I'm trying to get a better understanding of strength and stiffness requirements for steel per AISC 360-22. I have a few questions about Example A-6.2 from SCM Design Examples V16.0 (attached). It shows a 36 ft long pinned-pinned WT-shape column with W-shape point braces at quarter points (7'-6" apart). The W-shape braces are 12 ft long, simply supported, and rotated such that the flanges of the braces and the flange of the WT columns are attached at the midspan of the W-shape braces. 1) Strength and stiffness requirements for lateral bracing of columns is given in Appendix 6. I know that in most cases flexural buckling about the minor axis of bending will control over torsional buckling about the longitudinal axis, but are there any strength or stiffness requirements for torsional bracing of columns?2) The example assumes that the W-shape beams bracing the column are laterally braced and compact such that they can reach their plastic moment capacity. It uses this assumption when calculating the minimum plastic section modulus needed for the brace. Does the column laterally brace the beam against lateral-torsional buckling while the beam braces the column against flexural buckling such that the unbraced length of the W-shape brace is 6'-0"? Or is the unbraced length of the W-shape brace the full 12'-0"?3) The example states that the WT is assumed braced against flexural buckling about its y-axis by the axial strength and stiffness of the W-shape brace. Similarly to my last question, if one were to check the axial strength of the W-shape brace, does the WT column brace the W-shape against flexural buckling? Bracing Connections involve the bolting of flat, angle, channel, I-section, and hollow section members to a gusset plate to support the column or other members. The bracing member in a bracing connection can work in tension alone, or in both tension and compression and stabilize the main components by distributing the loads. In this article, we will explore the basics of bracing connectionsBracing connections serve as the backbone of many structural systems, providing lateral stability and helping resist forces like wind, seismic activity, and even the structural loads themselves. These connections transfer loads from the building or structure to the foundation, ensuring that it remains upright and safe even during extreme conditions.Some benefits associated with the use of structural steel for owners are:Steel allows for reduced frame construction time and the ability to construct in all seasonsSteel makes large spans and bay sizes possible, providing more flexibility for ownersSteel is easier to modify and reinforce if architectural changes are made to a facility over its lifeSteel is lightweight and can reduce foundation costsSteel is durable, long-lasting, and recyclableProcurement and management of structural steel are similar to other materials, but there are some unique aspects to steel construction:Steel is fabricated off-siteOn-site erection is a rapid processThis gives users of structural steel some scheduling advantagesCoordination of all parties is essential for achieving potential advantagesThe structure will be subjected to various kinds of loads (Fig. 1) likeForces from gravity, wind, and seismic events are imposed on all structuresForces that act vertically are gravity loadsForces that act horizontally, such as stability, wind, and seismic events (the focus of this discussion) require lateral load-resisting systems to be built into structuresAs lateral loads are applied to a structure, horizontal diaphragms (floors and roofs) transfer the load to the lateral load-resisting system.Fig.1: Forces acting on structuresThe type of lateral load-resisting system to be used in a structure should be considered early in the planning stage. Lateral stability and architectural needs must be metREAD Process Design of Marine SystemsThe three common lateral load-resisting systems are:Braced Frames (Fig. 2)Rigid Frames (Fig. 2)Shear WallsFig. 2: Braced and Rigid FramesSimple Connections.Moment Connections: Fully Restrained and Partially Restrained.All connections have a certain amount of rigidity.Simple connections (A above) have some rigidity but are assumed to be free to rotate.Partially-Restrained moment connections (B and C above) are designed to be semi-rigid.Fully-Restrained moment connections (D and E above) are designed to be fully rigid.Fig. 3: Steel frame connection typesDesigned as flexible connections.Connections are assumed to be free to rotate.Vertical shear forces are the primary forces transferred by the connection.Require a separate bracing system for lateral stability.The following few slides show some common simple framing connections.Designed as rigid connections that allow little or no rotation, Used in rigid frames.Moment and vertical shear forces are transferred through the connection.Two types of moment connections are permitted: Fully-Restrained and Partially-Restrained (Fig. 4).Fig. 4: Moment ConnectionsRigid frames, utilizing moment connections, are well suited for specific types of buildings where diagonal bracing is not feasible or does not fit the architectural designRigid frames generally cost more than braced framesDiagonal bracing creates stable triangular configurations within the steel building frameBraced frames are often the most economical method of resisting wind loads in multi-story buildings.Some structures, like the one pictured above, are designed with a combination of braced and rigid frames to take advantage of the benefits of bothREAD What is a Combined Cycle Power Plant?Structural steel frames require temporary bracing during constructionTemporary bracing is placed before plumbing up the structural frameThis gives the structure temporary lateral stabilityTemporary bracing is removed by the erectorIn a braced frame, temporary bracing is removed after the final bolt-up is complete and the permanent bracing system is in placeIn a rigid frame, temporary bracing is removed after the final bolt-up is completeBracing is concentric when the center lines of the bracing members intersect Common concentric braced frames used in buildings today include:Cross braceTwo-story XsChevronSingle diagonalsCross-bracing design is possibly the most common type of braces. Bracing can allow a building to have access through the brace line depending on the configurationThe diagonal members of Cross bracing go into tension and compression similar to a truss.The multi-floor building frame elevation shown above has just one braced bay, but it may be necessary to brace many bays along a column lineWith this in mind, it is important to determine the locations of the braced bays in a structure early in a projectConnections for X bracing are located at the beam-to-column jointsBracing connections may require relatively large gusset plates at the beam-to-column jointThe restriction of space in these areas may have an impact on the mechanical and plumbing systems as well as some architectural featuresFig. 5: Different types of BracingThe members used in Chevron bracing are designed for both tension and compression forcesChevron bracing allows for doorways or corridors through the bracing lines in a structureChevron bracing members use two types of connectionsThe floor-level connection may use a gusset plate much like the connection on X-braced framesThe bracing members are connected to the beam/girder at the top and converge to a common pointIf gusset plates are used, it is important to consider their size when laying out mechanical and plumbing systems that pass through braced baysREAD What is Structural Resonance? Its Effects and Mitigation OptionsEccentric bracing is commonly used in seismic regions and allows for doorways and corridors in the braced baysThe difference between Chevron bracing and eccentric bracing is the space between the bracing members at the top gusset connectionIn an eccentrically braced frame bracing members connect to separate points on the beam/girderThe beam/girder segment or link between the bracing members absorbs energy from seismic activity through plastic deformationEccentrically braced frames look similar to frames with Chevron bracingA similar V-shaped bracing configuration is usedFig. 6: Figure showing Combination FramesAs shown in Fig. 6 (left) a braced frame deflects like a cantilever beam while a moment-resisting frame deflects more or less consistently from top to bottomBy combining the two systems, reduced deflections can be realizedThe combination frame is shown above rightFew more useful resources for you..Structural Platforms: An In-Depth GuideA Short Presentation on Pile Foundation and its DesignAn article on Tank Pad FoundationAn Introduction to Braced ConnectionsA short article on Sun Shade for oil and gas industry and their DesignConsiderations for Project Site Selectionlink to GRE Design Envelope and Failure Envelopelink to Effect of Coating Factor on Buried Pipeline Stress Analysis

Column bracing design. Cross bracing design example. Design column. Bracing design example. Bracing design in steel structure. Column bracing.