to extend the site boundary and route to the generator or development. In the case of a mid-block stop with no adjacent sidewalk or trail, it is desirable to provide an accessible route to the nearest intersection or signalized crosswalk.

Accessible routes shall meet adopted standards for sidewalks and trails, including accessible standards for grades and ramps.

(d) **Transit Stop Amenities.** Amenities include the following:

(1) Waiting Areas. The stop should include adequate area and clearance for passenger access to buses, other amenities, and connecting sidewalks and trails.

(2) Benches. Bench placement shall be no closer than five feet from the curb where the posted speed limit is 35 miles per hour or less; no closer than 10 feet from the curb where the posted speed limit is greater than 35 miles per hour; and no closer than 10 feet where there is no curb. Bench design and construction must conform to the applicable zoning and development code.

(3) Shelters. Shelter placement shall meet the minimum standards established for benches. Shelters need to be aesthetically and functionally compatible with nearby uses. A shelter should not severely affect an adjacent residence or business use. Shelters should be considered at the following locations:

(i) Any stop serving more than 40 boarding/transferring passengers per day within major commercial areas.

(ii) Any stop serving more than 25 boarding/transferring passengers per day within urban and suburban areas.

(iii) Any stop that is a major transfer point between routes.

(iv) Any stops located near schools, senior citizen housing facilities or community recreation centers where large concentrations of the young or elderly are expected.

(4) Signs. All bus stops will be signed. Sign placement is shown in Figures 29.52.030.A and 29.52.030.B.

(5) Route and Schedule Information. Information including bus route, numbers, schedule information, transit riding tips and other appropriate information should be placed at all stops.

(6) Illumination. Passenger safety is enhanced by adequate lighting. Direct illumination of waiting passengers by a streetlight allows the transit driver to easily see waiting passengers. Supplemental lighting shall be provided at shelters in accordance with the applicable zoning and development code requirements.

(Res. 39-04, 4-21-04)

29.52.040 Bus stop siting and review policy.

Regional Transportation Planning Advisory Committee and the Mesa County Regional Transportation Planning Office

POLICY 1.0 – GRAND VALLEY TRANSIT POLICIES AND PROCEDURES

BUS STOP SITING AND REVIEW

ARTICLE I, PURPOSE

This policy and procedure establishes a systematic process for the purpose of siting new bus stops and reviewing current bus stops if any under scrutiny. This allows all staff, citizens and public officials to know exactly how new bus stops are sited and how bus stops can be reviewed in the case of criticism or complaints. This policy and procedure also ensures that the bus stops receive the proper technical review before they are moved or established.

ARTICLE II, BACKGROUND

Mesa County's contracted transit services, known as Grand Valley Transit (GVT), are overseen by the Regional Transportation Planning Office (RTPO). It has been the intent of the RTPO that all GVT bus stops are in compliance with the regulations that govern these types of uses in each applicable jurisdiction. It is also the RTPO's intent to provide an established and consistent method for the review of current bus stops when one is under scrutiny.

ARTICLE III, FARE INCREASE AND MAJOR SERVICE CHANGES

1. Initial Coordination by the Regional Transportation Planning Office (RTPO)

The suggestion of a potential bus stop location may originate from any of a number of sources. Each potential bus stop suggestion will be referred to the RTPO for coordination among the requisite agencies.

2. Functionality Assessment

Once a potential bus stop location has been proposed, the RTPO's Transit Coordinator will meet with the Operations Manager from Grand Valley Transit (GVT) to assess the functionality of the proposed bus stop. If the proposed stop meets GVT's functionality requirements, the Transit Coordinator will proceed with approval by the appropriate Traffic and/or Planning Departments and review of bench and/or shelter feasibility.

3. Bench and/or Shelter Feasibility

The Transit Coordinator will meet with a representative of the transit amenities provider to study the feasibility of adding a bench and/or shelter at the proposed stop either directly or in the future. If it is feasible for a bench and/or shelter to be installed at the proposed bus stop location, it is the responsibility of the transit amenities provider to obtain all necessary permits and/or other required documentation from the appropriate local agency and/or private property owner before the transit amenity is installed. If no bench and/or shelter is proposed, no further action in this area will be taken.

4. Approval by Traffic Departments

The proposed bus stop location must be approved to meet all of the appropriate Traffic Department's regulations for safety and access management.

5. Approval by Planning Departments

If there is a feasibility of adding a transit amenity to the proposed bus stop, the Transit Coordinator will forward the proposed stop location to the appropriate Planning Department for review of code compliance and zoning designation of the proposed stop.

6. Feedback Coordination by RTPO

Revisions by any of the participating agencies to the original bus stop location proposal will be referred to the Transit Coordinator for modification of the original proposal and re-sent to the appropriate agency for approval.

7. Notification to Agencies and Affected Property Owners

The Transit Coordinator will provide notification to the appropriate agency upon completion of the approval process. A letter of notification will be sent to any affected property owner/s informing him or her of the forthcoming bus stop.

8. Implementation

Implementation of a new or revised bus stop location will not commence until after the completion of the Bus Stop Siting Policy and Procedures process.

9. Complaint Procedure

Any complaints regarding an existing bus stop location will follow the adopted Bus Stop Siting Policy and Procedures process.

THE REGIONAL TRANSPORTATION POLICY ADVISORY COMMITTEE HEREBY APPROVES AND ADOPTS THE BUS STOP SITING POLICY AND PROCEDURES ON JANUARY 17, 2002.

_____

Kathy Hall

Chair, Regional Transportation Policy Advisory Committee

(Res. 39-04, 4-21-04)

Transit Routes (PDF)

Chapter 29.56
ALLEY STANDARDS

Sections:

29.56.010 Alley construction.

Alleys are a useful alternative for accessing properties, especially in the Central Business District (CBD). The construction of new alleys shall follow the design standards defined in the standard detail for alleys in the Standard Street Detail in GJMC 29.56.030. Any variation from the specifications defined in this drawing must go through the design exception process.

(Res. 39-04 (§ 12.0), 4-21-04)

29.56.020 Building setbacks.

Garages with overhead doors facing the alley must be set back a minimum of 25 feet from the far edge of the alley or the zoning setback, whichever is greater. This allows adequate maneuver room for backing and turning.

(Res. 39-04 (§ 12.1), 4-21-04)

29.56.030 Alley Standard Street Detail.

(Res. 39-04 (§ 12.0), 4-21-04)

Chapter 29.60
PRIVATE STREETS, SHARED DRIVEWAYS AND LOOP LANES

Sections:

29.60.010 Generally.

Private streets may be considered as an alternative to residential public streets without a specific design exception if the standards in this chapter are met. Private streets have historically posed problems over time as they deteriorate and property owners do not realize the burden of maintenance is theirs. Application of the criteria established in this chapter should avoid problems encountered in the past with private streets and provide property owners some protection through a maintenance agreement and funding.

The shared driveway (also called an “autocourt”) is a private street. The loop lane is intended as an alternative public street.

(Res. 39-04 (§ 13.0), 4-21-04)

Chapter 29.64
DESIGN EXCEPTIONS

Sections:

29.64.010 Design exceptions.

(a) This manual establishes standards for the construction of transportation and infrastructure improvements in the City and urban areas of the County. 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.

(b) 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.

(c) The flowchart depicts the design exception process.

(d) 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.

(e) 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.

(f) 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.

(g) 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.

(1) Colorado State Highway Access Code.

(2) CDOT Roadway Design Manual.

(3) Institute of Transportation Engineers’ “Traffic Engineering Handbook.”

(4) American Association of State Highway and Transportation Officials “A Policy on Geometric Design of Highways and Streets.”

Design Exception Process

(Res. 39-04 (§ 14.0), 4-21-04)

Chapter 29.68
ALTERNATE RESIDENTIAL STREET STANDARDS

Sections:

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 GJMC, 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.

(Res. 39-04 (§ 15.0), 4-21-04)

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.

(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. 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, limited block length, and possibly an alley, 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. 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 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.

(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.

(Res. 39-04 (§ 15.1), 4-21-04)

29.68.030 Application.

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, addressing design elements 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.

(Res. 39-04 (§ 15.2), 4-21-04)

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.

(Res. 39-04 (§ 15.3), 4-21-04)