

United States
Department of
Agriculture

Forest Service

Technology &
Development
Program

2400—Timber
April 1997
9624 1210—SDTDC



Strapping Log Truck Loads for Improved Accountability —A Concept



This publication describes advanced methods for marking smallwood, improving accountability with less reliance on an individual log marks, and the development of strapping products to more safely and economically fasten a truck load of logs.

Work continues at the San Dimas Technology and Development Center (SDTDC) to test new technology that can be used in forest product identification. Projects to test new technology are initiated by the Timber Sales Technology Committee. This committee meets annually to discuss field needs ranging from initial sale layout to the transportation of products. Work is prioritized and future projects are developed to address needs that appear to be multi-regional in scope.

Field personnel are encouraged to contact their regional representative on the committee if they see a need for the distribution of information, the application of new technology, or have ideas for new product development.

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Strapping Log Truck Loads for Improved Accountability

–A Concept



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BACKGROUND



Figure 1. Branded log end.

For decades, Forest Service (FS) timber sales have required the purchaser to identify logs harvested from a specific sale with a hammer brand on the log end (figure 1) and a spot of paint. With rising concerns over timber theft, and potential export of domestic sawlogs from public lands, emphasis has been increased on accounting for timber harvested from public land. The current desire is to have close to 100 percent of the timber from public land identified by some means, where in the past 80 percent was a more typical practice.

In some areas, where trees may be less than 8-inches dbh, the labor involved in marking the logs becomes quite extensive, if not cost prohibitive. Waivers have been issued to purchasers of smallwood sales which exempted them from the branding and painting requirement. It appears that the practice of issuing waivers will decrease in the future.

In order for smallwood to be harvested economically, while ensuring 100 percent accountability, another means of identifying logs is necessary. One method SDTDC is exploring is the use of "straps" that will be placed around a load of logs at or near the landing with a tamper-proof tensioning mechanism. Once the load has been strapped, it would remain intact until it is processed. A seal would be placed on the tensioning mechanism to ensure that it has not been tampered with and identify the sale the load came from.

Storing and handling smallwood is also a challenge. Arranging logs neatly in decks to minimize the area needed for storage is difficult and time consuming. Gripping and releasing logs with the stacker often results in breakage.

INTRODUCTION

Ideas for Change

Several years ago, SDTDC began to look at safer, more efficient methods for log marking. As a result, investigating the use of sealed straps for this purpose is the subject of this report.



Figure 2. Logs with paper tags.

Paper tags have been tried on several sales, but workers are still exposed to the same hazards when stapling the paper tags on log ends (figure 2). Also, tall decks cannot be marked without excessive effort. It is labor intensive to mark smallwood. Improved accountability will only be attained with less reliance on an individual log mark.

Many sale administrators require that 90 percent of the log ends be legibly marked. However, less than 70 percent of small logs can be tagged without sacrificing time and dedicating log handling equipment to the job.

One idea would be to replace the log marking entirely where it cannot be accomplished satisfactorily and safely. Forest products representatives support this idea and suggest securely bundling an entire truck load as an alternative. They see added benefits down the processing line, such as more efficient decks and fewer broken logs.

THE STRAPPING SYSTEM

In the summer of 1995, project personnel traveled to the Louisiana-Pacific Corporation's (LP) sawmill in Deerlodge, Montana with technical representatives from Strapex, Inc. A log load was strapped with light polypropylene strapping, unloaded, handled and drop-tested (figure 3). Although the strapping lacked sufficient strength, results were promising and further work was planned. A trip report is included in Appendix A.



Figure 3. Load in Deerlodge, Montana with light strapping.

SDTDC began searching the market for strapping products, and started testing them in the lab. A preliminary field test of this concept was performed on log loads arriving at the Sierra Forest Products sawmill in Terra Bella, California.

The logs were somewhat larger than what was originally targeted for this method. However, if the concept does not work on larger logs, it will not work on smallwood. By using commercially available cargo straps with a ratcheting take up mechanism, project personnel were able to successfully bind two loads on the SDTDC log truck and monitor tension in the straps.

After driving many hours on surfaces ranging from freeway to rough dirt, the straps held the load together and retained ample tension to discourage any attempts to remove logs from the load. The results were encouraging.

Tests indicate that an initial tension near 5,000 pounds (22.3 kN) is desired. By October of that year, a prototype strapping system—including seals—was developed. A trip report is included in Appendix B.

Nylon webbing was selected for the strapping system. The nylon webbing would relax in a short period of time causing the tension to drop. In one test, an initial tension of 3,200 pounds (14.2 kN) dropped to 2,610 pounds (11.6 kN) in 30 minutes. A day later, it had dropped to 2,025 pounds (9.0 kN). Log settlement had occurred throughout the transport periods, but tensile forces in the strapping remained as desired, above 1,000 pounds (4.45 kN). (See Figure 4).

As a comparison, steel wrappers in common use today are initially around 4,000 pounds (17.4 kN) after being tensioned with a cheater. During transport, however, log settlement reduced this tension to nearly zero requiring occasional retightening while enroute.



Figure 4. Strapping system used in Colorado.

A 2-inch wide (51 mm) by 50 foot (15 m) long woven nylon strap, with a breaking strength in excess of 10,000 pounds (44.5 kN) tension, was chosen. One desirable feature of the nylon strap is the high stretch rate compared with steel cable. The curves in figure 5 show the difference in stretch between a strap and a typical steel wrapper. This feature makes it possible to maintain tension as the load settles during transport.

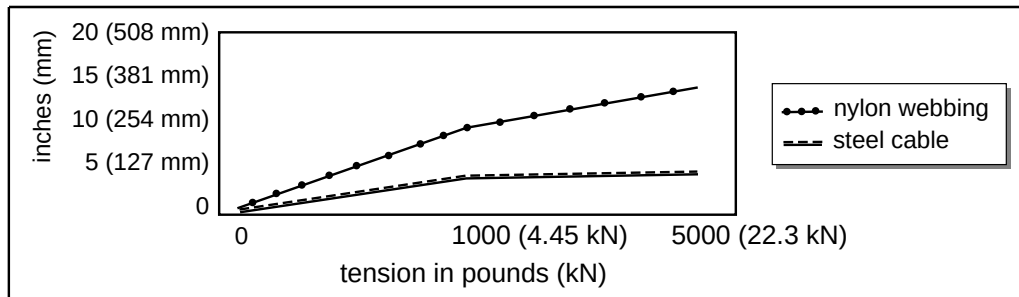


Figure 5. Two curves showing the differences in stretch of a 50-foot (15 m) steel cable and the nylon webbing selected.

The nylon webbing was sewn onto a small winch. This winch is easy to operate and safe to release; however, the winch handle was too short to bring the webbing to 5,000 pounds (22.3 kN) initial tension desired. A 3-foot (1 m) custom “cheater bar” was added to the system to create a lever arm long enough to develop this initial tension. After tightening, the winch handle was closed and a seal installed to prevent further adjustment (figure 6).

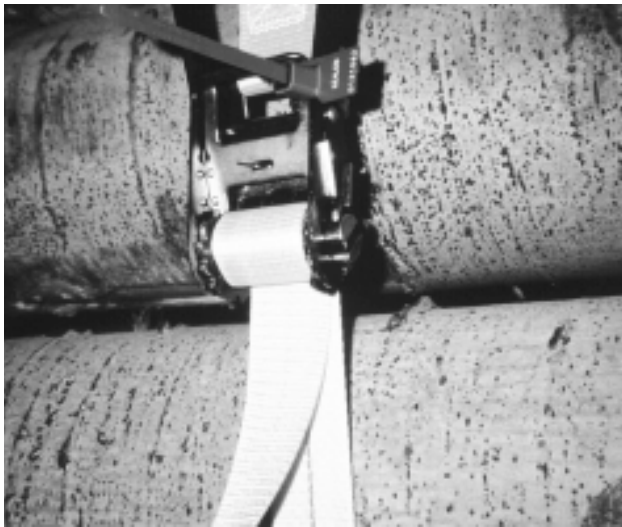


Figure 6. Winch handle closed and seal in place.

The system was load-tested and certified by the supplier to exceed 10,000 pounds (44.5 kN) tensile strength. The webbing and winch cost about \$35.00. The cost of sewing the nylon webbing to the winch was \$2.00, and the seals were fifty-cents each.

PROCEDURE

In October 1995, a field trial was planned at LP's Oriented Strand Board (OSB) plant in Olathe, Colorado. LP agreed to work with SDTDC on a test of log straps (figure 7).

From LP's standpoint, log straps could offer other benefits by keeping the logs in a uniform bundle. With the straps, more wood could be stacked per acre and yard efficiency improved. The straps should also help minimize breakage that commonly occurs when retrieving loosely stacked logs from a deck. Another hope is to obtain State Department of Transportation (DOT) approval for the straps as a replacement for the conventional cable wrappers that are required on every load. This would improve loading and offloading cycle times.



Figure 7. Debarking area at LP's OSB plant.

The Colorado site provided an opportunity to strap large loads. The western-style log trucks (figure 8) hauling to this site were permitted to carry a gross vehicle weight (GVW) of 85,000 pounds (39,000 kg). This is 5,000 pounds (22.3 kN) above the norm, but legal GVW in Colorado. The loads could also be 14-feet high (4.3 m). This large volume, combined with the non-symmetrical shape of the aspen, provided an excellent test situation.



Figure 8. Western-style log truck delivering aspen to the LP plant.

The first experiment was on a load of aspen that had just arrived at the yard. Two straps were placed around the load and tensioned using the cheater bar. This loaded the straps to around 5,000 pounds (22.3 kN) of tension when applying 150 pounds (670 N) to the handle. The load was then moved to another area in the yard and offloaded. When placed on the ground, it assumed a uniform bundle shape and did not become loose. Four more loads were strapped and stacked successfully.

Project personnel wanted to try this approach from the landing to the mill. A timber sale in eastern Utah provided a good opportunity to experiment. They used small aspen that required about 100 logs to make a 30-ton (27,000 kg) load. Once the logs were loaded, and the straps placed and tensioned, it was apparent that the elasticity of the webbing allowed the load to settle without becoming slack.

After 20 miles (32 km) of unpaved, rough, steep winding roads, the straps still retained a fair

amount of tension where the cable wrapper—required by law—had become slack and required retensioning twice. This load was brought to the mill about 150 miles (242 km) away. Upon arrival at the mill, it was stacked with the other strapped loads.

The following morning, project personnel went to another sale somewhat closer to the mill. Due to road conditions, the loggers were only able to access this landing during the darkest hours when the frost would stabilize the soil.

In order to get as many loads as possible strapped, two people worked in unison as the trucks came out five at a time. The two-mile spur leading to the landing was too rough for an automobile to negotiate, so they waited where the spur intersected the main road and applied the straps there.

Two nylon straps were tensioned and permanently sealed around the loads of logs. Steel wrappers were also tensioned around the loads in the conventional manner to ensure compliance with DOT regulations. The initial tension in both straps was recorded (figure 9).



Figure 9. Close-up of strap and wrapper as tensioned prior to transport.



Figure 10. Custom torque wrench used to measure tension.

After the load was transported about 100 miles (167 km) to the plant, the tension was measured again and the steel wrappers were removed (figure 10).



Figure 11. Close-up of strap and wrapper after transport—note how slack the steel wrappers are at the end of the trip.

The logs were off-loaded and stacked in the log yard with the straps in tact. The tensions were measured again (figure 11).

Seventeen loads were strapped. They all returned to the mill without becoming loose. The log deck, comprised of strapped bundles, was orderly and secure providing a somewhat higher wood density in the yard (figure 12). These loads remained



Figure 12. Long view of deck comparing neatness of strapped loads with conventional decking.

strapped until the wood was ready for processing. Breakage of the logs, as well as strap durability, was monitored.

Several loads were drop tested from a distance of 8-feet (2.5 m), and observed after the drop for damage. The loads remained decked throughout the winter. In May 1996, they were picked up by the loader and transported for processing.

A technique was developed for removing the logs from the deck, unstrapping, and firmly gripping them for transport to the debarker. Technical representatives photographed the operation. Once a strapped load was removed from the deck, the stacker's upper arms were opened. The load was then rolled along the ground by maneuvering the stacker forward and tilting the forks until the seals and winch handles were in a safe, accessible position for ground personnel to reach them (figure 13).



Figure 13. Winch handle in position to be released.

The arms were closed again. A technician approached and cut the seal.....positioned the winch handle for releasing the tension (figure 14)...



Figure 14. Seal being cut with a pocket knife.

...and stepped back to safety. The tension was released with a strike of a shovel (figure 15)...



Figure 15. Preparing to release tension by striking winch handle with the shovel blade.

...the loose straps were easily pulled free while walking away (figure 16).



Figure 16. Pulling straps while walking away.

Only once was a strap “stuck”, but it was easily released by signaling the stacker operator who lifted the forks slightly and released the hang up.

OBSERVATIONS

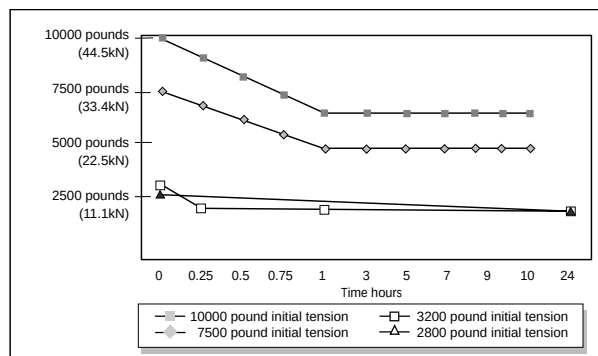


Figure 17. Drop in tension over time.

Table 1. Strap and binder tensions—pounds (kN).

BEGIN HAUL (in woods)	AFTER HAUL (on truck)	IN DECK (in yard)
1. 5,000 (22.5)	800 (3.6)	5,000 (22.5)
2. 5,500 (24.5)	1,000 (4.5)	4,500 (20.0)
3. 5,000 (22.5)	1,100 (4.9)	not measured
4. 6,000 (26.7)	900 (4.0)	not measured
5. 5,000 (22.5)	1,000 (4.5)	not measured

It is logical that strap tension would increase as measured in the deck, compared to after hauling while it is still constrained by the bunks on the truck. Tensions increasing to, or near, the original tension does not seem logical. With only two data points, and potential bias in the measurements—depending on where they were taken along the length of the straps—the “in deck” tensions may be questionable.

Removing a Log or Two From the Load

One question always asked by foresters when discussing the strapping idea is whether a log can be removed from the load? The answer is yes, in some circumstances, but it is not easy.

Logs must be positioned along the edge of both bunk sides higher than those in the middle (as arranged in figures 18 & 19), then a log or two can be pulled out. If too many logs are pulled out, the strap tension will be lost during transport making tampering obvious. The smaller the diameter of the logs, the less possible this becomes. As a result, proposed field use will initially be on loads greater than 80 logs per load.

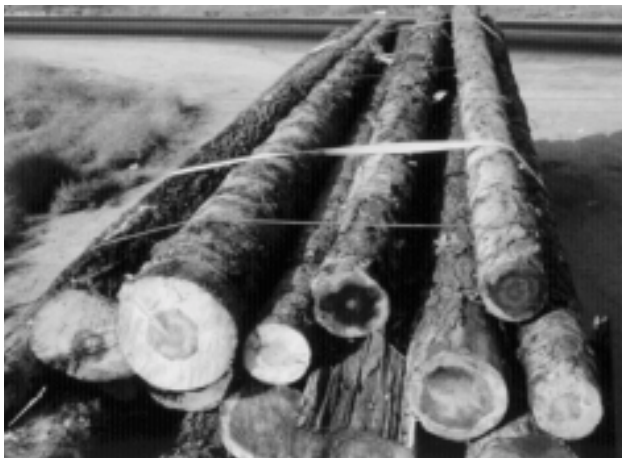
Log Breakage

The removal of strapped loads from the truck required no change in operations. The stacker operator was just learning to handle strapped loads during the time that SDTDC personnel observed the operation; however, no logs were broken. Prior to transport to the deck, several loads were



(a)

Figure 18 (a & b). Examples of logs which could be removed .



(b)

drop-tested. No logs were broken during the drops, but several broke as the stacker picked the bundles back up (figure 20).



Figure 19. Logs being pulled from deck after winter storage.

One or more logs were broken in each of the first eight bundles removed from the deck for processing. This breakage could be reduced with a more experienced operator placing stringers under the bundles, and using a larger machine with longer forks. Comparisons with reloading similar logs from unstrapped stacks were not done and cannot be speculated. If further trials are justified, logs should be monitored more closely for breakage.

Yard Equipment

Two different stackers were used in this trial—a Letro-Stacker and LeTourneaux stacker. Both machines were too small for this test. Neither machine had forks and arms long enough to completely surround an entire log bundle. To remove a strapped load from the deck, the stacker operator would extend the forks under the load as far as practical, close the upper arms, and pull the load from the deck.

In the fall, the Letro-Stacker was working in the log yard. In the spring, the LeTourneaux log stacker pulled the bundle from the deck, picked it up, and transported the logs to the debarking area. After removing eight loads from the deck, the electric lift motor on the LeTourneaux stacker failed.



Figure 20. Stacker at the deck pulling out a bundle.

Drop Test

Three loads were dropped 8-feet (2.4 m) from the stacker and picked back up. In the second drop, the seal was scraped loose, broken, and the winch handle opened while being dragged along the ground. This resulted in one strap becoming loose and ineffective.

No logs were broken. No straps, or system components, other than the seal just mentioned, were broken. This indicated that the tension did not exceed 10,000 pounds (44.5 kN).

Strength of the Strap

Test personnel noticed on several occasions that the straps were pulling bundled logs out from under other bundles and carrying logs that were not on the forks. However, the straps did not break (figure 21).



Figure 21. Arms and forks cannot encompass the load after storage. The straps must keep load intact.

As in the drop tests, one seal failed while being dragged along the ground. This allowed the winch handle to open and release the tension on one strap.

Weatherability

The straps and seals survived the winter in excellent condition.

DISCUSSION

Limited study by SDTDC reveals that it takes only 3.5 seconds per log end to brand and paint a deck of large logs on flat ground. That timeframe seems reasonable. As the diameter of logs in the deck decreases, and the slope of the ground increases, it will take longer and not be practical to mark all ends.

In the tests, 30 out of 100 log ends on the evenly arranged end of a 7-foot (2.1 m) high deck could not be reached by hammer or stapler without redecking. Half of these could not be reached with a bare hand. On higher decks, over half could not be reached.

This experiment indicates that the strapping concept has potential. Some refinement in the areas of tensioning devices, webbing material, tamper-proofing and identifying seals is needed. Most of the truckers were optimistic about this concept as was the mill superintendent. Log strapping appears to be the most promising method to provide a high percentage of log accountability.

The straps selected for this trial have been approved by DOT for use in tying down highway loads. However, investigations have not been made to determine the appropriateness of replacing steel wrappers with this system. Should that prove acceptable, then virtually no time and motion would be lost marking the logs. The straps could be put into place and sealed as rapidly as the wrappers are installed.

With DOT approval, the straps could facilitate loading and unloading without taking extra time. Drivers would only need to tension them once, and would not have to get out of their trucks to

unload. The straps are also safer than having a deckhand brand and paint each individual log and more economical. The ratchets are reusable and the webbing is recyclable.

The strap system could be supplied with these additional features:

1. A number which correlates with load receipt numbers, sale numbers, etc.
2. A time and dating procedure similar to a big game license.
3. A marking accessory to insure that strap tension remains above a predetermined minimum.
4. A tracer line to mark logs touching the straps—similar to a chalk line.

Although the components selected for this trial performed satisfactorily, further product development should be pursued prior to broadscale use. Also, SDTDC engineers contacted and discussed FS needs with River Cable, Limited—a Canadian company—that has marketed log bundling systems for 17 years.

Since the entire bundle was removed from the deck, the stacker carried a larger load; however this may overtax smaller stackers. To adequately handle these load-sized bundles, a larger stacker than the ones available for this test would be ad-

vantageous. Strapping loads will permit the density of wood in a deck to be increased, thereby improving the efficiency of the log yard.

One reason for branding is to mark the log with a sale specific mark. The load receipt can serve this function until the straps are removed. Should it become necessary to remove the straps, it would then be easier and safer to mark the logs in a yard with cleared, flat ground, and where power could be made available. Removing logs from the bundle is not a major issue. It would be slow, cumbersome, require a loader, and create obvious slack in the straps should several logs be removed.

There are some administrative features that have not been addressed. Among these are methods of controlling strap and seal distribution, numbering schemes, handling/recycling the strap and winch upon removal, and regulations regarding the timing of strap removal.

RECOMMENDATIONS

It is recommended that serious thought be given to developing this idea. Marking each end of small logs is laborious, and frequently waived from timber sale requirements. Further study should be given to solving the problems mills might have with smaller log handling equipment, determining how to deal with mixed species loads, and delineating situations where the overall cost of strapping would be acceptable.

APPENDIX A

Results of Trip to Deerlodge, Montana to Test Strapping

By Lamoure Besse, P.E.
August 1994

Attendance:

Bob Brown, Louisiana-Pacific Yard Foreman
Tony Coulter, Louisiana-Pacific Yard Superintendent
Dan Castillo, Forest Service, Regional Office, Northern Region
Tom Garrett, Strapex, Inc. Representative
LaMoure Besse, SDTDC Project Engineer
Joe Fleming, SDTDC Engineering Technician

On Monday evening, August 15, 1994, we arrived in Deerlodge, MT after driving from Spokane, WA. Tom Garrett had taken a similar drive. We learned that evening that Tom had lost his baggage—as we had. However, his was a little more sensitive because it involved his tensioning device, sealing device, and \$5,000 worth of customized strapping he had specially run for this event.

We coordinated with the airlines and chased bags the next morning until 1:00 p.m. At that time, we gave up on the strapping being found. The tools showed up, but the strapping—which was attached in a separate container—had torn loose and was not present. Since the tools and strapping were only marked with one baggage claim, which arrived with the tools, there was no further way to pursue the location of the custom strapping. Mr. Garrett had brought along some relatively light 700 pound tensile strength strapping which we decided to try on a very limited basis, simply to learn what we might be looking at in tensile loads.

I had explained that the purpose of our visit was to work with this strapping to learn the potential for requiring its use to improve our ability to account for logs. We were interested in seeing if this might be viable when a load is strapped in the woods with a permanent seal and left that way until processed.

As I saw it, the logs would need to be branded and painted if the strap were cut in the log yard and the logs were not processed in some short period of time, say four hours. Tony expressed concern that this would not work because most loads are mixed species or size and need to be sorted, which occurs at the debarking chain.

Dan later explained that it would probably only be necessary to require that any log leaving the mill be branded and painted because the Forest Service (FS) has an arrangement with mills accepting National Forest (NF) logs that they cannot leave and go to the export yards. (For correct details, ask Dan).

Other than this, I could not detect other reasons why the concept would not work. Tony was concerned about plastic getting into the by-products, but Tom alleviated those concerns when he said he would buy back the straps.

We detoured a loaded log truck which arrived at the mill and wrapped the 50,000 pound load of logs with seven wraps of this light strapping at each end. We then sealed each of the straps without tension and had the truck proceed to the log yard for unloading.

The entire load was picked up by a log handling machine in a manner similar to the way every load would be unloaded. The load was moved with this loader to a designated area and set on the ground as the loader backed from under the load. The light strapping held the load in tact. Then the loader moved in again, drove the forks under the log load and picked it up. Finally, as the operator rotated his forks and began to slide the logs off the front of the forks, a strap snapped causing the load to slide off in a random fashion.

Everyone was impressed with the light strapping's performance. Some of the thoughts and performance criteria that were discussed are as follows:

1. The area required to store logs might be reduced by as much as 25 percent by strapping the log loads because the decks could be much higher.

2. The amount of damage to logs should be reduced, because logs are quite often broken when handled by the big loader used in this trial.
3. When tests are run, the mill will be interested in strapping an entire sale, then strapping half the loads and not strapping the other half. This will allow them to evaluate log breakage, the merits and demerits of decking the logs strapped, etc.

Metal bands and inexpensive cable have been, and are used, in this type of application at the present time. However, a major drawback appears to be safety. Problems with bands snapping back, logs rolling into millwrights, breaking and removing the straps, etc. seem to be some of the problems. Using this strapping will require that the load be placed in specially built bunks near the debarking chain.

4. The strapping is recyclable. The company will sell strapping at one price and buy it back at another. We can use recycled strapping in our application. The only drawback to recycled strapping is that it does not feed straight in automated strapping machinery. This makes it a lot easier for the mill than I envisioned. I thought they would have to dispose of it in their burners or what ever.
5. There is a good chance that the cable binders used exclusively today over loaded log trucks could be replace with this strapping. This means that there would not be any lost time and motion to improve our accountability. This is long range and would require investigation into DOT and highway patrol requirements and standards.
6. The tensile strength of the strapping is a function of its width and it is extruded in wide sheets. Therefore, it is feasible to extract it in widths of say 2 1/2 inches should we determine that 8,000 pounds is the desired tensile strength. At the present time, the widest tensioner the company manufacturers is for 1 1/4 inch strapping. Therefore, there may be a need to do development work should the strapping concept be pursued beyond some limited testing.

7. When one looks at strapping as used in packaging, the quantity of strapping that can be projected for this application is quite limited. Therefore, even if one were to do market investigations to learn the potential for people accepting and wanting to use a product of this type, and widespread acceptance were found, the company would have little incentive to expend a great deal of development time or effort.

The consensus of the group was that we should investigate the concept further. In that vein, I would propose the following outline for a test:

1. Work with Strapex, Inc. representatives to develop a 4,000 or 8,000 pound strap that can be wrapped once or twice over the log load and tensioned to 50 percent of its ultimate tensile strength in the woods and sealed. The strap must be installed by one man (a truck driver) with hand tools. Power must be in the form of 12 volt dc limited to under 100 amp, or pneumatic limited to 100 psig and 16 cfm or less.
2. Manufacture and assemble 20 straps that are 50 or 100 feet long.
3. Test them on log trucks.
 - a. As close as practical to PDX.
 - b. Obtain video and still picture of the event.
 - c. Strap in the woods. Drive the load out.
 - d. Inspect straps several times.
 - e. Rig up a device to continuously measure tension over time.

At log yard:

- a. Unload the logs from the first load, perform load and unload tests, and drop tests until straps fail.
 - b. Unload remaining loads into decks at least 3 high.
 - c. After deck is complete, move deck to a new location.
 - d. Take notes of all happenings.
4. Modify prototypes as appropriate and assemble sufficient straps for use on one very large FS timber sale with very small trees. Plan to strap half the loads.

5. Assuming everything is satisfactory, and no earth startling events occur, prepare recommendations for FS managers to use in determining whether or not this should be implemented.

On Thursday, June 16th, Dan Castillo and I discussed experimenting with strapping as a means to account for smaller logs. We discussed the following details:

1. Probably the preferred site would be the Deerlodge NF. There is a lot of lodgepole and they have a loader which can unload a truck in one turn.
2. The first day, we would rent a loaded log truck for the day to see how the strapping will work and to experiment with dropping the loads on the ground from the loader.
 - a. We need to rent truck for day and loader for an hour or so.
 - b. We need to have factory representative in attendance with selected tools and strapping.
3. Assuming this looks promising, we would need to enter into an agreement with a major trucker to monitor the strapping and report any problems. They could also interview the participants and record opinions.
 - a. We would need someone at the local level, or one of our technicians, to ride with the trucker to monitor the strapping and report any problems. They could also interview the participants and record opinions.
 - b. We would probably do a show and tell near the end of the trial period for Salmon NF personnel, and Kelly Logging in particular, and any others service-wide that may have an interest.
 - c. We need video coverage, still photos, etc., for reports and meetings— need to monitor time to install straps.
 - d. We need to investigate feasibility of replacing binders with these straps to reduce labor costs.

APPENDIX B

Porterville Trip Report

By Lamoure Besse, P.E.

During the week of November 13, 1995, we visited a sawmill to perform some preliminary experiments with log strapping. After rectifying some problems with our test vehicle, we arrived at Sierra Forest Products yard in Terra Bella and loaded a 29-log load, giving us a gross vehicle weight of 77,750 pounds.

One conventional "wrapper" was secured midway around the load, then two nylon straps with double ratchet winch drums were placed around the load, with the front strap located approximately 2-feet behind the tractor bunk, and the rear strap approximately 3-feet ahead of the trailer bunk. The rear strap was tensioned to 2,600 pounds with two wraps on the drum. The front strap was tensioned to 3,000 pounds while still on the first wrap. In order to be street-legal, a cable wrapper was secured around each end of the load as well.

We then drove eight miles to town on a paved 55 mph road and parked. By then, the rear strap had only 800 pounds of tension on it and the front had 1,000 pounds. We checked the straps again the following morning and there was no noticeable difference. After driving around for a few hours on paved winding roads, we returned to the mill and checked the straps again. There was no real change in the strap tension from where it had been when we parked the night before.

After removing the cable wrappers, a loader removed the entire load with the straps still in place. It then dropped the load from about 4-feet, picked it back up, and dropped it again. At this point, there was more tension in the straps that we could relieve with the extension handle we were using to measure the tension. That would mean that it was in excess of 3,000 pounds, but probably no more than 5,000 pounds. One strap had visible damage and was photographed.

We took on a second load of 27 logs, yielding a GVW of 74,000 pounds. Three cable wrappers were set, one at each end and one in the middle. They were tensioned in the customary manner and then the straps were placed at each end of

the load. This time the front strap was about 5-feet ahead of the trailer bunk. The straps were both tensioned to 2,600 pounds and both on the second wrap around the drum.

The truck was then driven for a short distance, about five minutes, and tension was checked. The tension in the front strap had dropped to 1,700 pounds and the rear strap to 1,250 pounds. We then drove around for several more hours on the rear strap to 1,250 pounds. We then drove around for several hours on the highway and on an oil field service (dirt) road.

The end result was that both straps had only about 800 pounds of tension. This was considered to be at the low end of acceptable performance. We parked for the evening and put one of the straps used on a previous test (pre-tensioned) around the middle of the load. This was tensioned to 3,000 pounds and by morning it carried 2,250 pounds. Throughout this period, the cable wrappers were never retensioned, and upon returning to the mill they were completely slack with the binders dangling freely beneath the load.

This experiment demonstrated potential for using straps as a means of log accountability, load security, and improved yard handling and decking. Though there are still some areas that will require some development, i.e.: more tension in the straps initially; possible pre-stretching the webbing before use; a means of releasing straps safely prior to processing; and tamper-proofing the ratchet. We did learn that the webbing will likely have sufficient strength and elasticity to perform favorably on loads of numerous logs, perhaps 50 to 100 logs per load which is the intended application.

We also learned that the two ratchet systems we thought might be necessary to achieve ample tension in the webbing, are probably not necessary. Instead, it appears that a longer lever, or "cheater", should suffice particularly if the webbing is pre-stretched. Plans are to experiment with this system using small timber from an actual sale in areas where small diameter logs are commonly harvested. Refinements shall be made as problem areas are identified.

PROJECT PROPOSAL
USDA Forest Service
Technology and Development Program

SDTDC solicits input from the field for suggestions for future projects. Your suggestions are important to us, so please take a few moments to complete this form and return to the address provided.

Project Originator: _____ Name _____ Date _____

Title _____

Unit _____

Mailing Address _____

DG address _____ Telephone _____

Project Title: _____

Current Problem/Need

Describe how work is currently being done; current problem/need, location; why improvement is needed.

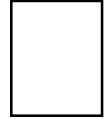
Proposed Solution

Describe your concept of the end product, i.e., new equipment design, video production, handbook, etc.

Potential Benefits

Describe how this product will improve safety, resource management; increase efficiency; customer satisfaction, productivity; reduce cost, time.

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USDA, Forest Service
SDTDC
Attn: Timber Program Leader
444 E. Bonita Avenue
San Dimas, CA 91773-3198

User Feedback Survey

User Name (optional) _____

Title _____

Unit _____

Strapping Log Truck Loads for Improved Accountability – A Concept 9624 1210

Benefits	YES	NO	Amount
Improves safety	_____	_____	_____
Saves money	_____	_____	_____
Saves time	_____	_____	_____
Increases efficiency	_____	_____	_____
Other	_____	_____	_____

How effective or relevant is this information?

What would you change?

General comments:



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