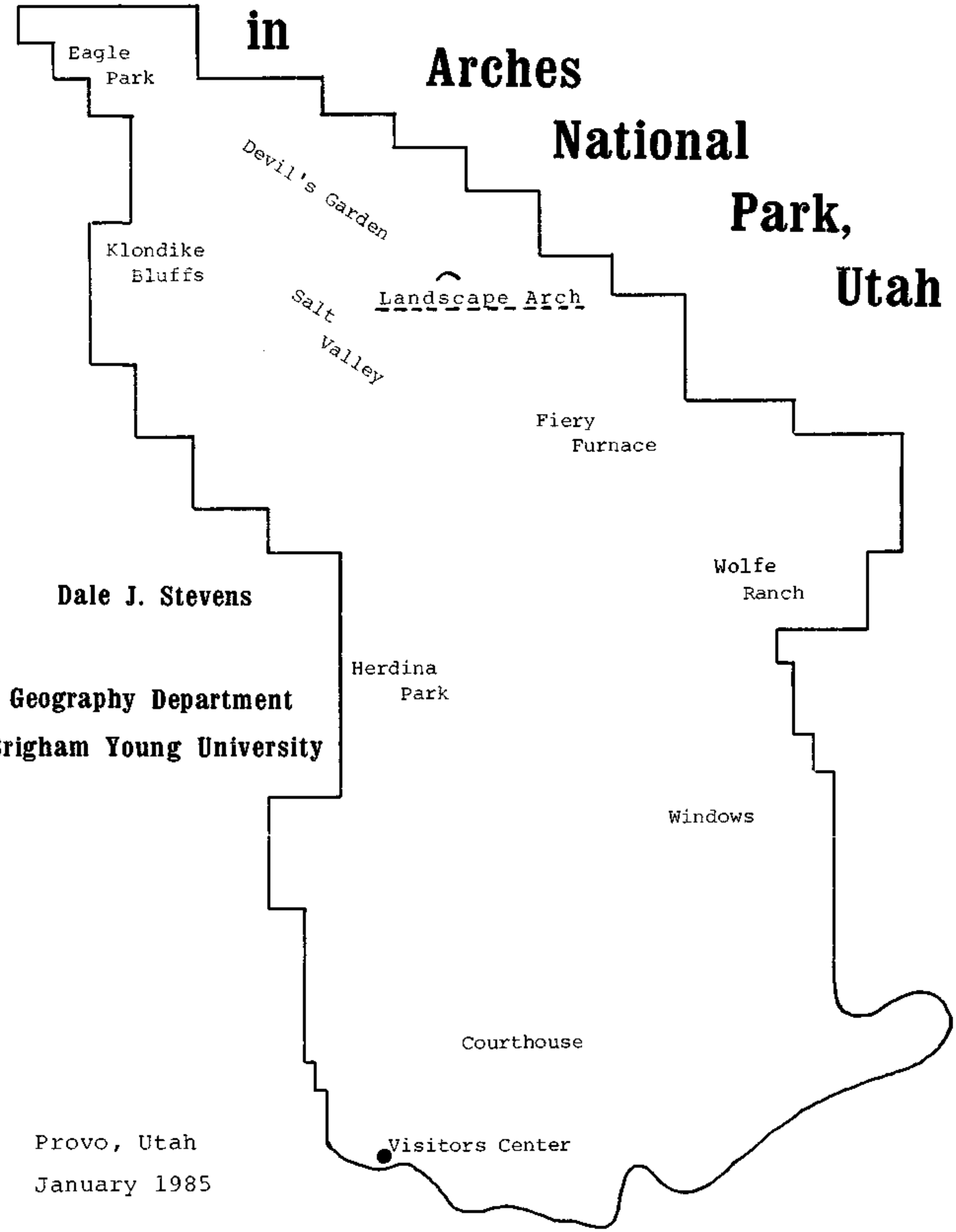
The Dimensions of Landscape Arch in Arches National Park, Utah



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The long graceful span and relatively large size of Landscape Arch sets it apart from all other natural arches in southern Utah. Although its existence was probably known by early explorers, trappers and ranchers, it first became known as Landscape Arch in 1934 when the Arches National Monument Scientific Expedition led by Frank A. Beckwith gave it the name. Because of its unusually large size, which has been claimed by some as being the largest in the world, it has become a focal point of interest to those who enjoy knowing as much as possible about such features of the earth's surface.

Several publications which deal with the features of Arches National Park give some dimensions to the arch, although they usually do not indicate how or by whom the measurements were made. Even if it is known who made the measurements, it is difficult to find out the details of how they were made and exactly what points on the arch were used to make the measurements. The most common value quoted for the size of the arch is that it is "291 feet long" (see Lohman p. 90, Hoffman p. 83 and official park pamphlets). If in fact Landscape Arch is the largest natural arch in the world, it would be desirable to know its true dimensions.

During the Fall months of 1984 I undertook a project to accurately map, measure and study all the arches in Arches National Park. This project was funded through a grant from Brigham Young University, College of Family, Home and Social Sciences. Before collecting any data I set up a system to collect and record information for each arch in the Park. When it came time to do Landscape Arch I set aside extra time as the size and setting of the arch, as well as the interest in its size, required special attention.

The dimensions of Landscape Arch were acquired on two different days as it took considerable time to physically get on top of the span to make measurements there and to set up the instruments needed to make the measurements on the ground. The vertical and horizontal thickness of the span were made on October 26, 1984 from on top the span. Those involved in this measurement were Jim Stiles, Arches National Park Ranger, Carl Horton, climber and BYU Geography student and Dale Stevens, professor of Geography at BYU. Horton and Stevens climbed onto the span by way of the fin to the north of the arch. This required more than just a casual walk as there were a few places where a certain degree of undaunted courage, rope rappelling and rope climbing were necessary. Stiles remained beneath the span to view the measuring devices and to direct those on top where to position themselves to make the measurements.

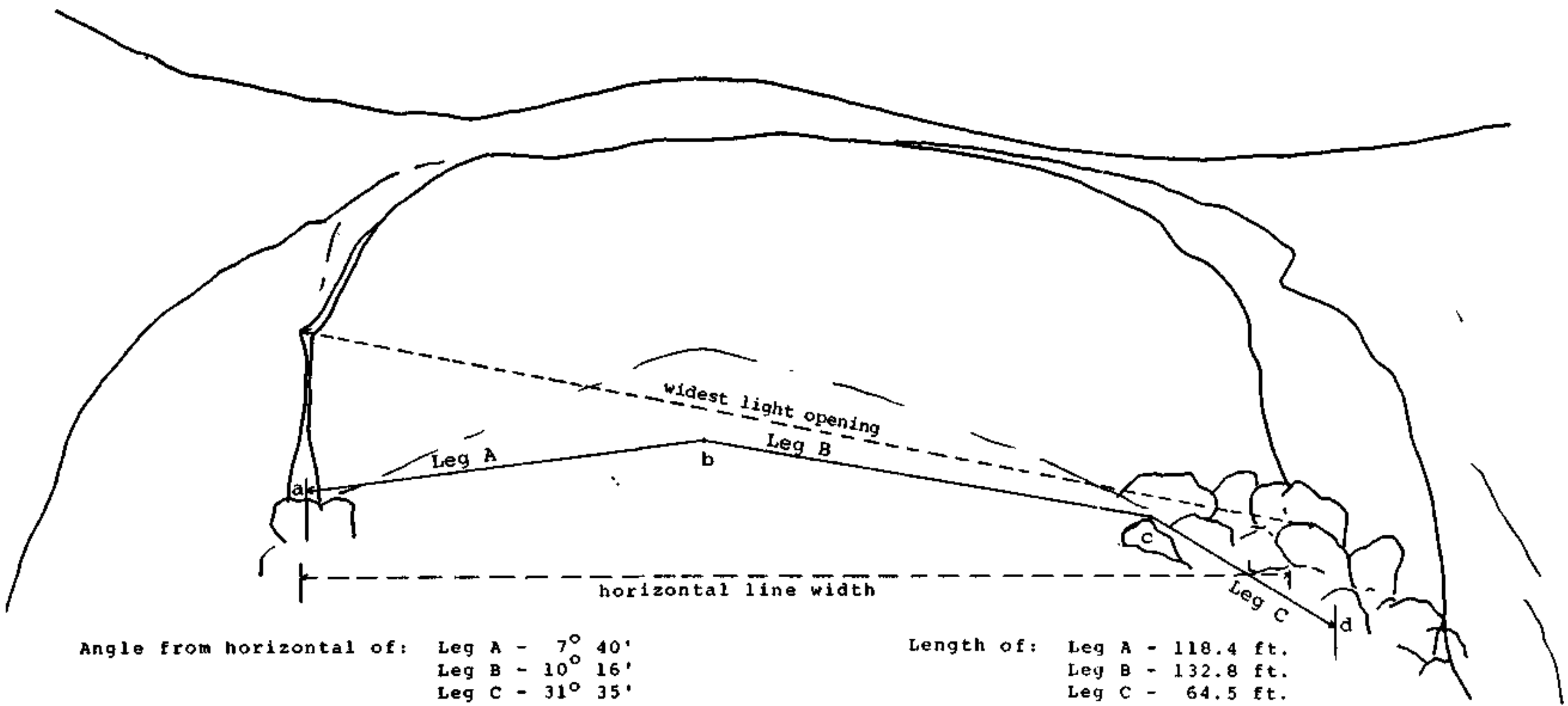
The vertical thickness was measured at the thinnest part of the span by Stevens who dropped a weighted nylon cord over the west side. This cord had previously been measured with masking tape markers placed at one foot intervals that could be seen easily from a distance. Stiles had climbed to the tip of the west slope beneath the span so that he was essentially level with the under edge of the span. He counted the number of markers (feet) from bottom to top.

The horizontal thickness was measured at the thinnest point by allowing the weighted string to hang from the end of a rod (similar to a fishing pole) held level with the top of the span so that the weighted line came in contact with the side of span at its most protruding point. This worked well for the west side as it is nearly vertical. The east side, however, slopes down from an eight-inch wide flat surface on top at 42° to a sharp edge at the underside of the eastern edge of the span. The rod was not long enough to extend out so the string could hang vertical. Therefore the length of the 42° slope was measured so that the horizontal distance could be mathematically computed. This value added to the eight inch top and the previously measured west side gave us the horizontal thickness of the span.

The end of a steel tape was also dropped from the top to measure the height, but because of the uneven surface below the span, several other height measurements were made later from the ground using a precision range-finder.

The measurements made from beneath the span were done on November 9, 1984 by Dale Stevens and his father Lawrence Stevens. One of the main problems in getting accurate distances beneath the span is the large sloping ridge of sand and rocks directly beneath the arch which do not allow a straight line view from one base to the other. Another problem is deciding where to establish the measuring point on the northern base as it is quite irregular and partially obscured with large boulders. To solve the problem of the ridge beneath the span a transit was used to determine the angles up and over the ridge as shown in the diagram. (see Figure 1) The precise distance between the transit positions and the base points were measured

LANDSCAPE ARCH MEASUREMENTS



Angle from horizontal of: Leg A - 7° 40'
Leg B - 10° 16'
Leg C - 31° 35'

Length of: Leg A - 118.4 ft.
Leg B - 132.8 ft.
Leg C - 64.5 ft.

Angle of widest light opening line - 11°

Distance from arch base to: point a - 3.5 ft.
point d - -7.0 ft.

Figure I

with a steel tape to the pivitol point of the transit. (In line with the line of sight, not parallel to it.)

In measuring arches three "widths" have been established, especially for those arches that have a funnel-type opening. (Landscape Arch has such a funnel shape on its northern base.) The three different "widths are described below so that there can be no confusion on the different measurements made.

The first dimension is the widest light opening. It is defined as the widest possible light opening beneath the span. For most arches that line is not necessarily a level line, but usually occurs at a slight angle. If a long rod could be passed through an arch, it would be the longest possible rod that would pass with the ends just touching the rock at the widest part of the opening. The second dimension is the opening beneath the span. Its value is derived by establishing a center-position line parallel to the span which extends from base to base. The third dimension is the length of the span which is sometime quite arbitrary as the span is not always discernible in some arches. It is a straight-line inside measurement made from one base to the other. Refer to figure II which diagrams the widths described above.

OVERHEAD VIEW OF TYPICAL

ARCH MEASURING POINTS

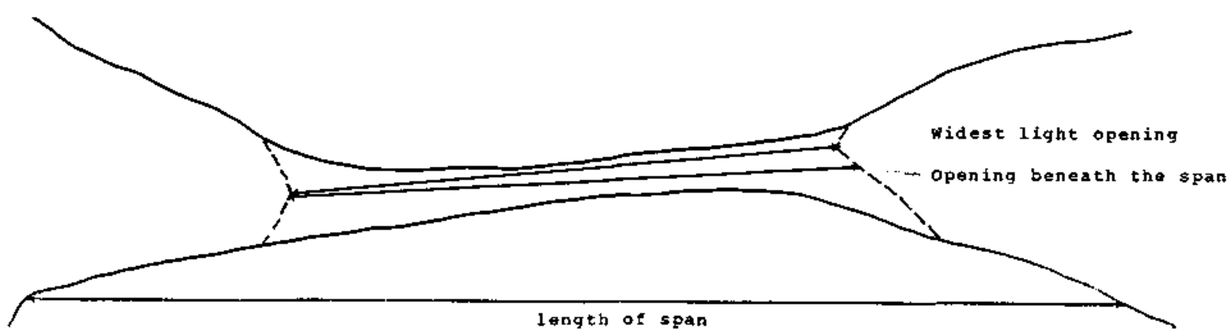


Figure II

The problem of the boulders at the northern arch base was overcome by using the top of one of the large boulders (point c) as a survey point that could be sighted from both point b and point d of the transect line. (See figure I) The transit was placed at point "b" first and after leg A and B were established, the instrument was moved to point "d" where leg C was measured. Since both points "a" and "d" were not at the exact place to be measured, those differences to the base points of the arch were measured horizontally from vertical lines with a steel tape.

There is also one other complexity about Landscape Arch that must be taken into consideration when measuring the arch. Thirty-seven feet up from the base of the south leg there is a notch that must be used when the widest light opening is determined. The depth of this notch was measured with the transit by "shooting" a vertical line from the southern-most part of the notch to the base.

The table below lists the major dimension of Landscape Arch.

LANDSCAPE ARCH
Major exposure NE

Span	Feet	Meters	How Measured
Horizontal thickness	15.5	4.7	Tape and Abney level
Vertical thickness	16	4.9	Tape
Length	434	132	Tape and Transit

Opening	Feet	Meters	How Measured
Light at widest place	306	93	Tape and Transit
Width beneath the span	325	99	Tape and Transit
Height beneath the span*	87	27	Tape and Range Finder
Horizontal line width	301	92	Mathematically from above data

*Five measurements were made from bottom of span to ground beneath span. The ranged from 79-92 ft.

So is Landscape Arch the longest in the world? The only known contender is Kolob Arch in Zion National Park, Utah. An arch that is oriented in nearly the same northeast exposure as Landscape Arch. There is only 18° difference in their alignment. Kolob Arch is located high on a cliff and is practically inaccessible for direct measurement. A measurement of this arch made in July 1983 by Naylor et.al. using electronic measuring instruments and triangulation from below but away from the arch indicated "the span of Kolob Arch is 310 feet plus or minus 12 inches." (see Blake 1984) It is not completely clear, however, the exact points at either base that were used to establish the 310 feet.

In May of 1984 a group headed by Dale Stevens also measured Kolob Arch by climbing to the top of the span then hanging a five-meter long rod into the opening beneath the span in line with where the measurement would normally be made. The arch was then photographed from a favorable vantage point with the rod in it. The width of the opening was then calculated from the photograph based on the length of the rod. Kolob's measurements according to Stevens are as follows:

	Feet	Meters
Horizontal thickness of span at narrowest place	41	12
Vertical thickness of span at narrowest place	82	25
Height of opening beneath span from back side	177	54
Widest light opening beneath span	292	89
Opening beneath the span	367	112
Length of the span	431	131

If one were to use the two most frequently used dimensions of light opening and span length Landscape Arch would be the largest using Stevens' measurements. If opening beneath the span and Naylor's light opening were to be used, Kolob Arch would be the largest.

Since aesthetics are also considered by many to be a factor in describing the characteristics of arches, one must not overlook the relatively thin span and distance from nearby rock masses that sets the free standing Landscape Arch apart from the cliff wall position and massive span of Kolob Arch. On the other hand the remote isolated location and brighter colors of Kolob Arch surely make it one of natures prized possessions to the viewer who enjoys the natural wonders of the world. Both arches are masterpieces of those geological processes that make southern Utah such a unique place.

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