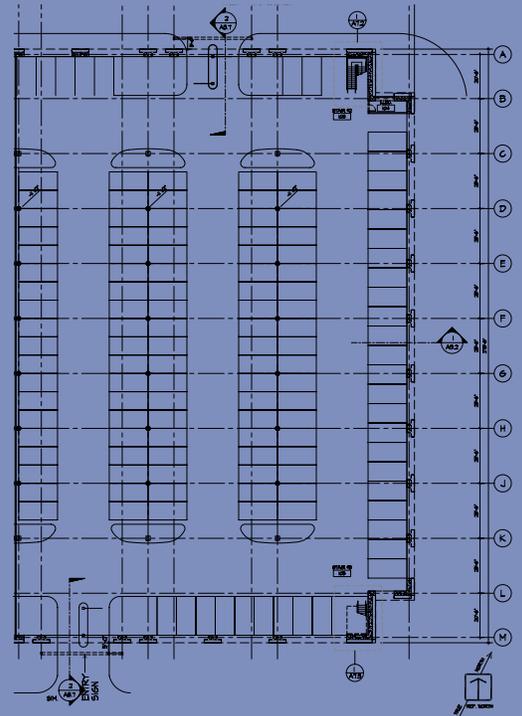
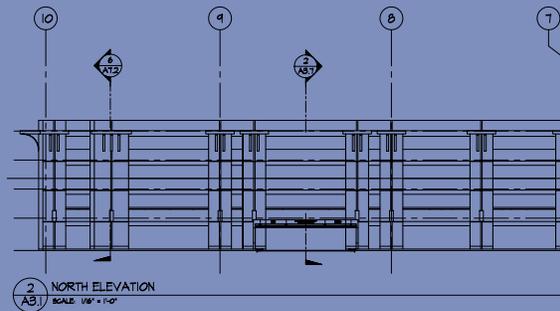


structural STEEL

Steel
SolutionsCenter



THE PARKING STRUCTURE PROTOTYPE III

Exploring Conventional Composite and
Castellated Composite Framing Options

USING THE AISC STEEL SOLUTIONS CENTER

What's this?

This package illustrates a representative conceptual solution developed by the AISC Steel Solutions Center (SSC). The information typically received by the SSC and the conceptual solution provided in reply are both presented here. The conceptual solution also comes with continued support throughout the life of the project from the SSC and more directly, AISC's Regional Engineers.

Project Inquiries

Projects find their way to the SSC in a number of ways. Common scenarios include:

- An owner or architect is developing concepts for a new project. Interested in exploring the advantages of a structural steel framing system, they contact the SSC.
- Project bids are over-budget in another material such as concrete or wood, and a steel alternative is suggested. The architect, engineer, general contractor, or owner contacts a local steel fabricator for assistance who in turn contacts either the SSC or an AISC Regional Engineer for assistance.
- A fabricator learns about a new project in the early stages of development. They contact the owner or project architect to discuss similar steel projects and highlight the advantages of various steel framed solutions for the project.

Developing a Solution

The AISC team and the client work together—often via conference call—to determine what can be done to move the project forward in steel. Depending on the timeframe, the SSC can provide a wide range of solutions from a simple bay framing study to a full conceptual solution. All SSC services are FREE to our clients; however, a level of commitment from the project decision maker to seriously consider the steel alternative is expected.

What do I have here?

This prototype is one example of a conceptual solution that the SSC can provide. Because it is representative of many similar structures, SSC clients often use this prototype as the first step in moving the project forward in steel.

The SSC has been involved in a broad range of projects since its inception in 2001. SSC staff can help you find innovative economical steel solutions for parking garages, office buildings, multi-story residential buildings, healthcare facilities, educational facilities, industrial structures, bridges, and other projects where structural steel can compete.

Please let us know how we can assist you with your next project.



Portland International Airport Parking Addition
Portland, Oregon
3,300 spaces added
Conventional steel beams with
composite slab on metal deck

This prototype dictates a typical scenario of how the AISC Steel Solutions Center (SSC) can help a project decision maker evaluate a steel-framed alternative. Below is an example of this parking structure challenge.

Comparison Parking Project

It is the beginning of the week, and a Missouri architect is working on a fast-tracked parking project in Kansas City, Missouri. Time and money are of the essence, as always, and the architects' goal is to identify the most efficient and economical solution for this unique parking structure. They recently attended a presentation on innovations in steel-framed parking structures by one of AISC's Regional Engineers. Interested in learning more, they decide to contact the SSC.

Engaging the Resources

A conference call is arranged between the architect, an AISC Regional Engineer, and an advisor in the SSC. A few key project parameters are discussed:

- The project is on an accelerated design-bid-build schedule, and a cost effective parking solution is needed. Speed of construction and overall cost are the main priorities.
- The owner is open to a steel-framed structure, but has expressed concern about fire protection requirements.
- The owner will operate the parking garage, and thus, life-cycle costs and patron security are very important.
- The owner wishes to push "green initiatives" in the design and operation of the structure, therefore, sustainability principles must be considered.

Additionally, the architects reveal that they have not worked with structural steel much in the past. They are concerned that the fire protection costs might push the overall budget for the steel solution out of the competitive range. The architect also mentions that the contractor on the job has more experience with concrete and will probably need guidance on achieving the benefits of a steel-framed system.

Steel Conceptual Solution

The SSC goes above and beyond the typical conceptual solution service for this project by providing a comparative conceptual solution—one framing scheme with conventional wide flange beams and the other with castellated steel beams. A castellated beam is typically lighter and deeper than a standard wide flange beam of comparable strength. This provides for potential material cost savings; however, the additional fabrication costs must also be taken into account. When comparing structural steel framing options, it is beneficial to consult a fabricator early on in the project for guidance on costs associated with each system.

The Regional Engineer discusses the advantages of a steel-framed parking solution with the architect:

- A steel frame is lighter than a traditional concrete frame, resulting in reduced foundation loads and costs.
- Typically, steel-framed systems can be constructed with a cost savings of 10% to 20% over an alternative framing option.
- Steel columns require 80% less floor space than equivalent concrete columns providing more parking spaces in the same building footprint.
- Small columns, bright finishes, long spans, relatively flat ceilings, and braced or moment frames make a steel-framed parking structure easier to illuminate and conveys an increased sense of patron security.
- A steel-framed parking structure can be erected in a period of weeks rather than months.
- Parking industry experts have indicated that over a 50-year life, steel-framed parking structures offer 40% savings on the cost to maintain the structure.
- Structural steel simplifies future expansion, or the conversion of a parking structure to a different use.

A steel-framed parking structure will meet the owner's needs and will provide cost savings up front and over the life of the project. In order to illustrate the structural steel alternative, the SSC develops a full conceptual solution tailored to the project's requirements, including a preliminary review of applicable fire protection requirements in the current building code.

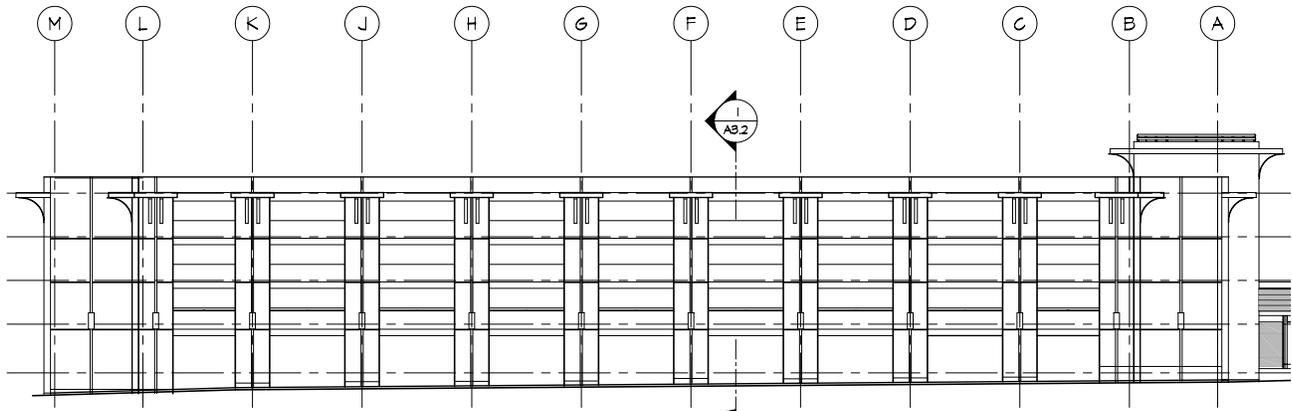


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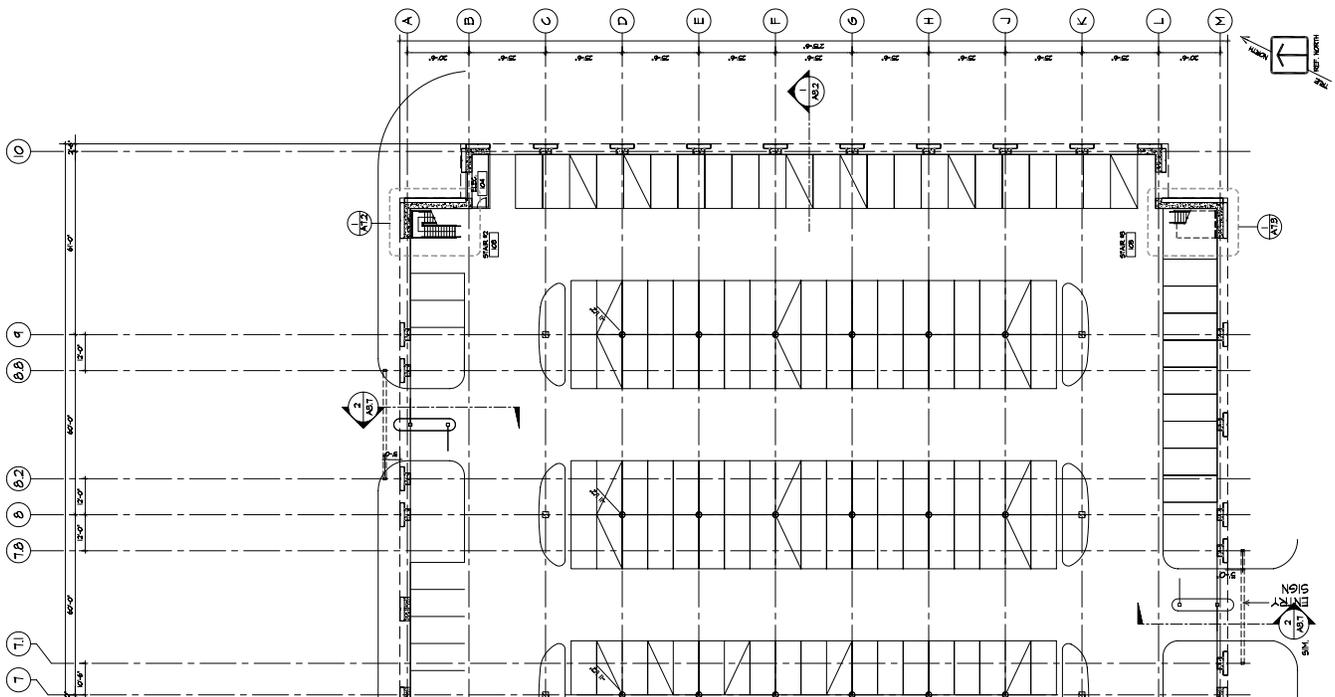
COMPARISON PARKING PROJECT

Received Information into the SSC from
the Architect and Structural Engineer

Architectural and Structural Preliminary Drawings



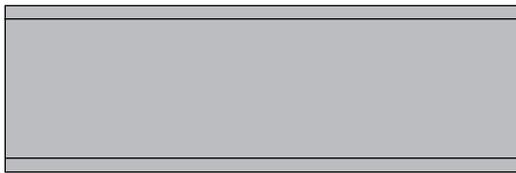
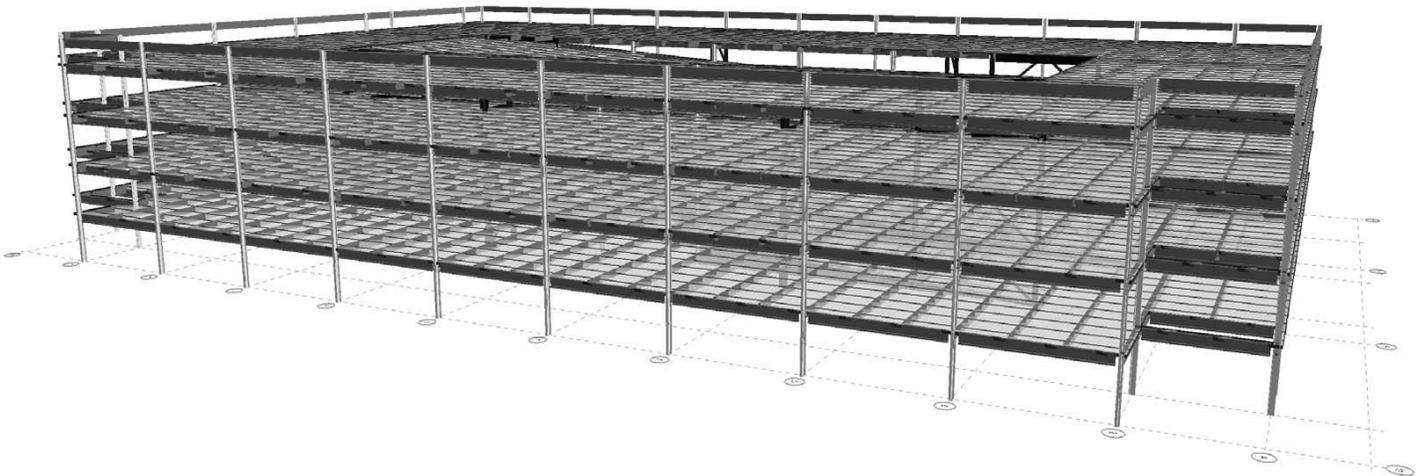
3 EAST ELEVATION
A3.1 SCALE: 1/16" = 1'-0"



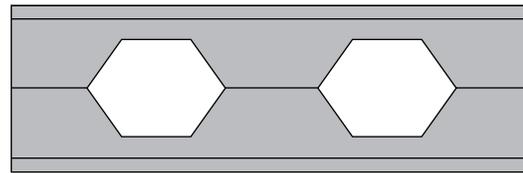
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COMPARISON PARKING PROJECT

Basic SSC Conceptual Framing Model



Conventional Wide Flange



Castellated Beam

This Package includes:

Comments on the Provided Solution	
Steel Quantity Takeoff	A: Conventional Composite B: Castellated Composite
Design Loads and Parameters	
Typical Floor Framing Plans	A: Conventional Composite B: Castellated Composite
Gravity Columns	A: layout B: Schedule
Braced Frame Elevations	Frames #1 and #2
Comparison of Framing Options	
Fire Protection Evaluation	
Sustainable Aspects of Steel	



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COMMENTS ON PROVIDED SOLUTION

Project Location: Kansas City, MO
Prepared for: Architectural Design Firm

Prepared by: SSC Advisor
Regional Engineer: Great Plains Regional Engineer

The information contained in this document is not intended as a basis for structural design for this or any project. Rather, it is a conceptual approach to the project that demonstrates the viability of the steel system for project requirements, budget, and schedule.

- 1) The design criteria per IBC 2006 is summarized and included in the following pages.
- 2) According to current IBC building code requirements, unlimited parking deck area is allowed without applied fire protection if the height of the OPEN parking structure does not exceed 75 ft and the distance from any point on the deck to an exterior opening does not exceed 200 ft. The definition of an open parking structure can be found in the applicable building code. It is important to note that local regulations may require applied fire protection where the model building codes do not. Local building codes have not been consulted to evaluate fire protection requirements.
- 3) The Steel Solutions Center has also provided an overview of fire protection requirements for open parking structures for IBC 2006 and NFPA 5000. The project has four open sides and proper separation from adjacent buildings. Therefore, it is demonstrated that fire protection is not required for the structural steel for this project.
- 4) The steel quantities and geometry are provided on floor layouts, a column and frame layout plan, a column schedule and frame elevations.
- 5) The lowest level of parking is slab-on-grade. The typical floor framing for the garage is 3 in. composite un-shored metal deck with 4 in. normal weight concrete with no structural topping (total slab depth of 7 in.) supported by composite steel framing. Framing for the ramp down to the next level was not modeled; however, the steel tonnage for the ramp framing is included in the steel quantities. Two options for composite steel framing were considered: conventional composite wide flange and castellated composite steel beams. A conceptual solution is provided for both options. This system will efficiently resist lateral loads while carrying gravity loads in a very light and economical manner.
- 6) The lateral force-resisting system consists of concentrically braced frames. The column splices may need to transmit tensile forces, which may require special detailing. The frame elevations indicate all of the structural steel in the lateral force-resisting system.
- 7) If the structural steel will be exposed to the elements, corrosion protection should be supplied. It is recommended that a high-performance coating or galvanizing system be specified to provide long-term protection for the steel framing structure. A galvanized G-90 (minimum) metal deck is recommended to minimize localized rusting or staining.
- 8) To account for the steel girders used at both the floor level and the ramp level at each floor, additional steel girders were added to estimate the overall weight and quantity for the steel system. However, for this study, only one column and girder line were actually included in the conceptual model.
- 9) Due to design considerations and requirements, lateral bracing of the bottom flange of the beams and girders was assumed in the modeling for the conceptual design.
- 10) Sustainable design principles are being considered. Contributions for the structural steel systems for recycled content have been addressed in this packet. Further information on steel sustainability can be found at www.aisc.org/sustainability.



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QUANTITY TAKEOFF SHEET: OPTION A: CONVENTIONAL COMPOSITE STEEL FRAMING

Project Location: Kansas City, MO
Prepared for: Architectural Design Firm

Prepared by: SSC Advisor
Regional Engineer: Great Plains Regional Engineer

Slab-on-Grade:

53,000 ft² Parking (130 spaces)

Suspended Floor Areas:

212,200 ft² Parking (520 spaces)

Estimated Steel Quantities:

Gravity Columns			
W12's	47 tons	0.44 psf	84 pieces
Gravity Beams			
Wide Flange	1,016 tons	9.58 psf	566 pieces
	19,282 studs		
Lateral Frames			
Columns	47 tons	0.44 psf	32 pieces
Beams	16 tons	0.15 psf	32 pieces
Braces (HSS)	20 tons	0.19 psf	48 pieces
Miscellaneous 5%	57 tons	0.54 psf	
	1,203 tons	11.3 psf	762 pieces

- The quantities are based on centerline dimensions.
- Miscellaneous steel accounts for framing not included in the model, such as framing for openings. It does not include connection material or slab edge material.

Material Specification

Wide flange shapes are A992, Gr. 50
Rectangular HSS sections are A500 Gr. B



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QUANTITY TAKEOFF SHEET:

OPTION B: CASTELLATED COMPOSITE STEEL FRAMING

Project Location: Kansas City, MO
Prepared for: Architectural Design Firm

Prepared by: SSC Advisor
Regional Engineer: Great Plains Regional Engineer

Slab-on-Grade:

53,000 ft² Parking (130 spaces)

Suspended Floor Areas:

212,000 ft² Parking (520 spaces)

Estimated Steel Quantities:

Gravity Columns			
W12's	47 tons	0.44 psf	84 pieces
Gravity Beams			
Castellated	514 tons	4.85 psf	328 pieces
Wide Flange	206 tons	1.94 psf	238 pieces
	19,282 studs		
Lateral Frames			
Columns	47 tons	0.44 psf	32 pieces
Beams	16 tons	0.15 psf	32 pieces
Braces (HSS)	20 tons	0.19 psf	48 pieces
Miscellaneous 5%	43 tons	0.40 psf	
	893 tons	8.4 psf	762 pieces

- The quantities are based on centerline dimensions.
- Miscellaneous steel accounts for framing not included in the model, such as framing for openings. It does not include connection material or slab edge material.

Material Specification

Wide flange shapes are A992, Gr. 50

Rectangular HSS sections are A500 Gr. B



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DESIGN PARAMETERS: INTERNATIONAL BUILDING CODE 2006

Project Location: Kansas City, MO
Prepared for: Architectural Design Firm

Prepared by: SSC Advisor
Regional Engineer: Great Plains Regional Engineer

This investigation is based on the following criteria. The Steel Solutions Center does not assert that these are the criteria that apply to this project. The criteria are chosen based on the project location and the widely adopted model building code, IBC 2006. Requirements by local and state jurisdictions have not been considered. If actual project criteria differ significantly from those listed, the results presented may no longer be valid.

Gravity Loads

Dead Loads	Floor=70 psf [3 in. metal deck with 4 in. normal weight concrete slab]
Live Loads	Floor=40 psf
	Stair=100 psf
Superimposed Dead Loads	Floor=10 psf [MEP, ceiling]
Cladding Loads	Precast façade=720 plf

Wind Load Parameters

Basic Wind Speed	90 mph
Wind Importance Factor, I_w	1.00
Exposure Category	B
Topographical Factor	1.00
Drift Limit	H/500

Basic Lateral-Force-Resisting System

Steel Centrally Braced Frames

Seismic Design Parameters

Seismic Design Category	C
Seismic Importance Factor, I_E	1.00
Site Class	D
Spectral Response Acceleration at Short Periods (0.2s), S_s	0.128 g
Spectral Response Acceleration at One Second Period, S_1	0.058 g

	X-axis	Y-axis
Building Period Coefficient, C_T	0.020	0.020
Response Modification Coefficient, R	3.0	3.0
System Overstrength Factor Ω_o	3.0	3.0
Deflection Amplification Factor, C_d	3.0	3.0

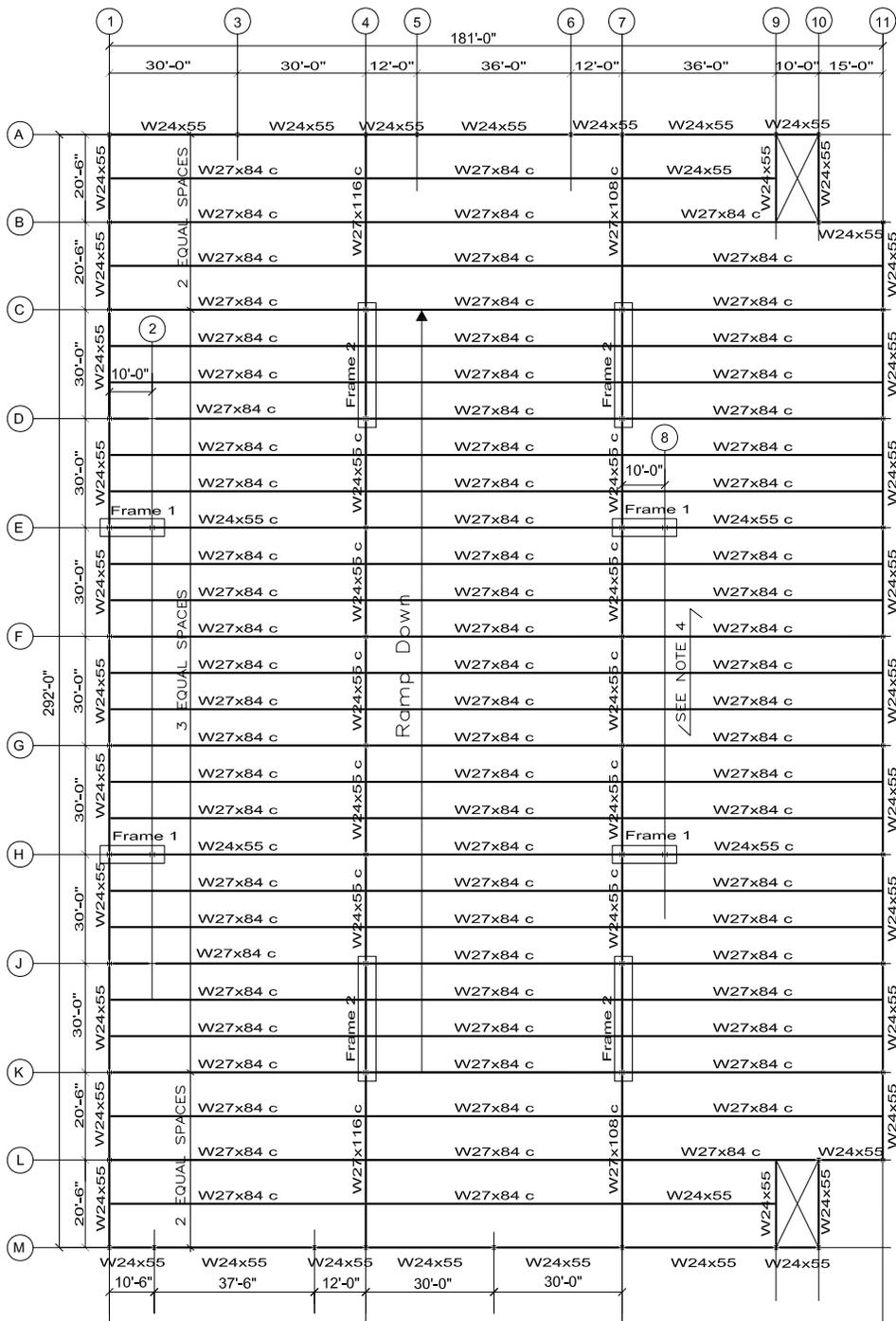
Note: The requirements of the AISC Seismic Provisions WERE NOT used in determining the quantity estimate for this project. Whether or not the special seismic requirements must be taken into account in the design is based on the applicable building code and local requirements.



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TYPICAL FLOOR FRAMING PLAN

OPTION A: CONVENTIONAL COMPOSITE STEEL FRAMING



NOTES:

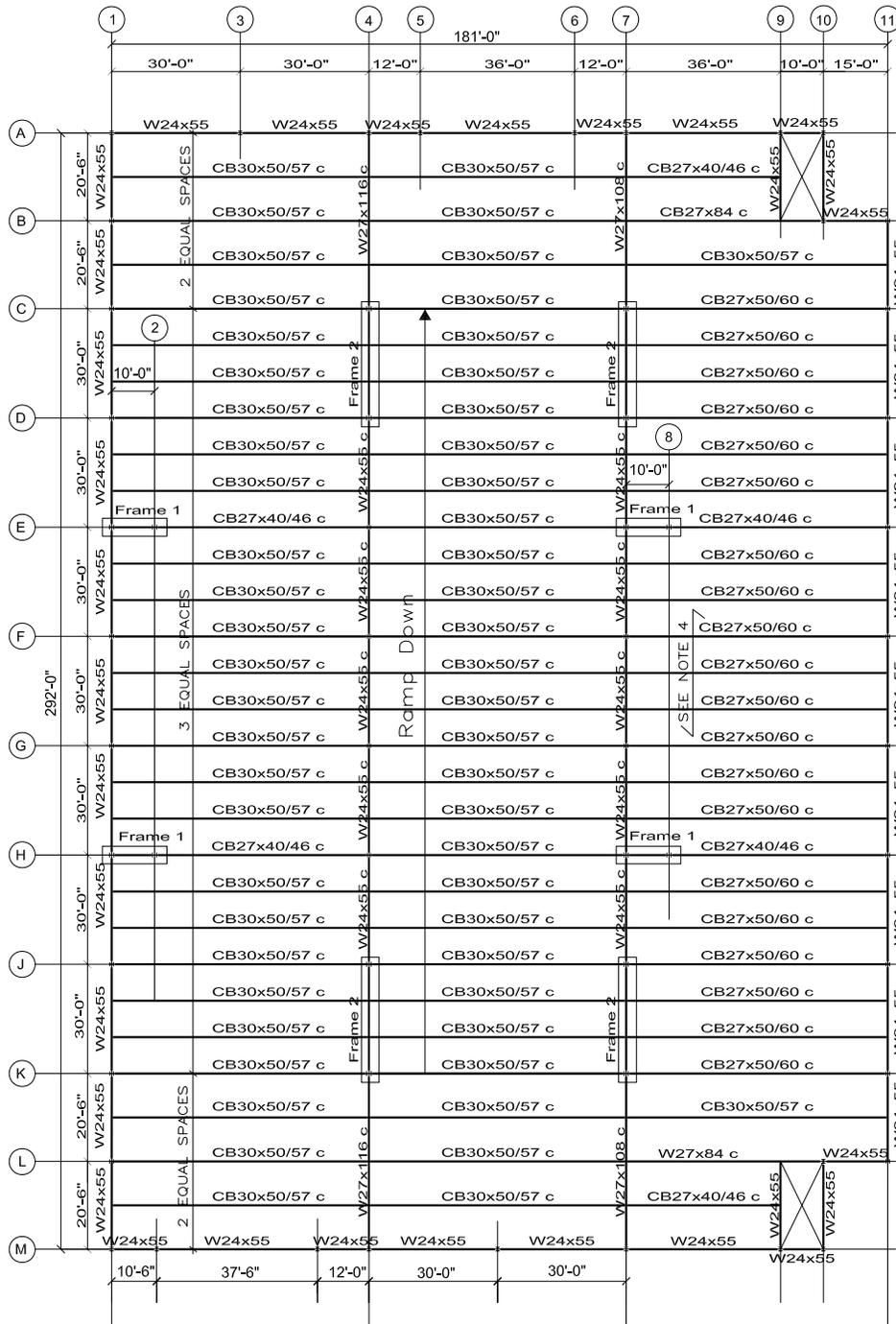
- 1) Each member is marked with the estimated member size for conventional wide flange beam and the designation for camber. If present, the designation "c" indicates an assumed camber from 3/4 in. to 2 in.
- 2) Boxes indicate lateral force resisting (Chevron braced) frames. NO special base plate detail is assumed for the columns.
- 3) See the Column and Frame Layout Plan and the Column Schedule for gravity column sizes.
- 4) ↙ ↘ Indicates direction of the estimated floor slab which consists of 3 in. metal deck with 4 in. normal weight concrete (total slab depth of 7 in.) unless otherwise noted.

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TYPICAL FLOOR FRAMING PLAN OPTION B: CASTELLATED COMPOSITE STEEL FRAMING



NOTES:

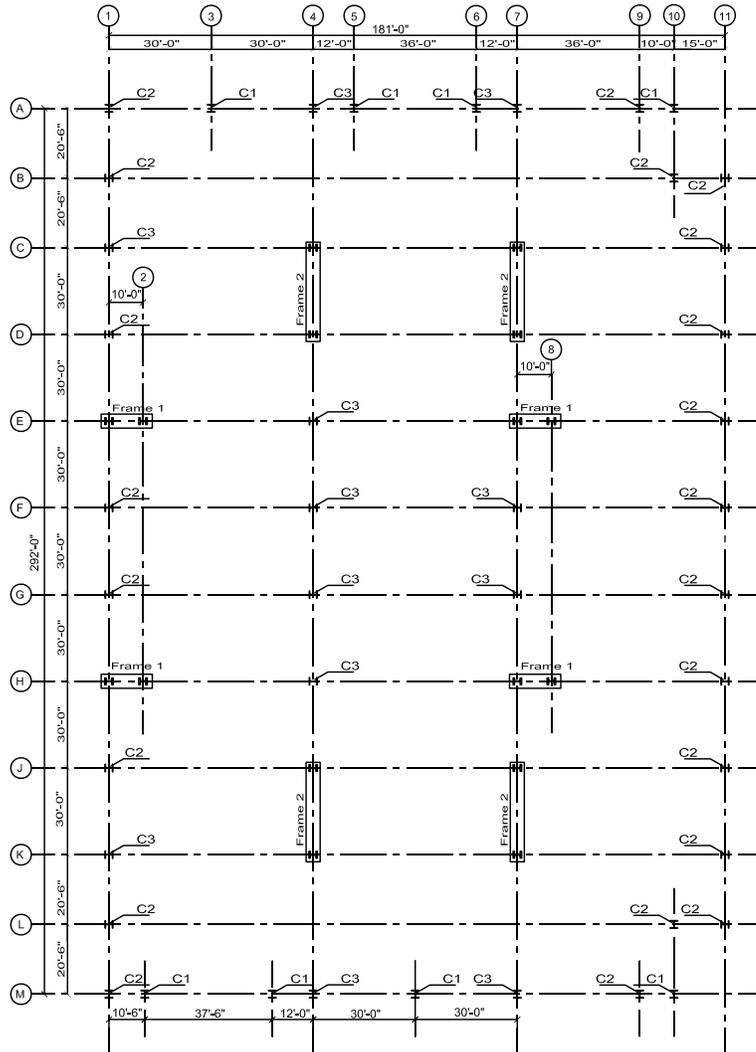
- 1) Each member is marked with the estimated member size for castellated beam and the designation for camber. If present, the designation "c" indicates an assumed camber from 3/4 in. to 2 in.
- 2) Boxes indicate lateral force resisting (Chevron braced) frames. NO special base plate detail is assumed for the columns.
- 3) See the Column and Frame Layout Plan and the Column Schedule for gravity column sizes.
- 4) ↗ ↘ Indicates direction of the estimated floor slab which consists of 3 in. metal deck with 4 in. normal weight concrete (total slab depth of 7 in.) unless otherwise noted.

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COLUMN LAYOUT AND PLAN OPTIONS A & B: CONVENTIONAL AND CASTELLATED STEEL FRAMING



NOTES:

1) Boxes indicate lateral force resisting (Chevron braced) frames. NO special base plate detail is assumed for the columns.

Column Schedule Options A & B:
Conventional and Castellated Steel Framing

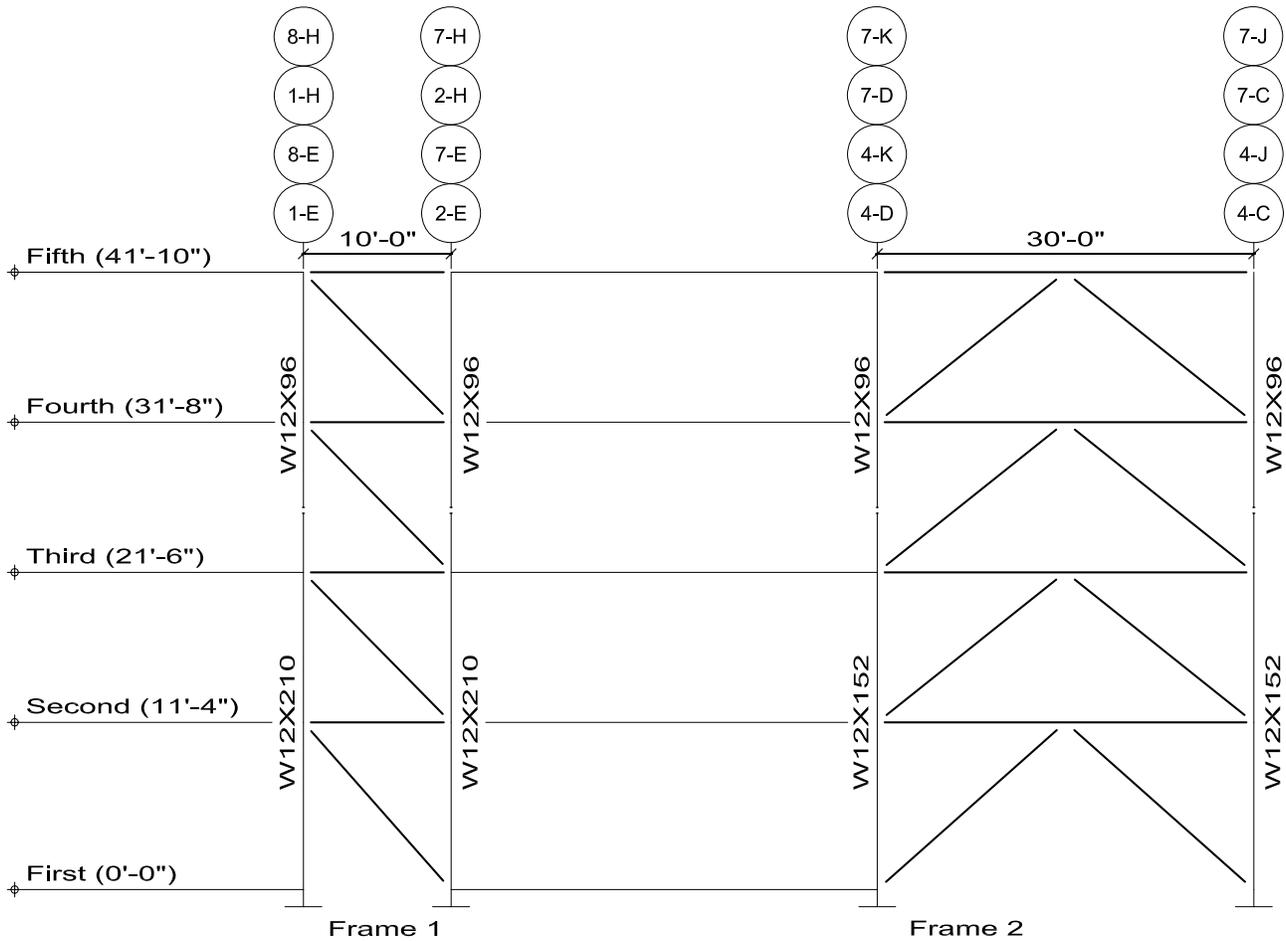
Floor	Column C1	Column C2	Column C3
Fifth (41'-10")			
Fourth (31'-8")	W12X40	W12X40	W12X65
Third (21'-6")			
Second (11'-4")	W12X40	W12X65	W12X106
First (0'-0")			

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FRAME ELEVATION OPTIONS A & B: CONVENTIONAL AND CASTELLATED STEEL FRAMING



NOTES:

1. All brace members are HSS7x7x⁵/₈ unless noted otherwise.
2. All beams are W24x55 unless noted otherwise.
3. The columns in the model were considered part of the lateral system down to their base.

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CASTELLATED FRAMING OPTION

Castellated Shape Usage

Castellated beams and girders have been used throughout the United States and Europe for many years. Castellated beams have been used in the United States for nearly every building usage and exhibit the inherent advantages of building with structural steel. In addition, castellated beams can also provide additional advantages particularly allowing the MEP systems to move from being placed below the beams and girders to within the opening of the castellated members. This can reduce the floor-to-floor height of the facility, and allows for easy organization and modification of these systems. Exposed castellated beams allow for the flow of light (natural or bulb) through the webs of the beams providing greater indoor environments.

Castellated Beam Advantages:

- Castellated steel members are lightweight and structurally sound.
- Castellated steel members, like wide flange framing, can be painted, galvanized or fire protected.
- Castellated beams provide lower floor-to-floor height by passing ductwork and utilities through openings.
- Castellated steel members, like wide flange framing, provide a bright and open look for added feeling of safety.
- Steel construction (both castellated and wide flange framing) has benefit of ease and speed of erection.

Fabrication

Castellated beams have two web opening geometries: hexagonal and cellular. The fabrication process for castellated members can be performed easily by today's more automated fabrication shops. The sections are created by cutting a standard wide-flange shape in a zig-zag pattern along the web, separating the member into two halves. The two halves (which can originate from two different parent wide flange sizes) are then welded at the web posts to create the castellated member. And during the creation of these members, camber can be fabricated into the cutting/welding of the member.

If hexagonal castellated beams are chosen, it is recommended that a high-performance coating system be utilized rather than galvanizing. This decreases the chances of cracks forming at the edges of the hexagonal openings during the galvanization process.

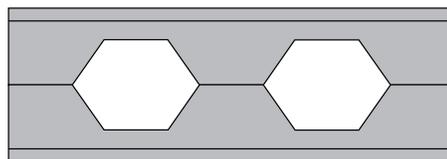
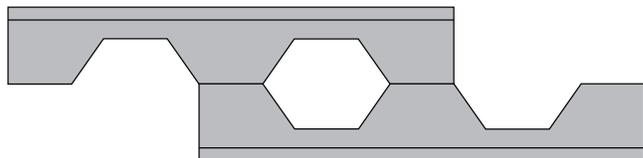
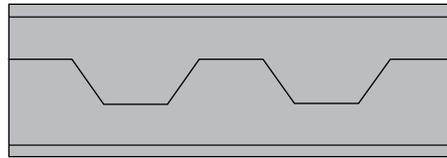
Designing Castellated Shapes

The theory behind the castellated members is to increase the member's strength without additional material. The castellation process increases the depth of the beam, thus increases the strength of the beam. When designing castellated members, there are three additional checks that must be evaluated:

- Vierendeel Bending
- Shear (both vertically through the opening and horizontally through the web post)
- Web Post Buckling

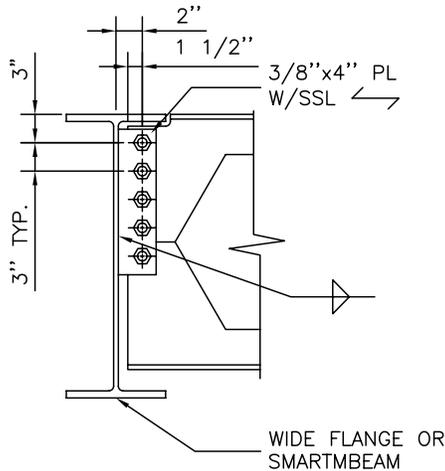
References:

AISC Design Guide 18: *Steel-Framed Open-Deck Parking Structures*
Design of Welded Structures, by Omer W. Blodgett

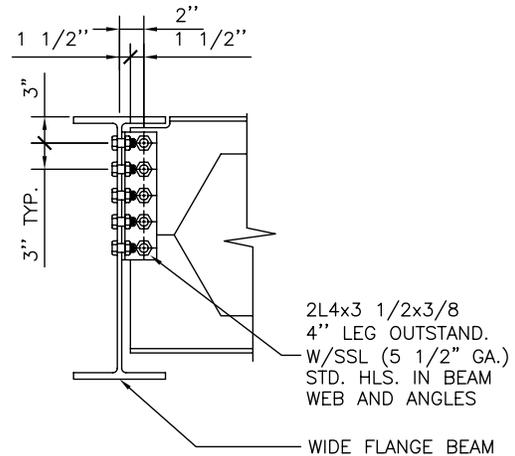


CASTELLATED BEAM STANDARD DETAILS

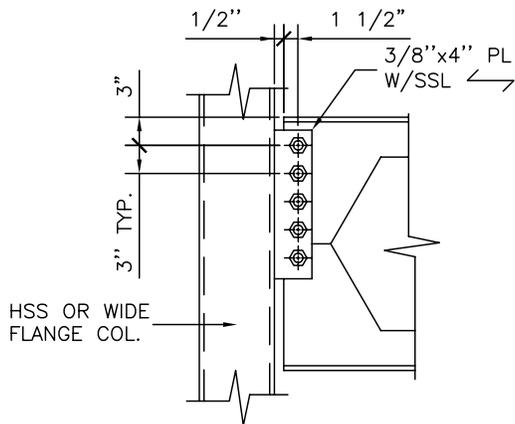
Below are four typical castellated beam connections
(details courtesy of CMC Steel Products):



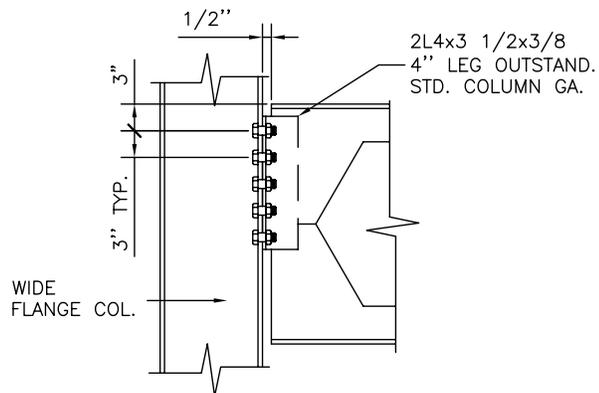
Beam-to-Beam
Shear Tab Conn.



Beam-to-Beam Bolted-
Bolted Clip Ang. Conn.



Beam-to-Column
Shear Tab Conn.



Beam-to-Column Bolted-
Welded Clip Ang. Conn.



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FIRE PROTECTION ISSUES: NFPA 5000 AND IBC 2006

Open-Deck Parking Structures

Code Applicability:

The International Building Code (IBC) and National Fire Protection Association (NFPA) 5000 Code contain information regarding fire protection of structural steel parking structures. NFPA 5000 (6.4.2.55) specifies that all types of parking structures conform to NFPA 88A. Verification of which code is applicable for a planned parking structure should take place as planning begins.

Code Definitions:

Care must be taken in understanding the provisions of the codes based on the definition of certain terms. These include:

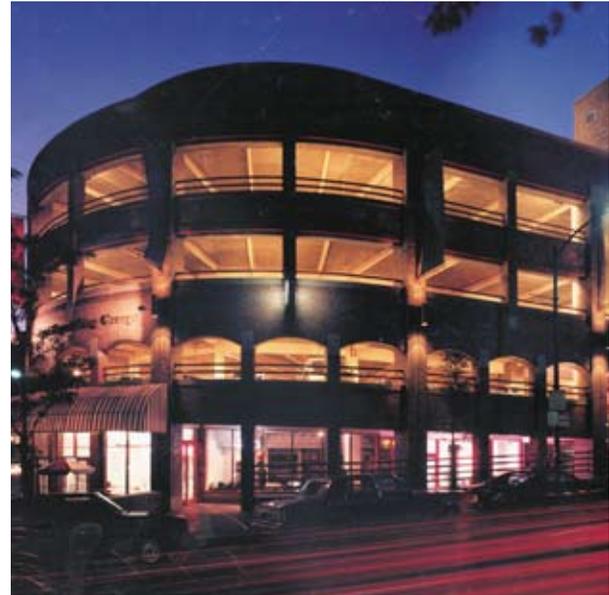
- Height: The IBC defines the height of a parking structure as the vertical distance from the grade plane to the highest roof surface. NFPA does not define height.
- Openness: The IBC defines required openness for a parking structure as having uniformly distributed openings on two or more sides of the structure comprising at least 20% of the total perimeter wall area of each tier and the aggregate length of the openings should constitute a minimum of 40% of the perimeter of the tier. Interior walls shall be at least 20% open (area) with uniformly distributed openings. NFPA defines openness as having distributed openings to the atmosphere of not less than 1.4 sq ft for each linear foot of its exterior perimeter. The openings should be uniformly distributed over 40% of the perimeter or uniformly over two opposing sides. Interior walls shall be at least 20% open (area) with uniformly distributed openings.

IBC Provisions:

Section 406.3.6 of the IBC allows a deck area of 50,000 sq ft per tier to a maximum height of eight tiers for Type IIB construction if the structure fits the definition of openness, without a fire resistive requirement. This provision can be extended in one of two manners. First, unlimited deck area is allowed if the height of the structure does not exceed 75 ft and the distance from any point on the deck to an exterior opening does not exceed 200 ft. Second, if 50% of the interior wall area of the sides over 75% or more of the perimeter of the building is open and equally distributed, the area of each deck may be increased by 25% and the height increased by one tier. With 50% of the interior wall area open and equally distributed on all four sides of the structure, the area may be increased by 50% and the height by one tier. These provisions are presented in tabular form under "Code Comparison."

NFPA Provisions:

For open parking structures as defined above, unlimited deck area is allowed if the height of the structure does not exceed 75 ft and the distance from any point on the deck to an exterior opening does not exceed 200 ft.



Harvard Square
Cambridge, MA
215 spaces

Conventional steel beams with composite slab on metal deck



Sabine Street Lofts
Houston, Texas
550 spaces

Castellated steel beams with composite slab on metal deck



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FIRE PROTECTION ISSUES: NFPA 5000 AND IBC 2006

Open-Deck Parking Structures

Code Comparison:

	NFPA 88A Type II		IBC Type IIB	
Fire Resistive Requirement	None		None	
Definition of Open Side	1.4 sq ft of each linear foot distributed along 40% of the perimeter		50% of interior wall area of the side	
	sq ft/tier	# of tiers	sq ft/tier	# of tiers
2 sides open	unlimited ¹	height <= 75 ft	50,000	8
3 sides open	unlimited ¹	height <= 75 ft	62,500	9
4 sides open	unlimited ¹	height <= 75 ft	75,000	9
Exception ¹			unlimited ¹	height <= 75 ft

¹The distance from any point on the deck may not be greater than 200 ft from an open side.

Subject Project:

An open-deck parking structure with four open sides (as defined under both NFPA and IBC) consisting of grade-level parking and four supported levels of deck (tiers). The footprint of the garage is 181 ft by 284 ft or 51,404 sq ft per tier. The structure height is 42 ft.

Code Application:

Under both NFPA and IBC the structure falls under the 75 ft exception with all points on any deck within 200 ft of an exterior opening allowing unlimited deck area with a NFPA Type II or IBC Type IIB classification. There is no fire resistive requirement for this project.

Research Findings:

Research data from actual fire occurrences over the past several decades in the U.S. has demonstrated that for an open parking structure, non-crash vehicle fires do not result in heat build-up or potential for flashover. The small percentage of area and volume of the parking structure involved in a vehicle fire (typically less than 2% of the area) allows adequate air volume in the uninvolved portion of the garage to mitigate the temperature and flashover potential

of the fire. While no evidence exists of heat build-up or flashover, the ventilation provided by the wall openings provides redundant protection for those concerns and tenable conditions for egress. Vehicle fires in parking structures are localized events that have not resulted in any fatalities. Further, research indicates that personal injuries in parking structure fires are rare and when they occur are generally unrelated to smoke or the fire itself.

Damage to the structural systems of parking garages as a result of vehicle fires has also been shown to be minimal. Data published in 1992 collected from 404 fire events reflected an average cost of structural damage of \$191 or a total cost for all fires of \$53,265. The evaluation of more recent fire events is consistent with the earlier findings.

Full-scale fire tests, such as the Scranton Fire Test of 1972 and the Australia Test of 1985, conducted in open-deck parking structures have indicated that temperatures reached in the structure do not approach the critical temperature of steel even in the unlikely event of multiple vehicles becoming involved in the fire.

Information regarding this research is available upon request.



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THE SUSTAINABLE ASPECTS OF STRUCTURAL STEEL

The green buildings movement is increasing at a rapid pace. More and more owners, architects, engineers and contractors are realizing the benefits of sustainable design and construction practices. When it comes to parking garages, these structures may achieve LEED accreditation when constructed as part of a multi-use facility, but standalone parking structures generally don't include many of the elements that allow buildings to garner LEED points. Regardless, parking garages can certainly be green structures on their own merits, and selecting structural steel as the framing system is one step toward elevating the sustainable or green status of a garage. There are several reasons why this is the case:

Recycled Content:

Steel made domestically via the electric arc furnace process (all wide-flange members, channels and angles and some plate and hollow structural sections) has a total recycled content of 93.3%, per 2009 data collected.

Recycling Rate:

There is an established market for steel scrap (structural and otherwise), and 98% of all structural steel is recycled at the end of a building's life.

Cradle-to-Cradle:

All materials can be recycled, but most are downcycled to a different product. For example, concrete from a deconstructed building can be used again as road aggregate, but it can't be used again as structural concrete. Steel, on the other hand, can be recycled over and over again, or "multi-cycled," without losing any of its strength or properties. This makes steel a true cradle-to-cradle product as opposed to a cradle-to-grave product.

Environmental Impact:

The domestic structural steel industry has decreased its energy use by 67% since 1980, its per-ton carbon footprint by 47% and per-ton energy intensity by 29% since 1990 and its per-ton greenhouse emissions by 45% since 1975. As the electric utility grid becomes more renewable, the embodied carbon in structural steel will continue to decrease. In addition, steel's superior water resource management results in a 95% water recycling rate with no external discharges.

Offsite Fabrication, Onsite Erection:

Steel is fabricated in highly automated facilities to strict tolerances, greatly minimizing additional work and the resulting additional labor hours and equipment required on a project site, thus lowering the steel-framed parking structure's environmental footprint.

Erection Schedule:

The erection schedule for a steel-framed parking structure is about one-third less than that of competing framing systems. This reduced construction schedule not only lowers the steel-framed parking structure's environmental footprint, it also allows the steel-framed parking structure to begin generating revenue earlier.

Minimal Fire Protection:

Spray-applied fire-resistant material is not required for steel-framed open deck parking structures less than 75 ft in height, thus removing an additional environmental footprint-increasing element from the project.

Foundations:

Lighter steel-framed parking structures result in lighter foundation loads, thus decreasing the materials needed for the foundation.

Early Involvement:

Adopting an integrated project delivery construction model on a steel-framed parking project means getting the fabricator involved early. An experienced fabricator can help you choose more efficient steel assemblies, saving you time, materials, and money.

Flexibility:

Steel framing allows for easier reconfiguration or expansion of a steel-framed parking structure.

Operation and Maintenance:

A steel frame with a quality paint system or galvanizing utilizing a cast-in-place, pre-cast or post-tensioned deck system, combined with a regular maintenance program, provides for the lowest life-cycle costs (both environmental and financial) of owning and operating a steel-framed parking structure.

Deconstruction:

Steel-framed parking structures can be easily deconstructed, and members can be remanufactured into new members or reused with minimal additional fabrication work.



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Further Support

The architect receives the completed conceptual solution the following week. The solution provides a comparison between conventional wide-flange beams and castellated steel framing options. The conceptual solution also addresses fire protection concerns.

In addition, the Regional Engineer contacts a local AISC member fabricator for estimated costs and erection schedule based on the conceptual solution. The architect uses this information to further evaluate the steel-framed systems against other options.

Putting the architect in touch with the steel fabricator also enables open communication about current structural steel supply, expected lead times, suggestions for economical framing and connection design, and project management strategies to optimize the project's budget and schedule.

Delivering the Message!

With the SSC's conceptual solution and fabricator's cost and schedule estimates in hand, the architect arranges a meeting with the owner, general contractor (GC), AISC Regional Engineer, and the fabricator to present their findings, which include:

- Reduced erection schedule—about a third less than competing systems
- Cost savings due to lighter foundation loads
- Spray-applied fire resistant material is not required for the project
- Earlier revenue generation due to reduced construction schedule
- A composite slab on metal deck and a steel frame with a quality paint system or galvanizing combined with a regular maintenance program provides for the lowest life-cycle costs of owning and operating the parking structure
- Increased design openness and flexibility
- A higher level of security due to the smaller member sizes
- Steel braced frames replace shear walls, eliminating potentially dangerous dark areas
- Various sustainable benefits including locally available materials with a high recycled content that can be easily expanded or deconstructed in the future with little to no negative environmental impact

The Regional Engineer also offers to visit the general contractor's office and give them a presentation on structural steel erection, safety, and tolerances. The owner, architect, and GC are impressed with the structural steel solution compared to competing materials. They are now convinced that structural steel is the material of choice for their project. The fabricator has demonstrated the value of his early involvement in the project, and he may have the opportunity to become part of the construction team. All parties involved are reassured knowing that the SSC will provide a high level of service throughout the life of their project. They voice their agreement that—"there is always a solution in steel!"

Postscript:

Yes, this is just a fictional account. But what happens in this story is repeated in the SSC on a daily basis. Project decision makers reach out to AISC Regional Engineers and the SSC for new ideas to solve their project challenges. The SSC has worked with mills, service centers, fabrication shops, engineering and architecture offices, general contractors, and code officials, just to name a few. The SSC provides tools that help demonstrate and communicate the benefits of steel-framed construction. The SSC provides a win-win outcome for everyone involved—and best of all, it is a free service!

What should you do next?

Now that you've reviewed this prototype conceptual solution, ask yourself if this system might be beneficial for your next project. Contact your local steel fabricator, AISC Regional Engineer, or the SSC directly to discuss what benefits a structural steel solution can provide to your next project.

There's always a solution in steel.



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COMPARISON PARKING PROJECT RESULTS



above, left:
Station Place Garage
Portland, Oregon
IDEAS2 Award Winner 2006
400 spaces
Constructed in 2005
Conventional steel beams with
composite slab on metal deck

above, right:
Bright House Networks
St. Petersburg, FL
675 spaces
Constructed in 2004
Castellated steel beams with
composite slab on metal deck

right:
Chestnut Street Garage
Lewiston, ME
610 spaces
Constructed in 2002
Conventional steel beams with
composite slab on metal deck



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