

Connection Optimization Provides Significant Cost Savings For Steel

Advances in connection design software technology results in streamlined steel fabrication, savings between \$40 and \$75 per ton

At a Glance

THE PROBLEM

With ever-increasing costs in the fabrication of steel and related labor, owners, CEOs and operations managers are continually searching for ways to optimize production and decrease their bottom lines.

THE SOLUTION

SDS/2's new connection optimization enhancement enables fabricators to lower material and labor costs by decreasing the number of bolts in connections while still meeting American Institute of Steel Construction (AISC) design specifications. 1234567891 1/4

THE BENEFIT

Connection optimization enables SDS/2 users to create connections with fewer bolts, resulting in lower material and labor costs associated with the fabrication and installation of connections.

A commonly overlooked area when seeking to reduce fabrication costs, the quantity of bolts used throughout a structure can present ample opportunity to eliminate expenses and associated labor.

Typically governed by one of three criteria — the load, either engineer-provided or system-generated; AISC's recommended plate length rule as it applies to stabilizing a beam; or an engineer-provided minimum number of bolts schedule — connections are often over designed, leading to excessive and unnecessary bolts.

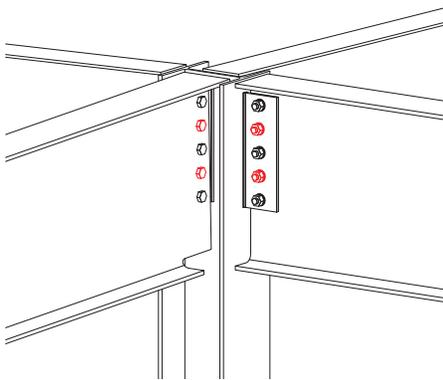
Working within AISC's schedule of minimums for shear connections, connection optimization eliminates redundant bolts, holes and welds; SDS/2's automated intelligence ensures that the connection still meets or exceeds design loads and related requirements.

The Nuts and Bolts of Connection Optimization

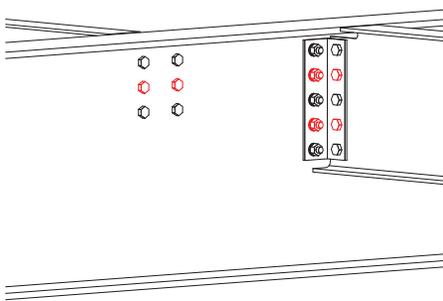
SDS/2's intelligent automation now allows detailers and fabricators to perform automatic connection optimization that results in overall lower material and labor costs.

Using connection optimization on a project does not affect the steel structure itself — the steel beams, columns and braces remain the same size and in the same location. Instead, connection properties





By optimizing connections, SDS/2 eliminated the bolts shown in red in each shear tab connection (above) and bolted clip angle (below); the resulting connections still meet or exceed design loads and related requirements.



within SDS/2 are modified by enabling expanded bolt spacing enhancements and by reducing the minimum number of bolt rows required by a member's nominal depth.

SDS/2 then identifies the connections that can be optimized while adhering to AISC requirements and redesigns them automatically.

The Methodology

Originally detailed and fabricated by SDS/2 customers, the as-constructed projects were priced out using average material and labor costs provided by fabricators located throughout the Midwest.

Next, connection optimization was applied.

By enabling expanded bolt spacing enhancements and reducing the minimum number of required bolt rows in the software, SDS/2 automatically applied those new design parameters to connections throughout the model.

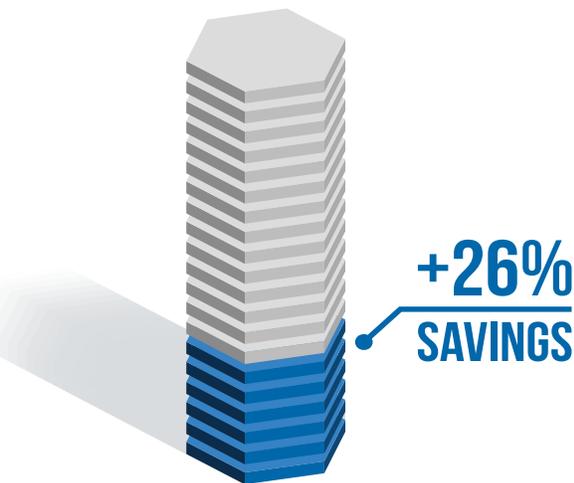
The projects were then priced out using the new material and labor numbers generated using optimization.

It is important to note that this optimization can be applied at the beginning of the project, during the project or at any time before fabrication has begun.

Based on the results of the case studies detailed here, SDS/2 users can expect to realize a savings between \$40 and \$75 per ton per project.

Optimizing bolted clip angle connections throughout the project led to a substantial reduction in bolts and holes.

	BOLTS	HOLES	WELDS	TOTAL
	bolt & labor costs	hole & labor costs	weld & labor costs	material & labor costs
Pre-Optimized	\$84,580	\$49,422	\$38,178	\$598,551
Optimized	\$62,311	\$36,090	\$34,656	\$557,399
Savings	\$22,269	\$13,332	\$ 3,522	\$ 41,152
% Savings	26.3%	27.0%	9.2%	6.9%



Connection optimization resulted in a bolt and related labor cost savings of more than 26%.

Case Study #1: Central Indiana

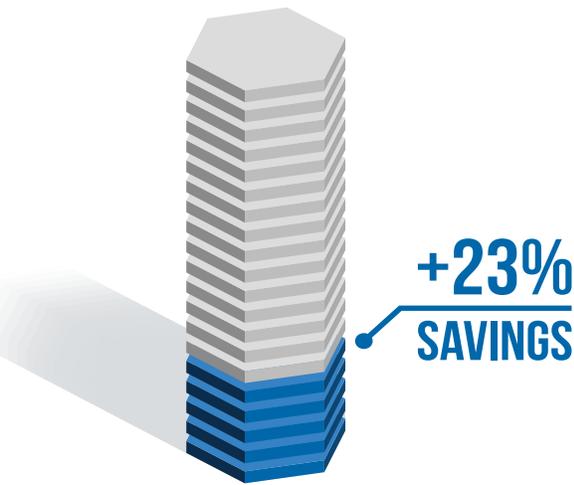
The test case involved the connection optimization of a 100,000-square foot ER, immediate care center and medical office building in central Indiana. Without optimization, this project totaled \$426,370 in steel costs such as beams, columns and connection material, as well as \$84,580 for bolts, \$49,422 for holes and \$38,178 for welds. The final material and labor costs for the project were \$598,550, with 546 reported tons.

Connection optimization resulted in substantial cost savings for the project. The bulk of the savings were realized in reduced bolt quantities and the labor required to install them. Bolt costs shrank to \$62,311 — a reduction of \$22,269 (26.3%). Associated costs for holes and welds were reduced to \$36,090 and \$34,656 respectively, a savings of \$13,332 (26.9%) and \$3,522 (9.2%).

Overall, connection optimization would have provided a savings of \$41,151 for the project, a reduction of total reported tons by 2.6, and a cost savings per ton of \$75.28.

Connection optimization makes a significant impact in savings over non-optimized connections, including double-digit percentage savings for both bolts and holes.

	BOLTS	HOLES	WELDS	TOTAL
	bolt & labor costs	hole & labor costs	weld & labor costs	material & labor costs
Pre-Optimized	\$92,188	\$37,285	\$93,323	\$999,479
Optimized	\$70,597	\$27,635	\$86,840	\$960,235
Savings	\$21,591	\$ 9,650	\$ 6,483	\$ 39,244
% Savings	23.4%	25.8%	6.9%	3.9%



Connection optimization resulted in a bolt and related labor cost savings of more than 23%.

Case Study 2: Lincoln, Nebraska

The test case involved the connection optimization of a six-story office complex located in downtown Lincoln, Nebraska. Without optimization, this project totaled \$776,682 in steel costs such as beams, columns and connection material, as well as \$92,188 for bolts, \$37,285 for holes and \$93,323 for welds. The final material and labor costs for the project were \$999,481, with 995.75 reported tons.

Connection optimization resulted in substantial cost savings for the project. After applying SDS/2's intelligent automation, the material costs on the project were lowered to \$775,162. The bulk of the savings were realized in reduced bolt quantities and the labor required to install them. Bolt costs shrank to \$70,597 — a reduction of \$21,591 (23.4%). Associated costs for holes and welds were reduced to \$27,635 and \$86,840 respectively, a savings of \$9,650 (25.8%) and \$6,483 (6.9%).

Overall, connection optimization would have provided a savings of \$39,244 for the project, a reduction of total reported tons by 1.95, and a cost savings per ton of \$39.41.

About the Company

SDS/2, a Nemetschek company, is a leading software innovator for the steel industry's fabrication, detailing and engineering sectors. SDS/2 software products provide automatic connection optimization, detailing, engineering information, fabrication data and much more, reducing the time required to design, detail, fabricate and erect steel. Founded in 1981 and headquartered in Lincoln, Nebraska USA, the company serves customers in 17 countries.



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