

The margins and fonts on these pages reflect the printer's adjustments for the 6 inch x 9 inch book

Appendix A: Sample Technical Report

This appendix presents an example technical report. This report describes the design and construction of structures using spaghetti. There was virtually no time to do formal analysis of the design performance; therefore, a mathematical treatment and the associated equations are not included. However, this report does show how to write report Introductions, how to cite and describe drawings, and how to prepare very simple drawings to illustrate designs. This sample report also shows a standard format. This report was prepared using the page design settings displayed in Table A.1.

Table A.1: Standard Format Settings

PAGE DESIGN SETTINGS

Margin settings for written reports:	1.0 inches on left, right, top and bottom of each sheet.
Justification of text:	Left Justification.
Display of figures:	Figures should be centered. Figures should be displayed following the text citation. Figures should be numbered and captioned.
Display of tables:	Tables should have light grids. Tables should be numbered and captioned above the table
Display of plots:	Plots should 3 ½ X 2 ¼ in. Plot backgrounds should be white. Legends should be on empty areas. Axes: Light, solid lines, Scaled to fit data tightly, Fonts between 16 and 20.

TYPOGRAPHY NORMS AND SETTINGS

Base typeface for written reports:	Times New Roman
Base font size for written reports:	12 point

TYPE STYLE SETTINGS

Title:	Times New Roman, 16 point, bold, Centered, Caps
Section Head:	Times New Roman 12 Point, Bold, Left Aligned, Mixed Case.
Subhead:	Times New Roman, 12 Point, Italic, Mixed case.
Indented Paragraph:	Times New Roman, 12 point. Left Justified, 1.5 lines/feed. Indent 0.25 inch. No blank lines between paragraphs.
Equation Display:	Equations are centered. Equation number is to the right of the equation.

The margins and fonts on these pages reflect the printer's
adjustments for the 6 inch x 9 inch book

ME 2110-X
Studio Project 1:
Design and Construction of a Spaghetti Bridge

Submitted to:
Instructor: J. S. Coon
GTA: G. P. Burdell
Date: January 18, 2007

Submitted by Team X-2:
M. Howard
L. Fine
M. Wie

ABSTRACT

This report describes two spaghetti structures that were built to span a distance of three feet and to bear weight. Each of the two spaghetti structures successfully spanned the required distance; the first structure bore a weight of four ounces, and the second bore a weight of sixteen pounds. The design, construction and testing of the structures is illustrated with conceptual drawings. An analysis explains why one structure performed much better than the other.

INTRODUCTION

The goal of this project was to build a bridge between two tables placed 3 feet apart. This bridge was to be constructed using only one box of spaghetti and one roll of tape. After the bridge was constructed, weights were to be hung from the bridge to determine how much load the structure would hold before failing.

The challenges posed by this project stem from the materials. Spaghetti is strong in compression, but it flexes, and it breaks easily. Therefore, it must be reinforced in order to be useful in construction. Tape can provide reinforcement for spaghetti in some circumstances, but it cannot prevent bending. Tape was found, however, to have tensile strength that was a useful complement to the compression strength of the spaghetti. Both of the bridges described in this report were designed to exploit tape's strengths to compensate for the weaknesses of spaghetti. For the first bridge, the design focused on the use of tape-reinforced spaghetti structures, while the second bridge was designed to fully exploit the strengths of tape.

OVERVIEW OF BRIDGE USING SPAGHETTI AS STRUCTURAL ELEMENT

The first spaghetti bridge, shown in Figure 1, used spaghetti as the main structural element, while using tape as a reinforcement. This bridge consists of a long central span of taped spaghetti bundles, two table anchors, also made of taped spaghetti bundles, and eight tape supports, which were introduced to prevent swaying and to prevent the bridge from collapsing under its own weight. The central span was designed to be strong by using reinforced spaghetti bundles, which are represented in Figure 2. Each component of this span was composed of three tape-wrapped bundles of spaghetti, which were wrapped together, forming a double-tape-wrapped central span member. Such members were then fixed together until reaching a length of 40 inches. Similarly wrapped members were taped to the tables as bridge anchors, to which the ends of the central span were taped. The support strands of tape were then strung from the table to four locations along the span in order both to stabilize the span and to prevent it from sagging and pulling itself loose from the anchors.

This bridge was able to hold four ounces of weight before it failed. Failure occurred when the spaghetti strands in the central span broke and pulled apart. When failure occurred, however, the reinforcing tape strands remained intact, simply unwinding from the remaining spaghetti elements of the

central span. This failure revealed that tape was by far the better material for holding weight; this information came to govern the second design.

OVERVIEW OF BRIDGE USING TAPE AS PRIMARY ELEMENT.

The second spaghetti-tape bridge, shown in Figure 3, used tape, rather than spaghetti, to bear weight. This bridge had a central span made of spaghetti, a primary support of individual tape threads and a secondary support frame of tape. The spaghetti cable, the tape frame and the tape web converged at a central point, which was designated as the support point for weights.

The spaghetti span was built of three six-strand spaghetti bundles wrapped in a tape sheath. Bundles were added to extend this span to a length of 40 inches. As a primary support for this central spaghetti span, a tape support web was formed of four long pieces of tape that ran diagonally between the two tables, crossing below the central span exactly at its mid point. A secondary tape frame provided additional support. Two doubled strands of tape ran parallel to the central span, with cross-pieces of tape forming a central support cradle.

This design was able to support 16 lbs. Although the spaghetti in the central span failed under heavy load, the two tape support structures never failed. Loading was terminated when the tables themselves were pulled together by the weights suspended between them.

DISCUSSION

This design was able to support 16 pounds; all other bridges in this section failed under loads of less than 1 pound. The design's unusual strength reflects an innovation in the use of materials, where tape was emphasized over spaghetti. While the central spaghetti span was thick, it was expected to fail under heavy load. The two layers of tape support, however, were designed to prevent the broken spaghetti cable from falling, and to support additional weight as they did so. These design expectations were borne out during testing, as the spaghetti span failed quickly, while the redundant layers of tape supported weight effectively. The recorded loading of this bridge was 16 pounds, but the actual strength of the bridge is not known, as the loading was removed before failure.

CONCLUSIONS

This report described two bridge structures that were developed using spaghetti and tape with the goal of supporting weight. The first such structure relied primarily on spaghetti to support the load. It only supported a load of four ounces. The second such structure utilized the high tensile strength of tape to support the load. It supported a load of 16 pounds without failure.

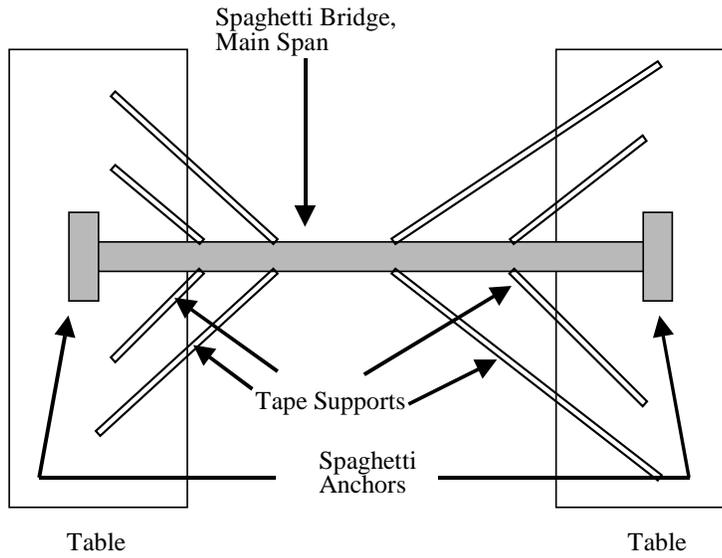


Figure 1. Overhead View of Spaghetti and Tape Bridge.

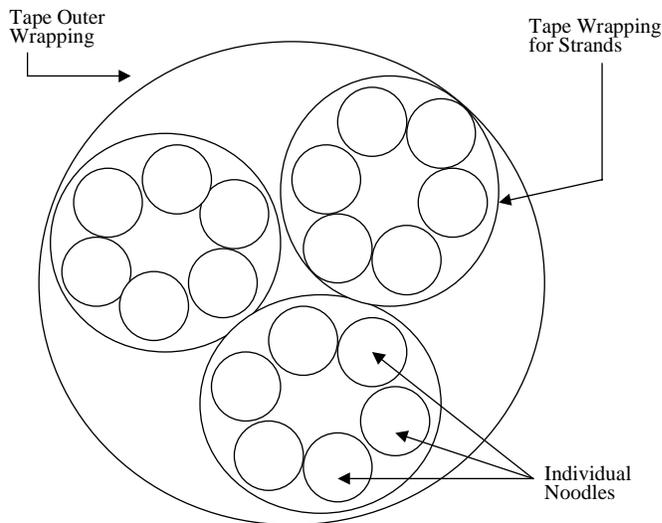


Figure 2. Cross Sectional View of the Central Span Cable.

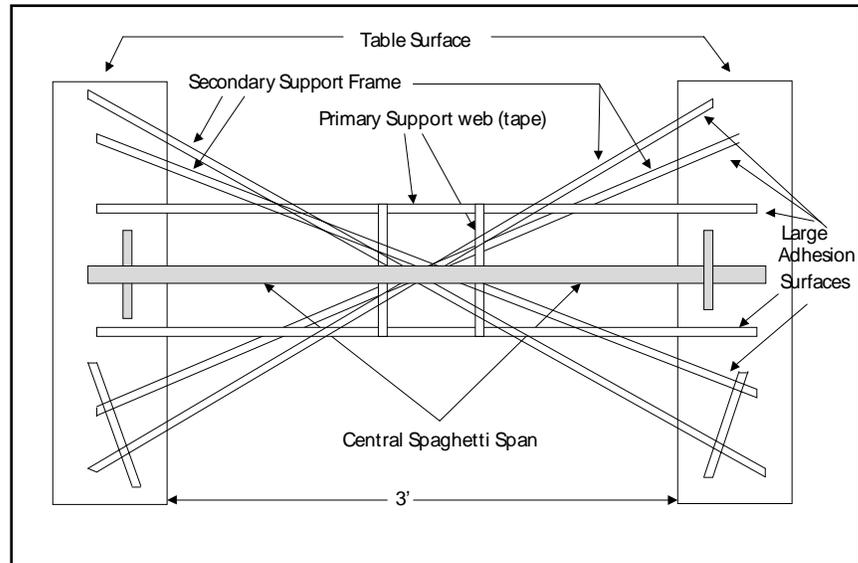


Figure 3. Spaghetti-Tape Bridge Using a Tape Web to Support Weight.