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CHAPTER 2 – STREET IMPROVEMENT DESIGN & CONSTRUCTION STANDARDS

2.1 ENGINEERING

2.1.1 Introduction

This section outlines design and construction requirements for all public street construction. The provisions and technical specifications herein set forth the requirements of the City of Independence for roadway construction and improvements. Interpretations of such provisions and their application in specific circumstances shall be made by the City Engineer. Refer to Chapter 1 for general provisions and requirements. All street designs shall provide for safe and efficient travel for the public. Streets shall be designed per the current Transportation System Master Plan to carry the recommended traffic volumes identified for each street classification. Streets shall also be designed to meet or exceed minimum guidelines. These guidelines are set forth in the "AASHTO Policy on Geometric Design of Highways and Streets" (latest edition). Traffic Control Devices shall conform to the "Manual on Uniform Traffic Control Devices for Streets and Highways," Federal Highway Administration, with Oregon Supplements, Oregon Dept. of Transportation's (latest edition)

2.1.2 Alternative Designs

A. If approved by the Public Works Director, alternative roadway design standards may be substituted for the standards specified herein. Any requests for substitution must be in writing, stamped by a Professional Engineer registered in the State of Oregon at the time of submittal, and submitted as part of the Land Use process.

B. If approved by the Public Works Director, alternative construction standards may be substituted for the standards specified herein. Any requests for substitution must be in writing, stamped by a Professional Engineer registered in the State of Oregon at the time of submittal, and submitted at least three weeks prior to the Engineering Plan Review submittal process.

2.1.3 General Requirements

A. **Functional Classification:** The functional classification of existing and proposed roads is established by the City of Independence's Transportation System Plan (TSP). Where the functional classification of a road is not defined by the TSP, the existing land use and existing operational characteristics shall be used by the Public Works authorized representative to determine the functional classification of the road in question.

B. **Access:** Access to city, county, and public roads shall conform to the City of Independence TSP.

C. **Width:** The width of the streets shall be in compliance with the City of Independence TSP and using **Table 2.1**. The City may increase the right-of-way and roadway widths at intersections.

Table 2.1 STREET AND RIGHT-OF-WAY WIDTHS

Type of Street	Right-of-Way	Roadway
Major Arterial - Typical	62’	36’
Major Arterial (With Turn Lane)	74’	48’
Major Arterial – OR 51 (West of Ash Creek)	74’	48’
Major Arterial – OR 51 (East of Ash Creek)	64’	38’
Major Arterial (Downtown)	70’	44’
Major Arterial (North of Downtown)	70’	48’
Minor Arterial - Typical	62’	36’
Minor Arterial (With Left Turn Lane)	74’	48’
Collector < 2,000 ADT (On-Street Parking)	60’	36’
Collector > 2,000 ADT (With Buffered Bike lanes)	60’	36’
Collector (With Left Turn Lane)	72’	48’
Collector (With Shared Use Path)	60’	29’
Local – Typical With On-Street Parking Both Sides	58’	34’
Local – No Parking	44’	20’
Cul-de-sac	45’ Radius	38’ Radius
Alley	20’	18’

D. **Number of Lanes:** The number of lanes for each class of road is defined by the City of Independence TSP. The City of Independence may require additional turning lanes where required by the Public Works Director or a traffic engineer’s report evaluating the need for additional turning lanes. Additional right-of-way width may be required to accommodate turning lanes, parking, and bike lanes.

E. **Sidewalks and Planter Strips:** Streets shall be provided with sidewalks and planter strips as specified in the City of Independence TSP.

F. **Design Speed:** The posted vehicle speed shall be 85% of design speed unless the road improvement increases to 85% speed. If road improvement is likely to increase the 85% speed, the design speed will be as follows using **Table 2.2**.

Table 2.2 DESIGN SPEED

Type of Street	Speed (mph)
Arterial (State)	Varies
Arterial (City)	30 - 45
Collector	25 - 30
Local	25
Cul-de-sac	25

2.1.4 Transportation Impact Analysis/Transportation Analysis Letter

Transportation Impact Analysis (TIA) is required for developments that are expected to have an impact on the transportation system. The analysis shall be based upon the latest edition of the ITE Trip Generation Manual or an agreed-upon alternative methodology where credible data is available to support the alternative methodology. When specific criteria generally associated with small developments are met, a Transportation Analysis Letter (TAL) may be substituted for the required TIA. At the discretion of the City Engineer, a TAL may satisfy the City's transportation analysis requirements, in lieu of a TIA, when a development meets all the following criteria:

A. The development generates fewer than 25 peak hour trips during either the AM or PM peak hour. (Two examples of common developments generating fewer trips than these threshold levels are: a subdivision containing 25 or fewer single-family residences or a general office (ITE 710) building less than 21,000 square feet).
B. The development is not expected to impact intersections that currently fail to meet the City's level of service standards or intersections that are operating near the limits of the acceptable level of service thresholds during a peak operating hour.
C. The development is not expected to significantly impact adjacent roadways and intersections that are high accident locations, areas that contain an identified safety concern, or high concentration of pedestrians or bicyclists such as school zones.
D. The development generates an increase in use of adjacent streets by vehicles exceeding the 20,000-pound gross vehicle weights by less than 10 vehicles per day.

Transportation Analysis Letter Contents: If the City determines based on information provided by the applicant and in accordance with the criteria specified above that a TAL is the appropriate document to submit, the following requirements shall apply.

A. The TAL shall be prepared by or prepared under the direct supervision of a Professional Engineer registered in the State of Oregon who shall sign and stamp the TAL.
B. The TAL shall include the following:
    1. The expected trip generation of the proposed development including the AM peak hour, the PM peak hour, daily traffic, and other germane periods as may be appropriate, together with appropriate documentation and references.
    2. Site plan showing the location of all access driveways or private streets where they intersect with public streets plus driveways of abutting properties and driveways on the opposite side of the street from the proposed development.
    3. Documentation that all site access driveways meet City of Independence Private Access Driveway Width Standards.
    4. Documentation that all site access driveways meet City of Independence's Minimum City Street Intersection Spacing Standards.

5. Documentation that all new site accesses and/or public street intersections meet AASHTO intersection sight distance guidelines.
6. Documentation that there are no inherent safety issues associated with the design and location of the site access driveways.
7. Documentation that the applicant has reviewed the City's TSP and that proposed street and frontage improvements do or will comply with any applicable standards regarding the functional classification, typical sections, access management, traffic calming and other attributes as appropriate.

Transportation Impact Analysis Requirements: Throughout development of the TIA (and beginning as early as possible), cooperation/coordination between the City of Independence and ODOT staff (as applicable), the applicant, and the applicant's traffic engineer is encouraged to provide an efficient and effective process.
City of Independence staff may, at their discretion, and depending on the specific situation, require additional study components in a TIA beyond what is outlined in this section or waive requirements deemed inappropriate.
These requirements are for subdivision and development applications that are expected to affect city and/or state facilities. For development applications that require an ODOT access permit, land use zoning changes, or comprehensive plan modifications, applicable ODOT requirements should be referenced and ODOT should be consulted during the project scoping process.
The City of Independence and ODOT assume no liability for any costs or time delays (either direct or consequential) associated with the preparation and review of a transportation impact analysis.

A TIA shall be required when:

A. The development generates 50 or more peak-hour trips or 500 or more daily trips.
B. An access spacing exception is required for the site access driveway(s) and the development generates 25 or more peak-hour trips or 250 or more daily trips.
C. The development is expected to impact intersections that are currently operating at the upper limits of the acceptable level of service during the peak operating hours; or
D. The development is expected to significantly impact adjacent roadways and intersections that have previously been identified as high crash locations or areas that contain a high concentration of pedestrians or bicyclists such as school zones.
E. A major construction project is anticipated to significantly impede normal traffic flow or roadway capacity, as determined by the Public Works Director.
F. A construction project is anticipated to cause significant deterioration of the roadway infrastructure, as determined by the Public Works Director.

Scoping Memorandum: For either a TIA or Transportation Assessment Letter, a scoping memorandum shall be prepared and submitted to the city and ODOT, if necessary. This memorandum must detail the proposed analysis approach, relevant assumptions, project background information, assumed trip generation and trip distribution for the site, and proposed study facilities, at a minimum.

Transportation Impact Analysis Contents: The following information shall be included in each TIA submitted to the City. Additional information specified by the City in the scoping summary or through the pre-application meeting or other project meetings shall also be included.

A. Completed TIA checklist signed by the Professional Engineer responsible for the preparation of the TIA.
B. Table of Contents – Listings of all sections, figures, and tables included in the report.

C. Executive Summary – A summary of key points, findings, conclusions, and recommendation including a mitigation plan.
D. Introduction, including:
   1. Proposed land use action including site location, zoning, building size, and project scope
   2. Map showing the proposed site, building footprint, access driveways, and parking facilities.
   3. Map of the study area that shows site location and surrounding roadway facilities.
E. Existing Conditions:
   1. Existing site conditions and adjacent land uses.
   2. Roadway characteristics of important transportation facilities and modal opportunities located within the study area, including roadway functional classifications, street cross-section, posted speeds, bicycle and pedestrian facilities, on-street parking, and transit facilities.
   3. Existing lane configurations and traffic control devices at the study area intersections.
   4. Existing traffic volumes and operational analysis of the study area roadways and intersections.
   5. Roadway and intersection crash history analysis.
   6. Intersection and stopping sight distance related to new and impacted driveways and intersections.
F. Background Conditions (without the proposed land use action):
   1. Approved in-process developments and funded transportation improvements in the study area.
   2. Traffic growth assumptions.
   3. Addition of traffic from other planned developments.
   4. Background traffic volumes and operational analysis.
G. Full Buildout Traffic Conditions (with the proposed land use action):
   1. Description of the proposed development plans.
   2. Trip generation characteristics of proposed project (including trip reduction documentation).
   3. Trip distribution assumptions.
   4. Full buildout traffic volumes and intersection operational analysis.
   5. Site circulation and parking.
   6. Intersection and site-access driveway queuing analysis.
   7. Recommended roadway and intersection mitigation measures (if necessary).
H. Conclusions and recommendations
I. Appendix- With dividers or tabs
   1. Traffic count summary sheets.
   2. Crash analysis summary sheets.
   3. Existing, Background, and Full Buildout traffic operational analysis worksheets with detail to review capacity calculations.
   4. Signal, left-turn, and right-turn lane warrant evaluation calculations.
   5. Signal timing sheets depicting the timing and phasing used in analysis.
   6. Other analysis summary sheets such as queuing.
J. To present the information required to analyze the transportation impacts of development, the following figures shall be included in the TIS:
   1. Vicinity Map.
   2. Existing Lane Configurations and Traffic Control Devices.
   3. Existing Traffic Volumes and Levels of Service for each required time period.
   4. Future Year Background Traffic Volumes and Levels of Service for each required time period.

5. Proposed Site Plan, including access points for abutting parcels and for those across the street from the proposed development.
6. Future Year Assumed Lane Configurations and Traffic Control Devices.
7. Estimated Trip Distribution/Assignment Pattern.
8. Trip reductions (pass-by trips at site access(es))
9. Site-Generated Traffic Volumes for each required time period.
10. Full Buildout Traffic Volumes and Levels of Service for each required time period.

Study Area: The study area shall include, at a minimum, all site-access points, and intersections (signalized and unsignalized) adjacent to the proposed site. If the proposed site fronts an arterial or collector street, the study area shall include all intersections along the site frontage and within the access spacing distances extending out from the boundary of the site frontage. Beyond the minimum study area, the transportation impact analysis shall evaluate all intersections that receive site-generated trips comprising at least 10% or more of the total intersection approach volume. In addition to these requirements, the City Public Works Director (or his/her designee) shall determine any additional intersections or roadway links that might be adversely affected as a result of the proposed development. The applicant and the Public Works Director (or his/her designee) will agree on these intersections prior to the start of the transportation impact analysis, preferably with input from ODOT if any state-owned facilities may be affected. The required study area may need to be expanded to comply with ODOT requirements.

Study Years to be Analyzed in the Transportation Impact Analysis: A level-of-service analysis shall be performed for all study roadways and intersections for the following horizon years:

A. Existing Year. Evaluate all existing study roadways and intersections under existing conditions.
B. Background Year. Evaluate the study roadways and intersections in the year where the proposed land use is expected to be fully built out, without traffic from the proposed land use. This analysis should include traffic from all approved developments that impact the study intersections, or planned developments that are expected to be fully built out in the horizon year.
C. Full Buildout Year. Evaluate the expected roadway, intersection, and land use conditions resulting from the background growth and the proposed land use action assuming full build-out and occupancy. For phased developments, an analysis shall be performed during each year a phase is expected to be completed.
D. Twenty-Year Analysis. For all land use actions requesting a Comprehensive Plan Amendment and/or a Zone Change, a long-term level-of-service analysis shall be performed for all study intersections assuming buildout of the proposed site with and without the comprehensive plan designation and/or zoning designation in place. The analysis should be performed using the future year traffic volumes identified in the Transportation System Plan (TSP). If the applicant's traffic engineer proposes to use different future year traffic volumes, justification for not using the TSP volumes must be provided along with documentation of the forecasting methodology. The required study area may need to be expanded to comply with ODOT requirements.

Study Time Periods to be Analyzed in the Transportation Impact Analysis: Within each horizon year, a level-of-service analysis shall be performed for the time period(s) that experience the highest degree of network travel. These periods typically occur during the mid-week (Tuesday through Thursday) morning (7:00 a.m. to 9:00 a.m.), mid-week evening (4:00 p.m. to 6:00 p.m.), and Saturday afternoon (12:00 p.m. to 3:00 p.m.) periods. The transportation impact analysis should always address the weekday a.m. and p.m. peak hours when the proposed land use action is expected to generate 25 trips or more during the peak time periods. If the applicant can demonstrate that the peak-hour trip generation of the proposed land use action is negligible during one of the two peak study periods and the peak trip generation of the land use action corresponds to the roadway system peak, then only the worst-case study period need be analyzed.

Depending on the proposed land use action and the expected trip-generating characteristics of that development, consideration of non-peak travel periods may be appropriate. Examples of land uses that have non-typical trip generating characteristics include schools, movie theaters, and churches. The Public Works Director (or his/her designee) and applicant should discuss the potential for additional study periods prior to the start of the transportation impact analysis.

Traffic Count Requirements: Once the study periods have been determined, turning movement counts should be collected at all study area intersections to determine the base traffic conditions. These turning movement counts should typically be conducted during the weekday (Tuesday through Thursday) between 7:00 and 9:00 a.m. and between 4:00 and 6:00 p.m., depending on the proposed land use. Historical turning movement counts may be used if the data is less than two years old but must be factored to meet the existing traffic conditions.

Trip Distribution: Estimated site-generated traffic from the proposed development should be distributed and assigned on the existing or proposed arterial/collector street network. Trip distribution methods should be based on a reasonable assumption of local travel patterns and the locations of off-site origin/destination points within the site vicinity. Acceptable trip distribution methods should be based on one of the following procedures:

A. An analysis of local traffic patterns and intersection turning movement counts gathered within the previous 12 months.
B. A detailed market study that is specific to the proposed development and surrounding land uses.

Intersection Operation Standards: The City of Independence will evaluate intersection operational performance based on level of service.

Intersection Levels of Service: The City of Independence will require all intersections within the study area to maintain an acceptable level of service (LOS) upon full buildout of the proposed land use action. LOS calculations for signalized intersections are based on the average control delay per vehicle, while LOS calculations for unsignalized intersections are based on the average control delay for the worst or critical movement. All LOS calculations should be made using the methods identified in the most recent version of the Highway Capacity Manual, published by the Transportation Research Board. The minimum acceptable level of service for signalized intersections is LOS “D” while the minimum acceptable level of service for unsignalized intersections is LOS “E”. Any intersections not operating at these standards will be considered to be unacceptable.

Review Policy and Procedure: The following criteria should be used in reviewing a transportation impact analysis as part of a subdivision or site plan review.

A. The road system is designed to adequately meet the projected traffic demand at full build-out.
B. Proposed driveways do not adversely affect the functional characteristics of the surrounding roadways.
C. Adequate intersection and stopping sight distance is available at all driveways.
D. Proposed driveways meet the City and ODOT’s access spacing standard or sufficient justification is provided to allow a deviation from the spacing standard.
E. Opportunities for providing joint or crossover access have been pursued.
F. The site does not rely upon the surrounding roadway network for internal circulation.

G. The road system provides adequate access to buildings for residents, visitors, deliveries, emergency vehicles, and garbage collection.
H. A pedestrian path system is provided that links buildings with parking areas, entrances to the development, open space, recreational facilities, and other community facilities per the Transportation Planning Rule.

2.1.5 Street Plans

A. It is the design engineer's responsibility to ensure that engineering plans are sufficiently clear and concise to construct the project in proper sequence, using specified methods and materials, with sufficient dimensions to fulfill the intent of the design guidelines in these standards.
B. All elevations on design plans and record drawings shall be based on an official benchmark acceptable to the City and be based on the NAVD 1988 datum to match the FEMA flood map elevations.
C. All engineering street plans shall be stamped by a Professional Engineer registered in the State of Oregon. At a minimum, the street plan shall contain the following:
    1. At least one sheet showing a plan view of the entire project site. If the project site is sufficiently large that detailed street plans on any given sheet do not encompass the entire project site, then a sheet showing the plan view of the entire site must serve as an index to subsequent detailed plans sheets.
    2. A topographic map showing existing conditions for the site, including:
        a) Existing topography for the site.
        b) Adjacent streets, including street names.
        c) Existing utilities, including franchised utilities above or below ground and drainage facilities that transport surface water onto, across, or from the project site. Existing drainage pipes, culverts, and channels shall include the invert or flow line elevations.
        d) Existing sensitive areas (e.g., ravines, swales, steep slopes, wells, springs, wetlands, creeks, lakes). For natural drainage features, show direction of flow, drainage hazard areas, and 100-year floodplain boundary (if applicable).
    3. Plans for proposed street improvements shall include the following:
        a) Grading and erosion control plans.
        b) Finished grades, showing the extent of cut and fill by existing and proposed contours, profiles, or other designations. Finished elevations shall be identified at all property corners.
        c) Curb return elevation data.
        d) ADA ramp elevation data for the four corners of the ramp; also, for connecting sidewalks up to a maximum distance of 15 feet out from ramp when running slopes exceed the general grade established for the adjacent street.
        e) Proposed structures, including roads and road improvements, parking surfaces, building footprints, walkways, landscaped areas, street lighting, public and private utilities, etc.
        f) Signing and striping plan.
        g) Lighting and illumination plan.
        h) Applicable detail drawings.
        i) Existing and proposed easements.
        j) Setbacks from environmentally sensitive areas or wetlands.
        k) Any proposed phasing of construction. (Note: water quality and quantity facilities must be constructed before completion of any phased construction)

4. Detailed grading and landscape plans will be provided. The plans shall include the following:
    a) Existing ground contours (shaded) and proposed ground contours at a minimum of a 1-foot contour interval. Slopes steeper than 6H:1V shall be identified.
    b) Location of all drainage structures as well as any other piped utilities in vicinity (i.e., at 0.1-foot detail).
    c) Landscape planting plan. Show all sewer laterals, water services, fire hydrants, and street lighting.
    d) Irrigation plan to achieve the required plant survival rate.
    e) Maintenance access, as applicable.
5. Cross sections shall be provided for at least the following:
    a) All street sections in 100-foot intervals.
    b) All amended soil sections, as applicable.
    c) Proposed ditches and swales, including vegetated swales.

2.1.6 Standard Details

A. The Standard details included in the Appendix are supplemental to the text of these design standards and show the City's minimum requirements for the construction of certain standard system components.
B. In the case of conflicts between the text of these design standards and the standard details, the more stringent as determined by the City Engineer and Public Works Director shall apply.
C. As required by these standards, all applicable standard details shall be included in the construction drawings. Details shall be placed in numerical order on the detail sheets, for ease of reference during construction.

2.1.7 Surveying

A. The design engineer shall be responsible for establishing the location of the street by means of reference stakes offset along the centerline. No construction shall be allowed to begin before construction staking. All staking shall be performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
B. Reference stakes shall be set at 50-foot station intervals along the centerline. Stakes shall, at a minimum, reference the following:
    1. Point of Curvature (PC), midpoint, Point of Tangency (PT) for horizontal curves.
    2. Begin Vertical Curve (BVC) point, low/high point, End Vertical Curve (EVC) point for vertical curves.
    3. Beginning and ending point of super-elevation.
    4. Beginning and ending of full super-elevation.
    5. Centerline of intersecting street.
    6. PC, midpoint, and PT for curb returns.
    7. Centerline of ADA access ramp.
    8. Centerline of driveways.
    9. Curb scoring for match into concrete street joints.
C. The design engineer shall also be responsible for identifying easements during construction.

2.1.8 Monumentation

A. In accordance with ORS 92.060 Subsection (2), the centerline of all street right-of-way shall be monumented before the City shall accept a street improvement. Monuments shall be set under the direction of a registered Professional Land Surveyor. A record of survey must then be filed in compliance with ORS 209.250 and any additional requirements set forth by the City.

B. Any existing or new street or property survey monuments within the paved street improvement areas, driveways, sidewalks or other hard surface areas or areas subject to vehicular traffic shall be set flush with the finish pavement surface with 2-inch aluminum caps. The City reserves the right to require monument boxes per standard detail when directed by the Public Works Director.

C. The following street centerline monuments shall be set as a minimum:
   1. All centerline to centerline at intersections.
   2. The centers of all cul-de-sacs.
   3. Curve points in accordance with ORS 92.06 and 209.15.

D. All public utilities within the right-of-way shall be placed in positions that do not interfere with centerline monumentation.

2.1.9 Special Items

A. The design of the following is considered special items and are not covered in detail in these Standards:
   1. Intersections with State highways
   2. Intersections with railroads
   3. Commercial/Industrial entrances
   4. Signalized Intersections
   5. Bridges or Culverted Stream Crossings, including private bridges for fire lanes. (see OFC 503.2.6).

B. Review and approval of the above special items by the City Engineer and Public Works Director shall be required. When requested by the City, full design calculations shall be submitted for review prior to approval.

C. Bridges or culverts on fire lanes shall also be subject to review and approval by the fire code official per OFC 501.3.

2.1.10 Other Jurisdictions

A. Other than the City, there is one other agency with authority over streets or roads within the City Limits. This agency is the Oregon Department of Transportation (ODOT) with jurisdiction over Oregon Highway 51.

B. In all cases, the City design standards shall be considered to be the minimum allowable standards for any streets within the City Limits and Urban Growth Boundary. ODOT may have additional or more stringent requirements. Approval from ODOT will be required prior to construction activities on any street or road under their authority.

2.1.11 Streets with Marginal Access

Where a subdivision abuts or contains an existing or proposed arterial street, the Public Works Director may require marginal access streets, reverse frontage lots with suitable depth, screen planting contained in a non-access reservation along the rear or side property line, or such other treatment as may be necessary for adequate protection of residential properties to afford separation of through and local traffic.

2.2 STREET DESIGN

Streets shall be designed by a Professional Engineer registered in the State of Oregon. Four copies of the stamped and signed street design plans shall be provided to the City for review and approval. Plan reviews are conducted by Engineering, Operations, Planning, and the Polk County Fire District.

2.2.1 Subgrade Evaluation

A. A subgrade evaluation with recommendations shall be prepared, stamped, and signed by a Professional Engineer registered in the State of Oregon whose area of expertise is geotechnical engineering and shall be summarized in a Geotechnical Report. Two hard copies and one electronic PDF copy of this Geotechnical Report shall be provided to the City.

B. Soil testing to obtain the strength of the soil is required for all roads to analyze and design the road structural section. Soil tests are needed on samples of subgrade materials that are expected to be within 3 feet of the planned subgrade elevation. Samples are needed for each 500 feet of roadway and for each visually observed soil type. Soil tests are required for at least two locations. The engineer shall coordinate with the City Engineer prior to testing.

C. The selected design structural strength of the soil must be consistent with subgrade compaction requirements. That is, the strength and compaction moisture content at optimum to slightly over optimum must be specified. The Geotechnical Report shall address subgrade drainage and groundwater considerations for year-round conditions. Recommendations for both dry-weather and wet-weather construction shall be included.

D. Test the subgrade and determine the modulus of subgrade reaction, k, or the resilient modulus (M_R) to design the street structure. The procedure for determining M_R is given in AASHTO T-292. Alternatively, these soil strength criteria can be based on either the California Bearing Ratio (CBR) or H-veem resistance testing (R-value). The CBR will be determined in accordance with AASHTO T-193, based on the modified proctor (AASHTO T-180). R-values shall be determined at 300-psi exudation pressure in accordance with AASHTO T-190.

1) A correlation of M_R to CBR is given by the following relationship (Heukelom and Klomp, 1962):

   M_R (psi) = 1,500 x CBR

2) A correlation of M_R to R-value is given by the following relationship (Asphalt Institute)

   M_R (psi) = A + B x (R-value)

   Where A = 772 to 1,155, B = 369 to 555

3) A correlation of M_R to R-value for fine-grained soils (R-value ≤ 20) is given by the following correlation (AASHTO, 1993):

   M_R = 1,000 + 555 x (R-value)

4) A correlation of CBR to k may be made using **Table 2.3**.

Table 2.3. RELATIONSHIP BETWEEN CBR AND k

CBR Value	Modulus of Subgrade Reaction (k) (psi/in.)
3	100
5.5	150
10	200
20	250
50	500
80	710

SOURCE: Portland Cement Association (PCA).

2.2.2 Subsurface Drainage

Subsurface street drainage must be considered in the design of each street:

a. Subsurface drains shall be designed and constructed according to the recommendations of the Geotechnical Report. In the event that no subsurface drainage is required based on the

Geotechnical Report, a transverse perforated drainpipe with a minimum diameter of 4 inches shall be installed below the base rock at the point of each sag vertical curve, or low point at the end of a street.

b. The subsurface drains are for the purpose of collecting and conveying subsurface water only, not surface runoff. They are not to be considered part of the storm drainage system for purposes of sizing storm pipes.
c. Subsurface drains shall connect and drain into the storm drainage system at catch basins, gutter inlets, manholes, or roadside ditches. Surcharge from the storm drainage system shall not be allowed to back up into the subsurface drains.
d. Alternative subsurface drainage measures may be used if approved by the City.

2.2.3 Structural Section

a. Arterial or Collector Streets may be constructed of:
    1. AC with crushed aggregate base and/or treated bases and subgrade geotextile fabric, or
    2. PCC with crushed aggregate base and subgrade geotextile fabric.
b. Residential Streets may be constructed of:
    1. AC with crushed aggregate base and/or treated bases and subgrade geotextile fabric, or
    2. PCC with crushed aggregate base and subgrade geotextile fabric.

2.2.4 Crushed Aggregate Design

When crushed aggregate is included in the pavement design section, it shall consist of at least 1”-0 crushed aggregate (See Subsection “Granular Fill”). The base rock shall be separated from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the base rock. Minimum aggregate base thickness shall be a minimum twelve (12) inches for Local streets, fifteen (15) inches for Collector and Minor Arterial streets and eighteen (18) for Major Arterial streets per the table below. Regardless of the recommendations of the geotechnical engineer, the minimum base rock thickness shall be per **Table 2.4**. Placement of geotextile fabric shall be after the installation of pipes, manholes, and inlet bases.

2.2.5 Asphalt Pavement Design

A. AC pavement shall be designed using nationally recognized procedures: the AASHTO method or the Asphalt Institute method.
B. The wearing surface of AC pavement shall conform to the Oregon Department of Transportation Standard Specifications for Construction (ODOT SSC) Section 00745, “Hot Mixed Asphalt Concrete,” for either Level 2 or Level 3 HMAC, as determined by the City Engineer. The minimum total thickness of AC on local streets shall be four (4) inches placed in at least two lifts. The minimum total thickness of AC on Collector streets and all Arterial streets six (6) inches placed in at least two lifts, see the table below. Minimum lift thickness shall be 2”; maximum lift thickness shall be 3”. The base courses for AC pavement shall conform to ODOT SSC Section 00745, “Hot Mixed Asphalt Concrete,” for either Level 2 or Level 3 HMAC, as determined by the City Engineer.
C. Pavement thickness design criteria shall be accomplished in accordance with the AASHTO method or the Asphalt Institute method, using soil strength criteria based on either the CBR or R-value (see Subsection “Subgrade Evaluation”).
D. Use a minimum 25-year design period.
E. Regardless of the recommendations of the geotechnical engineer, the minimum asphalt section shall be per **Table 2.4.**

Table 2.4

Minimum Asphalt Pavement Sections		
Street Classification	**AC Pavement Thickness (inches)**	**Base rock Thickness (inches)**
Major Arterial	6	18
Minor Arterial	6	15
Collector	6	15
Commercial/Industrial*	6	15
Local Residential	4	12
Cul-de-sac (*Residential*)	4	10
Private Street (*3 or more dwelling units*)	4	9

*Commercial/Industrial streets, regardless of classification, shall be designed for truck traffic.

2.2.6 Portland Cement Concrete Pavement Design

A. At the direction of the City's authorized representative, certain streets may be required to be designed and constructed using PCC.
B. PCC pavement shall be designed using nationally recognized procedures: the PCA method or the AASHTO method.
C. Use a minimum 40-year design period.
D. Minimum thickness of PCC and crushed rock base shall be per the **Table 2.5** below.
E. PCC for pavement construction shall conform to ODOT Class 4000 – 1 ½, Continuous Reinforced or Plain Concrete Pavement.
F. Due to the significant distance of concrete batch plants to the city, PCC for pavement construction shall include the use of curing retardant in the mix design.
G. Design of concrete joints shall follow the guidelines and requirements outlined in the American Concrete Pavement Association (ACPA) publication, “Design and Construction of Joints for Concrete Streets,” except for the following:
   1. Maximum joint spacing shall be 12 feet.
   2. Joints shall be designed to be skewed 6:1 when meeting the edge of pavement.
   3. For doweled contraction joints, do not lubricate the dowels.
   4. Isolation joints shall be used around manhole covers. Isolation joints shall be circular with a 3-foot spacing from the manhole cover.
   5. Joints at curb shall align with pavement joints. A curb joint plan is required.
H. All castings for manholes in concrete streets shall be standard type.
I. PCC for curbs, sidewalks, and miscellaneous construction shall conform to ODOT Class 3000–¾”, Commercial Grade Concrete.

Table 2.5

Minimum Concrete Pavement Sections		
Street Classification	**PCC Thickness (inches)**	**Base rock Thickness (inches)**
Major Arterial	8	8
Minor Arterial	7	8
Collector	7	6
Local Residential	6	6
Alley	6	4

2.2.7 Pavement Transition – Portland Cement Concrete to Asphalt

Where PCC paving abuts AC paving, there shall be a lateral transition zone extending 4 feet, with a cross-section designed according to City standard detail.

2.2.8 Segmental Concrete Paver Design

A. The City may approve the design and construction of segmental concrete paver roadway on local residential streets and alleys.
B. Segmental concrete pavement shall be designed using nationally recognized procedures: the ICPI method for municipal streets and roadways.
C. Where segmental concrete pavement transitions to AC or PCC pavement, a lateral concrete band shall be used as an edge restraint. Full paver required at edge restraint.

2.2.9 Pavement Overlay Design

A. AC pavement overlays may include non-woven fabric specifically designed for use with AC pavement.
B. The standard minimum overlay thickness shall be 2-inches. In no case shall the overlay thickness be less than 1½-inches. This minimum thickness shall be increased as necessary to provide the required cross slopes, with smooth transitions between all variations in cross-slope.
C. Design of overlays shall be based on an analysis of the existing pavement condition by a registered professional engineer experienced in the design of pavements and shall result in the minimum practical design life as specified. Unless otherwise approved by the City Engineer, testing of the existing pavement shall include the following as a minimum.
    1. Coring of the street at maximum 200-foot intervals to establish the thickness and condition of existing pavement and aggregate base. Where, in the opinion of the City Engineer, the public records indicate reasonable uniformity of the pavement structure, the spacing between borings may be increased to 400 feet. In no case shall less than two drilled borings be taken through the existing pavement structure.
    2. Non-destructive falling weight deflectometer tests on the existing pavement proposed for overlay.
    3. Preparation of an engineering analysis of overlay thickness required to provide the specified design life with all anticipated truck traffic.
D. Areas of existing pavement and base rock which exhibit deflection or alligator cracking or have otherwise failed shall be excavated and replaced with new geotextile fabric, compacted base rock and AC pavement prior to the overlay. Base rock and AC pavement repair thicknesses shall match standard section thicknesses. All cracks greater than 1/8-inch in width shall be cleaned out and filled with an asphalt emulsion slurry and sand, or other method approved by the City Engineer. All crack sealing, skin patching and plugging of dig out areas must be approved by the City Engineer prior to the placement of the final overlay.
E. Asphalt overlays shall include grinding as required to allow the minimum overlay thickness at existing paving, catch basins, gutter pans and other structures which cannot be raised to grade. Unless otherwise approved by the City Engineer, all existing manholes, valve boxes and other structures shall be raised to grade before the overlay. Structures raised to grade following placement of the overlay shall have the pavement sawcut around the structure as required by the City Engineer and a reinforced PCC concrete patch placed around the structure.
F. Any existing survey monuments within AC pavement overlay areas shall be provided with a monument box to City and County Surveyor standards, installed prior to overlay paving.

2.2.10 Horizontal Alignment

Alignments shall meet the following requirements:

A. Centerline alignment of improvements should be parallel to the centerline of the right-of-way. The centerline of a proposed street extension shall be aligned with the existing street centerline.

B. Horizontal curves in alignments shall meet the minimum radius requirements of **Table 2.6**:

Table 2.6

Minimum Centerline Radius (feet) for Normal Crown Streets		
Design Speed (mph)	**-2%**	**-3%**
15	50	55
20	110	115
25	200	210
30	335	355
35	510	545
40	765	825
45	1040	1125

Note: Cul-de-sac: 160'

2.2.11 Vertical Alignment

Alignments shall meet the following requirements:

A. Minimum longitudinal street gradients shall be 0.4% along the crown and curb for all streets.

B. Maximum street centerline gradients shall be 6% percent for arterial and collector streets, and 12% for local streets with 12% grades not exceeding 100-feet in length and not at intersections.

C. Cross-slope of the street section shall be no less than 2% and no greater than 5%.

D. Local streets intersecting with a minor collector or greater functional classification street shall provide a landing that averages 2% gradient or less. Landings are that portion of the street within 20 feet of the edge of the intersecting street at full improvement.

E. Grade changes of more than 1% shall be accomplished with vertical curves.

F. Street grades, intersections, and super-elevation transitions shall be designed not to allow concentrations of storm water to flow over the pavement.

G. Offset crowns may be allowed and must be approved by the City on an individual basis.

H. Streets intersected by streets not constructed to full urban standards shall be designed to match both present and future vertical alignments of the intersecting street. The requirements of these standards shall be met for both present and future conditions.

I. Vertical curves shall conform to the values listed in **Tables 2.7 and 2.8**.

J. Slope easements shall be dedicated or obtained for the purposes of grading outside the right-of-way.

Table 2.7. DESIGN CONTROLS FOR CREST VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

Design Speed	K
25	12
30	19
35	28
40	44
45	61

Where: K = L / A = feet / percent.
L = length of vertical curve (feet).
A = algebraic difference in grades (percent).

Table 2.8. DESIGN CONTROLS FOR SAG VERTICAL CURVES BASED ON STOPPING SIGHT DISTANCE

Design Speed	K
25	26
30	37
35	49
40	64
45	79

Where: K = L / A = feet / percent.
L = length of vertical curve (feet).
A = algebraic difference in grades (percent).

Note: Values may be reduced if street lighting is present for sag vertical curves. AASHTO publication, "An Informational Guide for Roadway Lighting" (1984), shall serve as a guide.

2.2.12 Transitions

The following specify the minimum requirements for street transitions:

A. Street width transitions from a narrower width to a wider width shall be designed with a 10:1 taper. Delineators, as approved by the City's authorized representative, shall be installed to define the configuration.

B. For street width transitions from wider to narrower, the length of the transition taper shall be determined as follows:

$L = S \times W$, for $S \geq 45$ mph

$L = \frac{W \times S^2}{60}$, for S less than 45 mph

Where: L = minimum length of taper (feet).
S = design speed (mph).
W = edge of pavement offset (feet).

C. Delineators, as approved by the City's authorized representative, shall be installed to define the configuration. Maximum spacing of delineators shall be the numerical value of the design speed, in feet (i.e., a 35-foot spacing for a 35-mph speed).

D. In situations where a tapered transition cannot be provided, a Type III barricade shall be installed at the end of the wider section of the street and a taper shall be appointed and delineated as approved by the City's authorized representative. The barricade shall conform to City details; diagonal striping shall slope down in the direction of the taper. If the wider section does not provide an additional travel lane, only a barricade is required without the transition.

2.2.13 Street Cross-Sections & Cross Slopes

A. Cross-slope of the street section shall not exceed two percent (2%) unless otherwise approved by the City Engineer, based on a demonstration by the design engineer that PROWAG standards are met.
B. Symmetrical street cross sections with opposite curbs at the same level are preferred.
C. Off-set crown cross-sections are acceptable only where required due to sidehill lies and to match existing facilities. Off-set crowns shall not exceed 12 inches between the high curb and the low curb, and the crown location shall not be less than 12 feet from the face of curb.
D. Inverted crown sections are not acceptable for public streets.
E. Shed roof cross sections are not acceptable for public streets, except within and immediately adjacent to street intersections. The design of shed cross sections shall include provisions to avoid concentrated drainage sources from flowing across the pavement surface.

2.2.14 Super-elevation Cross-Sections

A. Design elements for super-elevation shall be based on AASHTO design guidelines.
B. Offset crown cross-sections are not acceptable as super-elevation sections.

2.2.15 Intersections

The following specifies the minimum requirements for intersections:

A. Connecting street intersections shall be located to provide for traffic flow, safety and turning movements, as conditions warrant.
B. The interior angle at intersecting streets shall be kept as near 90 degrees as possible unless existing development or topography make it impracticable. Where intersecting streets cannot be kept at right angles, the interior angle shall in no case be less than 75 degrees, unless approved by the City after consultation with the Polk County Fire District.
C. A horizontal tangent section shall be carried a minimum distance per the **Table 2.9**. The length of each tangent leg shall be measured from the extension of the curbline of the intersected street.
D. Opposing intersections shall be designed so that no dangerous offset to the traveling public is created.
    1) Intersection distances shall be measured from right-of-way centerline to right-of-way centerline.
    2) Intersections on major collector/arterial streets shall be separated by at least 600 feet.
    3) Intersections on local streets shall be separated by at least 300 feet.
E. Curb radii at intersections shall be as shown in **Table 2.10** for the various function classifications with exceptions subject to approval by the City Engineer. The right-of-way radii at intersections shall be sufficient to maintain at least the same right-of-way-to-curb spacing as the lower classified street.
F. Sidewalk access ramps shall be in conformance with ADA requirements.

Table 2.9 MINIMUM HORIZONTAL TANGENT LENGTH

Street Classification	Tangent Length (feet)
Arterial	100
Collector	75
Commercial/Industrial	75
Residential	50

Table 2.10. MINIMUM TURNING RADII

FROM EDGE OF PAVEMENT OR CURB (feet)

Street Classification	Arterial	Collector	Commercial /Industrial	Residential
Arterial	30	30	30	25
Collector	30	30	30	25
Commercial/Industrial	30	30	30	25
Residential	25	25	25	20

Streets serving commercial/industrial properties may be required to install larger curb radius as required for vehicle movements. In the opinion of the Public Works Director, truck turning movements may be required to verify sufficient curb radius. The Public Works Director will determine the size of vehicle used.

2.2.16 Cul-de-Sacs, Eyebrows & Turnarounds

The design engineer's plans must be approved by Polk County Fire District and the City. The following specifies the minimum requirements for cul-de-sacs and turnaround areas. Other turnaround geometrics may be used when conditions warrant and when the City approves the design and application of its use.

A. Cul-de-sacs and other turnaround areas shall be allowed only on residential streets and commercial/industrial streets that cannot be extended or connected into the street network. Residential cul-de-sacs shall not be more than 200 feet long and serve no more than 20 units unless approved by the Planning Commission (IDC 90.90.010.M).
B. The standard details show the minimum requirements for cul-de-sac turnaround areas. Other turnaround geometrics may be used when conditions warrant, and the City Engineer approves the design and application of its use. Cul-de-sacs in commercial or industrial developments shall provide adequate turnarounds for the type of vehicle serviced by the street, as approved by the City Engineer.
C. The minimum curb radius for transition into cul-de-sac bulbs shall be 25 feet, and the right-of-way radius shall be sufficient to maintain the same right-of-way-to-curb spacing as in the adjacent part of the road.
D. Cul-de-sacs and other turnaround areas shall have an 8-foot public utility easement extending outside the right-of-way around the cul-de-sac continuously.
E. The finished pavement grade from the center point of cul-de-sac turnarounds to the curb shall not be less than two and one-half percent negative (-2.5%).
F. Cul-de-sac curb profiles shall be provided with a smooth vertical alignment. Curbline grade changes in excess of 1% shall use a vertical curve, with a K-value not less than 3.

G. No parking is allowed in cul-de-sacs or turnarounds.
H. An eyebrow corner may be used on a local street where expected average daily traffic (ADT) counts will not exceed 500 vehicles

2.2.17 Stub Streets

A. Stub streets allow for future extension of the roadway. A reserve strip at the terminus of the right-of-way shall be provided. The reserve strip shall be at least one foot long and extend the full width of the right-of-way and be provided to the City.
B. A paved turn around shall be provided for stub streets with lengths greater than 300 feet, or as required by the Oregon Fire Code (150-foot maximum length without turnaround per OFC D103.4, unless otherwise approved by the Fire Code Official).
C. A Type III Street Barricade conforming to City standards shall be erected at the edge of pavement of the stub street and “No Parking” signs installed on either side of the barricade; a Type II Sidewalk Barricade conforming to City standards shall be erected at the end of any sidewalks on the stub street. Streets 50 feet in length or greater shall provide a garbage/recycling vehicle paved turnaround approved by the City.
D. A sign stating road to be extended in the future shall be installed at the end of all stub streets per Standard Detail.

2.2.18 Permanent Dead-End Streets

A. A standard cul-de-sac turnaround shall be provided at the end of a permanent dead-end street that does not provide looped circulation. Permanent dead-end streets shall be limited to serving no more than 20 dwellings and shall not exceed 200' in length from the point of the nearest centerline/centerline intersection.
B. A permanent dead-end street is measured from the right-of-way line at the nearest intersecting street, which has at least two points of access, to the right of way line at the furthest end of the dead-end street.

2.2.19 Half Streets

Street widening construction is generally not acceptable. Where such a Street is justified, the right-of-way and pavement width will be approved by the Public Works Director. In no case shall the pavement width be less than that required to provide two lanes of traffic to pass at a safe distance. Half streets will only be approved when the abutting or opposite frontage property is undeveloped, and the full improvement will be provided with development of the abutting or opposite (upon right-of-way dedication) frontage property. Half street improvements shall include curb, sidewalk, planter strip if required, and storm drainage on one side of the street. When a half street improvement is required, the entire street shall be designed. A development on an unimproved street shall be responsible for constructing a continuous City standard street to a connection with the nearest standard street.

Whenever a half street improvement is approved, it shall conform to the following:

A. Street section design and construction shall be in conformance with these standards.
B. Minimum pavement width shall be 24 feet for arterial and major collector streets, and 20 feet for minor collector and local streets. A two (2) foot wide gravel shoulder is required on the unimproved side of the street.
C. Intersection improvements shall be adequate to provide turn lanes where required. See **Table 2.1**.
D. A reserve strip at the limits of the right-of-way shall be provided to the City. The reserve strip shall be at least one foot wide, extend the full width of the right-of-way, and access control shall be governed by the City.

2.2.20 Street Widening & Trench Cuts

Where pavement is installed next to existing pavement and at all trench cuts, the existing pavement shall be a saw cut a minimum of one foot from the edge of pavement. Bench grind and install asphalt per Standard Details.

2.2.21 Private Streets

Private streets are prohibited unless otherwise approved by the City Council. If approved by City Council, the private street shall meet the requirements of City code and/or planning approval and the following requirements:

A. Private streets shall meet the requirements of the Polk County Fire District.
B. Private streets shall not be used for ingress and egress into mixed use developments.
C. Private streets shall be designed with the same structural section in conformance with these Standards.
D. Storm systems only serving private streets shall be private storm systems and meet City standards for detention and water quality before discharging into the public storm system.
E. Private streets shall be signed with a blue street name sign in conformance with Subsection, “Street Name Signs and Posts”. In addition, all private streets shall be signed with a sign stating, “Street not maintained by the City of Independence.” Sign shall have a white background with black lettering.

2.2.22 Alleyways

Alleyways may be provided in commercial and industrial developments with approval by the City Engineer. A residential alleyway shall be a minimum width of 20 feet and dedicated to the City. All alleyways shall be concrete and constructed per alley Standard Detail. Design for alleyways shall meet the same criteria as other public streets. The exceptions to those criteria may be centerline radius and design speed. No parking allowed on alleys and shall be signed “No Parking Fire Lane”.

2.2.23 Raised Medians and Traffic Separators

The following specify the minimum requirements for raised medians:

A. Raised center medians and landscape medians are allowed where feasible on certain arterial streets as defined in the City of Independence TSP.
B. Where raised medians are allowed, the following criteria must be met:
    1. Objects, such as trees, shrubs, signs, light poles, etc., shall not physically or visually interfere with vehicle or pedestrian traffic in the travel way.
    2. The style and design of the raised median shall be site specific. The raised median shall be safe for the design speed. Raised medians shall be designed in conformance with AASHTO guidelines.
    3. Design shall be in conformance Curb and Gutter Style as provided in Subsection, “Curbs and Gutters” and consider the use of rolled curbs and appropriate surface loading for emergency vehicle left-turn access. Raised median designs shall be subject to City approval.

2.2.24 Sight Distance

A clear vision area shall be maintained on each corner of property at the intersection of any two streets, a street and a railroad, or a street and a driveway. Clear vision area shall be in conformance with City Code and this standard. The following specifies the minimum sight distance requirements for roads that intersect each other, and for driveways that intersect roads:

A. The minimum intersectional sight distances shall be based on the posted speed of the road. The intersectional sight distance shall be
   1. Based on an eye height of 3.5 feet and an object height of 2.0 feet above the road surface.
   2. Measured at the center of the drive lane 10 feet from the extended curb line or edge of pavement of the crossroads.
   3. All branches and foliage for street trees shall be removed to a height of eight (8) feet above grade behind the face of curb and over the sidewalk (i.e., on the property side of the curb or edge of pavement).
   4. All branches and foliage for street trees shall be removed to a height of fourteen (14) feet above grade in front of the face of curb (i.e., on the street side of the curb or edge of pavement).
B. No structures, plantings, or other obstructions shall be allowed that would impede visibility between the height of 30 inches and 10 feet, as measured from the top of curb, or in absence of a curb, from the established street centerline elevation.
C. Trees placed in sidewalk planting areas must be located at least 30 feet from the nearest intersection and 10 feet from driveways.
D. Minimum intersectional sight distance for railroad and street intersections shall be in conformance with AASHTO design guidelines.
E. Minimum intersectional sight distance shall be equal to 10 times the posted speed of the road for grades of 3% or less, as shown in **Table 2.11.** For grades in excess of 3%, sight distances must be adjusted and shall be in conformance with AASHTO design guidelines. For significant road improvement projects, the following intersectional standards shall be met in addition to the AASHTO remaining sight distance standards.

Table 2.11. INTERSECTIONAL SIGHT DISTANCE

Design Speed (mph)	Distance Along Crossroads (feet)
25	250
30	300
35	350
40	400
45	450

2.2.25 Clear Vision Area

Table 2.12 shall establish measurements for the clear vision areas:

Table 2.12

Clear Vision Area Measurement	
Type of Intersection	Measurement Along Each Lot Line or Drive Edge[1]
Controlled Intersection (*Stop sign/signal*)	20 feet
Uncontrolled Intersection (≥60’ ROW)	30 feet
Uncontrolled Intersection (<60’ ROW)	40 feet
Commercial/Industrial Driveways	20 feet
Common Use Residential & Alleys	20 feet
Single Residential Driveways	10 feet
[1]At the intersection of different classification streets, the measurement shall apply to the measurement along the rights-of-way line as specified for each classification.	

A. Clear vision provisions shall not apply to the following:
   1. A public utility pole.
   2. A tree trimmed (*to the trunk*) to a line at least 8 feet above the level of the sidewalk, and 14 feet above the road surface in front of the curb.
   3. An official traffic control sign or signal.

2.2.26 Driveway Spacing & Location

A. No more than one driveway per property shall be permitted in residential zones. Exceptions to this requirement shall be determined by the Public Works Director. Exceptions may include:
   1. Duplexes on a corner lot that face two directions may have two driveways if the roadway classification does not exceed a local street.

B. A second driveway is prohibited for an accessory dwelling unit. Accessory dwelling units shall use the existing driveway for parking purposes or on-street parking when allowed in specific land use zones.

C. Driveways for corner properties (corner lot) shall be located on the lowest classification street and as far from the intersection as possible.

D. Driveways shall be located on longest street frontage of the lot unless that frontage is located on a higher street classification.

E. Driveways on through lots shall be located on the lowest classification street.

F. Residential driveways of adjoining properties shall have a minimum of 10 feet clear between the edges of the driveways.

G. Location of all driveways serving commercial, industrial, or multifamily facilities shall be approved by the City.

H. Driveways shall be separated from an intersection by a minimum of 30 feet or one-half the lot frontage, whichever is greater.

2.2.27 Driveways, Driveway Approaches, Alleys

A. Driveways shall conform to the City of Independence Standard Details. Curb removal for driveways shall be by saw cutting or grinding that produces a smooth surface.

B. Sidewalks crossing driveway approaches shall be concrete per City standards.

C. Driveway Approaches:

1. All driveway or alley approaches shall be paved or otherwise hard surfaced as specified. In cases where durable non-paved surfaces meeting City standards are allowed, driveways and alleys shall be provided with a minimum 10 foot paved or concrete extension of the approach beyond the back of sidewalk location in all cases (measured from back of future sidewalk location for unimproved street frontages. Gravel is not allowed.
2. Driveway approaches on curbed streets shall be constructed of concrete and shall be a minimum of 6-inches thick. Driveway approaches on turnpike (non-curbed) segments may be either concrete or asphalt.
3. Driveway approaches shall be constructed to meet current ADA and PROWAG standards at all locations where sidewalks cross or will cross the driveway.

D. Driveways shall be constructed so that they do not block drainage along the street.

E. Common Use, Commercial & Industrial Driveways: Driveway shall be a minimum of 24 feet wide and a maximum of 40 feet wide at the property line.
   1. Common/Multiple use, commercial or industrial type driveways (as well as any driveway exceeding 10% slope) shall be paved completely.
   2. Common driveways serving multiple lots and flag lot driveways over 150 feet in length shall be provided with an emergency turnaround meeting the requirements of the Oregon Fire Code.

F. Single family residential driveways: Driveway shall be a minimum of 12 feet wide and a maximum of 24 feet wide at the property line.

G. Alleys (or unimproved street ROW) used as Driveways:
   1. New alleys shall be constructed per Standard Detail.
   2. Existing alleys or unimproved street rights-of-way used as driveways for new structures (whether or not land use approval is required) shall be constructed to City standards from the improved public street from which vehicular access is taken, along the entire portion of the alley or unimproved ROW used as a driveway (including turning/backing areas as applicable).
   3. The improvement width shall meet applicable minimum width required for common driveways or fire lanes, or as required by applicable City approvals, whichever is greater.

H. The angle between a driveway centerline and the parallel vehicle travel lane shall be between 75 degrees and 105 degrees.
   1. Maximum Driveway Slope. Maximum slope of driveways shall not exceed 12%.

I. Driveways connecting to a street that has not been improved to its ultimate width, the driveway profile (i.e., vertical profile) shall be designed to allow for future street widening without reconstruction of the driveway. Driveways on turnpike or streets narrower than standard shall be constructed such that the surface of the driveway matches the future back of sidewalk elevation (i.e. future back of sidewalk elevation to be based on design street width and cross slope per current City standards, assuming the future street will be centered in the future right-of-way unless otherwise directed by the City). This requirement applies both to new driveways and to existing driveways reconstructed in conjunction with street improvements.

J. Setback to Garage. Unless otherwise approved in writing by the Public Works Director, garages shall be set back a minimum of 20 feet from property lines, or from the edge of an access easement where common driveways cross properties, or from the edge of a driveway or sidewalk which serves multiple units on the same property (i.e. in order to accommodate full-sized pickups or service vehicles without encroaching into a vehicle travel path or sidewalk).

2.2.28 Curbs and Gutters

A. All streets shall include curbs on both sides except in situations of interim width improvements. The minimum tangent curb gradients shall be as outlined under Subsection, “Vertical Alignment”.

B. The standard curb for City Streets shall be Type A curb and gutter for all road classifications.
   1. Use of Type C curbs for public streets requires written approval by the City Engineer for each location proposed and is typically limited to replacement of short lengths of existing Type C curbs, used at raised islands, or where required by ODOT standards.
   2. Where Type A curb and gutters are installed along the edge of existing paved streets (*where pavement widening is not required and where changes to the vertical alignment or cross slope is not required*), the pavement shall generally be sawcut at the edge of the gutter pan and the new curb and gutter paced against the sawcut, in order to minimize the need for street patching and repaving.

C. The ends of all curbs shall be tapered down to prevent damage to vehicle tires.

D. A six (6) inch curb exposure is normally required on residential streets and streets with curb and gutter. A seven (7) inch exposure may be required by the Public Works Director on streets where Type C curbs are allowed. Greater curb exposure shall also be provided where required by ODOT standards *(including near railroad crossing as required by ODOT rail).*

E. Three (3) inch diameter curb weep holes shall be provided through curbs with inverts ½-inch above the gutter line, at the locations outlined below. Drain pipe shall be provided under all sidewalks to connect to all curb weep holes (*drainpipe under sidewalks shall extend 12-inches behind back of sidewalk and be capped*). The location of all weep holes shall be shown or defined in the drawings.
   1. Opposite existing or anticipated roof drain downspouts (*minimum 2 per lot*).
   2. At 16-foot on center along low areas where curb top is above adjacent ground.
   3. At 16-foot on center adjacent to bank areas to receive groundwater.

F. Joint spacing in curbs shall be 12-foot maximum for contraction joints and 48-foot maximum for expansion joints. In addition, expansion joints shall be located at all curb return points and at driveway curb drop transition points.

G. Newly constructed public curb and gutters or replaced curb and gutters shall be stamped on the top of the curb with the capital letters “S” at the location of each sanitary lateral crossing, the capital letters “D” at the location of each storm drain lateral crossing, the capitol letter “W” at the location of each water line crossing, and the capitol letter “C” at the location of each franchise conduit crossing. Letters shall be 2 inches in height and embossed a minimum of ⅛-inch deep.

H. Where trees are located within 8 feet of public curbs, they shall be protected from root intrusion with a root control barrier system designed by a Professional Landscape Architect registered in the State of Oregon; root control barrier shall be approved by the City Engineer before installation. Generally, the root control system should be installed a minimum of 24 inches deep, with a minimum 20-foot length centered on the root source. Installation of such systems shall be done so as not to disturb the curb or base rock previously installed. Provide landscaping plan showing location of root control barrier system.

2.2.29 Grading Within Public Right-of-Way and Public Utility Easement

A. Grading for local street and commercial/industrial classifications shall not exceed the following cross slopes:
   1. From curb to 1 foot behind the sidewalk: 1.5% upward.
   2. From 1 foot behind sidewalk to property line: 5H:1V upward or downward.
   3. Within the street frontage public utility easement (PUE): 5H:1V upward or downward.

4. Outside of right-of-way and public utility easement (PUE): 2H:1V upward or downward.
5. Along the edge of turnpike streets (from the back of the gravel shoulder: 3H:1V downward, unless otherwise approved on a case-by-case basis by the Public Works Director and City Engineer.

B. Side slopes may be increased to 2H:1V up or down within 2 feet from the back of the sidewalk with approval from the City Engineer and affected utilities.

C. Where street improvements do not include curbs along both sides of a street, the design shall include a full depth gravel shoulder on the non-curbed side (2' minimum width, wider shoulder may be required by Public Works Director to address site specific circumstances) and shall address collection of storm water drainage on the non-curbed side of street improvements. Where ditches are necessary along the non-curbed side (i.e., where ground does not slope away from the street), ditches shall conform with PWDS requirements and standard details (including driveway culverts which meet City standards) and shall drain to an approved point of disposal.

2.2.30 Sidewalks & Multi-Use Access Paths

The following specifies the requirements for sidewalks:

A. The location of sidewalks shall be based on the City of Independence TSP, the City's Parks Master Plan in accordance with this subsection. Sidewalks shall be designed with following minimum widths:

1. Arterial: 6 feet
2. Downtown Commercial: Varies
3. Collector: 6 feet
4. Commercial: 6 feet
5. Local: 6 feet
6. Cul-de-sac: 6 feet

Sidewalk thickness, slope, finish work, and location of expansion and contraction joints shall be as specified in the Detail Drawings. Final facility location and design are subject to the approval of the City Engineer.

B. All public-owned pedestrian facilities shall be constructed within a public right-of-way. All new development or redevelopment shall consider access to adjacent properties in their development plans, especially schools, retail, and commercial areas. Easements shall be provided as necessary for compliance with the ADA Standards for Accessible Design.

C. All sidewalks shall fully comply with all ADA and PROWAG standards as applicable. Sidewalk ramps meeting current ADA and PROWAG standards shall be provided at all corners of intersections where crossing is permitted, regardless of curb type (or absence of curb), and at the ends of all sidewalks.

D. Sidewalk ramps shall be located so as to avoid conflict with storm drain catch basins.

E. Unless otherwise allowed, sidewalks shall be provided on both sides of curbed streets for all road classifications, as well as for private streets.

F. Monolithic curb & public sidewalk placement is not permitted *(i.e., curb concrete & public sidewalk concrete shall be placed separately, except where approved by the City at pedestrian ramps).*

G. Sidewalks shall be constructed of concrete and shall be a minimum of 4-inches thick except at driveway crossings and pedestrian ramps, which shall be a minimum of 6- inches thick *(8-inch thickness required for commercial type driveways).*

H. Multi-Use paths shall be a minimum of 4-inches thick concrete *(any pathways used for maintenance vehicle access to utilities shall be 6" thick & reinforced with #4 bar at 12" OC EW, unless 8" concrete thickness is provided).*

I. Drain pipe shall be installed under sidewalks as required to connect to all curb weep holes or other storm drain facilities. Surface discharge of roof drains or other drain pipes across sidewalks is not allowed, nor is the sheet flow from parking lots, commercial/industrial driveways, common residential driveways, or concentrated flow from long flag lot driveways allowed to flow across sidewalks.

J. Water meters, utility poles, etc. are not permitted within sidewalks unless authorized in writing by the Public Works Director.

K. Where single or clustered mailboxes or other objects are within a sidewalk, the sidewalk shall be widened to provide clearance equal to the required sidewalk width. For retrofit installations only where specifically approved in writing by Public Works Director, the sidewalk clear space may be reduced to 48 inches minimum, provided that all other PROWAG requirements are satisfied. All existing mailboxes shall be set on new posts at the time of sidewalk construction.

L. Sidewalks to be constructed in conjunction with street improvements or to be provided as part of a development may be deferred at the City's option until building construction except for the following situations:

1. Arterial or collector streets fronting corner lots.
2. Sidewalks along streets from which vehicular access to the fronting lot is restricted.
3. Sidewalks fronting existing structures.
4. Offsite sidewalks not abutting the property within the development.
5. Pedestrian walkways not along public streets.
6. Sidewalks fronting non-buildable tracts or parcels.
7. All required ADA pedestrian curb ramps within or adjacent to public or private streets, as well as sidewalks required for ADA compliant pedestrian access to CBU mailboxes.
    a. CBU mailbox location must be acceptable to the local postmaster and provide for ADA compliant access.
    b. A pedestrian curb ramp must be located within 50 feet of the CBU.
    c. Installation of CBU mailboxes within the curb radius at street intersections is prohibited.

M. Where sidewalks or pathways are parallel and adjacent to a driveway or street (public or private), they shall be raised six inches and curbed or separated from the driveway/street by a 3-foot minimum landscape strip, berm, bollards, or other physical barrier. If a raised path is used, the ends of the raised portions must be equipped with curb ramps.

2.2.31 Bike Lanes

A. The City shall determine bikeway locations. Bikeway facilities shall meet the requirements of this document and the American Association of State Highway and Transportation Officials publication, Guide for Development of New Bicycle Facilities, as amended and adopted by the Oregon Department of Transportation.

B. A bikeway may be constructed adjacent to the curb within the pavement area.

C. Structural sections of bikeway facilities on streets shall conform to that of the street or be integral with the curb.

D. Bikeways not within a street shall be constructed as concrete multi-use paths per Subsection “Sidewalks & Multi-Use Access Paths”.

E. Design Standards regarding horizontal alignment, grade, sight distance, intersections, signing, marking, structures, drainage and lighting shall conform to the AASHTO Standards. When bikeways are integrated with a curb, all inlet grates shall be designed to protect the bicyclist from the grate or opening.

2.2.32 Bike Path Crossings

Bike paths intersecting with roadways require physical barriers to deter use by unauthorized motor vehicles. A lockable, removable post(s) may be used to discourage such use and still permit authorized vehicles to access the paths. The post shall be brilliantly colored and permanently reflectorized. If more than one (1) post is required, the spacing shall not exceed a separation of more than five (5) feet. An alternative to deterring the motor vehicles is to design two (2) five (5) foot wide lanes separated by low landscaping at the intersection.

2.2.33 Barricades & Guardrails

The following specify the minimum requirements for the location and type of guardrails:

A. The decision whether to install a guardrail shall be based on information in the AASHTO publication, “Guide for Selecting, Locating, and Designing Traffic Barriers,” or most recent edition.
B. Guardrails shall be designed in conformance with AASHTO design guidelines and constructed according to ODOT SSC Section 00810, “Metal Guardrail.”

2.2.34 Roadside Ditches

Roadside ditches shall be designed in conformance with Subsection “Channel Construction for New Roadside Ditches”.

2.2.35 Utilities

The following specifies the minimum requirements for utilities:

A. Franchised utilities shall be located underground, outside the paved roadway to avoid future cuts in pavement.
B. 8-foot-wide Public Utility Easement (PUE) shall be required adjacent to rights-of-way on all frontages to public roadways. PUE’s shall be graded as per Subsection “Grading Within Public Right-of-Way and Public Utility Easement” from back of curb or sidewalk unless otherwise approved by the City Engineer. Earthen berms, retaining walls, or any other encroachments are not allowed within a PUE.
C. On all phased (interim) road improvements, the necessary utilities shall be stubbed across the interim improvement to ensure that cuts are not necessary when the road is expanded to its full width. A five (5) year moratorium will prohibit street cuts on all projects. The moratorium begins when a project is complete, and the warranty begins. Check with the Public Works Department for a current list of streets on the 5-year moratorium.
D. Except for sanitary sewers, storm sewers and water mains, underground utilities intended to provide direct service to adjacent properties with future connections shall be located in the 8-foot-wide PUE.
E. Underground utilities that must cross an existing paved street shall not be installed by any method that cuts the pavement, unless approved by the City Engineer.
F. Underground utilities shall be buried at a minimum depth of 24 inches, measured from finished grade to top of utility.

2.2.36 Mailboxes

Joint mailbox facilities shall be provided in all residential developments, with each joint mailbox serving at least two (2) dwelling units.

A. Joint mailbox structures shall be placed adjacent to roadway curbs.
B. Proposed locations of joint mailboxes shall be designated as part of the development plan and shall be approved by the City Engineer and USPS Postmaster for the City of Independence.

C. Plans for the joint mailbox structure to be used shall be submitted as part of the development plan for approval by the City Engineer and Postmaster.
D. CBU mailbox locations must be acceptable to the local postmaster and must provide ADA compliant access.
E. A pedestrian curb ramp must be located within 50 feet of the CBU.

2.2.37 Retaining Walls

A. Private Property Walls – Retaining walls shall be self-supported and not located within a public easement or public right of way. Retaining walls shall not require anchoring or any other structural support that relies on public right of way or public easement. Retaining walls adjacent to public right of ways or public easements that are greater than four (4) feet in height or support a surcharge shall be designed by a Professional Engineer licensed in the State of Oregon and require a Public Works permit for construction. All costs for plan review, permitting, and independent inspection by the City will be at the owner's expense. Site plans shall include property lines, adjacent streets and easements, property addresses, north arrow, distance between buildings and retaining wall, impervious areas, all engineering calculations, and soil reports.
B. Public Retaining Walls – Retaining walls shall be self-supported and designed by a Professional Engineer licensed in the State of Oregon, regardless of wall height, and be incorporated into a City project plan set.

2.3 MATERIAL SPECIFICATIONS

2.3.1 Granular Fill

A. Crushed aggregate for base rock, leveling course, and surface replacement shall consist of an aggregate base as specified by the design engineer, with approval of the City Engineer, and shall be in conformance with ODOT SSC Section 02630, "Base Aggregate," for gradation, fractured faces, and durability. The leveling course shall consist of 1"-0 grade crushed aggregate material and be a minimum thickness of 2 inches when compacted.
B. The aggregate shall consist of uniform-quality, clean, tough, durable fragments of rock or gravel, free from flat, elongated, soft, or disintegrated pieces, and other objectionable matter occurring either free or as a coating on the stone.
C. Gradation requirements of the crushed aggregate shall be as indicated in **Table 2.13**. Sieve analysis shall be determined according to AASHTO T-27.

Table 2.13. GRADATION REQUIREMENTS FOR GRANULAR FILL

	2 ½" - 0	**2" - 0**	**1 ½" - 0**	**1" - 0**	**¾" - 0**
Sieve Size	**Percent Passing**				
2 ½"	95 – 100	100			
2"	--	95 – 100	100		
1 ½"	--	--	95 – 100	100	
1 ¼"	55 – 75	--	--	--	
1"	--	55 – 75	--	90 – 100	100
¾"	--	--	55 – 75	--	90 – 100
½"	--	--	--	55 – 75	--
3/8"	--	--	--	--	55 – 75
¼"	30 – 45	30 – 45	35 – 50	40 – 55	40 – 60

U.S. No. 10 sieve	40 – 60	40 – 60	40 – 60	40 – 60	40 – 60

Note: All percentages are by weight. Sieve analysis shall be determined according to AASHTO T 27. The aggregates shall conform to one of the grading requirements of Table 02630-1. Fracture of rounded rock shall be determined according to AASHTO T 335.

2.3.2 Asphaltic Concrete

A. The wearing surface and base courses of AC pavement shall conform to ODOT SSC Section 00744, “Asphalt Concrete Pavement” for either Level 2 or Level 3 HMAC, as determined by the City Engineer.
B. Asphalt cement shall be 85-100 penetration paving asphalt conforming to ASTM D-946.
C. Liquid asphalt for use as a prime coat under AC shall conform to ODOT SSC Section 00730.
D. The temperature of the AC during mixing, placement, or while in storage shall not be less than 240°F as per ODOT SSC Section 00744.41.

2.3.3 Portland Cement Concrete

A. PCC for concrete pavement shall be in conformance with Subsection “Portland Cement Concrete Pavement Design”.
B. PCC for curbs, sidewalks, and miscellaneous construction shall be in conformance with Subsection “Portland Cement Concrete Pavement Design”.
C. All forms for curbs and sidewalks shall be 2-inch lumber, plywood, or metal forms. Forms on the face of the curb shall have no horizontal form joints within 7 inches of the top of the curb. All forms shall be approved by the City's authorized representative.
D. Reinforcement steel shall conform to ASTM A-615, Grade 40, deformed bars.

2.4 CONSTRUCTION SPECIFICATIONS

2.4.1 General Provisions

The specifications in this chapter and any other applicable requirements of the City shall govern the character and quality of material, equipment, installation, and construction procedures for roadway construction or improvements.

2.4.2 Scheduling

The contractor shall plan their construction work in conformance with Chapter 1 Subsection “Scheduling”.

2.4.3 Environmental Protection, Erosion Prevention, and Sediment Control

The contractor shall take all appropriate measures and precautions to minimize their impact on the environment and control erosion, as outlined in Chapter 1 Subsection “Environmental Protection, Erosion Prevention, and Sediment Control”.

2.4.4 Interferences and Obstructions

Various obstructions may be encountered during the course of the work. The contractor shall follow the guidelines established in Chapter 1 Subsection “Interferences, Obstructions, and Abandoned Utilities”.

2.4.5 Contaminated Soil or Hazardous Material

If during construction contaminated soil with hazardous materials or chemicals are encountered, the Contractor shall follow the procedures specified in Chapter 1 Subsection “Contaminated Soils or Hazardous Materials”.

2.4.6 Trench Excavation, Preparation, and Backfill

Trench excavation, preparation, and backfill shall conform to the requirements of Chapter 6, “Trench Excavation and Backfill Standards”.

2.4.7 Steel Plates

Where excavated trenches located in the right-of-way are not backfilled at the end of the construction day, the trench shall be covered with Steel Plates. Use of Steel Plates shall conform to “Progress of Construction” as provided in Chapter 1 Subsection “Scheduling”.

2.4.8 Preservation, Restoration, and Cleanup

Cleanup of all construction debris, excess excavation, and excess materials and complete restoration of all fences, mailboxes, ditches, culverts, signposts, and similar items shall be completed according to Chapter 1 Subsection “Preservation, Restoration, and Cleanup”.

2.5 WORKMANSHIP

2.5.1 Demolition

Debris from the demolition of pavement, sidewalks, curbs, or gutters shall be hauled off site and disposed of in a manner approved by the City Engineer.

2.5.2 Clearing and Grubbing

A. Brush shall be cut as near to the ground surface as practicable and removed to a disposal site approved by the City Engineer. Under no condition shall excavated materials be permitted to cover brush before the brush is cleared and disposed of. Ground surface shall be stripped of all organic soil and unsuitable material as recommended in the Geotechnical Report. Stripping operations shall be approved by the City Engineer prior to proceeding with any construction activity.
B. Erosion-prevention and sediment-control measures shall be installed before the start of clearing and grubbing. The applicant shall call the City's authorized representative for inspection and approval of all erosion-prevention and sediment-control measures before beginning any site clearing, grubbing, or grading.

2.5.3 Subgrade

Subgrade shall be prepared according to the recommendations in the Geotechnical Report and must be approved by the City Engineer. The subgrade shall be compacted to 95% of the maximum dry density, as determined by AASHTO T-180. In periods of dry weather, a proof-roll of the subgrade shall be observed by the City's authorized representative. Soft areas shall be repaired or replaced.

2.5.4 Base and Leveling Course

Base and leveling course shall consist of crushed aggregate as specified in Subsection “Granular Fill.” Base and leveling aggregate material shall be placed and compacted to the required depth of finished pavement and for proper matching with the adjacent existing pavement. Material shall be compacted to 95% of the maximum dry density, as determined by AASHTO T-180. A proof-roll of the base and leveling course shall be observed by the City Engineer. Soft areas shall be repaired or replaced.

2.6 CONSTRUCTION PROCEDURE

A. The geotechnical engineer reserves the right to vary the classes of backfill and the type of resurfacing best serves the interest of the City, with the approval of the City's authorized representative. Base rock shall be approved by the City Engineer prior to placement of asphalt concrete or Portland cement concrete.

B. A state approved mix design for asphalt concrete or Portland cement concrete shall be submitted to the City Engineer for approval a minimum of seven (7) calendar days prior to placement taking place. PCC for concrete pavement, curbs, sidewalks, driveways, and miscellaneous construction shall conform to Subsection "Portland Cement Concrete Pavement Design". Testing shall be in conformance with Subsection "Testing". Portland cement concrete whose batch time exceeds 90 minutes, does not contain curing retardant, and has not yet been placed may be refused by the City Engineer.

C. Segmental concrete pavers, bedding sand and joint sand shall conform to Subsection "Segmental Concrete Pavers".

2.6.1 Curb and Gutter

A. Curb and gutter shall be installed as per City standard detail. At the direction or approval of the City Engineer, traffic concrete separator curb shall be installed for certain specific applications.

B. When medians are specified, curb and gutter shall be installed as per City standard detail.

C. At no time shall construction equipment or traffic be allowed on the new curb and gutter until laboratory tests indicate that at least 90% specified design strength has been attained; this includes installation of adjacent asphalt pavement.

D. Root Barriers shall be installed in conformance with Subsection "Curb and Gutters". Generally, the root control system should be installed a minimum of 24 inches deep, with a minimum 20-foot length centered on the root source. Installation of such systems shall be done so as to not disturb the sidewalk, curb or base rock previously installed. Provide landscaping plan showing location of root control barrier system.

2.6.2 Asphalt Pavement

A. After the leveling course is compacted, an asphalt prime coat, specified above, shall be applied to the edges of the existing pavement. Also, curb and gutter, cast iron manhole frames and cleanout frames shall be tack-coated below grade.

B. Asphalt Concrete

1. **Thickness:** Minimum total thickness of AC shall be in accordance with Subsection "Asphalt Pavement Design". Place AC after the prime coat has set. If the thickness is six (6) inches or greater, place the asphalt in three lifts. Maximum lift thickness shall be 3 inches. Spread and level the AC with use of a self-propelled machine or hand tools, depending on the area to be paved. Bring the AC to the proper grade and compact by rolling or use hand tampers where rolling is not possible. Temperature of the AC material shall be in conformance with Subsection "Asphaltic Concrete".
2. **Placement:** Lay the AC mixture in strips of such width as to hold to a practical minimum the number of longitudinal joints required. The longitudinal joints in any layer of pavement shall be offset from those joints in layers below by not less than 6 inches. Joints shall not be located in wheel paths.
3. **Compaction:** Roll with power rollers capable of providing compression of 350 pounds per linear inch. Begin rolling from the outside edge of the replacement and progress toward the existing surfacing, lapping the existing surface at least half the width of the roller. If the existing surfacing bounds both edges of the replacement, begin rolling at the edges of the replacement, lapping the existing surface at least half the width of the roller and progressing toward the center of the replacement area. Overlap each proceeding track by at least half the width of the roller and make sufficient passes over the entire area to produce the desired result. AC pavement shall be compacted to a minimum of 92% relative density,

based on the theoretical maximum density determined in accordance with ASTM D-2041, Rice Gravity.

4. **Finished surface:** The finished surface of the new compacted paving shall be flush with the existing surface and shall conform to the grade and crown of the adjacent pavement.

2.6.3 Portland Cement Concrete

A. Construction of PCC pavement shall be in conformance with the guidelines in ODOT SSC Section 00756, "Plain Concrete Pavement."
B. Construction of concrete joints shall follow the guidelines and requirements outlined in the ACPA publication, "Design and Construction of Joints for Concrete Streets," except for the following:
   1. Maximum joint spacing shall be 12 feet.
   2. Transverse joints shall be designed to be skewed 6:1 when meeting the edge of pavement, at the gutter line.
   3. For doweled contraction joints, do not lubricate the dowels.
   4. Staking of curb joints shall be required and performed by or under the direction of a Professional Land Surveyor registered in the State of Oregon.
   5. Isolation joints shall be used around manhole covers. Isolation joints shall be circular with a 3-foot spacing from the manhole cover.
C. All joints shall be sealed in conformance with the ACPA publication, "Design and Construction of Joints for Concrete Streets."
D. The surface finishing and smoothness of PCC surfaces shall follow the guidelines outlined in ODOT SSC Section 00756.49, "Surface Finishing" and Section 00756.55, "Surface Tolerance, Testing, and Correction."
E. At no time shall construction equipment or traffic be allowed on the new pavement until laboratory tests indicate that at least 90% specified design strength has been attained, and the City Engineer and the design engineer agree that the street is ready for traffic and construction loads.

2.6.4 Segmental Concrete Pavers

A. Concrete Unit Pavers
   1. Provide the City with paver manufacturer's/installation subcontractor's drawings and details: indicate perimeter conditions, junction with other materials, expansion and control joints, paver layout, patterns, color arrangement, installation and setting details and relationship of paving joints to fixtures, and project formed details.
   2. Furnish and install pavers meeting the ASTM C 936 with an average compressive strength of 8,000 PSI with no less than 7,300 PSI when tested to ASTM C 140 standards. The pavers shall be 3-1/8" (80 mm) minimum thickness.
   3. A submittal shall be provided to the City which includes:
      a. Paver manufacturer's catalog sheets with production specifications.
      b. Two representative full-size sample of each paver type, thickness, color, and finish. Submit samples indicating the range of color expected in the finished installation.
      c. Laboratory test reports certifying compliance of the concrete pavers with ASTM C 936.
      d. Minimum 3 lb. samples of subbase, base and bedding aggregate materials.
      e. Sieve analysis of aggregates for subbase, base, and bedding materials per ASTM C 136.
      f. Project specific or producer/manufacturer source test results for void ratio and bulk density of the base and subbase aggregates.

4. Prior to beginning construction, the contractor shall provide to the City's authorized representative proof of representative tests confirming compliance to the minimum requirements. If the tests reflect failure to meet the requirements, then the whole lot will be rejected.
5. The City reserves the right to determine the suitability of some concrete pavers for use on exposed faces, edges, or corners.
6. Concrete containment edge restraints shall be required with all concrete paver street installations in compliance with Standard Details.
7. Segmental Concrete Pavers shall be designed with a minimum 1" layer of bedding sand, over a minimum 8" layer base of ¾"-0 fractured rock; a greater thickness may be required on the soil conditions as provided in the Street Design Report. Crushed aggregate shall be separated from native subgrade soils using geotextile fabric to prevent fine material migrating up into the base rock.
8. Sand for leveling (bedding) course shall be sound, sharp, washed, natural sand or crushed stone complying with gradation requirements shown in **Table 2.14**; sand for joint filler material shall comply with the gradation requirements shown in Table **2.15**.

Table 2.14 ASTM No. 8 Bedding & Joint Filler Grading Requirements

Sieve Size	ASTM No.8 Percent Passing
½ in.	100
⅜ in.	85 - 100
U.S. No. 4 Sieve	10 - 30
U.S. No. 8 Sieve	0 - 10
U.S. No. 16 Sieve	0 - 5

Table 2.15 ASTM No. 89 and No. 9 Joint Opening Sand Grading Requirements

Sieve Size	ASTM No. 89 Percent Passing	ASTM No. 9 Percent Passing
½ in.	100	--
⅜ in.	90 – 100	100
U.S. No. 4 Sieve	20 - 55	85 – 100
U.S. No. 8 Sieve	5 - 30	10 – 40
U.S. No. 16 Sieve	0 – 10	0 – 10
U.S. No. 50 Sieve	0 - 5	0 - 5

9. On large projects, a 10' x 10' mockup area may be used to review quality control. Upon acceptance of the mockup area, all future work will be compared to this mock up area for acceptance on the project.
10. The contractor shall supply the City with a minimum of 100 square feet of additional material of each type, color, and/or thickness of pavers for use by the City for maintenance and repairs. The additional pavers shall be delivered on a pallet and wrapped in plastic.

B. Permeable Concrete Unit Pavers
1. For Permeable Concrete Pavers, the submittals shall be as outlined above.

2. Compliance shall generally follow the Concrete Unit Paver specification listed above with revisions as listed below.
3. Permeable Concrete Pavers shall be designed with a minimum 2” layer of bedding sand, over a minimum 4” base layer of ASTM No. 57 stone, over ASTM No. 2 stone sub-base of sufficient thickness to hold the design storm and as provided in the Street Design Report. The No. 2 stone shall be separated from native subgrade soils using a geotextile fabric to prevent fine material from migrating up into the rock.
4. The crushed stone shall have 90% fractured faces, LA Abrasion < 40 per ASTM C 131, with a minimum CBR of 80% per ASTM D1883.
5. Round river rock will not be allowed on applications subject to vehicular traffic.
6. All stone material shall be washed with less than 1%, passing the No. 200 sieve.
7. Sand for the leveling/bedding course and for the joint/opening filler, shall conform to ASTM No. 8 gradation as shown on **Table 2.14**.
8. Gradation requirements for the ASTM No. 57 stone and ASTM No. 2 stone shall be in conformance with **Table 2.16** and **Table 2.17**, respectively.
9. Gradation criteria for the bedding and base:
    a. D15 base stone / D15 bedding stone <5
    b. D50 base stone / D50 bedding stone > 2

Table 2.16 ASTM No. 57 Aggregate Grading Requirements

Sieve Size	ASTM No.57 Percent Passing
1 ½ in.	100
1 in.	95 – 100
½ in.	25 – 60
U.S. No. 4 Sieve	0 – 10
U.S. No. 8 Sieve	0 – 5

Table 2.17 ASTM No. 2 Sub-Base-Aggregate Grading Requirements

Sieve Size	ASTM No.2 Percent Passing
3 in.	100
2 ½ in.	90 – 100
2 in.	35 – 70
1 ½ in.	0 – 15
¾ in.	0 – 5

2.6.5 Driveways

A. Construct driveways in accordance with Subsection “Portland Cement Concrete Pavement Design” and the Standards Details.
B. At no time shall construction equipment or traffic be allowed on the new driveway until laboratory tests indicate that at least 90% specified design strength has been attained; this includes installation of adjacent asphalt or concrete pavement.

2.6.6 Sidewalks

A. Construct new sidewalks in conformance with Subsection "Portland Cement Concrete Pavement Design" and Standard Details.
B. Sidewalk repairs, replacement or reconstruction shall be in conformance with Subsection "Portland Cement Concrete Pavement Design" and Standard Details. The finish shall match that of adjacent panels or as directed by City Engineer.
C. ADA ramp repairs, replacement or reconstruction shall be in conformance with Subsection "Intersections" and Standard Details.
D. Root Barriers shall be installed in conformance with Subsection "Curbs and Gutters". Generally, the root control system should be installed a minimum of 24 inches deep, with a minimum 20-foot length centered on the root source. Installation of such systems shall be done so as not to disturb the sidewalk, curb or base rock previously installed. Provide landscaping plan showing location of root control barrier system.

2.6.7 Testing

A. **Asphalt pavement:** Asphalt pavement shall have minimum density testing performed every 100 feet of each panel installed. The pavement shall be compacted to a minimum of 92% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, "Rice Gravity."
B. **PCC pavement:** Portland cement concrete shall be tested at a minimum of once per 4 hours of work or 100 cubic yards of concrete installed. Testing shall include temperature, slump, air content, and minimum of four (4) test cylinders. No water or other additives may be added to the concrete load after testing sample has been taken. The 28-day compressive strength shall meet or exceed 4,000 psi; a minimum compressive strength of 3,600 psi is required to allow traffic on the pavement.
C. **Curb, gutter, and driveways:** Portland cement concrete shall be tested a minimum of once per 4 hours of work. Testing shall include temperature, slump, air content, and minimum of 4 test cylinders. No water or other additives may be added to the concrete load after testing sample has been taken. The 28-day compressive strength shall meet or exceed 3,000 psi. A minimum compressive strength of 2,700 psi is required to allow traffic.
D. **Testing Frequency:** City reserves the right to direct testing agency on frequency of testing.

2.6.8 Weather Conditions

A. AC pavement shall not be placed during periods of rainfall, sand or dust storms, or any imminent storms that might adversely affect the finished pavement quality. AC material shall not be applied over frozen surfaces or standing water. AC shall be placed at temperatures not colder than the minimum atmospheric temperatures specified in **Table 2.18.** Temperature of the AC material shall be in conformance with Subsection "Asphaltic Concrete".

Table 2.18. ATMOSPHERIC TEMPERATURE REQUIREMENTS

Individual Lift Thickness	Atmospheric Temperature
2" to 2½"	50° F
2½"+ to 3"	40° F

B. PCC pavement shall not be placed during periods of rain or on frozen bases. Placement shall not occur when descending air temperature falls below 40°F, nor shall it resume until ascending air temperature reaches 35°F. The contractor shall protect PCC pavement from weather damage. The contractor shall protect unhardened PCC from precipitation with protective material. If PCC is placed during cold weather, and the air temperature is forecast to drop below 35°F, the contractor shall prevent the PCC from freezing for at least 7 days.

2.6.9 Protection of Structures

A. Provide whatever protective coverings may be necessary to keep oil or asphalt from splashing on the exposed parts of bridges, culverts, curbs, gutters, posts, guardrails, road signs, and any other structures during paving operations. Remove any oil, asphalt, dirt, or any other undesirable matter from these structures that resulted from the paving operations.

B. Where water valve boxes, manholes, catch basins, or other underground utility appurtenances are situated in the area to be surfaced, the resurfacing shall be level with the top of the existing finished elevation of the appurtenances. If it is evident that an appurtenance does not match the proposed finished grade, notify the proper authority to have the item altered before proceeding with the resurfacing around the obstruction, unless otherwise approved by the City Engineer. Protect all covers during asphalt application.

2.6.10 Excess Materials and Trench Settlement Repair

Contractors shall dispose of excess materials. Contractor shall be responsible for repairing all settlement of pavement over trenches for a 2-year period.

2.6.11 Rock Surfacing

Where gravel shoulders have been disturbed, place ¾”–0” crushed aggregate backfill (see Subsection “Granular Fill”) as surfacing material for the full width of all streets, driveways, parking areas, street shoulders, and other areas disturbed by the construction. Spread the material by “tailgating” and supplement by hand labor when necessary. Level, grade, and compact the aggregate to conform to existing grades and surfaces.

2.7 SURFACE RESTORATION

2.7.1 Scope

This section covers the work necessary for all required replacement of pavement, curbs, sidewalks, rock surfacing, and drainage facilities that were removed during construction. Replacement pavement and base course thickness design shall conform to current City standards.

2.7.2 Asphalt Concrete Replacement

A. Base, sub-base, or subgrade material that has been removed shall be replaced with ¾”–0” crushed aggregate backfill (see Subsection “Granular Fill”) or control low strength material (CLSM, minimum 28-day compressive strength shall be 100-200 psi). Bring the trench or excavation to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for AC pavement. Crushed aggregate trench backfill placed within 3 feet of finished grade shall be compacted to 95% of the maximum dry density, as determined by AASHTO T-180. Crushed aggregate backfill placed below 3 feet of finished grade shall be compacted to 90% of the maximum dry density. Place the leveling course for the full width of the trench where pavement was disturbed, including bituminous surface shoulders.

B. Compact the base rock and leveling course material to 95% of the maximum dry density, as determined by AASHTO T-180. At the conclusion of each day’s operation, the contractor shall patch all trench or excavation areas. Cold-patch asphalt mix may be used as a temporary patch but must be maintained daily until final paving.

C. After backfilling and compacting to base rock, the contractor shall make a 1-foot T-cut in the existing pavement surrounding a trench or excavation. Trim existing pavement to a straight line to remove any pavement that has been damaged or that is broken and unsound to create a smooth, sound edge for joining the new pavement.

D. Within five (5) working days, weather permitting, after completion of all paving or utility work, the contractor shall repair all trench or excavation areas with hot-patch asphalt mix and tack and sand all joints and saw-cuts. AC pavement thickness shall be a minimum of 4 inches or match existing pavement depth, whichever is greater. AC pavement shall be compacted to a minimum of 92% relative density, based on the theoretical maximum density determined in accordance with ASTM D-2041, “Rice Gravity.”
    1. When the pavement surface has been cored, the area shall be repaired as follows: At the conclusion of each day’s operation, the contractor shall backfill, compact, and patch all cored areas. Cold-patch asphalt mix may only be used as a temporary patch.
    2. Within five (5) working days after completion of all paving or utility work, the contractor shall repair all cored areas with hot-patch asphalt mix.

2.7.3 Asphalt Restoration for Streets Listed on 5-Year Moratorium

When emergencies or special circumstances require access to underground utilities, the City may allow street cuts in streets listed on the 5-year moratorium (see Subsection “Utilities”). In addition to the repair work outlined in Subsection “Asphalt Concrete Replacement,” an additional mill and inlay shall be required over the repaired area to a point 1-foot beyond the T-cut perimeter.

2.7.4 Portland Cement Concrete Replacement

A. **Trenching or Excavation on Pavement and Driveways**: The Public Works Director encourages directional boring under existing concrete streets and discourages trenching or excavation work in streets or driveways. If this is unavoidable, the contractor shall remove and replace all panels that have been cut or damaged within five (5) working days, weather permitting, after completion of all paving or utility work. New panels shall be connected with No. 4 reinforcement tie-bars into the adjacent existing panels. Tie-bars shall be epoxied in place using an epoxy bonding agent as provided in the ODOT QPL. Bring the trench to a smooth, even grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for the base, leveling course, and PCC pavement.

B. **Coring:** When the pavement surface has been cored, the area shall be repaired as follows:
    1. Base or subgrade material that has been removed shall be replaced with ¾”–0” crushed aggregate backfill (see Subsection “Granular Fill”) or CLSM. Bring to a smooth, even compacted grade at the correct distance below the top of the existing pavement surface so as to provide adequate space for PCC pavement.
    2. At the conclusion of each day’s operation, the contractor shall patch all cored areas within roadways with concrete having a minimum 4,000-psi compressive strength at 28 days (concrete with a minimum 3,000-psi compressive strength may be used in driveways).

C. **Surface Smoothness:** The surface smoothness of the replaced pavement shall be such that when a straightedge is laid across the patched area between the edges of the old surfaces and the surface of the new pavement, the new pavement shall not deviate from the straightedge by more than ¼ inch.

D. **Curbs and Gutters:** Replace concrete curbs and gutters with the same section, width, depth, line, and grade as that removed or damaged. Cut the ends of existing curb to a vertical plane. Before replacing the sections, properly backfill and compact the trench to prevent subsequent settlement.

E. **Catch Basins:** Reinstall catch basins in their original locations and reconnect them to the drainage system in a manner equal to the original. If the existing catch basins are damaged beyond repair by operations, construct new basins of similar size, cross-section, and design as the original.

2.7.5 Sidewalk Replacement

A. Construct sidewalks in accordance with Subsection “Portland Cement Concrete Pavement Design” and Standard Details.
B. Match finish work to existing panels; re-compact base rock if disturbed.
C. Replacement ADA ramps shall meet current standards as per Standard Drawings.

2.8 STREET NAMES AND TRAFFIC CONTROL SIGNAGE AND STRIPING

2.8.1 Street Name Signs and Posts

A. Street signs shall be installed on all new or reconstructed public and private streets. Street names for all newly platted streets shall be approved by the City.
B. All street signs (material, color, wording, etc.) shall conform to OSSC (ODOT/APWA) Specifications, Standard Details, and the Manual of Uniform Traffic Control Devices (MUTCD). Location and type of signs shall conform with MUTCD and City Standards.
C. Signs along State rights-of-way shall be approved by ODOT as appropriate.
D. All signs shall be ordered, installed, and paid for by the developer. Street names and sign types shall be approved by the City prior to placement of the sign order.

2.8.2 Traffic Control Signage and Pavement Marking

Traffic control signing and striping shall be in conformance with the Standard Details and the current MUTCD. A signage and striping plan shall be included with plan submittals for new street construction and street improvements.

2.9 STREET LIGHTING

A. Street lighting design shall be provided as part of the street design and/or development process at the developer's cost. Streetlights shall be located as near as possible to lot line extensions and not in the middle of lots.
B. Spacing and location of street lighting shall be approved by the City based on City spacing standards or a photometric design, subject also to the location and spacing standards summarized herein. The design and installation of streetlights shall be paid for by the developer, including any redesign costs required to comply with City spacing or location standards. Any line extension fees shall be the responsibility of the developer.
C. Streetlights shall be placed at all street intersections and at cul-de- sac bulbs. Unless otherwise approved by the City, streetlight spacing shall not exceed 200 feet or as authorized by the City Engineer. As noted above, lesser spacing must be used whenever required in writing by the City, based on public safety concerns or by a photometric design.
    1. Unless otherwise approved by Public Works and the utility company, streetlights shall be installed a minimum of one foot behind curbline sidewalks.
    2. Streetlights may be installed between the curb and property line sidewalks provided the streetlight is a minimum of three feet behind the face of curb and 1 foot from the sidewalk.
D. Any street light relocation, if requested by a resident or developer (or where relocation is required in conjunction with new development), must be approved by the Public Works Director, and the resident or developer will be responsible for the cost of such relocation.
E. Where pedestrian paths or offsite sidewalks are required in conjunction with a development project, streetlights, or pedestrian lighting (acceptable to the Public Works Director) shall be provided along the sidewalks or paths where adequate lighting does not already exist.

2.10 STREET ACCEPTANCE POLICY

The City of Independence will accept new public street installations or systems built to these standards, providing that the following conditions are met.

2.10.1 Legal Recordings

All plats are recorded with the County Surveyor, all easements and dedications are recorded with the County Recorder and the Public Works Department receives a reproducible copy of the recorded documents.

2.10.2 Project Completion

After completion of construction of the total project, and after all testing has been satisfactorily completed, project closeout shall proceed as outlined in Subsection “Project Closeout.”

2.10.3 Maintenance Period

A. The Contractor or Applicant shall be responsible for providing Maintenance Assurance for Public Improvements as outlined in Subsection “Maintenance Assurance and Warranty.” Public street improvements shall be warranted for a minimum of two (2) years.
B. At any time during the warranty period, the City Engineer has reason to believe the public street improvements have defects that were the result of faulty workmanship or flaws in construction material, the responsible party shall be required at that party’s own cost, to repair any faults to the public street improvements deemed necessary by the City Engineer.
C. Before the end of the Construction Maintenance period, the City's authorized representative shall inspect the project for any remaining deficiencies. If the deficiencies that remain are determined to be the responsibility of the contractor or the applicant, the contractor or applicant shall then make such repairs.