# Alpine Citadel engineering approach

Coordinate the enclosure layout, structural loads, anchorage and concrete support in one project submittal. This document explains the Alpine Citadel engineering approach for design professionals and contractors. Member sizes, base plates, anchors and foundations shown are example outputs: project engineering determines them for each site, with base-plated or embedded posts chosen to suit.

**ASCE 7-22**
wind design; steel per AISC 360; anchorage per ACI 318 Ch. 17

**Per site**
wind speed, exposure category and risk category; no single wind rating

**50 states**
sealed structural calculations available

**< 1 week**
typical turnaround after complete project inputs

## 01 DESIGN STANDARDS

| STANDARD | USED FOR |
|---|---|
| **ASCE 7-22** | Wind loads on the screen wall (solid freestanding walls, see ASCE 7-22 Ch. 29); wind speed, exposure and risk category; other loads where a project requires them |
| **AISC 360** | Steel posts, gate posts, base plates and welds |
| **ACI 318 Ch. 17** | Anchorage of base plates to concrete |
| **IBC** | Permits (§105.2), risk category (§1604.5), special inspection (§1705), embedded posts (§1807.3) |

Code editions follow the building code adopted by the jurisdiction. The project engineer confirms the governing editions in each submittal.

### Information to send for a project check

- Site address: wind speed, exposure, special wind regions.
- Risk category, if already assigned.
- Wall height and layout: site plan, prototype detail or sketch.
- Slab: new or existing, thickness, concrete strength, joints near posts.
- Soil class or geotechnical report for embedded posts.
- Local rules: masonry, opacity, roof, gate width, permit status.

## 02 HOW EACH PROJECT IS ENGINEERED

Alpine Citadel has no single wind rating. Each project is engineered to ASCE 7-22 for its own site and covered by its own sealed calculations.

| PARAMETER | ENGINEERED PER PROJECT |
|---|---|
| **Height** | 5 to 10 ft; 6, 7 and 8 ft standard |
| **Ultimate wind speed** | Per site, from the ASCE Hazard Tool |
| **Exposure category** | B, C or D, per site |
| **Risk category** | As assigned for the project |
| **Face** | Solid slats, 100% opaque, designed as a solid wall |
| **Bays** | 15 in to 96 in clear, post to post |
| **Posts** | Typically HSS 4 × 4 line and corner posts; 8 in round gate posts |
| **Mounting** | ¾ in base plates anchored to a concrete slab, or embedded posts |

**Higher-wind sites** are handled with closer post spacing, heavier base plates and anchors, or embedded posts, which raise wind resistance substantially. Nearly any project site can be accommodated.

## 03 WIND LOAD ON A SCREEN WALL

ASCE 7 treats a freestanding screen wall as a solid freestanding wall under the provisions for other structures (see ASCE 7-22 Ch. 29). In outline:

1. **Wind speed.** Look up the ultimate wind speed V for the site address and risk category with the free ASCE Hazard Tool (ascehazardtool.org).
2. **Velocity pressure** $q_h$ at the top of the wall, from V and the site's exposure category, topography and ground elevation.
3. **Force coefficient** $C_f$ for a solid freestanding wall, from its length-to-height ratio and clearance to grade: load Cases A and B, plus Case C for longer walls, whose free ends see higher pressure. Corner returns modify the end-zone coefficients.
4. **Design force** on the solid area, with the resultant located as the load case requires.

$$F = q_h \cdot K_d \cdot G \cdot C_f \cdot A_s$$

ASCE 7-22 moves the directionality factor $K_d$ from the velocity-pressure equation into the force equation. See ASCE 7-22 Ch. 26 and Ch. 29.

### Spaced slats and perforated panels

A wall counts as **solid while less than 30% of its gross area is open**. For a solid wall with openings, ASCE 7 permits the solid-wall force to be multiplied by a porosity factor:

$$\text{factor} = 1 - (1 - \varepsilon)^{1.5}$$

ε = solid area ÷ gross area. At 30% open or more the wall is no longer solid and the open-structure coefficients apply. See ASCE 7-22 Ch. 29.

The standard face is 100% opaque (ε = 1), designed for the full solid-wall force. Custom slat spacing and perforated panels reduce wind load, taken only in a project calculation for the actual open area. Check opacity rules at the same time: spacing can fail a 100%-opaque screening requirement.

## 04 LOAD PATH

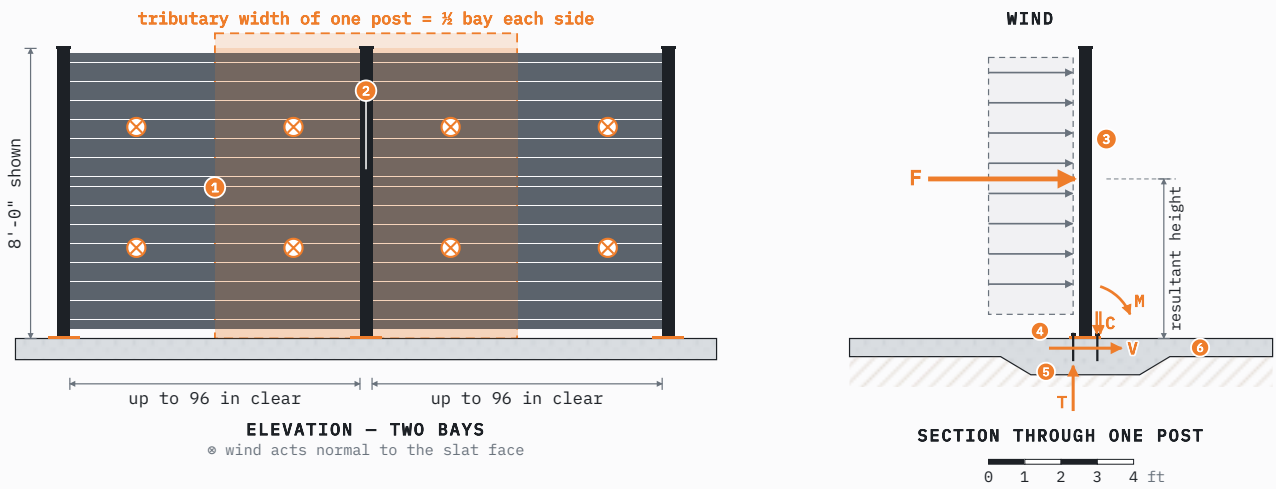



**Figure 1.** Load path of a standard 8 ft screen wall with two 96 in bays, drawn to scale; forces shown qualitatively. F = wind resultant, V = base shear, M = overturning moment, T = anchor tension, C = plate bearing. Typical — every project is engineered.

1. **Slat face.** Wind acts on the full face of 0.79 × 3.15 in (20 × 80 mm) steel tube slats, stacked tight: the face is loaded as a solid wall.
2. **Slats to posts.** Captive slats slide into channels welded to the posts, span post to post and bear on the posts; only the top and bottom slat of each bay are bolted. **No structural credit is taken for the slats**: they neither brace the posts nor share load.
3. **Posts.** Each post is a vertical cantilever from its base plate, designed for the wind on its tributary width (half a bay each side) with no load sharing. HSS 4 × 4 line and corner posts; 8 in round gate posts also carry the gate leaves.
4. **Base plate.** Base shear V and moment M pass through a ¾ in hot-dip galvanized plate: tension T in the windward anchors, bearing C under the leeward edge.
5. **Anchors.** ¾ in anchors carry tension and shear into the concrete, designed to ACI 318 Ch. 17: steel, breakout, pullout, side-face blowout and bond in tension; steel, breakout and pryout in shear; and interaction.
6. **Slab.** The slab, thickened at each post, develops the anchors and resists overturning. It is designed by the project engineer to Alpine's base-plate and slab requirements.

## 05 FOUNDATIONS

### A · Base-plated on a concrete slab STANDARD

Every post stands on a ¾ in hot-dip galvanized steel base plate anchored to the slab. Slab requirements in the typical configuration:

- Concrete f′c ≥ 4,000 psi.
- Thickened to 12 in at posts; 30 × 30 × 12 in at gate posts.
- Edge distance and nearby joints or sawcuts coordinated with the anchor design.

The project engineer designs the slab: thickness, reinforcement, jointing and subgrade.

### B · Embedded posts CUSTOM

Posts can be set in concrete piers where there is no suitable slab or a project calls for it, including roofed enclosures. Embedded posts are custom and engineered per project:

- Pier diameter and embedment designed to IBC 1807.3 for the post's shear and moment.
- Lateral soil bearing from the soil class (IBC Table 1806.2) or a geotechnical report.
- Post profile, setting tolerance and corrosion protection specified per project.

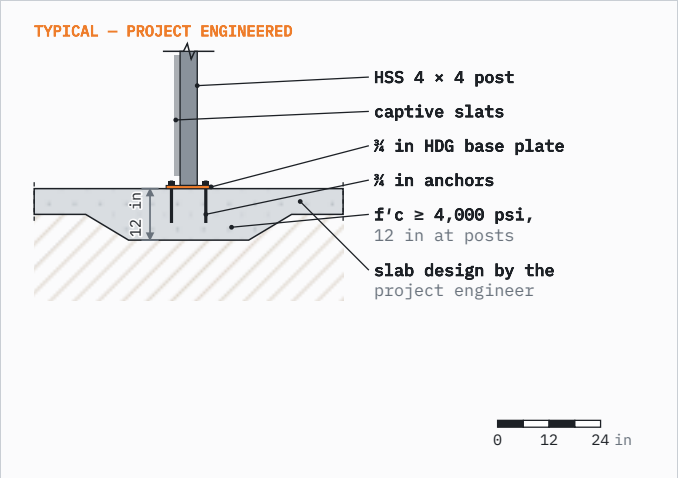



**Figure 2.** Foundation details A and B, drawn to scale. Typical — project engineered. Slab thickness away from posts, anchor embedment, pier diameter and embedment depth are set by project engineering and are drawn for illustration only.

## 06 ANCHORS

| PLATE | SIZE | ANCHORS |
|---|---|---|
| **Line post** | 10½ × 8 × ¾ in | 4 × ¾ in |
| **Corner post** | 10½ × 10½ × ¾ in | 4 × ¾ in |
| **Gate post** | 18½ × 13 × ¾ in | 8 × ¾ in |

The anchor type is selected and engineered per project for the slab, edge distances and site loads:

- **Adhesive anchor:** ¾ in threaded rod in a code-listed adhesive (qualified under ACI 355.4).
- **Mechanical anchor:** a code-listed ¾ in mechanical anchor (qualified under ACI 355.2).

The project calculation names the anchor product and its evaluation report, embedment, hole size, edge distance and installation requirements. Install per the manufacturer's printed instructions, with special inspection per IBC 1705 and the evaluation report.

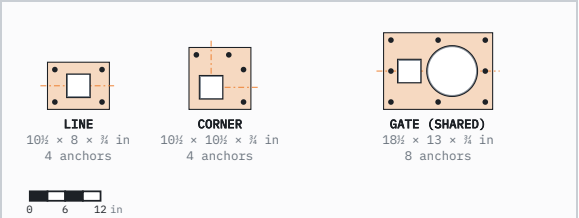



**Figure 3.** Base plates in plan, drawn to scale from the shop drawings: post positions, anchor holes and fence lines (dashed). The line plate's 10½ in side runs along the fence, so its 8 in anchor spread is parallel to the fence and the 5½ in spread is across it. The corner post sits in the corner; the shared gate plate carries the square end post and the round gate post. Anchor type and embedment are engineered per project.

## 07 CUSTOM ENGINEERING ENVELOPE

Every project, standard or custom, is engineered for its own site and covered by the project's sealed calculations.

| PARAMETER | STANDARD | CUSTOM — ENGINEERED PER PROJECT |
|---|---|---|
| **Height** | 6 ft, 7 ft, 8 ft | Built from 5 ft to 10 ft; other heights by engineering |
| **Wind speed** | Per site, from the ASCE Hazard Tool; no single wind rating | |
| **Exposure** | B, C or D, as determined for the site | |
| **Risk Category** | As assigned for the project by the project engineer or building official | |
| **Posts** | HSS 4 × 4; 8 in round gate posts | Custom post profiles and sizes |
| **Bays** | 15 in to 96 in clear | Non-standard widths |
| **Infill** | Solid slats, 100% opaque | Custom slat spacing; perforated metal panels, with the porous-wall reduction where the open area allows |
| **Foundation** | Base-plated on slab | Embedded posts |
| **Gates** | 12 ft or 16 ft clear, double leaf | 20 ft clear, 6 ft single leaf, corner-hinged and multiple gates |
| **Roof** | Open top | Covered, steel-roofed enclosures |

### Covered and roofed enclosures

A roof turns a screen wall into a building. Expect a building permit and a full structural design: roof dead load, snow load (ASCE 7 Ch. 7), wind on the roof including uplift, and seismic where it applies. Posts, connections and foundations are engineered for the roof, often on embedded posts. Local rules on roof height, drainage and fire separation also apply.

## 08 ENGINEERING PACKAGE AND PROCESS

### What the package contains

- Sealed structural calculations for the site: wind parameters and post, base plate, weld and anchor checks. Available in all 50 states.
- Layout drawing and bay schedule solved to the architect's drawing.
- Post, plate and anchor schedule, with anchor product, embedment and installation requirements.
- Slab and base-plate requirements for the project engineer, or the pier design for embedded posts.
- Product data and finish specification; where a code names masonry, an alternate-materials submittal.

**Included for the example configurations.** Non-standard engineering (custom heights, high wind, Exposure D, embedded posts, roofs, custom profiles) is quoted per project.

### Process

1. Send the site plan, prototype detail or sketch, and the site address.
2. We solve the layout and set the site's wind speed, exposure and risk category.
3. Posts, plates, anchors and foundation are engineered for the site, and the calculations are sealed for the project's state.
4. **Engineering package delivered typically in under one week after complete project inputs.**
5. We answer plan-review comments through permit.

## 09 PERMITS AND CODE NOTES

### Building permit

**IBC §105.2** exempts fences not over 7 ft high from a building permit (the 2024 text excludes swimming pool barriers). The exemption does not waive code compliance or zoning review, and many jurisdictions still permit trash enclosures. 8 ft walls and roofed enclosures usually need a permit.

### When sealed calculations help

- Walls over 7 ft, and any roofed enclosure.
- Where a code names masonry: an alternate-materials submittal with sealed calculations and a building-matched finish.
- High-wind sites, Exposure D, or a risk category above I.
- Commercial site-plan review, or when the owner or contractor needs the foundation substantiated.

### Tire storage yards

**IFC §3407.2** (2021 text): outdoor tire storage over 20,000 ft³ needs a fence at least 6 ft high with gates at least 20 ft wide. Alpine Citadel builds 20 ft clear gates as a custom design for these yards. Confirm the edition adopted locally.

### Wind speed by address

Use the ASCE Hazard Tool (ascehazardtool.org). It covers ASCE 7-10, 7-16 and 7-22 by address or coordinates and risk category. The former ATC Hazards by Location site closed on December 31, 2024.

### Limits of a screen wall

A slatted steel screen is a visual screen. It is not a noise barrier and not a fire barrier, and it does not reduce NFPA 855 clearances around battery energy storage.

## 10 PLAN-REVIEW CHECKLIST

| ITEM | IN THE PROJECT PACKAGE | CHECK AGAINST |
|---|---|---|
| **Design criteria** | $V_{ult}$, risk category, exposure, height and code editions | ASCE Hazard Tool; adopted code |
| **Wind load** | Solid-wall force; porous reduction only with an open-area calculation | ASCE 7-22 Ch. 26 and 29 |
| **Steel** | Posts, gate posts, base plates and welds for the site loads | AISC 360 |
| **Anchors** | Product and evaluation report, embedment, edge distance, inspection | ACI 318 Ch. 17; IBC 1705 |
| **Foundation** | Slab requirements at posts, or pier design for embedded posts | Project slab design; IBC 1807.3 |
| **Seal** | Professional engineer licensed in the project's state | State licensing board |

## 11 MATERIALS AND FINISH

| COMPONENT | STANDARD |
|---|---|
| **Steel** | Structural steel, ASTM A36 or equivalent, sized by the project design; mill certificates available. Hardware typically Grade 8 and 316 stainless steel |
| **Posts** | 4 in square structural steel tube (HSS 4 × 4), capped, with welded slat channels; electro-galvanized |
| **Gate posts** | 8 in round steel, capped; hot-dip galvanized |
| **Slats** | Solid steel tube 0.79 × 3.15 in (20 × 80 mm), captive slide-in, stacked tight; middle slats unfastened, only the top and bottom slat of each bay bolted through the channels; electro-galvanized |
| **Plates, sleeves** | ¾ in steel base plates and steel post sleeves, all hot-dip galvanized |
| **Finish** | Powder coated to Qualicoat standards, superdurable polyester with UV protection; any RAL color. Alpine offers different types of galvanizing and can hot-dip galvanize the entire structure where the site or specification calls for it |
| **Fire** | Noncombustible steel construction |

## 12 ENGINEERING FAQ

**Do the slats contribute to strength?**

No. The slats are captive in the post channels and collect the wind, but no structural credit is taken for them. The posts, plates and anchors carry the load.

**Is there a wind speed limit?**

No. Alpine Citadel has no single wind rating. Every project is engineered for its own wind speed, exposure, risk category, height, anchor type and foundation.

**How do I find the design wind speed?**

Enter the address and risk category in the ASCE Hazard Tool (ascehazardtool.org), or send us the address and we will do it.

**Which risk category applies?**

IBC Table 1604.5 does not list fences or screen walls, so the project engineer and building official assign it. Utility and essential facilities may require a higher category; each project is engineered for the one assigned.

**Do spaced slats reduce the wind load?**

Yes, through the ASCE 7 porous-wall reduction, but only by project calculation for the actual open area. Spacing also affects opacity rules for trash-enclosure screening.

**Can posts be embedded instead of base-plated?**

Yes, as a custom design. Pier size and depth are engineered per project from the soil class or a geotechnical report (IBC 1807.3).

**What slab do I need?**

In the typical configuration: f′c ≥ 4,000 psi, thickened to 12 in at posts and 30 × 30 × 12 in at gate posts. The project engineer designs the slab from Alpine's requirements.

**Adhesive or mechanical anchors?**

Either, selected per project. Both are ¾ in, four per line or corner plate and eight per gate plate, with the product, embedment and inspection stated in the calculations.

**Can it replace CMU where the code names masonry?**

Often, through the code's alternative-materials path. We provide an alternate-materials submittal with sealed calculations and a building-matched finish.

**Who seals the calculations, and how fast?**

A professional engineer licensed in the project's state. Sealed calculations are available in all 50 states, and the engineering package is delivered typically in under one week after complete project inputs, included for the example configurations.

## REFERENCES


- ASCE/SEI 7-22, Minimum Design Loads and Associated Criteria for Buildings and Other Structures
- AISC 360, Specification for Structural Steel Buildings
- ACI 318, Chapter 17, Anchoring to Concrete; ACI 355.2 and 355.4, post-installed anchor qualification
- AISC Design Guide 1, 3rd ed. (2024), Base Connection Design for Steel Structures
- International Building Code §105.2, §1604.5, §1705, Table 1806.2, §1807.3
- International Fire Code §3407, tire storage fencing
- ASCE Hazard Tool, ascehazardtool.org


**Start a project**

Send a site plan, prototype detail or sketch and the site address. We return a layout, bay schedule and engineering package typically in under one week after complete project inputs.


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Alpine Enclosure Systems is a division of Alpine International Trading Co. This overview describes the engineering approach for Alpine Citadel; it is not a sealed document and does not replace project calculations. Alpine Citadel is engineered per project; dimensions, loads, anchors and foundations shown are typical and are confirmed by project engineering. Code references are summaries; the adopted code text governs. Specifications subject to change. © 2026 Alpine International Trading Co.