ENGINEERING TECHNICAL INFORMATION SYSTEM

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CHANGE TO SEPTEMBER FIELD NOTES

Volume 8, Number 9

FLOW CAPACITIES OF 12- AND 24-INCH RECTANGULAR OVERSIDE DRAINS

Flow capacity line graphs on pages 8 and 9 were transposed in makeup.

Correct page 8 figure title to read:

Figure 3. Flow capacity at various depths for 24-inch rectangular overside drain.

Correct page 9 figure title to read:

Figure 2. Flow capacity at various depths for 12-inch rectangular overside drain.

OBSERVATIONS ON LOW-COST ROADS IN NEW ZEALAND

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EDITOR'S NOTE

Professor Lund has worked for the Forest Service in Region 6 during the summers and on a "When Actually Employed (WAE)" basis. His assignments have mainly concerned various aspects of the Forest Service Transportation System.

In the Spring of 1976, Professor Lund visited New Zealand and studied low-volume roads and geothermal developments in that country. The Washington Office requested Professor Lund to document his observations on low-volume roads in New Zealand and to prepare a comprehensive report on his findings. The following article is an abbreviated version of the full report. It is interesting to note that although there are some differences in approaches and nomenclature, low-volume road technology in New Zealand generally parallels developments in this country.

The majority of roads in New Zealand consist of a crushed rock base course surfaced with a wearing surface of a single or multiple chip seal. The chips are generally of a coarser nature than used in the U.S., thus they give a somewhat noisy ride. More recently the higher volume roads have been surfaced with asphaltic concrete. In all cases, these pavements appeared to give excellent service at a minimum of cost and construction time. This is especially true of the chip seal surfaces.

The use and performance of chip seal pavements was perhaps the most impressive road construction type seen in New Zealand. This type of construction probably has the best application for Forest Service low volume roads.

In general, for high volume roads the tendency is to use the largest size chips possible as they are more tolerant to construction variables. Thus a maximum size of 3/4 to 7/8 inch (19 to 22 mm) may be used, giving a rough texture and a noisy ride--but excellent performance. For low volume roads a smaller chip size is used (1/2 to 3/8 inch or 13 to 9 mm). In urban areas, a finer chip may be placed to prevent loss by scuffing on turns and for public relations viewpoint. The heavier the traffic, the lower the penetration grade of the asphaltic binder.

Pavement thickness design is based on National Roads Board's Highway Standards NRB S/4, "Pavement Design," dated October 1974. This standard is in turn based on the "Shell 1963 Design Charts for Flexible Pavements." Three different types of pavements are considered:

1. Flexible - generally consisting of a crushed rock base covered by a thin wearing surface such as a chip seal.
2. Semi-rigid - these are pavements having a structural wearing surface of hot mix, asphaltic concrete providing slab strength to the system.
3. Rigid - portland cement concrete pavements.

Thus chip seals are separated from the AC pavements and not grouped under "flexible pavements" as is done in this country. The "flexible pavements" in N.Z. are somewhat similar in design to most of our low volume forest roads that may have dust oil or other minimal surface treatment on a crushed rock base.

Design traffic loads are based on the 8,200 kg axle load (18,000 lb) or Equivalent Design Axle (EDA). All pavements are designed to withstand at least $1x10^3$ EDA per lane. The national average on the State highway system is 0.50 EDA per vehicle and the average loaded log truck is 1.30 EDA. The average percentage of trucks or "heavies" is 10-15 percent on N.Z. roads. Chip seal surfacings are considered to withstand traffic loadings up to $2x10^6$ EDA for the design life. For a life of 10 years, a chip seal will stand about a maximum of 4,000 vehicles per lane per day. On semi-rigid pavements (AC) a skid resistant chip seal will last only 5 years with traffic of 8,000 vehicles per lane per day.

All subgrades are required to have a minimum CBR of 3, however, a value of 15 or greater cannot be considered unless it meets the requirements for subbase material. Both flexible and semi-rigid pavements are required to have between 4 and 6 inches (100 to 150 mm) of primary basecourse (M/4 specifications) overlying a permeable material that has a permeability at least 1 to 2 times that of the base course. This latter layer is designed to limit the degree of saturation in the base course and to enable transient pore pressures to dissipate quickly. Provision is made for the water to drain from the material at the edges. This permeable layer varies from 2 to 7 inches (50 to 175 mm) in thickness, and is controlled by the percentage passing the 3/16 inch (4.75 mm) sieve or with SE $>$ 40.

The primary basecourse (M/4) has specifications similar to that used in the U.S., however, they also attempt to control the shape of the gradation curve within the gradation envelope by a "Grading Shape Control" requirement. A maximum of 4 inch lifts (100 mm) are placed in the field and required to be rolled with a three-wheel steel roller, loaded to at least 6,800 kg per meter of width (4,600 lbs per foot of width). No compaction control is required on the base course; however, the contractor is responsible for the performance of the pavement through the winter following construction. In most cases I saw both steel wheel and rubber tire rollers being used for compaction--evidently the winter "performance" requirement was more than adequate to control compaction.

Subgrade compaction requirements were 100 percent of BS (AASHTO T 99) 18 inches (450 mm) below finished surface and 95 percent below this depth in fills. Originally the base course specification allowed 2-1/2 inch maximum size (64 mm), but this was reduced to 1-1/2 inch (38 mm) maximum 5 years ago. For local rhyolite (breccia and tuff) in the Rotorua area the 2-1/2 inch maximum is still used as much of the material breaks down in processing and laying. Before the replacement of the LAA test, a maximum value of 30 was allowed on the base course, with the rhyolite being extended to 70 maximum.

Most county roads have a paved surface width of from 18 to 24 feet (5.5 to 7.3 m) with a 6 to 8 inch high by 3 foot wide berm (150 to 200 mm by 0.9 m) on each side to prevent erosion (and appears to provide a safety barrier). Sod is usually grown up to the pavement edge. For gravel surfaced roads ("metal" in N.Z.) the cross slope is usually 3/8 inch per foot (3 percent) for the 4 to 6 inch (100 to 150 mm) of crushed rock pavement thickness.

Where chip seals are used, a 3/8 inch (9 mm) maximum size is used for the first course for low volume roads. In the Taupo area a second seal is required after 1 to 3 years and a third seal after an additional 10 to 12 years. The first seal generally requires a spread rate of 1/3 gal/sy (1.4 l/m^2) and a chip coverage of 40 lbs/sy (22 kg/m^2).

As in this country, logging roads are constructed with a minimum of effort and construction control. In most cases, however, the N.Z. logging roads appeared to perform with excellent results. Very few roads are paved with an asphaltic surface, except some of the main haul roads and loading yards. Chip seals are used for these roads and AC for the loading yards. In some cases extreme loads are applied to pavements. The Kaingaroa Logging Company near Murupara (East Central North Island) uses three trailer logging trucks for carrying 90 metric tons of logs (120 tons total) or 5,000 BF per trailer for a total of 15,000 BF per unit. In the loading yard 40 metric gross ton loaders lift 30 tons of logs. The loading yard consists of an 18 inch (450 mm) pavement section with a 2 inch (50 mm) AC wearing surface.

Surface rock replacement is a major concern. At Kinleith, the N.Z. Forest Products Company estimates that 1 to 1-1/2 inch (25 to 38 mm) of surface loss per year on gravel roads is due to maintenance. Kaingaroa Logging Company estimates 3 inches (75 mm) of loss per year for $15x10^6$ ft3 ($4.2x10^5 m^3$) of logs hauled or approximately 1 inch per 60 MMBF. One-third to one-fourth of this loss is due to maintenance (other than traffic).

The cost of this loss is 35¢ per ton-mile (51¢ per ton-km). This is based on $4 per cy ($3 per m^3) for base rock.

Foam asphalt is a technique used successfully on logging roads in New Zealand. It is a process developed in Australia and is a Mobil Oil Corporation patent. Approximately 200,000 sy (170,000 m^2) has been laid in New Zealand. The process consists of using 3 to 5 percent of 180/200 penetration grade asphalt at around 360 F (180 C) and introducing 2 percent water (by weight of asphalt) at the mixing plant. This introduction of cold water produces a 10 to 20 times volume expansion of the asphalt for approximately 3 minutes. The asphalt is very active and will readily coat any fines present. Thus 3 to 5 percent passing the #200 sieve (.074 mm) is needed, as the asphalt will not coat the coarser material. Fortunately the fine grained material is usually the problem material in most mixes, thus the coating tends to improve the characteristics of this fraction. Sometimes an 80/100 penetration grade asphalt is used if the weather is hotter. If more than 5 percent ashpalt is used, then the final product will tend to deform under wheel traffic.

The resulting material is either blade or machine laid, as pulver mixing in the field does not produce good results. A water soaking and compression test is used to evaluate the final product.

VERTICAL CURVES AND THEIR INFLUENCE ON THE PERFORMANCE OF LOG TRUCKS

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INTRODUCTION

The problem of road location is becoming more important in the harvesting of the timber resource. As the easily accessible timber is removed, this problem increases. In the past, very little concern has been shown in determining the minimum length of vertical curve that a log truck could negotiate. With increasing cost of road construction, limiting topography, and more restrictive environmental constraints, reduction of the amount of fill or excavation required to construct long vertical curves may be desired. Since many forest roads are used mainly for hauling timber, there is a real need to determine what the limiting factors are.

The general rule of thumb has been to limit the minimum length of vertical curves to 100 feet, regardless of the geometry and capability of log trucks. This article attempts to consider all aspects, and to show mathematically how the dimensions of a truck determine what minimum length of curve is required.

There are three factors that will be considered important in this analysis:

1. log truck geometry,
2. length of vertical curve, and
3. algebraic difference of intersecting grades.

After a description of geometry and dimensions of a typical log truck, a general procedure is developed which can be used to analyze any situation, given certain dimensions of the truck and trailer. A Hewlett-Packard 9830 Programmable Calculator is used to generate a graph showing the algebraic difference of grades of a log truck and log load for various lengths of curves. Then, these values of algebraic difference of grades are used to determine the minimum length and maximum algebraic difference of grades for both sag and crest vertical curves.

LOG TRUCK GEOMETRY AND DIMENSIONS

Dimensions of log trucks are highly variable, depending on the make of truck and trailer, and on the lengths and diameters of logs being hauled. This necessitates a very general approach to the problem, so that any dimension can be applied.

The following dimensions and terms are required to analyze our problem, as illustrated in figure 1.

A = Distance between the front wheels and the center of the dual rear wheels of the truck.

B = Distance between the center of the dual rear wheels of the truck and the center of the dual rear wheels of the trailer.

C = Distance that the logs extend over the front bunk.

D = Distance between the top of the frame of the truck and the bottom of the logs at the front of the load.

X = Distance between the bottom of the logs and the point where the truck and trailer are connected together.

Y = Distance between the ground and the bottom of the trailer reach.

Two other dimensions that could be critical and are discussed later are:

Z1 = Distance between the front of the logs and the cab of the truck; and

Z2 = Height of the logs.

Several terms need to be defined: The *reach*, shown in figure 1, is a square or rectangular steel tube that connects the rear wheels of the trailer to the truck. It comes in various lengths, and can be adjusted by sliding it back and forth through the rear wheels. Originally, these reaches were made of wood and, therefore, were prone to breakage. With steel reaches, breakage is no longer a serious problem, even though they occasionally are bent.

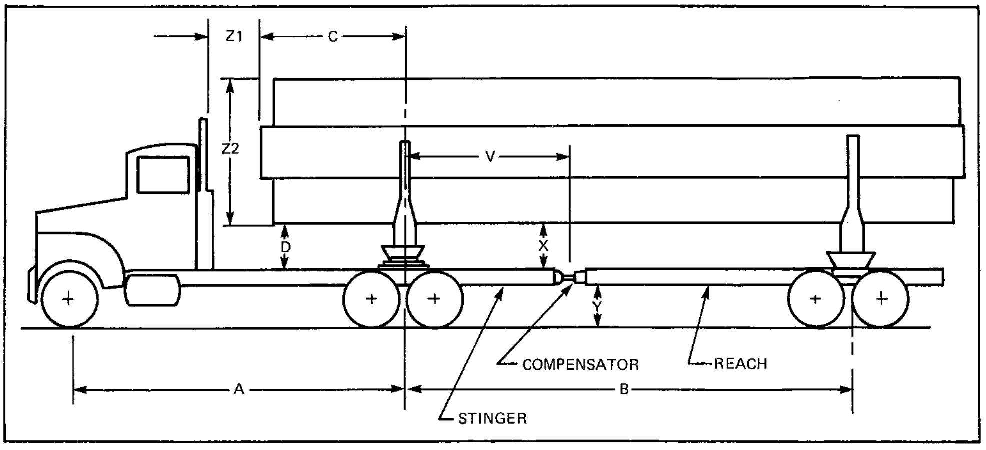

Figure 1. Log truck geometry and dimensions.

The *stinger*, as shown in figure 1, is an extension of the frame of the truck to which the reach is connected. The length of this stinger is an important factor in analyzing crest vertical curves. The distance from the center of the dual rear wheels to the end of the stinger (V in figure 1) is normally 9.5 feet; this distance has been determined to be the best for trailer steering and to enable the trailer to track better around horizontal curves.

The last term that needs to be defined is the *compensator*, also shown in figure 1. The compensator plays a very important role in enabling a log truck to negotiate both horizontal and vertical curves. It is attached to the front of the reach and consists of a steel cylindrical tube that is free to slide inside a housing. It is not restricted by a spring and will slide as necessary. The compensator is designed to allow a truck to turn without causing a stress to develop between the trailer reach and the stinger of the truck. As a log truck is being turned, the distance between the bunks (controlled by the log load) remains fixed, while the reach of the trailer has to lengthen. Thus, the compensator is designed to extend the distance necessary to allow for this lengthening.

Peerless Manufacturing Company[1] indicated that the distance a compensator can slide ranges from 43 feet to over 100 feet, depending on the particular truck configuration and length of logs being hauled. The compensator is not a limiting factor for trucks trying to negotiate vertical curves.

DEVELOPMENT OF THE GRAPH

To determine the restrictions that a vertical curve puts on a log truck, it is necessary to calculate the absolute algebraic difference of grades that a log truck makes as it moves through a vertical curve. The maximum algebraic difference of grades occurs when both the front and rear wheels of the log truck are in the vertical curve. Figure 2 shows the determination of the difference in grades by calculating the mid-ordinate E and the vertical distances Y1 and Y2 at the horizontal distances A and B from the vertical point of intersection of the curve. The distances A and B correspond to the distance between the front and rear wheels of the truck and the distance between the rear wheels of the truck and the trailer wheels, respectively. The assumption is that for grades of 20 percent or less, the horizontal distance of A and B are nearly equal to their slope distance.

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[1]Telephone Conversation; Peerless Manufacturing Company; May 12, 1976.

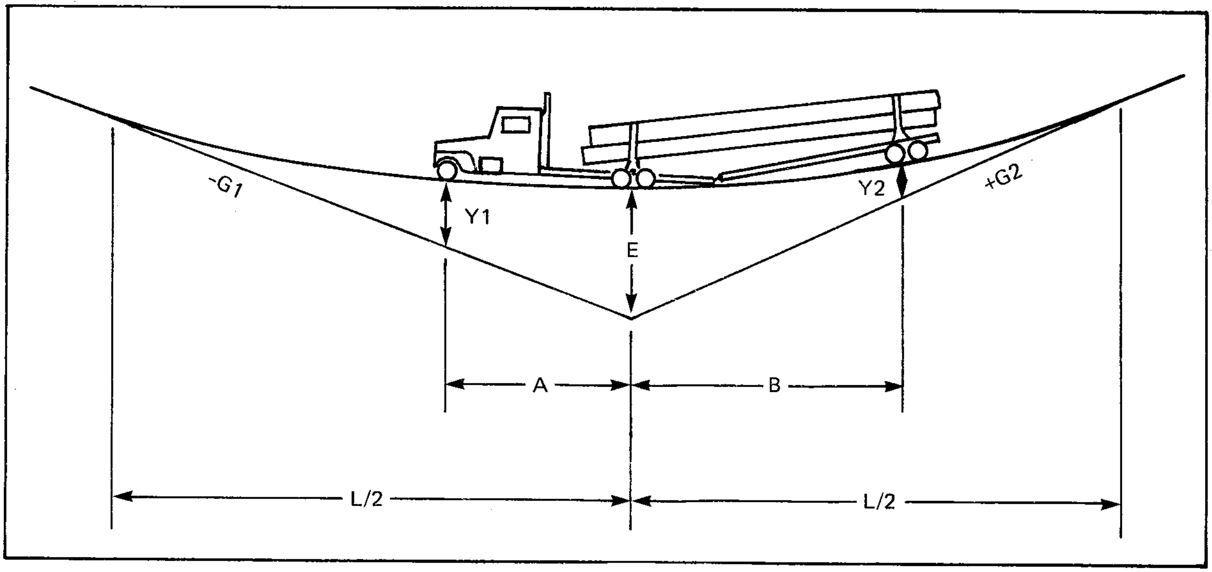

Figure 2. Front and rear wheels in vertical curve.

Given the length of vertical curve and intersecting grades, the values described can be generated using the following equations:

$$E = (G2 - G1) \times L/8$$

$$Y1 = (L/2 - A)^2 \times (G2 - G1)/(2L)$$

$$Y2 = (L/2 - B)^2 \times (G2 - G1)/(2L)$$

Note that A, B, and L must all be in dimensions of stations (1 station = 100 feet). With these values, the grades of the truck and log load are determined by the difference in elevation between the front wheels of the truck and its rear wheels and the difference in elevation between the rear wheels of the trailer and the rear wheels of the truck, divided by the respective lengths A and B.

With this information, the truck and tractor geometry graphs shown in figure 3 are developed. The horizontal axis is the algebraic difference of intersecting grades, and the vertical axis is the algebraic difference of grades of the log truck and log load. The length of the vertical curve varies from 0 to 100 feet.

In the example provided,

A = 16' and B = 24'.

For analyzing a log truck with different dimensions, it is necessary to generate a new graph. A program for generating graphs (figure 3) using the Hewlett-Packard 9830 Programmable Calculator has been included as Table 1.

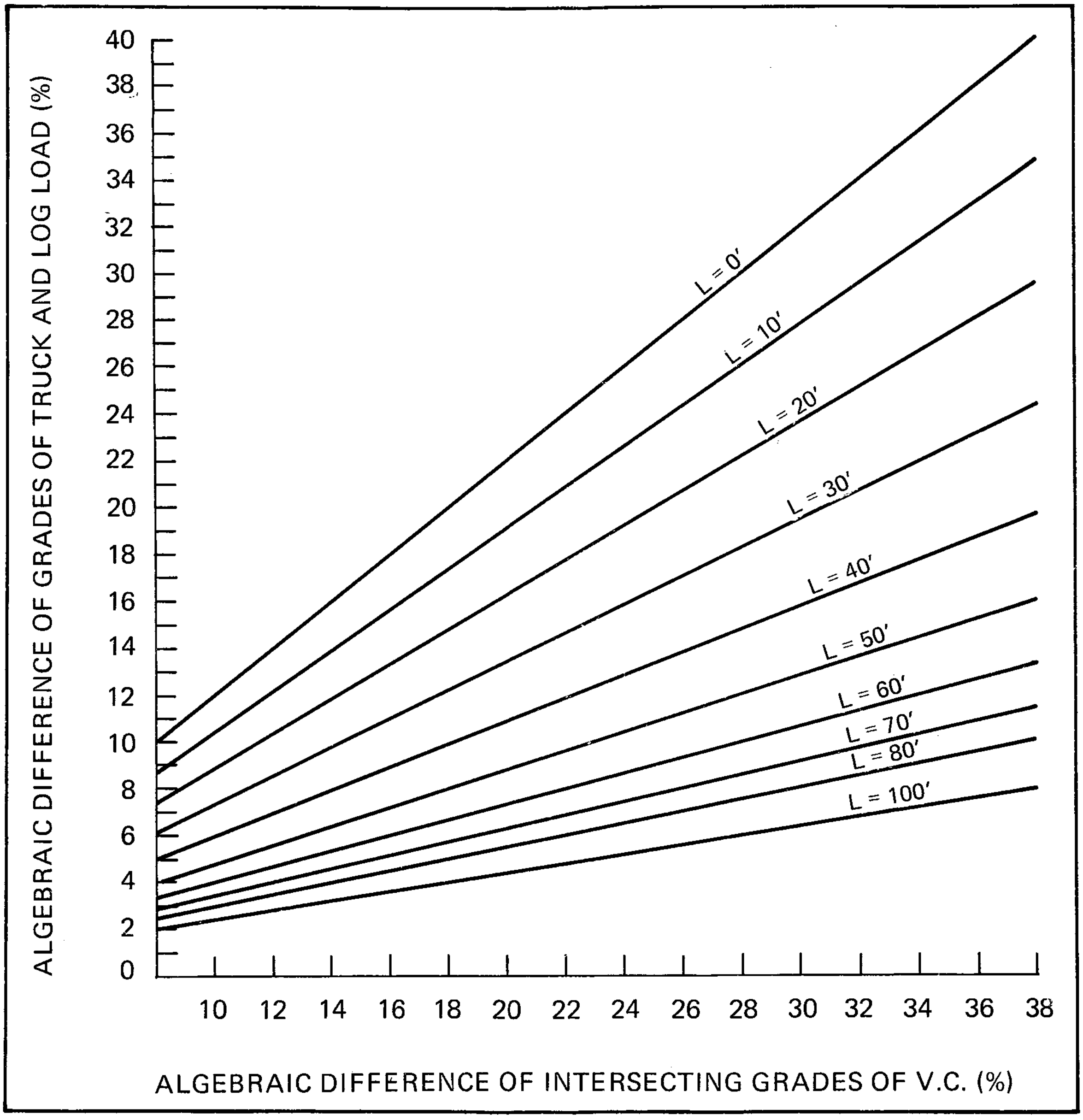

Figure 3. Truck and trailer geometry as a function of vertical curve geometry.

ANALYSIS OF SAG VERTICAL CURVES

There are two dimensions that are important when looking at sag vertical curves:

(1) Distance that the logs extend over the front bunk of the truck; and

(2) Height that the logs ride above the frame of the truck.

The height of the logs above the frame of the truck will vary, but generally will not be less than 1.3 feet. The distance that the logs extend over the front bunk is highly variable and depends on the length of the logs and the way they are loaded. Since the distance between the front bunk and the cab of the truck is approximately 11 feet, the overhand and is usually 8 feet and should never be greater than 10 feet. In the example, if 34-foot logs were being hauled, and the distance between bunks was 24 feet, then approximately 8 feet of log would be extending over the front bunk.

As a log truck travels through a sag vertical curve, the distance between the front end of the logs and the frame of the truck decreases. This decrease is a function of the algebraic difference of grades of the truck and log load and the distance that the logs extend over the front bunk. For example: if the total algebraic difference of grades of the truck and log load was 10 percent and the extension of the logs over the front bunk was 8 feet, then the amount of movement of the front of the logs downward would be:

$$\text{Movement} = (\text{Extended length over front bunk}) \times (\text{total sum of grades divided by } 100)$$

or

$$\text{Movement} = (8 \text{ ft})\ (10\%)/(100) = 0.8 \text{ ft}$$

By considering the 1.3-foot clearance between the front of the logs and the frame of the truck as the controlling factor, the critical algebraic difference of grades of the truck and the log load for logs extending 8 feet over the front bunk can be determined as follows:

$$\text{Critical total sum of grades} = (\text{clearance}) \times (100 \text{ divided by extended length over the front bunk})$$

or

$$\text{Total sum of grades} = 1.3 \text{ ft} \times 100/8 \text{ ft} = 16\%$$

A total algebraic difference of grades of greater than 16 percent could cause damage to the frame of the truck.

With this value of 16 percent, the various combinations of lengths of curves and algebraic differences of grades can be determined as shown in figure 3. The graph shows that a curve length as short as 50 feet and an algebraic difference of grades of 40 percent could be used before the logs would hit the frame of the truck. From this, it can be concluded that there is no real problem with sag vertical curves restricting the physical performance of a log truck. The truck's ability to pull steep grades, instead of curve length, will be the limiting factor. Also, a vertical curve with a length of 50 feet or less would be very difficult to maintain.

Two other dimensions were considered on sag vertical curves:

(1) the height of the load, and
(2) the distance between the front of the logs and cab of the truck.

The height of the load has the same effect as the distance that the logs extend over the front bunk, in that the top of the load will move toward the cab of the truck for some given geometry. For example: if the height of the load was 6 feet and the algebraic difference of grades of the truck and log load was 10 percent, then the top of the load would extend 0.6 feet toward the cab of the truck. Normally, this will be no problem because a distance of at least 2 feet is maintained between the front of the logs and the cab of the truck. It could certainly be a factor if the logs were positioned improperly on the truck and the resulting distance between the load and truck cab was less than 1 foot.

ANALYSIS OF CREST VERTICAL CURVES

The critical dimensions of a log truck when analyzing crest vertical curves is the length of the stinger and the vertical distance between the end of the stinger and the bottom of the logs. The length of stinger on most log trucks is 9.5 feet. The vertical distance between the end of the stinger and the bottom of the logs will depend on the length and diameter of the logs being hauled. The vertical distance at the bunk is 1.3 feet, the same as the vertical distance between the front of the logs and the frame of the truck. However, this vertical distance is decreased due to the deflection or sag of the logs over the unsupported length between bunks and natural sweep or crook of the logs.

To determine what the deflection is, the following formula can be used:[2]

$$\text{Deflection} = \frac{q\ x}{24\ E\ I}(L^3 - 2\ L\ x^2 + x^3)$$

where

q = uniform loading on the bottom layer of logs,

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[2]Mechanics of material by Timoshinko and Gere.

L = total length between bunks,

x = length of stinger,

E = modulus of elasticity for species of timber being hauled,

and

I = moment of inertia for a circular section.

For coastal Douglas fir logs of 12 feet average diameter and 24 feet between bunks, the amount of deflection was 1-1/2 feet. If the unsupported length between bunks was 30 feet, the amount of deflection is .25 feet. The longer the unsupported length between bunks and the smaller the log diameter, the greater the deflection.

In addition to log deflection, sweep of a log will also reduce the vertical clearance between the end of the stinger and the bottom of the logs. For purposes of determining critical vertical curve lengths and algebraic sums of intersecting grades in this article, a vertical clearance of 1 foot will be used.

As a log truck travels through a crest vertical curve, the end of the stinger will be forced upward toward the bottom of the logs. The amount of movement is a function of the algebraic difference of the grades of the truck and log load and the length of the stinger of the truck. For example: if the algebraic difference of the grades of the truck and log load is 10 percent and the length of the stinger is 9.5 feet, the vertical movement of the end of the stinger will be: 9.5' x 10%/100 = 0.95', very close to the recommended clearance.

Again, using the graph in figure 3, a 50-foot vertical could be designed, but the algebraic difference of intersecting grades could only be 25 percent. Thus, the crest vertical curve is more restrictive to the performance of a log truck than a sag curve.

Normally, short crest vertical curves can be eliminated on main haul roads by increasing the amount of excavation. The problem of short crest vertical curves occurs most frequently at the intersection of spur roads with the main haul road. A large change of grade can occur in a very short distance due to limitations in topography. Crest vertical curve limitations should be considered when designing haul and spur road intersections.

CONCLUSIONS

In designing forest highways and high use recreation roads, safe visibility, comfort and appearance must be considered when designing vertical curves. In logging road design, the ability of trucks to negotiate vertical curves is of importance. By keeping vertical curves as short as possible, the fill required on sag curves can be reduced with lower construction costs. In mountainous regions, the topography of the land may limit the length of curve.

The general conclusion is that sag vertical curves can be as short as 50 feet and algebraic difference as great as 40 percent before they become critical to the performance of log trucks. A vertical curve shorter than 50 feet would be difficult to maintain with a road grader. The ability of log trucks to pull sustained grades of 20 percent and greater will be more restrictive than the length of vertical curve. The compensator has been discussed and is not considered a limiting factor on either sag or crest vertical curves.

Close attention should be paid to the proper design of crest vertical curves. They will be more critical than sag vertical curves because the deflection and natural sweep of the logs decreases the clearance between the bottom of the logs and the end of the stinger. The algebraic difference in the grades of the truck and log load should never be greater than 10 percent. The result could be damage to the stinger or reach, or the stripping of the load from the front bunk. A possible remedy would be to raise the bunk height. New graphs would have to be developed if the truck dimensions were different than the ones covered in this article.

Table 1. Program for generating truck and trailer geometry graphs. (Hewlett-Packard 9830)

```
10 DEG
20 SCALE 10,40,0,40
30 XAXIS 0,2,10,40
40 YAXIS 10,1,0,40
50 DISP "INPUT A, IN STATIONS";
60 INPUT A
70 DISP "INPUT B, IN STATIONS";
80 INPUT B
90 FOR L=1 TO 0 STEP -0.1
100 FOR G1=5 TO 20
110 G2=G1
120 E=(G2+G1)*L/8
130 Y1=((((L/2)-A)↑2)*(G2+G1))/(L*2)
140 Y2 =((((L/2)-B)↑2)*(G2+G1))/(L*2)
150 IF L/2 <= B THEN 260
160 I=(G1*A)
170 J=G2*B
180 G3=(I+Y1-E)/A
190 G4=(J+Y2-E)/B
200 G=G3+G4
210 H=G1+G2
220 PLOT H,G
230 NEXT G1
240 PEN
250 NEXT L
260 IF B  = 0.3 THEN 300
270 IF B  = 0.3 THEN 280
280 IF B  = 0.25 THEN 320
290 IF B  = 0.25 THEN 340
300 P=0.6
310 IF P=0.6 THEN 360
320 P=0.5
330 IF P=0.5 THEN 360
340 P=0.4
350 IF P=0.4 THEN 360
360 FOR L=P TO 0 STEP -0.1
370 FOR G1=5 TO 20
380 G2=G1
390 Y1=((((L/2)-A) ↑2)*(G2+G1))/(L*2)
400 IF L/2 <= A THEN 520
410 E=(G2+G1)*L/8
420 I=(G1*A)
430 J=(G2*B)
440 G3=(I+Y1-E)/A
450 G4=(J-E)/B
460 G=G3+G4
470 H=G1+G2
480 PLOT H,G
490 NEXT G1
500 PEN
510 NEXT L
520 FOR L=0.3 TO 0 STEP -0.1
530 FOR G1=5 TO 20
540 G2-G1
550 E=(G2+G1)*L/8
560 I=(G1*A)
570 J=(G2*B)
580 G3=(I-E)/A
590 G4=(J-E)/B
600 G=G3+G4
610 H=G1+G2
620 PLOT H,G
630 NEXT G1
640 PEN
650 NEXT L
660 END
```

<u>FEDERAL AID PLOTS FOR PERCENT ABNEY LEVEL (PAL) SURVEYS</u>

Ron McCall
Civil Engineering Technician
Region 8

There is a method of obtaining Federal Aid plots for Percent Abney Level surveys when this type of survey is the final horizontal alignment. The controlling criteria for submittal of the PAL survey data to the Road Design System (RDS) section in each Regional Office is specified in FSH 7109.16.

After submittal to the RDS section, data is keypunched and stored at the Fort Collins Computer Center. To obtain Federal Aid plots the following steps are necessary:

1. Have traverse data with coordinates (Card Type 11) and station and ground elevation (Card Type 48) punched out on cards. This is accomplished by use of options documented in the overlay writeup called *PAL.

2. After receiving this punched out data on cards, both sets of cards must be modified.

The traverse data card deck must be reproduced, changing the number in card Column 8 to 0 (zero), thus creating Card Type 10 (Horizontal alignment data). The station and elevation cards that were punched out (Card Type 48) must be modified by reproducing and changing card columns 7 and 8 to the number 20, then place the punched out station and elevation in the proper card columns as specified for Card Type 20, (Profile Grade Data Form 7700-529). The Computer Services section in each Regional Office would be able to provide Services section in each Regional Office would be able to provide these reproduction requirements.

This reproduced data, Card Type 10 and 20, is then stored with the original information. The designer may make grade modifications if desired, and request Federal Aid plots when needed.

Several options are documented in the *FEDAID overlay, such as suppressing V.P.I. information data, grade-line, bearings, etc.

EDITOR'S NOTE

It is possible to use the described procedure without punch output. It requires a knowledge of the computer commands @BRKPT, @ED, and @ADD. For more detailed information, contact your Regional ADP coordinators.

REQUESTS FOR ENGINEERING PUBLICATIONS

A limited number of copies of the following publications are available from the Washington Office, Engineering Technical Information Center, for USDA-Forest Service internal use.

Any requests for these publications from outside the Forest Service should be referred to:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

Orders for these publications must include the GPO Stock Number.

Smith River Highway Visual Analysis Study (EM 7700-3), GPO Stock Number 001-001-00406-5. Price: $2.15 ea.

Aerial Tramways, Ski Lifts, and Tows, Description and Terminology (EM 7320-1), GPO Stock Number 001-001-00400-6. Price: $1.80 ea.

Evacuation of Aerial Passenger Tramways (EM 7320-2), GPO Stock Number 001-001-00409-0. Price: $1.05 ea.

Engineering Field Tables--Fourth Edition (EM 7100-10), GPO Stock Number 001-001-00417-1. Price: $2.45 ea.

WASHINGTON OFFICE NEWS

OPERATIONS

Harold L. Strickland
Assistant Director

CIVIL LIABILITY OF GOVERNMENT EMPLOYEES

Because of our work, Engineers and paraprofessionals have always been subject to civil suits if negligence could be demonstrated. The Freedom of Information Act (FSM 6271) and the Privacy Act (FSM 6272) have substantially increased the potential of personal suits; this is especially so where accident investigations or personal information concerning our employees are concerned. As a result of this increased exposure, we recommend your careful review of FSM 6271 and 6272, and are publishing the following letters from the Office of the General Counsel for your information.

DEPARTMENT OF AGRICULTURE
OFFICE OF THE GENERAL COUNSEL
WASHINGTON, D.C. 20250

SUBJECT: Suits Against Employees in their Individual Capacities.

TO: Deputy General Counsel
Assistant General Counsels
Division Directors
Regional Attorneys
Attorneys-in-Charge

As you know, the number of suits filed against employees in their individual capacities for actions taken within the scope of their official duties has increased dramatically in the last few years. This subject was dealt with in my Memorandum to Heads of Department Agencies dated March 1, 1976.

Because of the understandable concern of Department employees when they are sued individually for actions taken within the scope of their official duties and the importance of affording such employees the maximum protection and effective representation, it is necessary that prompt action be taken when such a suit is filed.

The time limits for responding to such a suit are normally much shorter than the 60 days available in the case of most suits in which the United States is named as a defendant, the precise time varying and depending on whether the case is filed in a State or local court or Federal court.

Because of these short time limits for responding it is necessary that the various Divisions and field offices cooperate in the preparation of the necessary litigation reports and documentation necessary to provide effective representation to the employee.

The Research and Operations Division is normally responsible for the overall coordination of the defense of suits filed solely against employees in their individual capacities. However, because the suit against the individual may turn upon complex program matters, *e.g.*, the closing of a meat processing plant or the handling of a FmHA or REA loan, and the fact that the suit is against the employee instead of the Government is often a minor and incidental factor in the overall handling of the litigation, it is at times necessary that a program division or field office take the lead or play a major role in the handling of the case. In some situations, the proximity of field offices to the employees involved in the action out of which the litigation arises makes it desirable that the field office assist in the preparation of affidavits and other documents necessary to a defense of the suit.

I am advised that the cooperation of all units in the handling of such suits has been excellent and that as a result the Government has been successful in protecting both the interests of the employee and the Government. I want you to know that I appreciate your continuing efforts in this regard.

JAMES D. KEAST
General Counsel

UNITED STATES DEPARTMENT OF AGRICULTURE
OFFICE OF THE GENERAL COUNSEL
WASHINGTON, D.C. 20250

March 1, 1976

MEMORANDUM TO HEADS OF DEPARTMENT AGENCIES

Questions have recently been raised by administrative officials as to the policy of the Department of Justice regarding the availability of legal representation to Department employees when they are used in their individual capacities for actions taken within the scope of their authority as government employees. Specifically, concern has been expressed by such officials as to the possibility that an employee might be held individually liable for such actions.

It has long been the general policy of the Department of Justice to afford counsel and representation to government employees who are sued civilly as a result of the performance of their official duties.

The possibility that a government employee may be held personally liable for actions taken while acting within the scope of his employment was one of the factors that prompted the Congress to pass the Federal Driver's Act, an amendment to the Federal Tort Claims Act, 28 U.S.C. 2679, which provides that remedy by suit against the United States is exclusive, and the employee may not be sued personally, where damage to property or injury results from the operation by the employee of a motor vehicle while acting within the scope of his official duties. While the Department of Justice has sought legislation which would extend this "exclusive remedy" principle to other cases in which the employee was acting within the scope of his employment, no such legislation has been enacted.

Notwithstanding the fact that Congress has not seen fit to extend the "exclusive remedy" principle of the Federal Driver's Act to other situations in which the employee is sued in his individual capacity, there are certain protections afforded such an employee.

In such cases, it is the responsibility of this Department to supply the Department of Justice with information--usually in the form of affidavits from the employee involved and his supervisor--to show that the employee was in fact acting within the scope of his official duties.

If the Department of Justice is satisfied that the employee was acting within the scope of his official duties, it will remove the action to Federal court if filed in a State or local court, and will file a motion in Federal court to dismiss the action against the employee under the official immunity doctrine set out in the Supreme Court cases of Barr v. Matteo, 360 U.S. 564 (1959) Doe v. McMillan, 412 U.S. 306 (1973).

Immunity is ordinarily a very good defense in such cases. The Department of Justice has asked us to make it clear to employees, however, that, while the possibility of employees being held personally liable in such cases is remote, the Department of Justice "will not and cannot provide a guarantee to that effect." Letter dated February 6, 1975, from Assistant Attorney General Carla A. Hills to the Department of Agriculture, concerning a request by SCS employees for representation. The letter states as follows:

> "The Supreme Court recently declined to hold that the immunity of a federal employee from civil liability for acts done while acting within the scope of his employment was absolute; instead it advised '. . . a discerning inquiry into whether the contributions of immunity to effective government in particular contexts outweigh perhaps recurring harm to individual citizens.' Doe v. McMillan, 412 U.S. 306, 319 (1973).
>
> "The Department of Justice will represent [the employees involved] and it is anticipated that a motion will be made to dismiss the action as to them. We cannot be as certain of the outcome as they appear to be. Immunity appears to be a very strong defense under the circumstances of this case but the Department of Justice cannot and will not guarantee its acceptance by the Court. Further, if a judgment were to be entered against the United States and one or more of the individuals, it would normally be satisfied by the United States as a matter of policy and plaintiff could not collect from the individual(s) [28 U.S.C. 2676].
>
> If a judgment is entered solely against one or more of the individuals, however, there is no authority by which the United States could pay it. Again, the facts indicate that the possibility of such a result is indeed remote; however, the Department of Justice will not and cannot provide a guarantee to that effect."

In view of this possibility that an employee may be held personally liable, the Department of Justice recommends that the employee be advised of his right to secure private counsel.

Cases wherein federal employees have been held personally liable for acts done within the scope of employment are few. This results in part from the fact that plaintiffs are concerned with the prospects of having any judgment obtained satisfied and the Federal Tort Claims Act provides a statutory basis for suing the agency concerned and having the judgment satisfied out of federal funds.

Under all the circumstances, we believe that it is extremely unlikely that an employee would be found individually liable if he is indeed acting within the scope of his authority. Nevertheless, neither this Office nor the Department of Justice can guarantee that defense will be provided the employee in every case or that the employee will never be found civilly liable in his individual capacity.

The Office of the General Counsel intends to do everything it can to assure prompt liaison with the Department of Justice and to encourage full representation of any employee who was acting within the scope of his employment. It is requested that administrative officials and employees promptly call to the attention of the appropriate Regional Attorney or Attorney-in-Charge, or other appropriate representative of this Office any lawsuits filed against them, so that the necessary action may be promptly taken to obtain representation by the Department of Justice.

JAMES D. KEAST
General Counsel

TECHNOLOGICAL IMPROVEMENTS

Heyward T. Taylor
Assistant Director

NEW RDS DATA FILE SYSTEM

A new and improved system for maintaining RDS data files has been developed and tested for field use. It has been successfully implemented in R-10 and Service-wide implmentation is expected by the end of the year.

The improved system was the result of a joint effort by the Forest Service Engineering Support Group and the Department of Agriculture's Agency Application Branch; both are located at the FCCC in Ft. Collins, Colorado. The Service-wide Engineering Applications Steering Committee (ECASC) identified the need for the new system and directed Regional tests and implementation procedures. Improvements in the new system are:

1. Two methods for temporarily archiving inactive projects;
2. Efficient automatic recovery of each project from the archives without user command;
3. Reduction in on-line mass storage for RDS projects;
4. Effective methods for maintaining projects which have been postponed for later timber sales;
5. Efficient techniques to recover postponed projects with minor user involvement;
6. Improved storage controls to prevent computer system problems from adversely affecting RDS data;
7. Overall reduction in computer operation costs.

CONSULTATION AND STANDARDS

Charles R. Weller
Assistant Director

SOLAR ENERGY UPDATE

The economic utilization of solar energy in the heating and cooling of buildings, generation of electricity, crop drying etc., represent some promising contributions to a solution of the world's energy problems.

The following references will assist those who are involved with either feasibility studies or actual design.

1. Buying Solar; June 1976 booklet; Joe Dawson, Office of Consumer Affairs, Department of Health, Education, and Welfare; printed by Federal Energy Administration, Office of Synfuels, Solar and Geothermal Energy.

2. Solar Heating of Buildings and Domestic Hot Water; January 1976 Naval Facilities Engineering Command Technical Report R835; Civil Engineering Laboratory, Naval Construction Battalion Center, Port Hueneme, Calif. 943043.

3. A Floridian's Guide to Solar Energy and How To Build a Solar Water Heater; March 1976; State Energy Office, 108 Collins Building, Tallahassee, Fla. 32304.

4. How to Build a Solar Heater; 1975; Ted Lucas; Ward Ritchie Press, Pasadena, Calif. 236 pp.; $4.95.

5. New Low-Cost Sources of Energy for the Home; 1975; Peter Clegg; Garden Way Publishing, Charlotte, Vt. 05445; 252 pp.; $5.95.

6. Other Homes and Garbage--Designs for Self-Sufficient Living; 1975; Leckie, Masters, Whitehouse and Young; Sierra Club Books, San Francisco; 302 pp.; $9.95.

7. Energy Primer, Solar Water, Wind, and BioFuels; 1974; by Portola Institute, 558 Santa Cruz Avenue, Menlo Park, Calif. 94025; 200 pp.; $4.50.

8. Putting the Sun to Work in Arizona; March 1976; Dan Halacy; Arizona Solar Energy Directory and Arizona and Tomorrow's Solar Power Plants; available free from Arizona Solar Energy Research Commission, 1645 West Jefferson, Suite 435, Phoenix, Ariz. 85007.

9. Solar Flair; 1975; available free from New Mexico Department of Development, 113 Washington Avenue, Santa Fe, New Mex. 87503; 32 pp.

10. Bibliographies

a. Solar Energy Update: March 1976; 76-1.
June 1976; 76-2.

b. Solar Energy--A Bibliography; March 1976; Vol. 1 citations TID - 3351-R1P1 $13.75; Vol. 2 Indexes TID - 3351-R1P2 $10.75.

All of the above are available from ERDA, Technical Information Center, P.O. Box 62, Oak Ridge, Tenn. 37830.

c. Solar Energy Bibliography and Solar Energy Catalog; available free from Centerline Corporation, 401 South 36th Street, Phoenix, Ariz. 85034.

11. New publications available from GPO:

a. Solar Swelling Design Concepts--A general report on the background of solar heating and cooling and examples of applications to various architectural styles. ($2.30)

b. Solar Heating and Cooling Demonstration Program: A Descriptive Summary of HUD Solar Residential Demonstrations, January 1976--One page descriptions of the demonstration projects selected in the first cycle. ($1.15)

INVITATION TO READERS OF *FIELD NOTES*

Every reader is a potential author of an article for *Field Notes.* If you have a news item or short article you would like to share with Service engineers, we invite you to send it for publication in *Field Notes.*

Material submitted to the Washington Office for publication should be reviewed by the respective Regional Office to see that the information is current, timely, technically accurate, informative, and of interest to engineers Service-wide (FSM 7113). The length of material submitted may vary from several short sentences to several typewritten pages; however, short articles or news items are preferred. All material submitted to the Washington Office should be typed double-spaced; all illustrations should be original drawings or glossy black and white photos.

Field Notes is distributed from the Washington Office directly to all Regional, Station, and Area Headquarters, Forests, and Forest Service retirees. If you are not currently on the mailing list ask your Office Manager or the Regional Information Coordinator to increase the number of copies sent to your office. Copies of back issues are also available from the Washington Office.

Each Region has an Information Coordinator to whom field personnel should submit both questions and material for publication. The Coordinators are:

R-1	Bill McCabe	R-4	Ted Wood	R-9	Norbert Smith
R-2	(Vacant)	R-5	Jim McCoy	R-10	Frank Muchmore
R-3	Bill Strohschein	R-6	Kjell Bakke	WO	Al Colley
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