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The Log Chutes of North Idaho

by
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OF NORTH IDAHO

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1. Introduction

Winding through the forests of north Idaho are hundreds of miles of rotten logs spiked to wooden cross ties. These structures, called log chutes, were once the most important element of north Idaho's transportation system for the logging industry. As a general definition, any timber channel in which logs are transported can be considered a log chute.

This paper examines the development, characteristics, and use of log chutes in north Idaho. The purpose of this paper is to provide enough information to allow log chutes to be managed as an historical resource. This paper is also intended to direct future fieldwork into areas which are in need of further investigation or areas which promise some understanding of history.

2. Development of Log Chutes

Logging in the United States began with the arrival of the first European settlers. As the forest resources were depleted in one area, logging interests searched out new stands of timber. In the 1820's and 1830's, the logging frontier was centered in the State of Maine. By the 1850's, the frontier had moved west to the Great Lakes Region (Wood 1935:226ff). In the late 1800's, the logging frontier had fully enveloped the Pacific Coast (Williams 1976:48ff), largely bypassing the Rocky Mountains.

The lack of transportation and the difficult terrain discouraged development of the Rocky Mountain timber resources. This situation began to change at the end of the nineteenth century.

> By the turn of the century, the supply of old-growth white pine was virtually exhausted in the New England and eastern states, and was shrinking rapidly in the lake states. Large sawmills, employing band saws and resaws, were ripping out the lumber at an unprecedented rate. New fields for future operations appeared to be essential if the industry was to survive. Accordingly, many concerns dispatched agents, men widely experienced in the business of evaluating timber stands, to size up the white pine forests of north Idaho... (Strong and Webb 1970:4).

The production of lumber in north Idaho skyrocketed beginning in about 1900, with 72 major sawmills operating in Kootenai, Benewah, and Shoshone counties alone by 1910 (Strong and Webb 1970:177-8).

In the early years of logging, trees were cut and hauled by hand. By the time the logging frontier had reached Maine, logs were transported by sleigh in the winter to rivers to be carried to mills on the spring floods. Sleighs also dominated the transport of logs in the Great Lakes Region, but on the Pacific

Coast other types of technology were required to transport logs. The steep terrain, large logs, and lack of snow in many areas prevented the use of sleighs. In the beginning "skidroads" were used. These skidroads consisted of logs laid crosswise, partly buried in the ground, at intervals of a few feet in a dirt road. The logs being transported would be pulled over this road with teams of oxen. Skidroads served well for the more accessible timber but, as Williams points out, in mountainous county other methods were required.

> For all its ingeniousness, the skidroad had its limitations: it could not work on a hill whose gradient was too steep for the oxen, and it could not be more than a couple of miles long because not even the doughtiest of animals were strong enough to pull the heavy logs very much further... Loggers wracked their brains for fast, effective ways to move the big sticks down from the heights. The log chute, a spectacular device, was the first that did not rely primarily on the muscle power of men or beasts... The principle behind the chutes was simplicity itself: since the course was downhill, let gravity do most or all of the work. In essence, the chutes were long troughs, usually made of peeled tree trunks, that served as conduits for the logs (1976:99-102).

Log chutes originally were developed in Europe. The idea was probably brought to the United States by the hundreds of Scandinavian immigrants imported into the logging camps in the 1800's. Williams (1976:102) notes that log chutes were in use in the far western United States by the late 1850's. From this period log chutes were used extensively either by themselves or, more often, in conjunction with other log transport methods. Horses, steam donkeys, railroads, flumes, wagons, sleighs, and caterpillars were used in conjunction with log chutes over the years.

In the early 1930's log chutes were in use in the northern and central Rocky Mountains, the northeastern United States, southern Appalachian hardwoods, and in eastern Canada (Brown 1934:118-120). Improvements in roads and equipment, especially trucks, in the 1930's rapidly caused the abandonment of the use of log chutes in north Idaho. By 1940 no log chutes were being used in the Idaho Panhandle (Strong and Webb 1970:115).

3. Physical Properties of Log Chutes

The physical principles behind the operation of log chutes are fairly simple. The force of gravity is employed to move or assist the movement of logs down a chute. The force of friction acts in an opposite direction to the movement of the logs down the chute. Finally, the log chute itself exerts a force (called normal force) perpendicular to its surface against moving logs which keeps the logs in the chute (Von Almburg 1911:161ff). These principles conform to some basic laws of physics which are worth reviewing in a very general way.

The force of gravity causes objects dropped near the surface of the earth to fall with the same acceleration as in a vacuum. As everyone knows, Newton propounded a law which explains the acceleration of an object under force. Without going into a technical discussion of Newton's Second Law of Motion, it can be stated that acceleration will be proportional to force and inversely proportional to mass (Giancoli 1980:39).

The force of friction results when two surfaces rub against one another. No surface is perfectly smooth, so the irregularities in a surface will come to oppose irregularities in another surface rubbing across it. No less a man than Leonardo da Vinci first observed that the force of friction is proportional to the perpendicular force that one surface exerts on another. Thus, there is no significant connection between the force of friction and the total area of contact between two surfaces (Giancoli 1980:47). As in many areas of the physics of force, the force of friction is only partly understood (Sears and Zemansky 1964:33).

The roughness of two surfaces being rubbed together changes what is technically called the "coefficient of friction". This coefficient is different for a standing object (static) and an object in motion (kinetic). The coefficient for kinetic friction is usually less than for static friction. Thus, it would take more force to get an object started to slide than to keep it in motion. For a wood surface sliding on another wood surface the approximate coefficients of friction are: 0.4 for the static figure and 0.2 for the kinetic figure (Giancoli

1980:47). Figure 1 illustrates the relationship of normal force, the force of friction, and the force of gravity as it would relate to a log chute.

The speed at which the log will accelerate in a chute can be found by using the following formula:

a = acceleration in meters per second squared.
g = the acceleration of gravity (9.8 m/s^2).
s = angle of slope.
c = coefficient of friction.

$$a = g\ (\sin s - (cg)(\cos s))$$

For a log in motion down a wooden chute on a 30^o slope, the acceleration would be (0.50 - (1.98)(0.866) 9.8 = 11.9 m/s^2. In five seconds the log would be traveling (11.9 m/s^2)(5.0 s) or 59.5 m/s (Giancoli 1980:50).

Another useful relationship occurs when the tangent of the slope equals the coefficient of kinetic friction. This is the point at which a log will slide at a constant speed once in motion and below which, without an assisting force other than gravity, it will come to a stop (Sears and Zemansky 1964:38).

An additional area which should be reviewed is that of "momentum". The momentum of a moving object is defined in physics as the mass times the velocity. Thus, the momentum of a log sliding down a chute can be found by multiplying the weight by the speed. Momentum is a directional force. A change in the momentum of a log is proportional to the amount of the net force applied to it. This relationship is important to understanding what happens when a sliding log encounters an obstruction or irregularity in a log chute. The momentum is changed in proportion to the net force which is the sum of all forces acting on it. This means that the direction of a log's movement down a chute can be altered by encountering a normal force from an irregularity in the chute. The new direction will be the sum of the momentum and the normal force.

Any effort to slow logs down must be applied symetrically or the logs will tend to cartwheel. Just as a speeding car in which only one front break engages, a log hitting an obstruction on one side of the chute will turn out of the chute.

So far we can calculate the point at which a log will slide in a chute at a constant speed, the acceleration of a log on slopes of various angles, and have some idea of the concept of momentum. Once in motion, a log would have a tendency to travel in a straight line. This tendency is called "inertia". To overcome inertia and move a log in a curved log chute, a sideways force is required. This is sometimes called "centripetal force". The force needed to turn the log can be calculated in the following manner:

N = unit of force.
f = force required to accelerate the log around a curve.
m = mass in kilograms.
v = velocity in meters per second.
r = radius of curve in meters.

$$f = m\frac{v^2}{r} = N$$

A 100 kg log traveling 59.5 m/s in a log chute with a 100 meter radius curve equals a net force of 1190N. The net force exerted on the log by the chute is equal to the weight times the force of gravity, (w)(g) or (1000 kg)(9.8 m/s^2) = 9800N. With a coefficient of kinetic friction of 0.2, the maximum force of friction would be 1960N. The force of friction would be overcome by inertia and the log would jump the chute (Giancoli 1980:67).

A way to compensate on tight curves and keep the logs in the chute is to bank the curve so that part of the normal force will be toward the center of the curve. Giancoli (1980:68) notes that for every angle of banking there is a speed at which no friction is needed to provide centripetal acceleration. This can be found by taking the normal force times the sin of the banking angle. In the above problem if the chute was banked 12^{o} with a normal force of 9800N, a force of 2037N will be provided without the need of the force of friction. Thus, the log would stay in the chute.

This technical discussion, while difficult to grasp at first reading, provides an accurate way to evaluate the information obtained on the construction and use of log chutes in the past. In-depth treatment of these topics can be found in any introductory physics text.

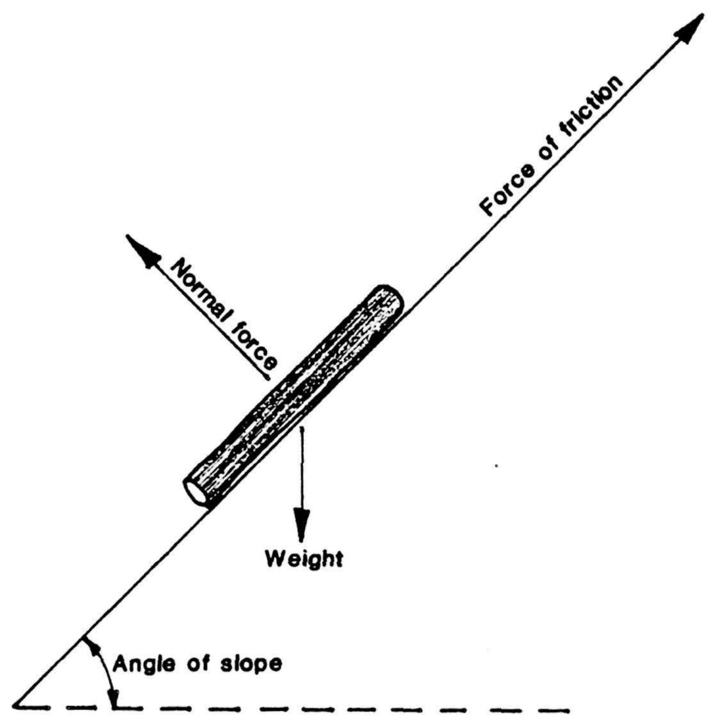

Figure 1, The relationship of normal force, the force of friction, and the force of gravity on a sliding log.

4. The Parts of a Log Chute

There were several types of log chutes built in north Idaho. More than 95 percent of the ones built in north Idaho were the "hewed two-pole" type (Neff 1927:38). Other types which were only very occasionally used included the three-pole chute, the ground chute, the saw-timber chute, and the roller chute (Neff 1927:38). In this paper, the discussion will concentrate on the history of two-pole hewn chutes because it was this type of chute that had the only real importance in north Idaho.

A two-pole hewn chute consists of two log rails (called chute sticks or chute timbers) laid side-by-side and spiked to cross ties. The interior sides of the chute sticks are hewn at an angle so that they form a "V" shaped channel. The beginning of the chute was sometimes called the "head", the chute proper was occasionally called the "slip", and the terminus of the chute was called the "apron" in some areas.

At the head of a chute, there were usually a series of "skidways." These structures consisted of two parallel log skids perpendicular to the chute sticks. The ends of the skids butted against the outside edge of one chute stick and the tops of the skids were slightly elevated above the tops of the chute sticks (Figure 3). Logs were piled on the skidways where they were stored until they were loaded into the chute. Logs were generally brought to the skidway by skidding the logs over the ground with a team of horses. Occasionally skidways consisted of a series of parallel skids each elevated slightly above the other (Figure 3).

The chute sticks were generally joined by a simple lap joint. The chute sticks were between 9 to 18 inches in diameter and were spiked with 12-inch long, 3/4-inch square chute spikes. When the chute stick had a greater diameter than the length of the spikes, the spikes were inset in notches cut into the outer sides of the chute sticks (Figure 2). The cross ties (sometimes called cross skids or crossers) support the chute sticks at an interval ranging from 8 to 16 feet. In

Components of a Typical Log Chute

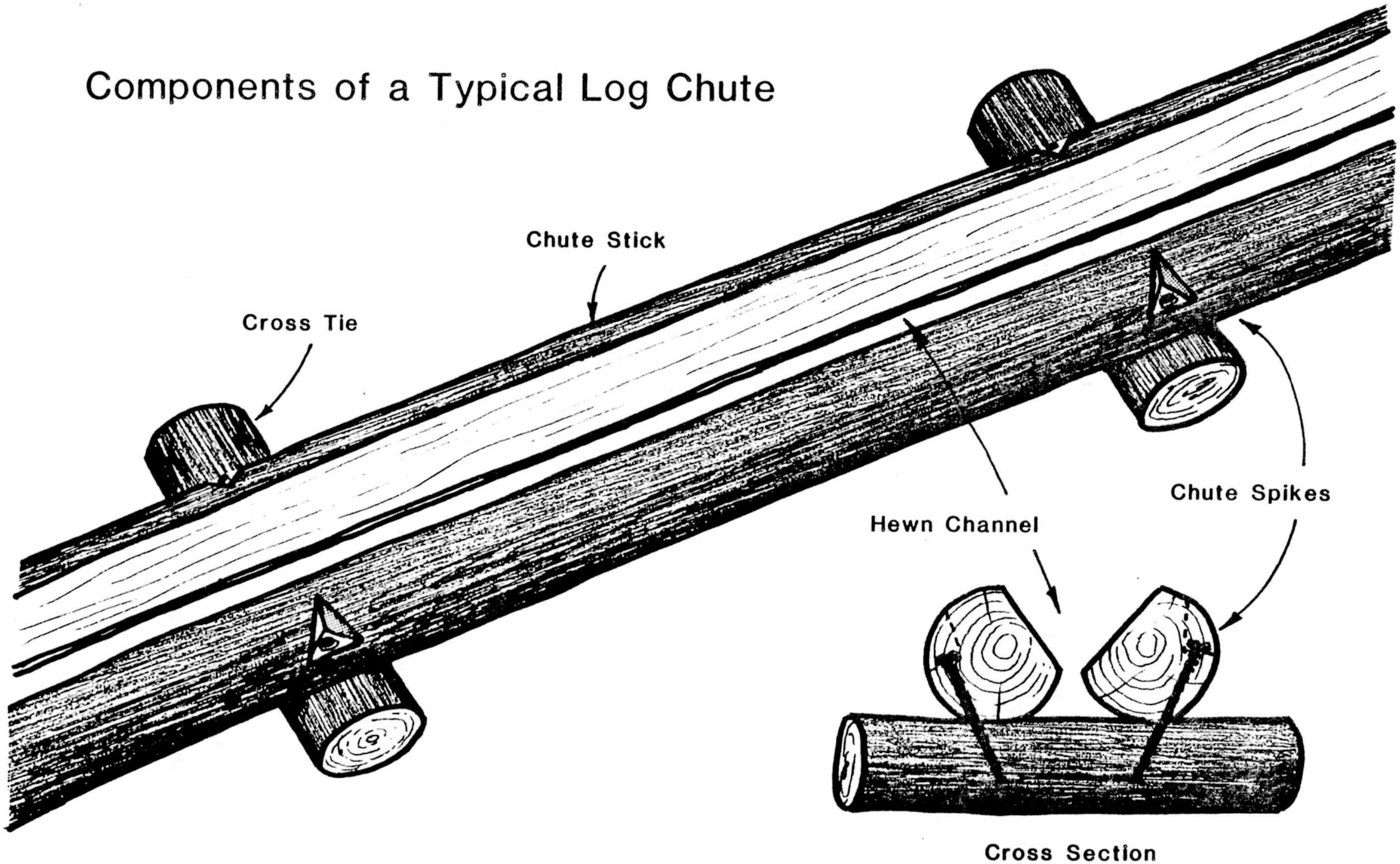

Figure 2

some cases chutes were constructed without crossties. In this type of chute the chute sticks are embedded in the ground with occasional perpendicular supports to keep the logs in place (Figure 13).

Along the chutes there would often be a number of auxiliary structures. When the chute passed over a depression or low area, a crib framework was used to support the chute sticks (Figures 19, 20, 21, and 23). On sharp curves the hewn channel could be banked by using a crib framework to elevate the outer chute stick (Figures 13 and 23) or fender poles could be attached to the top of outer chute stick (Figure 22). Cribbing consists of a rectangular framework of notched logs and is the simplest type of structural support. Trestle-type supports used less wood but were more difficult to build. To our knowledge, trestle-type supports were seldom, if ever, used in conjunction with log chutes.

Log chutes with little or no gradient required some means to pull the logs along the chute. The pulling power was generally supplied by horses (Figures 7, 8, and 9), but tractors (Figure 14) and steam donkeys (Figure 11) were also used. For horses and tractors, a tow path was constructed along one side of the chute. This tow path was generally just a wide dirt trail. In areas where the ground was very broken or swampy, the tow path was paved with logs laid down horizontal to the direction of the chute. This log covering formed a "corduroy road" (Figure 10). Tow paths were also constructed with logs parallel to the direction of chute and with earth fill.

On chutes with a steep gradient where logs were propelled by the force of gravity, various mechanisms were installed to slow the descent of the logs. These mechanisms included goosenecks, chain riprap, railroad spikes, and bear traps. Some chutes might employ one of these devices while others would use a combination of them to slow the speed of the logs (Figure 32).

A gooseneck (also goose-neck and goose neck) was a hand-forged, 1-1/2-inch to 2-inch square, recurved iron bar with a chisel point. As Bryant (1913: 240) explained, goosenecks are

> ...placed in holes bored through the slide timbers and as the logs pass over them, the prongs bite into the wood and retard the progress. Logs will leave the slide unless the goose-necks are placed opposite each other. The holes in which the goose-necks are fitted are bored entirely through the slide timbers so that dirt cannot accummulate in them. When not in use the goose-necks may be removed or dropped into notches cut into the slide timbers for that purpose.

Figure 29 shows the shape and placement of a common form of gooseneck. Figure 39a shows a gooseneck from north Idaho and Figure 12 shows two goosenecks in place in a log chute. Railroad spikes were occasionally used in the same manner as goosenecks. They were set into the chute in groups of 2 or 4 and took less of a bite out of passing logs (Anderson 1930:202).

Chain riprap or "roughlocks" consist of chain secured to the sides of the log chute channel. As one old-time chute builder remembers

> The logs run over that chain, tear the bark off, and then the bark would get in and kind of like sand in the chute, and it would impede the progress of the logs (Barton 1980:232).

Little mention is made of chain riprap in either the literature or the oral history. However, this may be more a result of a consistent oversight on the part of interviewers and authors than the lack of use of chain riprap.

"Bear traps" were constructed in a fashion similar to dead falls used to kill bears. Figure 30a illustrates a bear trap on a slide in Europe. Bryant (1913: 240) describes a bear trap as consisting

> ...of a log, one end of which is pivoted to a framework erected above the slide. The free end is armed with spikes that drag on the logs as they pass under them.

To withstand the impact of large, fast-moving logs, a bear trap would have to be very substantially constructed. The extent of the use of bear traps was not recorded, but in 1930 I. V. Anderson (1930:202) advocated a greater utilization of this device.

At the terminus or apron of the chute there were several methods of unloading the logs. Where the logs were running by the force of gravity, it was common to end the chute at a pond. The logs simply leave the end of the chute and enter the water. The water in the pond would stop the logs where they could then be stored until they were moved to a mill by some other means of transport (Figures 25, 26, and 27).

Chutes could also be unloaded from the side by several methods. Bryant (1913: 233) states that:

> A common method of dumping logs from a slide is to build one side several inches lower than the other. Another method used where there are several dumping grounds is to hew down the side of the slide on the dump side and place a switch called a "whip-poor-will" diagonally across the slide timbers. The lower part of the slide ends at a landing, where the grade should be level or slightly ascending to check the speed of the logs. When the log strikes the switch it is shunted off. When it is desired to send logs past a given dump, the upper end of the switch is removed and placed across the depression on the slide timber and fastened by two heavy tree nails.

This type of switch is illustrated in Figures 24 and 30a.

Logs shunted from the side of a chute, by whatever method, usually dropped onto a rollaway. Like a skidway, a rollaway generally consisted of a platform of parallel logs perpendicular to the chute sticks. This platform was used as a storage area for logs (Figure 24) and a means of transfering logs from chutes to other forms of transportation such as flumes. The platform was often tilted down from the side of the chute so that logs would roll away from the chute once they were unloaded.