



Retaining Wall Design Checklist

- To be filled out by the Design Engineer

- All required files to be compiled into one document, both hard and electronic

The following checklist should accompany each retaining wall design. If the subject property will have more than one type of retaining wall, such as concrete walls, MSE walls or rockeries, then a separate checklist should be complete for each type of retaining wall. All retaining walls more than four feet in height, as measured from bottom of footing to top of wall, require a building permit (2012 IBC, Section 105); however, only design of retaining walls over 4 feet in exposed height shall require submittal of design calculations as stipulated herein. Retaining walls should be designed in accordance with ARTICLE 3.32 RETAINING WALLS (Ord. No. 2018-05, 09/11/18) of the Alpine City Development Code (see attached document).

Project Information:

Project Address: _____

Applicant Name and Address: _____

Type of Retaining Wall: _____

Design Engineer and Company Name: _____

In left column indicate page, sheet or figure number where item is located.

LISTS MARKED ANY OTHER WAY WILL BE RETURNED TO APPLICANT TO CORRECT.

Page, Sheet or Figure No.	Required Submittal Items
	0. No wall exceeds 9' in height unless previously approved by City Council
	1. Is a fence required? See 3.32.3.5.7
	2. Do any of the wall components extend beyond property boundaries? See 3.32.3.5.8. If yes, is written permission included in the application? _____
	3. Profile drawings if the retaining wall is longer than 50 lineal feet, with the base elevation, exposed base elevation and top of wall labeled at the ends of the wall and every 50 linear feet or change in grade.
	4. Cross-sectional drawings including surface grades and structures located in front and behind the retaining wall a distance equivalent to three times the height of the retaining wall, and if the retaining wall is supporting a slope, then the cross section shall include the entire slope plus surface grades and

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	structures within a horizontal distance equivalent to one times the height of slope.
	5. A site plan showing the location of the retaining walls with the base elevation, exposed base elevation and top of wall labeled at the ends of wall and every 50 lineal feet or change in grade.
	6. A copy of the geotechnical report used by the design engineer. If a design specific study was completed, then skip to Item 5 below. The geotechnical report shall include requirement of Item 5 below otherwise additional laboratory testing is required in Item 5.
_____	7. The material strength parameters used in the design of the retaining wall, substantiated with laboratory testing of the materials as follows
_____	a. for soils, this may include, but is not limited to, unit weights, direct shear tests, triaxial shear tests and unconfined compression tests;
_____	b. if laboratory testing was conducted from off-site but similar soils within a 2000 foot radius of the proposed wall location, the results of the testing with similar soil classification testing needs to be submitted;
_____	c. minimum laboratory submittal requirements are the unit weight of retained soils, gradation for cohesionless soils, Atterberg limits for cohesive soils, and shear test data;
_____	d. soil classification testing shall be submitted for all direct shear or triaxial shear tests;
_____	e. if a Proctor is completed, classification testing shall be submitted with the Proctor result; and,
_____	f. laboratory testing should be completed in accordance with applicable American Society for Testing and Materials (ASTM) standards;
_____	g. for segmented block walls, the manufacturer's test data for the wall facing, soil reinforcement, and connection parameters shall be submitted in an appendix.
_____	8. The design engineer shall indicate the design standard used and supply a printout of the input and output of the files in an appendix with factors of safety within the design standard used as follows:
_____	a. design calculations ensuring stability against overturning, base sliding, excessive foundation settlement, bearing capacity, internal shear and global stability;
_____	b. calculations shall include analysis under static and seismic loads, which shall be based on the PGA as determined from probabilistic analysis for the maximum credible earthquake (MCE), with spectral acceleration factored for site conditions in accordance with the current IBC;
	c. Mechanically Stabilized Earth (MSE) walls shall be designed in general accordance with current FHWA or AASHTO standards for design of

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_____	<p>Mechanically Stabilized Earth Walls and Reinforced Soil Slopes or the current National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls;</p>
_____	<p>d. rock walls shall be designed in general accordance with 2006 FHWA-CFL/TD-06-006 "Rockery Design and Construction Guidelines," or current FHWA standard of care and;</p>
_____	<p>e. concrete cantilever walls shall be designed in general accordance with specifications provided in current American Concrete Institute or American Society of Civil Engineers standards and specifications.</p>
_____	<p>9. A global stability analysis with minimum factors of safety of at least 1.50 under static conditions and at least 1.10 under seismic loading conditions as follows:</p>
_____	<p>a. factors of safety results shall be presented to the nearest hundredth;</p>
_____	<p>b. seismic loads shall be based on the PGA as determined from probabilistic analysis for the maximum credible earthquake (MCE), with spectral acceleration factored for site conditions in accordance with the current IBC;</p>
_____	<p>c. the cross-sectional view of each analysis shall be included, and the printout of the input and output files placed in an appendix; and,</p>
_____	<p>d. the global stability analysis may be omitted for concrete cantilever retaining walls that extend to frost depth, that are less than nine feet in exposed height, absent of supporting structures within 30 feet of the top of the wall, and which have less than 10H:1V front and back slopes within 30 feet of the retaining structure.</p>
_____	<p>10. A drainage design, including a free draining gravel layer wrapped in filter fabric located behind the retaining wall with drain pipe day-lighting to a proper outlet or weep holes placed through the base of the wall, however:</p>
_____	<p>a. a synthetic drainage composite may be used behind MSE walls if a materials specific shear testing is completed to determined friction properties between the backfill and synthetic drainage composite;</p>
_____	<p>b. a synthetic drainage composite is not allowed behind rock walls;</p>
_____	<p>c. a synthetic drainage composite may be used behind the stem of the concrete cantilever walls;</p>
_____	<p>d. if the engineering can substantiate proper filtering between the retained soils and the drain rock, then the filter fabric may be omitted, and;</p>
_____	<p>e. if the retaining wall is designed to withstand hydrostatic pressures or the retained soils or backfill is free-draining as substantiated through appropriate testing, then drainage material may be omitted from the design.</p>
	<p>11. The design engineer's acknowledgement that the site is suitable for the retaining wall;</p>

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	12. An inspection frequency schedule.
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I _____, declare that I have read Article 3.32, understand and have
(Engineer of Record)
complied with the required submittal requirements, accept responsibility for all documents
contained herein that relate to the design of the subject retaining wall and have signed and sealed
the design calculations and accompanying construction drawings.

Signature of Design Engineer: _____

ARTICLE 3.32

RETAINING WALLS (Ord. No. 2015-07, 06/09/15, Ord. No. 2018-05, 09/11/18)

3.32.1 APPLICABILITY. This section applies to all retaining walls as defined in Article 3.1.11.45

3.32.2 EXCEPTIONS FROM ARTICLE 3.32. The City Council may grant an exception from these standards. Prior to the City Council considering the exception, the City Engineer shall submit a written recommendation to the Planning Commission. The recommended exception shall be based on generally accepted engineering practices. The Planning Commission shall review the recommendation and advise the City Council as to whether or not the exception should or should not be granted.

3.32.3 PURPOSE AND INTENT. The purpose of this ordinance and the intent of the City Council in its adoption is to promote the health and safety and general welfare of the present and future inhabitants of Alpine City. The ordinance will accomplish this purpose by:

1. Building Permit Required. Except as otherwise provided in Subsection (2), all retaining walls require a building permit prior to construction or alteration. Permit applications shall be processed and issued in accordance with building permit procedures and applicable provisions of this section. Building permit review fees will be assessed and collected at the time the permit is issued.
2. Building Permit Exemptions. The following do not require a building permit:
 1. Retaining walls less than four feet in exposed height with less than 10H:1V (Horizontal: Vertical) front and back slopes within ten feet of the wall;
 2. Non-tiered retaining walls less than four feet in exposed height with back slopes flatter than or equal to 2H:1V and having front slopes no steeper than or equal to 4H:1V;
 3. Double tiered retaining walls less than four feet in exposed height per wall and which have front slopes and back slopes of each wall no steeper than or equal to 10H:1V within ten feet of the walls, 2 foot spacing between front face of the upper wall and back edge of the lower wall;
 4. Retaining walls less than 50 square feet in size, less than 4 feet tall.
3. Geologic Hazards. If construction of any retaining wall, which requires a building permit, occurs within sensitive land areas as outlined by Article 3.12, then all analyses required for the design of retaining walls or rock protected slopes shall follow the Sensitive Lands Ordinance, specifically in regards to limits of disturbance and the required geologic hazard and engineering geology reports (3.12.6.4)
4. Engineer Design Required. All retaining walls required to obtain a building permit shall be designed by an engineer licensed by the State of Utah.
5. Height, Separation and Plantings.
 1. For the purposes of this subsection, the height of a retaining wall is measured as exposed height (H) of wall of an individual tier.
 2. A single retaining wall shall not exceed nine feet in exposed height if it can be seen from the nearest public right-of-way or adjacent properties to which it is exposed.
 3. Terracing of retaining walls is permitted where justified by topographic

conditions, but the combined height of all walls shall not exceed a height of 18 feet if exposed or can be seen from the nearest public right-of-way or adjacent properties. Walls with a separation of at least $2H$ (H of largest of 2 walls) from face of wall to face of wall shall be considered as separate walls for analysis purposes and applicability to this ordinance. If walls are within $2H$ (H of largest of 2 walls), then the combined height of the terrace shall be used for limitation of height.

4. In a terrace of retaining walls, a minimum horizontal separation of $H/2$ (H of largest of 2 walls) is required as measured from back of lower wall to face of higher wall. If the walls are not viewable from the nearest public right-of-way or adjacent properties, then there is no limitation of height.
 5. The view of the nearest public right-of-way or adjacent property shall be verified by the City Official during the review process and prior to permit for construction.
 6. For terraced walls viewable from the nearest public right-of-way, the horizontal separation between walls shall be planted with a minimum of five shrubs for every 20 linear feet of planting area. The size of the shrubs shall be less than one-half the width of the terrace. Shrubs shall be watered by drip irrigation to minimize erosion by property owner, not by Alpine City.
 7. Walls greater than four (4) feet in height (H) placed within $H/2$ of an adjacent property line, which would create a drop-off for the adjacent property, shall install a fence along the top of the wall in accordance with section 3.21.6.
 8. No retaining wall component shall extend beyond property lines unless written permission is obtained from the affected property owner.
6. Submittals. The following documents and calculations prepared by a licensed engineer of the State of Utah shall be submitted with each retaining wall building permit application:
1. profile drawings if the retaining wall is longer than 50 lineal feet, with the base elevation, exposed base elevation and top of wall labeled at the ends of the wall and every 50 linear feet or change in grade;
 2. cross-sectional drawings including surface grades and structures located in front and behind the retaining wall a distance equivalent to three times the height of the retaining wall, and if the retaining wall is supporting a slope, then the cross section shall include the entire slope plus surface grades and structures within a horizontal distance equivalent to one times the height of slope;
 3. a site plan showing the location of the retaining walls with the base elevation, exposed base elevation and top of wall labeled at the ends of wall and every 50 lineal feet or change in grade;
 4. a copy of the geotechnical report used by the design engineer. The geotechnical report shall include requirement of Item 5 below otherwise additional laboratory testing is required in Item 5;
 5. material strength parameters used in the design of the retaining wall, substantiated with laboratory testing of the materials as follows:

- a. for soils, this may include, but is not limited to, unit weights, direct shear tests, triaxial shear tests and unconfined compression tests;
 - b. if laboratory testing was conducted from off-site but similar soils within a 2000 foot radius of the proposed wall location, the results of the testing with similar soil classification testing needs to be submitted;
 - c. minimum laboratory submittal requirements are the unit weight of retained soils, gradation for cohesionless soils, Atterberg limits for cohesive soils, and shear test data;
 - d. soil classification testing shall be submitted for all direct shear or triaxial shear tests;
 - e. if a Proctor is completed, classification testing shall be submitted with the Proctor result; and,
 - f. laboratory testing should be completed in accordance with applicable American Society for Testing and Materials (ASTM) standards;
 - g. for segmented block walls, the manufacturer's test data for the wall facing, soil reinforcement, and connection parameters shall be submitted in an appendix.
6. the design engineer shall indicate the design standard used and supply a printout of the input and output of the files in an appendix with factors of safety within the design standard used as follows:
- a. design calculations ensuring stability against overturning, base sliding, excessive foundation settlement, bearing capacity, internal shear and global stability;
 - b. calculations shall include analysis under static and seismic loads, which shall be based on the PGA as determined from probabilistic analysis for the maximum credible earthquake (MCE), with spectral acceleration factored for site conditions in accordance with the current IBC;
 - c. Mechanically Stabilized Earth (MSE) walls shall be designed in general accordance with current FHWA or AASHTO standards for design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes or the current National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls;
 - d. rock walls shall be designed in general accordance with 2006 FHWA-CFL/TD-06-006 "Rockery Design and Construction Guidelines," or current FHWA standard of care and;
 - e. concrete cantilever walls shall be designed in general accordance with specifications provided in current American Concrete Institute or American Society of Civil Engineers standards and specifications.
7. a global stability analysis with minimum factors of safety of at least 1.50 under static conditions and at least 1.10 under seismic loading conditions as follows:
- a. factors of safety results shall be presented to the nearest hundredth;

- b. seismic loads shall be based on the PGA as determined from probabilistic analysis for the maximum credible earthquake (MCE), with spectral acceleration factored for site conditions in accordance with the current IBC;
 - c. the cross-sectional view of each analysis shall be included, and the printout of the input and output files placed in an appendix; and,
 - d. the global stability analysis may be omitted for concrete cantilever retaining walls that extend to frost depth, that are less than nine feet in exposed height, absent of supporting structures within 30 feet of the top of the wall, and which have less than 10H:1V front and back slopes within 30 feet of the retaining structure.
 - 8. a drainage design, including a free draining gravel layer wrapped in filter fabric located behind the retaining wall with drain pipe day-lighting to a proper outlet or weep holes placed through the base of the wall, however:
 - a. a synthetic drainage composite may be used behind MSE walls if a materials specific shear testing is completed to determined friction properties between the backfill and synthetic drainage composite;
 - b. a synthetic drainage composite is not allowed behind rock walls;
 - c. a synthetic drainage composite may be used behind the stem of the concrete cantilever walls;
 - d. if the engineering can substantiate proper filtering between the retained soils and the drain rock, then the filter fabric may be omitted, and;
 - e. if the retaining wall is designed to withstand hydrostatic pressures or the retained soils or backfill is free-draining as substantiated through appropriate testing, then drainage material may be omitted from the design.
 - 9. the design engineer's acknowledgement that the site is suitable for the retaining wall;
 - 10. an inspection frequency schedule.
7. Preconstruction Meeting. At least 48 hours prior to the construction of any approved retaining wall, a preconstruction meeting shall be held as directed by the Building Official. The meeting shall include the Building Official, the design engineer, the contractor and the project or property owner. The preconstruction meeting can be waived at the discretion of the Building Official.
 8. Inspections and Final Report. The design engineer shall make all inspections needed during construction. A final report from the engineer shall state that the retaining wall was built according to the submitted design. The report shall include detail of the inspections of the wall in accordance with the inspection frequency schedule. All pertinent compaction testing shall also be included with the final report.
 9. Maintenance. All retaining walls shall be maintained in a structurally safe and sound condition and in good repair.