NEW MILLENNIUM
BUILDING SYSTEMS
Building a better steel experience.

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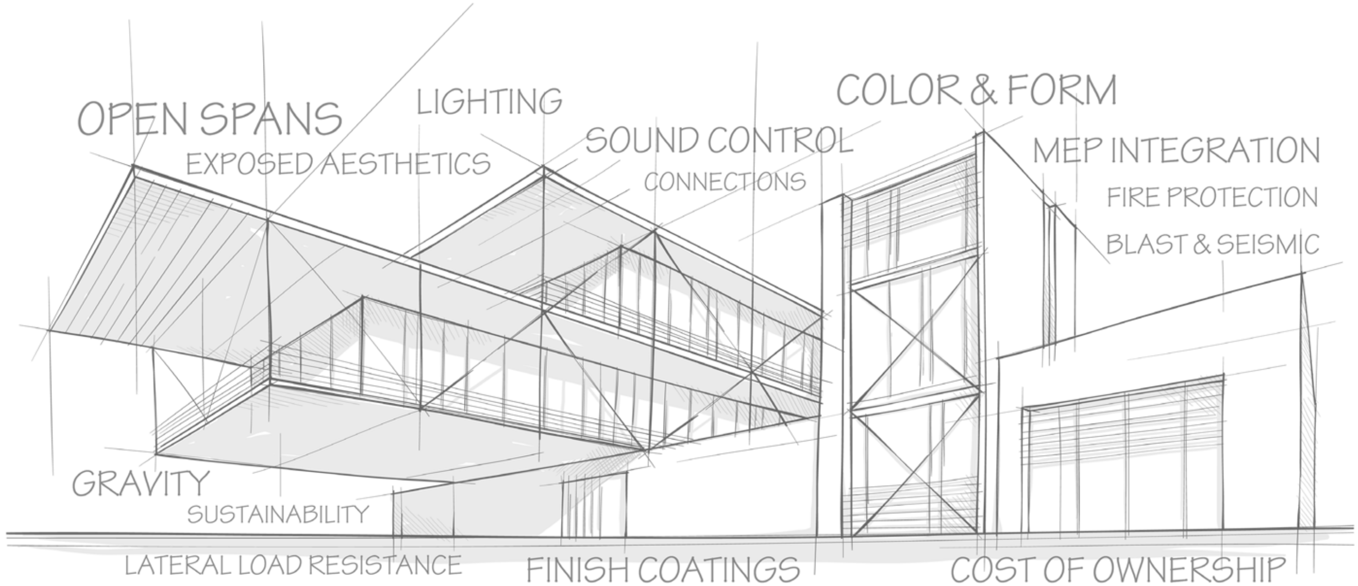
Learning Objectives
After reading this article, you should be able to:

A. Identify the trends in the market that are driving structural steel building system innovation.

B. Recognize how changes in the definition of sustainability bring deeper evaluations of cost and performance, with greater opportunities for improved project delivery.

C. Know your steel building system options based on their structurally engineered distinctions, attributes, and optimal applications.

D. Determine the prevailing design and engineering criteria for a given project to arrive at the right steel building system for that project.



PROFILES IN STEEL

Understanding your options for better building design and construction

Architects and structural engineers today have access to an unprecedented range of steel building system options. Within your reach are system solutions that are tried-and-true as well as innovative and new. While certain systems may not be very familiar to you, they are all well proven in the building design and construction marketplace.

The following will give you a working knowledge of today's range of steel building systems, the market trends that are driving them, and the prevailing design and engineering criteria used for systems comparison and selection.

Taking the owner's point of view

Every year, hundreds of construction management (CM) graduates flow from expanding college and trade tech construction curriculums to meet building owners' increasing demands for improved project performance and costs. The General Services Administration (GSA), one of the largest building owners in the country, has established procedures for the federal hire of CMs.

The management of construction time, cost and quality are explicitly mandated within the contract terms of the GSA. For steel building projects, this encompasses expectations for the design and delivery of the structural steel package that is largely composed of steel joists, decking and beams. However, the means to achieve these higher objectives are not made explicit by GSA.

The expectation is that a construction manager should not be bound by traditional bid-build procedures, but by whether the right resources are brought together to truly collaborate on a cost and performance optimized building: An approach that takes the project owner's point of view regarding the finished structure and the life of that structure.

Growth of the design-build process

Taking the owner's point of view fosters a collaborative process aimed at balancing form, function and cost. Practically speaking, the leveraging of this perspective requires the early participation of those who can bring significant value to the design phase of a project.

Early collaboration aligned with the best interests of the building owner is a fundamental expectation of integrated delivery and a core tenet of the design-build method.

In a recent survey of AEC firms participating in design-build projects, 60% said they participated as preferred partners on true design-build projects, rather than as lowest qualified bidders.* This distinction is important, because an advantage of the design-build process is the ability of participants to take the owner's point of view from the start of a project. In such cases, the survey found that the process for project delivery departs significantly from the traditional design-bid-build process. Here is how survey participants described the difference between the design-build process and the conventional design-bid-build process:

Design-Build Process	vs.	Design-Bid-Build Process
Collaborative		Transactional
Design for total building cost/performance		Design for lowest component costs
Accelerated communication		Requests for Information (RFIs)
Suppliers contribute to the design and plan		Suppliers react to the design and plan

* Source: Survey of Design-Build Professionals / Centrifuge Research

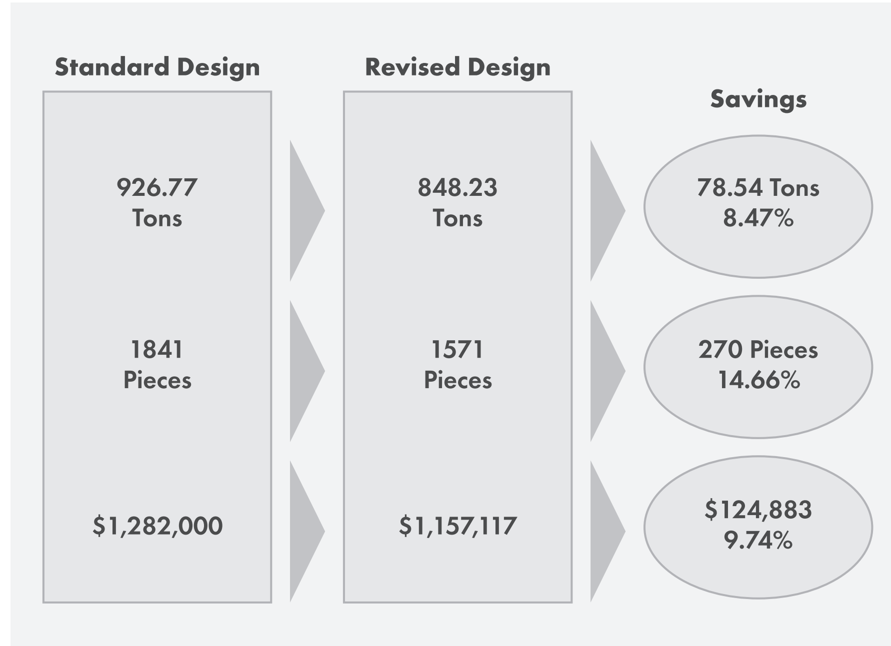
When the building design and construction process is guided by the owner's point of view on cost-accountable form and function, the process itself is more collaborative and efficient from the start. The individual and collective efforts of the building design team are proactive rather than reactive. The efforts of strategic partners are focused on creating value for the building owner, rather than on meeting standardized specifications handed down with embedded cost issues.

Moving beyond standard

Cost-effective design is seldom "standard" in the realm of building design and construction. Yet for decades, steel joist and deck manufacturers have been asked to bid design specifications that are based on standard gauges and dimensions found in charts and tables, rather than based on exact structural requirements.

Without the early counsel of a steel joist and deck engineering team, joist and deck design specifications are pushed onto the steel joist and deck supply "auction market" to the lowest qualified bidder. The risk continues to be that these design specifications are embedded with unnecessary short-term and long-term costs to the project owner, and to the environment.

Alternatively, when a joist and deck supplier's engineering team is called upon to contribute early to the building design, the project owner often gains a competitive edge in steel building design and construction cost efficiency. A more cost-efficient joist and deck system can be collaboratively selected to meet the design intent; and the right system or systems can then be cost effectively engineered to meet exact structural loads and design objectives.



Precision in design: On many design-bid-build projects, 1% to 10% of the steel joist costs can be eliminated, because the drawings released for bid are based on standardized load tables and dimensional data. On this midsized warehouse project, spacing the joists based on actual structural loads reduced the steel joist material. The more precise design resulted in less overall steel material and a lower piece count that resulted in a $124,883 savings. This did not include the related savings for shipping, handling, storage and erection.

Modern industrial design

The use of exposed structural building systems in support of modern industrial design is a trend that has been described as raw and edgy. While earlier styles strived to cover and conceal, modern industrial design bares it all, reveling in the display of structural elements that may seem unfinished, yet work together as stylish and smart.

The movement may have grown out of the need to convert warehouses and industrial buildings into commercial enterprises and multi-story residential facilities; but today the industrial look is being designed into a wide range of spaces displaying an open, space-optimized and often lower-cost aesthetics.

More open and space-optimized designs can be achieved using a range of steel building system solutions.

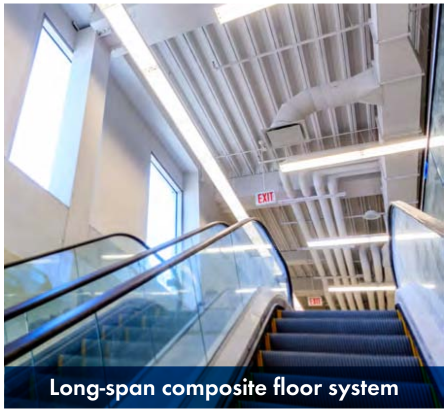
The raw, industrial look of an overhead painted and exposed steel joist/deck system, with pipes and HVAC ductwork woven through the joist diagonal web members, can often support both the roof of a building and the brand image of the occupying business. Such is the goal for many retail and commercial spaces, including restaurants, craft beer destinations and urban multi-story business campuses.

Lower cost to the project is another frequent benefit of industrial interior design.

For example, rather than cover up the underside of a steel joist and deck roof system with an acoustical drop ceiling, the steel deck itself can be acoustical: Left exposed, the system creates the open, industrial aesthetic, meets sound dampening requirements, and eliminates an array of costs associated with the supply and installation of the drop ceiling.

Another example may be the prioritization of space efficiency, as when designing a multi-story residential project. A long-span composite floor system, set upon load-bearing support members, eliminates the use of supporting joists or beams to create large, open spaces and maximum floor-to-ceiling heights. The thin slab floor system, consisting of deep ribbed steel decking or dovetail steel decking, can be left exposed underneath to create lineal ceilings.


Steel joist and deck system



Long-span composite floor system

As the industrial interior design trend gains momentum, architects are reminded that the right steel building system can often answer the call for exactly the right aesthetics and cost accountability.

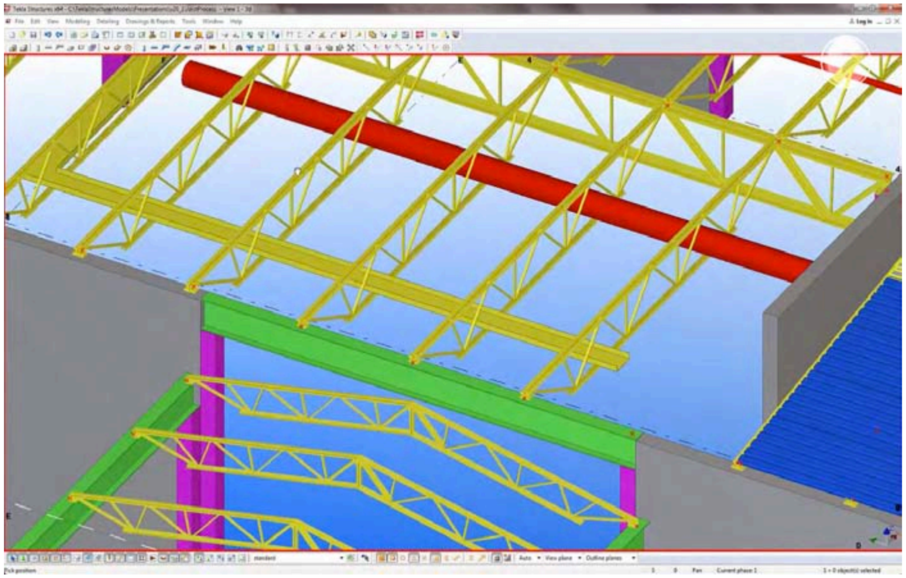
Early collaboration and BIM

Every evolving industry finds a way to adapt technology-driven best practices. As the inefficiencies of the traditional design-bid-build approach is increasingly recognized, Building Information Modeling (BIM) will be given its due as a forerunner technology proven to address these inefficiencies and more.

In the absence of early technology-assisted design collaboration, structural engineering drawings will continue to be incomplete when handed down by the structural engineer of record (EOR). Subsequent design and construction efforts by trade partners will continue to be impeded by a Request for Information (RFI) process that is inefficient, with continued value loss being passed to the project, to the building owner and to the environment.

A 2012 McGraw-Hill Construction study concluded that BIM was most needed in support of early design collaboration among such trade partners as the steel building systems provider; because the design decisions made at this project stage will impact lifecycle costs to both the building owner and the environment.

In 2013, the U. S. General Services Administration (GSA) established the National 3D-4D-BIM Program to accelerate the recognition of BIM based collaboration as the means to improved building design and construction. Moreover, the GSA now requires BIM adoption for all major government building design and construction projects. For more information, visit gsa.gov/bim.com



BIM is a relatively new technology in an industry that is slow to adopt change. Early adopters and leading industry associations have studied the ways in which the technology supports needed changes in project delivery, changes that will be increasingly demanded by building owners and all who act on their behalf.

Taking the LEED on cost reduction

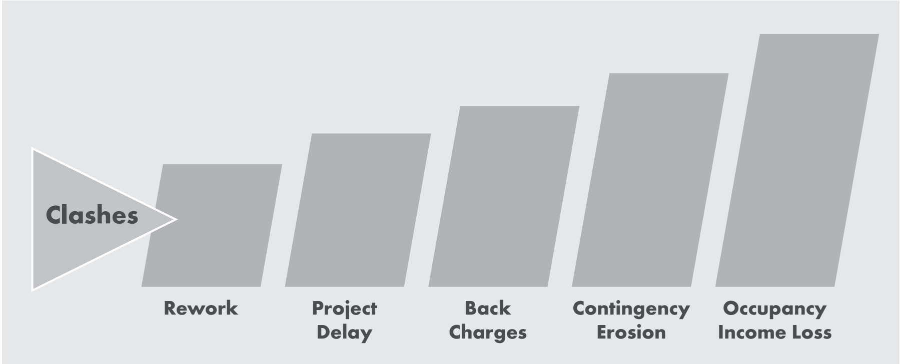
The LEED v4 update passed by the U.S. Green Building Council (USGBC) in 2013 brings a greater emphasis on designing for building cost efficiency and performance. Many of the changes in LEED v4 improve the clarity, functionality and interconnectivity of the building system, emphasizing a more holistic and integrated approach to green building.

LEED v4 addresses the continuum of costs that exists for any given building system design. The update takes into account each step in the life cycle of a building system, from raw material production to fabrication, shipping, erection, maintenance and the ultimate removal of the system for disposal or recycling – costs that are currently being passed on to the building owner, as well to the environment.

By this measure, sustainable design is also cost effective design across the entire cycle, from concept to building afterlife: No longer should the question be, what is the cost per square foot or per ton of material? The question should be, what is the cost contribution and cost savings to the total project? These savings can come by way of both pre and post waste, as addressed by the Life-cycle Assessment (LCA) approach to cradle-to-grave (also called cradle-to-cradle) building design and construction. The right steel building system can contribute to energy efficiency in several ways, such as the creation of more open building spaces to support efficient daylighting and airflow. Savings are from the early life of the building through demolition and post.

As building owners look carefully at the structural steel design phase of a building, they will see beyond material supply. They will see a cascading cost effect, generated by a lack of early design collaboration at the execution level: They will see clashes and rework, project delays, needless back charges and the draining of contingency fees. A delayed move-in can cause huge losses to the owner, whether by way of lost retail revenues or lost occupancy income.

As these costs become increasingly understood, the design trends outlined in this document will gather all the more momentum: Early design-build collaboration in the area of steel building system selection and design, precision in specification, industrial design, and space conservation will all be in service to the LEED v4 strategy.



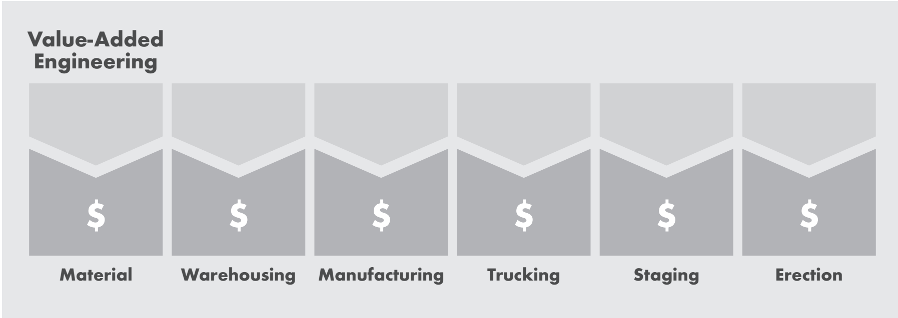
Cascading costs occur on design-bid-build projects when the steel building system is not fully and holistically evaluated early in the design process. LEED v4 addresses such inefficiencies by promoting an early, comprehensive and synergistic approach to project delivery.

About materials – less is more

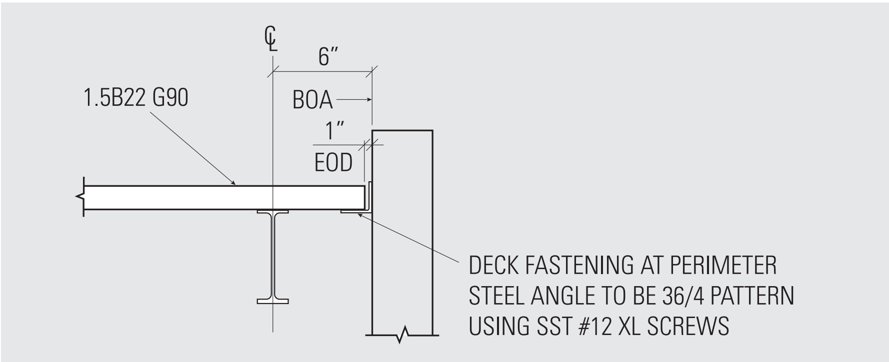
Material reduction is also a clear outcome of the LEED v4 protocol. The use of secondary materials, added to conceal primary structural materials, will now increasingly come into question. The design challenge will be to achieve the desired aesthetic using primary structural materials, avoiding the costs associated with low function and mainly decorative added materials. In concert with this endeavor toward minimalized materials will be the selection of steel building systems that can improve sound, lighting, and structural capacity.

As architects look to increase material use efficiencies, they will look anew at the types of steel building systems on the market and the design-cost advantages each brings when left exposed. LEED v4 encourages an open assessment of these system options and the avoidance of "one design fits all" thinking, even for the most basic of structures. Options range from traditional steel joist and deck systems, to the more recent long-span composite floor systems and the use of exposed "architectural" steel decking for ceilings, exterior cladding and even for outdoor screens and canopies.

Proactive engineering on the part of the steel joist and deck supplier will add to sustainable building design and cost prevention. Every ton of steel removed can cut from $800 to $1,000 dollars out of a project, depending on steel costs at the time. That's just for material cost. Compounding costs are also prevented, including for warehousing, manufacturing, the number of delivery trucks. Less material means less costs on site for steel handling and erection – and ultimately less cost for material removal and recycling. Related cost reductions can occur due to less inspection costs and quality control issues.



Steel material reduction during the early design stage contributes to a reduction in costs to a project, both to the building owner and to the environment.



Sustainable, cost-managed building design often comes down to the details. Shown here are detailing notes for the safe, cost-efficient erection of a steel building system. This guidance is provided by the system supplier's engineering team.

Cost efficient erection practices also contribute to sustainability. The use of an automated deck-fastening tool, versus traditional welding, can significantly reduce steel deck installation time.

The most recycled material

A greater understanding of steel building system design options will bring sustainable solutions that are defined by their lower cost long-term, both to the building owner and to the environment.

The Steel Market Development Institute (SMDI), reports that at the end of a steel building's lifetime, more than 90 percent of that building's steel is reused or recycled into another steel product using significantly less energy than was necessary to create the original product. The SMDI adds the following observations regarding the use of steel for sustainable building design:

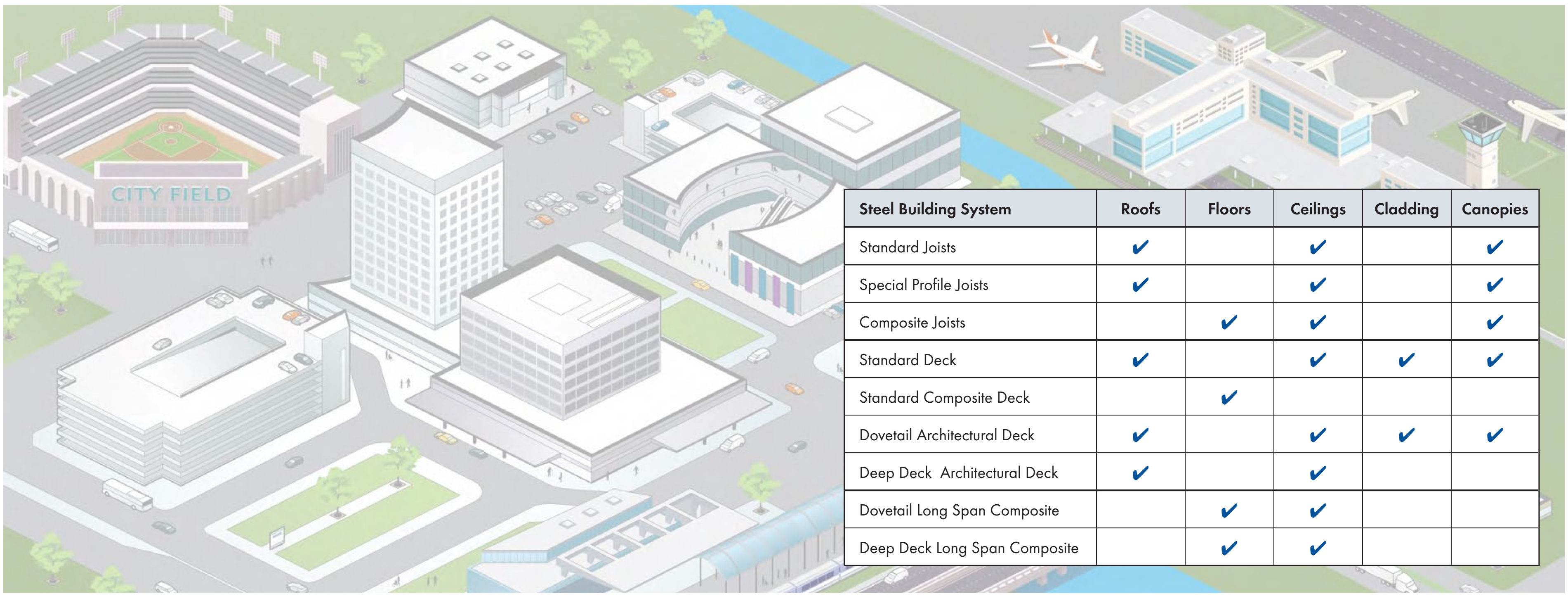
- Steel is the world's most recycled material.
- Steel is fully recyclable with a current 98% recovery rate for structural steel.
- When recycled, steel loses none of its inherent properties.

Note: Even when used for exterior cladding, Division 5 steel decking is recyclable – unlike many of the Division 7 architectural cladding systems that use aluminum composite layers with a "plastic" core that is not recyclable.

STEEL BUILDING SYSTEM OPTIONS

Freedom of choice

The unprecedented range of steel building systems on the market today gives building owners and architects greater design freedom. The right system or combination of systems can holistically address aesthetics, building performance, total project costs, and long-term sustainability.



Steel Building System	Roofs	Floors	Ceilings	Cladding	Canopies
Standard Joists	✔		✔		✔
Special Profile Joists	✔		✔		✔
Composite Joists		✔	✔		✔
Standard Deck	✔		✔	✔	✔
Standard Composite Deck		✔			
Dovetail Architectural Deck	✔		✔	✔	✔
Deep Deck Architectural Deck	✔		✔		
Dovetail Long Span Composite		✔	✔		
Deep Deck Long Span Composite		✔	✔		

Standard steel joists and deck

Steel joists and decking form tried-and-true systems for many roofing applications. These systems may conjure up images of massive, open-bay distribution centers and projects considered low in design complexity. But when the design is carefully considered (see goal prioritization in the Criteria for System Selection on page 15 of this course), even the most basic steel joist and deck structure becomes a highly engineered system: Early design collaboration can significantly reduce costs and improve building performance.

Allowable Uniform Loads and Maximum Construction Spans – ASD

Span Condition	Gage	Allowable Uniform Total Load (psf) / Load that Produces Span/240 Deflection (psf) — Center to Center Span (ft. - in.)										Max. Constr. Span (Ctr. to Ctr.)
		5 - 0	5 - 6	6 - 0	6 - 6	7 - 0	8 - 0	9 - 0	10 - 0	11 - 0	12 - 0	
Single	22	95 / 83	78 / 63	66 / 48	-	-	-	-	-	-	-	5 - 10
	20	117 / 106	97 / 80	81 / 61	69 / 48	60 / 39	46 / 26	-	-	-	-	7 - 3
	18	157 / 145	130 / 109	109 / 84	93 / 66	80 / 53	61 / 35	49 / 25	39 / 18	-	-	9 - 9
	16	200 / 182	165 / 137	139 / 105	118 / 83	102 / 66	78 / 44	62 / 31	50 / 23	41 / 17	35 / 13	12 - 6
Double	22	93 / 209	77 / 157	65 / 121	56 / 95	48 / 76	37 / 51	-	-	-	-	7 - 1
	20	118 / 259	98 / 195	83 / 150	71 / 118	61 / 95	47 / 63	37 / 44	-	-	-	8 - 9
	18	156 / 349	129 / 262	109 / 202	93 / 159	81 / 127	62 / 85	49 / 60	40 / 44	33 / 33	28 / 25	11 - 10
	16	195 / 439	162 / 330	137 / 254	117 / 200	101 / 160	78 / 107	61 / 75	50 / 55	41 / 41	35 / 32	15 - 0
Triple	22	115 / 164	96 / 123	81 / 95	69 / 74	60 / 60	46 / 40	-	-	-	-	7 - 2
	20	145 / 203	121 / 153	102 / 118	87 / 92	76 / 74	58 / 50	46 / 35	-	-	-	8 - 10
	18	192 / 273	160 / 205	135 / 158	116 / 124	100 / 99	77 / 67	61 / 47	50 / 34	41 / 26	35 / [illegible]	12 - 0
	16	240 / 344	200 / 258	169 / 199	145 / 157	125 / 125	96 / 84	76 / 59	62 / 43	51 / 32	43 / [illegible]	15 - 3

Type B - Factory Mutual Maximum Ctr. to Ctr. Spans (ft. - in.)

FM Class	1 - 60						1 - 75						1 - 90					
Deck Gage	22	21	20	19	18	16	22	21	20	19	18	16	22	21	20	19	18	16
Single Span	5-11	6-3	6-7	7-1	7-7	8-6	5-11	6-3	6-7	7-1	7-7	8-6	5-11	6-3	6-7	7-1	7-7	8-6
Double Span	7-0	7-5	7-9	8-4	8-11	10-0	7-0	7-5	7-9	8-4	8-11	10-0	7-0	7-5	7-9	8-4	8-11	10-0
Triple Span	7-0	7-5	7-9	8-4	8-11	10-0	7-0	7-5	7-9	8-4	8-11	10-0	7-0	7-5	7-9	8-4	8-11	10-0

Maximize deck capacity: A fundamental way to reduce total project cost on most any steel building project is to maximize deck capacity. Space deck support members to meet actual loads, rather than "standard" load table specifications.

Deck gauge and cost calculation example:

Roof project in Shepherdsville, KY
6,056 squares of deck, specified painted 22ga
Total weight: 488 tons

Potential ton and cost savings:

23ga vs. **22ga**

Gravity load capacity: 25 psf total
23ga allowable for 3-span @ 5′- 6 $^{5}/_{8}$″

	Diaphragm strength required:	**Pattern:**
22ga	325 p/f interior	36/5 – 5 side laps
	464 p/f edges	36/7 – 7 side laps
23ga	330 p/f interior	36/5 – 8 side laps
	465 p/f edges	36/7 – 10 side laps

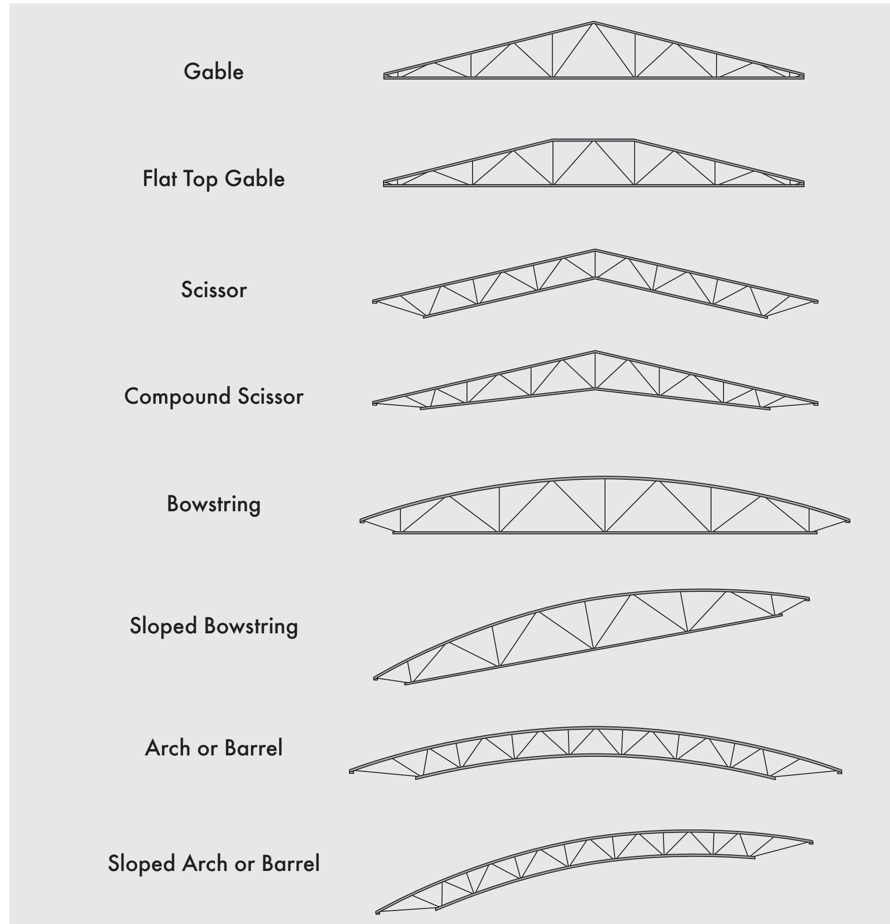
Total weight/cost savings for 23ga deck: **8%**

Total savings for joist and deck package: **2%**

Specify the deck gauge: Rather than default to a standard gauge of steel deck, maximize deck capacity by specifying the thickness of the steel decking. This reduces steel volume and piece count, cutting down on fabrication and erection costs.

Special profile steel joists

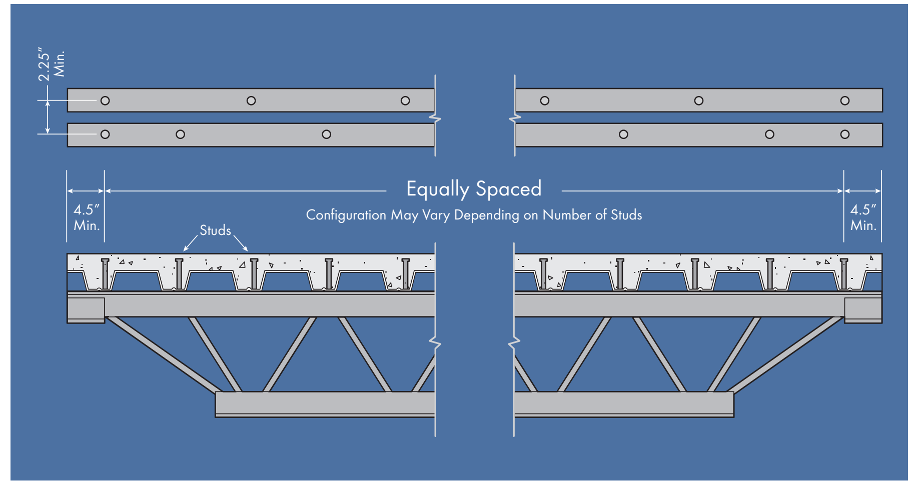
Less familiar to many architects are the special profile steel joists. This family of uniquely shaped joists emanates from a range of profiles with such descriptors as gable, scissor, bowstring, and arch. From these profiles come new configurations and combinations that have been made practical to specify with the development of vastly expanded engineering tables. Over 40,000 combinations of special profile steel joists can now be specified to serve the most unique rooflines.



Composite steel joists and deck

A composite slab is central to this type of building system. In more technical terms, a composite slab is a floor system consisting of a concrete slab that is formed by stay-in-place steel decking, whereby the two materials act compositely in flexure and shear. To produce basic composite decking, the deck is rolled with embossments to mechanically interconnect with the cured concrete after it is poured into the decking. For a composite joist, studs are used to fasten the decking to the steel joist or beam, such that the studs interconnect with the cured concrete.

The advantage of a composite building system to the architect is the creation of more open spaces. The advantage to the structural engineer is high strength and longer floor spans with fewer supporting columns. The advantage to the erector is that the composite slab acts as a working platform, stabilizing the building frame. And the advantage to the building owner is a reduction in costs, including long-term costs for building maintenance, moves, adds and changes.



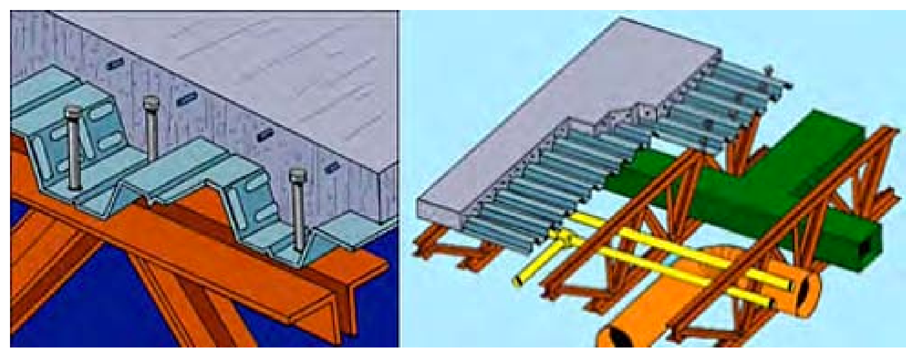
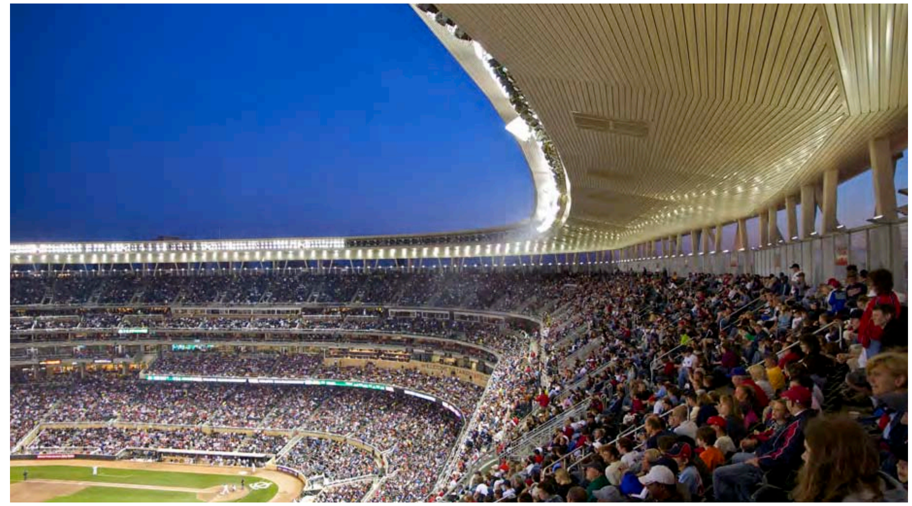


Image Source: Steel Deck Institute

Architectural steel decking

Architectural metals used in the design of building facades are categorized under Division 7 of the Construction Specifications Institute. Architectural metals address surface aesthetics and generally do not contribute to the structural integrity of a building. In addition, these high-end systems can come at a high-end cost.

Alternatively, a structural steel decking system left exposed, can meet the desired ceiling or cladding aesthetic and contribute to structural integrity for substantially less cost than a Division 7 architectural system. Architects looking for these combined design advantages may be surprised to learn that these systems are not found in Division 7 construction. They are found in Division 5 construction.



Left exposed, Division 5 steel decking can create lineal plank ceilings, exteriors, canopies, perforated screens and structural accents. "Cellular" decking for ceilings can be perforated and filled with acoustical batting for sound control. Surfaces can be factory coated for color consistency and lasting protection, with no on-site spray painting, no on-site release of volatile organic compounds, and no related project delays.

Division 5 ceiling and cladding systems are often installed by Division 7 contractors that are trained in the installation of trimmed and fitted exterior Division 7 systems. This approach can combine the cost savings of a Division 5 material with the erection efficiency of a Division 7 installation crew, to achieve a properly installed, aesthetic, lasting and overall lower-cost building system solution.

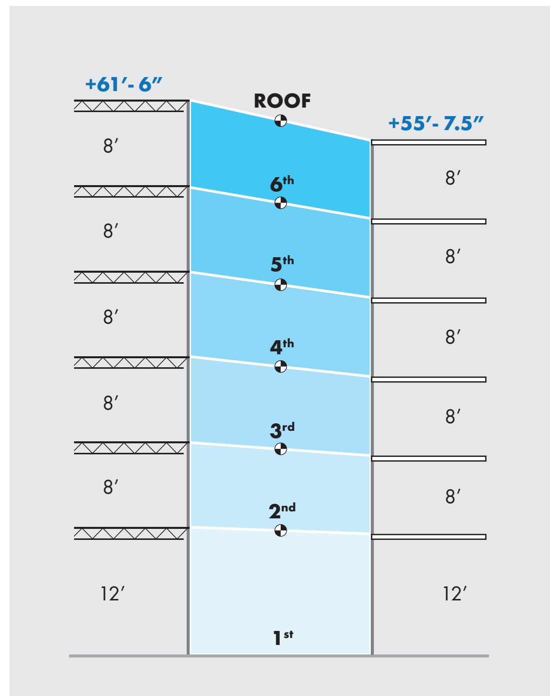
Long-span composite floor systems

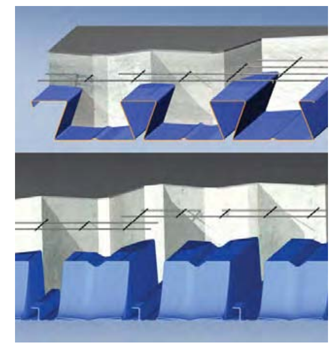
A long-span composite floor system combines the advantages of the two systems lastly discussed above: composite slab and architectural deck. When integrated with today's wide range of building framing options, the system creates altogether new possibilities in building design and construction.

It's a composite floor: By increasing the depth of the composite deck and by adding rebar to the concrete, a long-span composite floor system achieves the longest unsupported spans. Steel deck profiles range from 2 inch and 3.5 inch dovetail, to 4.5 inch, 6 inch and 7.5 inch deep rib deck. The deeper deck profiles, additionally strengthened by on-site side lap connections, span up to 36 feet between support members.

It's an architectural ceiling: The system also features the use of architectural decking, whereby the underside of the system can be left exposed to create an aesthetic ceiling that is integral to the floor. Options include lineal plank, deep fluted and smooth surfaces.

Long-span composite floor systems integrate with all weight-bearing beams and framing options, with up to 40% less dead weight than cast-in-place concrete. The systems are intrinsically fire resistant up to 4 hours, depending on system design, without the addition of fire-resistive spray or gypsum protection. Sound control is also superior, meeting both STC and IIC sound ratings of the International Building Code.





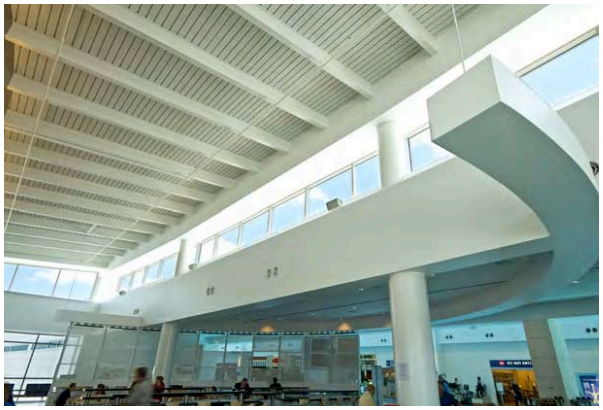
Right system selection:
For many multi-story buildings, a long-span composite floor system will often provide greater advantages than composite joist systems.
The right choice will depend on the prevailing design goals for the project.

Setting clear expectations

Research sponsored by the Charles Pankow Foundation and the Construction Industry Institute has documented how integrated delivery has improved building design and construction, especially when there is a high correlation between goal setting and early design collaboration.**

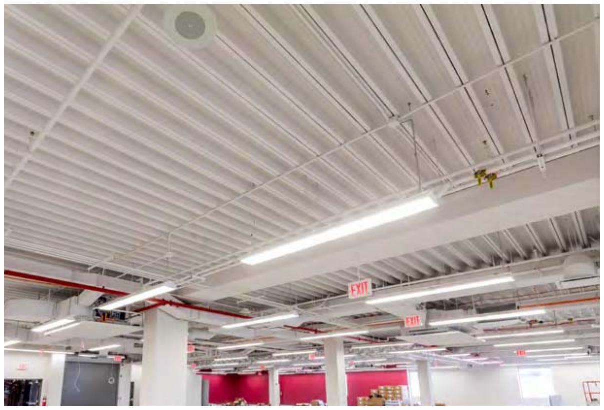
The research concluded that to optimize project success, early collaboration among all project partners is to be guided by a prioritization of the performance criteria for each of four project delivery goals: schedule, quality, functionality and cost. For example, if the building owner and architect establish quality as a high priority goal, then the criteria for meeting this goal may be to create a significant or unique design, meet or exceed project requirements, and to select the right team to achieve these measures.

Deeper criteria for discerning the right building system can be developed in collaboration with the participating steel joist and deck supplier. The following actual project examples illustrate these deeper considerations. In each case, the resulting designs corresponded to the prevailing criteria established by the owner and architect for that project.



Smooth lineal plank surface, accoustical treatments.

Steel joist and dovetail deck with MEP integration.



Long span, deep fluted surface.

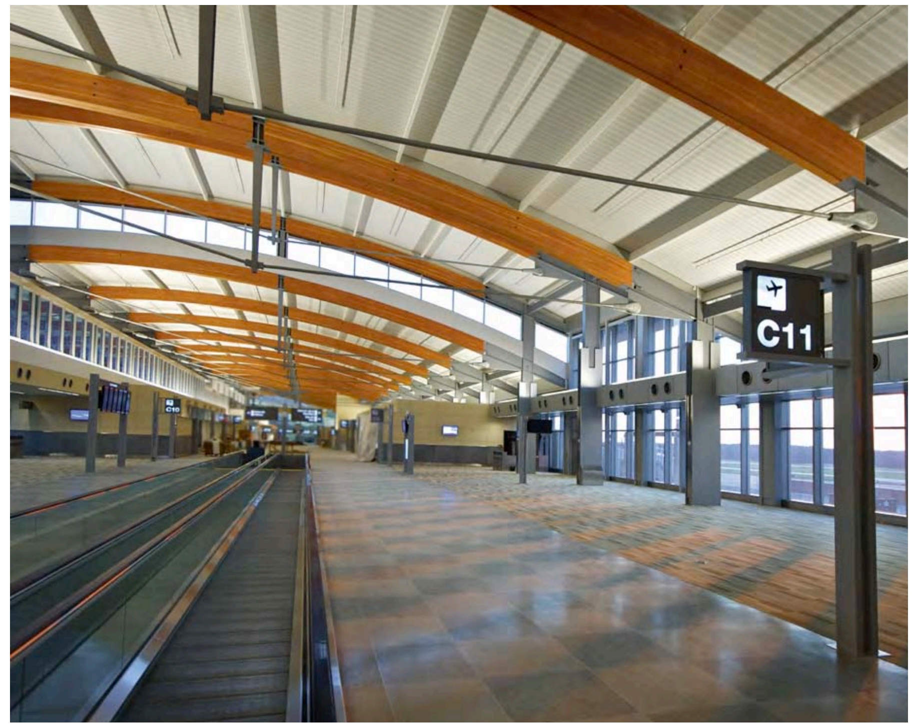
** Examining the Role of Integration in the Success of Building Construction Projects. Charles Pankow Foundation and Construction Industry Institute, January 2014.

Airports

Detroit: The prevailing design criteria for this project included sound control and the concealed integration of lighting, fire sprinkling system and other mechanical, electrical and plumbing functions. A curved, special profile steel joist and standard deck roofing system was chosen along with a secondary acoustic ceiling to close off the structure.

Special profile steel joist and standard deck with acoustical drop ceiling.

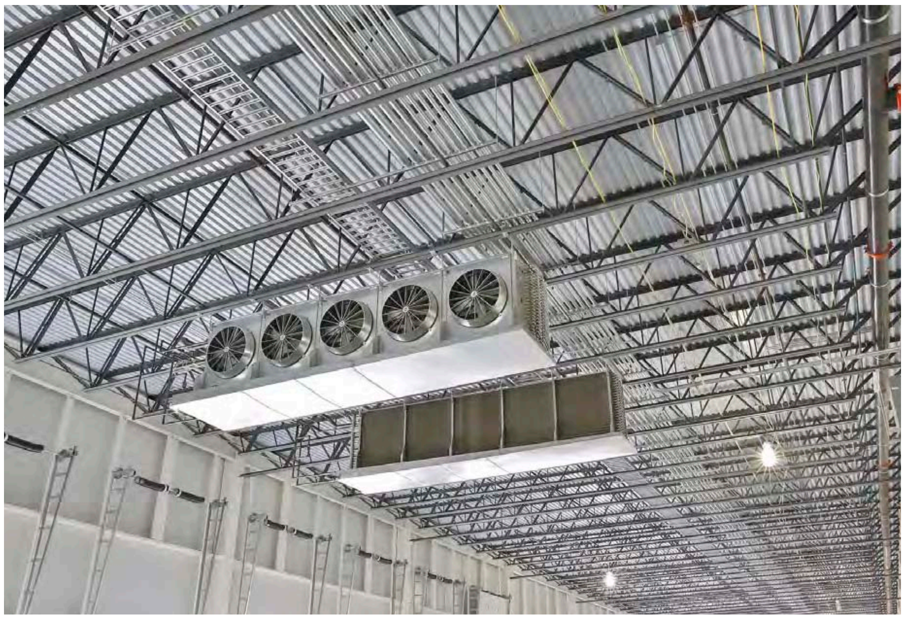
Raleigh-Durham: Here the prevailing design criteria were sound control and a more open, lineal aesthetic. An exposed architectural steel deck system was chosen to run perpendicular to the ribbing and parallel to laminated wood beams. The steel decking is cellular to provide a noise reduction coefficient (NRC) value of 1.0.



Architectural steel deck with an NRC value of 1.0 and an open aesthetic.

Warehouses

Delaney's: For this mid-sized warehouse project, the prevailing design criteria were cost and functionality. The engineer of record (EOR), specified a standard steel joist and deck system and provided structural drawings based on standardized bay dimensions and load tables. The joist and deck supplier's engineering team recommended more cost efficient design, based on actual load requirements. Joists were spaced further apart, dropping joist count by 17% to decrease overall steel tonnage and total project costs by 9.74%.

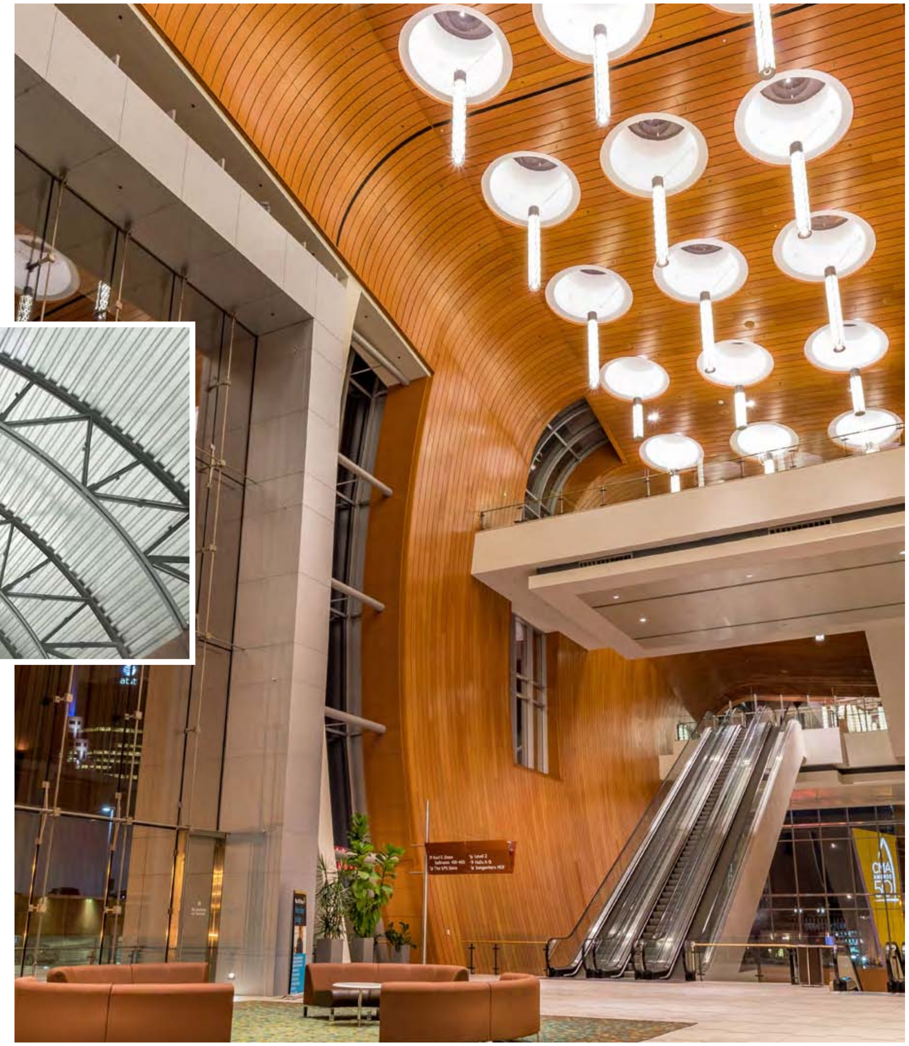


Standard steel joist and deck with engineered efficiencies.

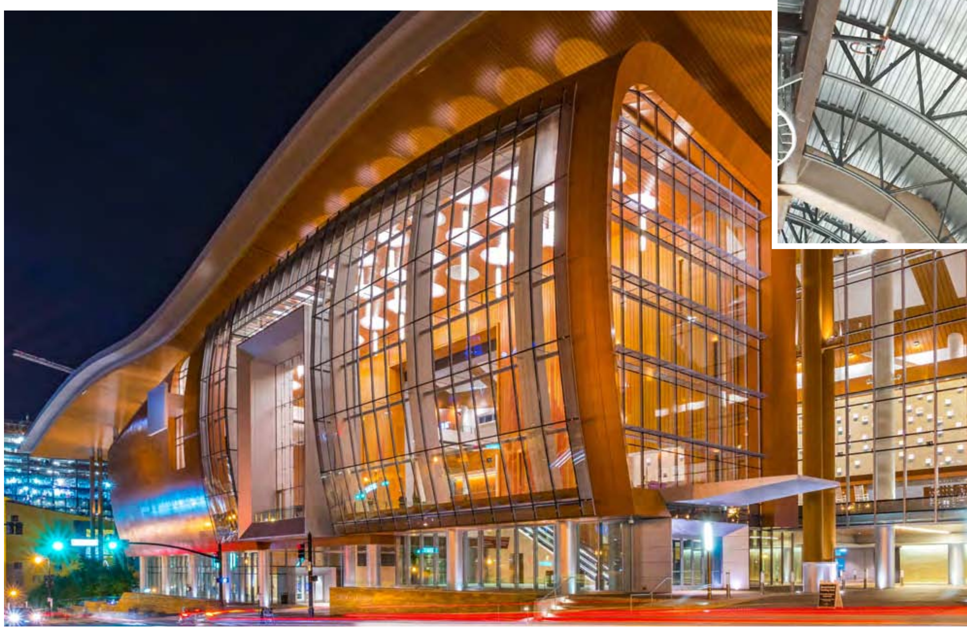
System Design Criteria	Cost Reduction
Materials	$124,833
Transportation	$6,726
Handling	$1,700
Erection	$60,000
Total:	**$193,259**

Convention Centers

Nashville Music City Center: Here, the prevailing design goals were high in the areas of quality design and functionality – and cost efficiency. Contract drawings were about 50% complete, calling for a grand entryway featuring a curved roof using steel joists and deck. Special profile barrel joists were recommended by the engineers at the joist and deck supply company; with vertical structural steel transitions into a pitched and sloped roof. The detailing of the system was critical to achieving exact joist angles, helping the project achieve tens of thousands of dollars in cost savings.

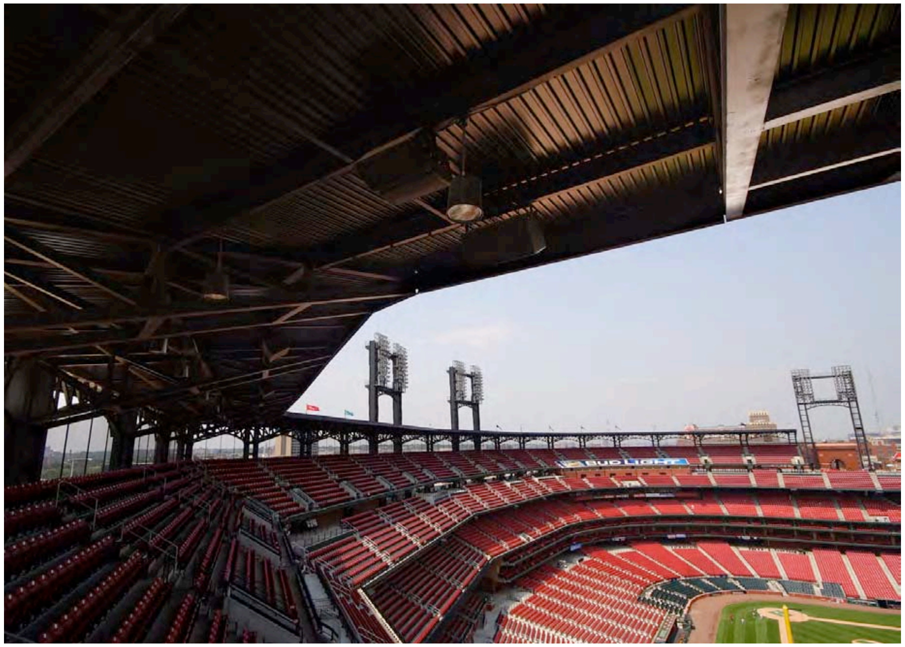


Special profile steel joists and decking for curved entry.



Stadiums

Busch Stadium, MO: Prevailing design goals were functionality and quality of design, leading to the selection of several standard profiles of roof and floor deck for concourses, concessions, skyboxes and grandstands. An open, industrial design esthetic is protected by a factory pre-finished coating system to account for a range of protection, including full UV exposure. Silica-modified-polyester finishes can also be factory applied for scratch resistance during installation and post-installation.



Standard steel joist and deck systems with factory coatings.

Target Field, MN: A priority goal for this stadium was to create a new age, sweeping aesthetic and the functionality of integrated lighting. The Division 7 architectural metal cladding system originally specified for the project became a cost priority, when the steel joist and deck company recommended a much lower cost Division 5 architectural steel deck cladding system. The functionality of the exposed dovetail decking, installed by a Division 7 contractor, was further addressed by a PVDF factory coating with a 20-year warranty.

Architectural steel decking with lineal plank aesthetic as stadium cladding.

Outdoor Concepts

Anaheim Regional Transportation Intermodal Connector (ARTIC): The design for the roof of the center's open-air connector bridge emphasized long-term costs and aesthetics. Exposed architectural steel decking addresses these goals, with the recommendation of G90 galvanization of the steel decking over standard G60 coating weight. A factory-applied primer added to the long-term protection of the bridge's year-around open-air design.

Architectural steel decking for open-air walkway ceiling.

Canopies and sunscreens: Here the prevailing design criteria are functionality and cost, with the added desire to incorporate an unexpected aesthetic flair. Exposed architectural steel decking meets all of these goals. Steel decking can be curved, and when perforated can reduce direct solar heat gain to act as a sunscreen.

Perforated architectural steel decking for UV protection.

Multi-Story

Elan Heights, TX: The prevailing goal here was to create the highest space efficiency for the least cost. A traditional 3-inch steel deck would provide spans up to 14 feet; alternatively, the chosen deep deck long-span composite floor system provided for unsupported spans up to 25 feet. The thin slab floors conserved building height and material costs. The floors are UL fire-endurance rated for two hours, without the cost of additional spray-on or gypsum fire protection.

Long-span composite floor system for large, open spans.

443 Greenwich, NY: The restoration of this historic 1883 book bindery into upscale condominiums placed an emphasis on quality of design and efficiency of schedule. A long-span, deep deck composite floor system produces clear spans over 18 feet. Highest possible floor-to-ceiling heights open the way to an industrial interior design featuring restored original wood columns. The low vibration floor system provides verified superior sound control, meeting International Building Code requirements for STC and IIC with a rating of 70.

Long-span composite floor system for space efficiency.

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Thank you.

This concludes this course for 1.0 PDH credit or American Institute of Architects Continuing Education Systems Program AIA 1.0 LU / HSW credit.

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