Fact Sheet # 27: Design of Acoustic Deck

Version 1: August 2009

Introduction

Cold formed steel roof deck is a standardized product manufactured by a number of CSSBI member companies. Some of these roof deck products have a pattern of small holes punched into the web elements (perforated webs), as illustrated in the photograph in Figure 1, and are commonly referred to as "acoustic deck". In a typical acoustic deck the holes are 3 mm (1/8 in.) in diameter spaced on 9.5 mm (3/8 in.) staggered centres. The perforations would remove approximately 10% of the web area.

Acoustic deck is used because it can improve the acoustical properties in a building as discussed in CSSBI Fact Sheet #16. The structural strength and stiffness of the standard roof deck is well known and can be calculated using the *North American Specification for the Design of Cold-Formed Steel Members*, CSA-S136-07. The subject of this fact sheet is the effect the web perforations have on the flexural strength and stiffness of the deck.

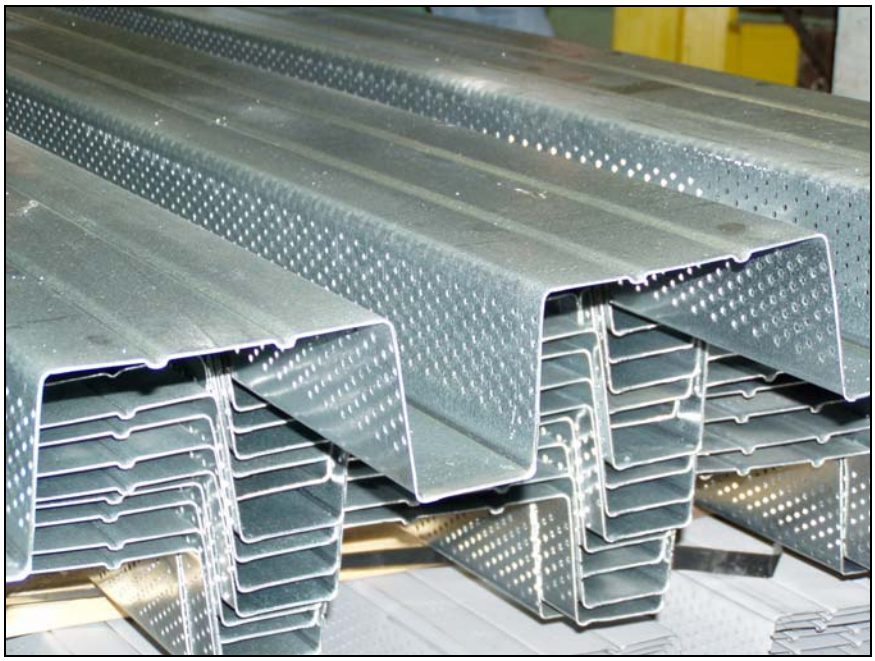

Figure 1: Photograph of Acoustic Deck

Research Project Summary

A research projects was carried out at the University of Waterloo under the supervision of Prof. R.M. Schuster. The objective of this project was to conduct comparative flexural tests of standard plain and acoustic deck to determine the impact of the perforations on the strength and stiffness. The results are summarized in this bulletin, but the complete results are reported in *Flexural Strength and Stiffness of Acoustic Roof Decks*, Canadian Cold Formed Steel Research Group Report 06-09, June 2009.

The test matrix is provided in Table 1. The test specimen sizes were selected to be representative of the most common products used. Three tests were carried out in each configuration, resulting in a total of 24 tests.

Table 1: Test Matrix

Deck Type	Deck Depth	Deck Thickness
Plain	38 mm (1-1/2 in.)	0.762 mm (0.030 in.)
		1.22 mm (0.048 in.)
	76 mm (3 in.)	0.762 mm (0.030 in.)
		1.22 mm (0.048 in.)
Acoustic	38 mm (1-1/2 in.)	0.762 mm (0.030 in.)
		1.22 mm (0.048 in.)
	76 mm (3 in.)	0.762 mm (0.030 in.)
		1.22 mm (0.048 in.)

Test Procedure and Results

The test procedure involved conducting two-point loading bending tests on simply supported deck specimens. All 38 mm (1.5 in.) deck specimens were 1.83 m (6 ft) in overall length and 914 mm (36 in.) in width, and all 76 mm (3 in.) specimens were 2.44 m (8 ft) in overall length and 610 mm (24 in.) in width. The two-point loading creates a constant moment region with no shear at mid-span between the loading points. Measurements were taken of the applied load and the resulting mid-span deflection for each test. In all cases failure at the ultimate load was caused by local buckling in the compression flange between the load points.

The effect of the web perforations on the **ultimate strength** was determined by comparing the failure loads for the acoustic deck to the failure loads for the corresponding plain deck. The test results showed that there was a reduction in the ultimate strength of the acoustic deck that depended on the deck depth and thickness. The thicker the base steel and the deeper the deck, the more effect the acoustic holes had on reducing the ultimate strength.

The effect of the web perforations on the **stiffness** of the deck was determined by comparing the slope of the load-deflection curves in the initial linear region. A reduction in stiffness was observed that increased with the depth of deck but not the steel thickness.

Conclusions

Based on these test results, the CSSBI recommends the reduction factors listed in Table 2 for calculating the strength and stiffness of the typical acoustic deck.

Table 2: Acoustic Deck Reduction Factors versus Plain Deck

Deck Depth	Strength Reduction (%)	Stiffness Reduction (%)
38 mm (1-1/2 in.)	5	No reduction
76 mm (3 in.)	10	5