SYMPOSIUM: "WOOD PRESERVATION PAYS"

WOOD POLE PRESERVATION AND MAINTENANCE PAYS

by

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INTRODUCTION

Wood Protection in its rudimentary form can be traced back several hundred years when marine wood consisting of the rot resistant heartwood from white or European Oak was used for building ships. This wood was quite often liberally coated with pine tar to protect it from marine borers. This was a very early recognized form of wood protection that paid.
More importantly, wood preservation began in earnest in the U.S. early in the 19th century. It is interesting to note however, that in Europe in 1767 copper sulphate was recommended to protect wood from the ravages of decay. Following this, the 1830's were very active in developing patented wood preservatives and processes such as the use of mercuric chloride in the Kyanizing process and the use of copper sulphate in the Boucherie process which was designed to treat living trees and unseasoned, unpeeled wood. This treatment was ineffective on seasoned timbers.

In 1838, a coal tar creosote using the Bethell process was patented in Europe (1). It was the middle of the 19th century before patented wood preservatives became of practical importance in the U.S. (1). The Boulton process was patented in 1881 and the Rueping empty cell process in 1902 and the Lowry process in 1906 (1).

So you can see from this that there was a very early recognition of an advantage of preservative treatment. It was realized that the dollars spent on a product could be spread over a much longer period with a preservative treatment. The economic advantages of preservative treatment were realized on many products several years ago.

Preservative treated poles started to be utilized extensively in the U.S. from 1925 (1). In Canada, the boom in preservative treated poles was closer to 1940's, although cedar butt treatments were abundant previous to this.

Past experience has taught Manitoba Hydro the advantages of full length pressure or thermal treated poles. The use of no treatment or inferior short life treatments was an expensive lesson in the need for proper preservative treatment of poles. We also learned in the 50's, the economic value of groundline treating poles to extend their life and to prevent the already occurring preservative failures of particular populations of poles.

Experience has taught that the bad economics of installing untreated or badly treated poles shows up within 7 to 15 years. For this reason and the fact that most utilities in Canada are using preservative treated poles, the rest of this paper will concentrate on the economics of "in-service" pole maintenance.

IN-SERVICE MAINTENANCE JUSTIFICATION

In Canada today, electrical utilities have placed 8.7 million poles in service (2). A very high percentage of these poles are preservative treated with one process or another. Creosote is probably the most prevalent. Also, a very high percentage of these 8.7 million poles are above or approaching an age of thirty years. However, irregardless of age, these poles represent a huge investment in Canada's pole plant. To give an example, Manitoba Hydro's distribution plant is considered as an asset worth $372 million which was basically the cost of building the system. Poles represent a very high percentage of these assets. It is therefore very important for Canadian utilities to maintain this plant to achieve maximum service life from any pole. Doing this at the correct time dramatically reduces future pole replacement costs and will effectively spread future replacement costs out over a great number of years. It is a fact that an aging plant will become infected with rot and very quickly thereafter fall down if no in-service maintenance is done on that pole population. For this reason, every utility should have developed good pole maintenance policies and procedures. These policies and procedures should recognize the need for inspection cycles and identify for field staff the techniques for remedial maintenance dependent on types of problems. Policies and procedures however are not designed to justify large expenditures on major programs of pole maintenance such as the six year program in Manitoba Hydro to groundline treat 250,000 poles.

To justify the substantial expenditures required to complete this program, we looked at:

1. The 'as is' condition of this part of the plant:
   - done by field samples in various soil conditions on these poles
   - poles sampled in field were also groundline treated
   - results were also supported by previous monitoring in pole yards on salvage poles of this vintage - it is noteworthy that the pole yard provides an excellent location to confirm expected or anticipated rot problems in older poles.
   - This sampling gave an indication of the plant condition and expected costs of a groundline treating program.

2. Methods of calculating a forecast of future pole retirements if a groundline treating program was not undertaken. We also forecasted the cost associated with doing a groundline treatment of 250,000 poles.
3. The cost/benefit analysis associated with a "do nothing" approach and a groundline treating approach.
4. Management's understanding of the real problem which was rot. We went as far as to demonstrate to them the what, when, why and how of rot infestation of a pole plant.
   Pole maintenance people should not assume that managers controlling the letting of program dollars need not be informed of the pros and cons of a particular program on pole maintenance. If management is not informed properly of the problem, supported by concrete evidence, then maintenance dollars will be very difficult to obtain.

Now, to be more specific, I will outline the approach we took to economically justify a six year groundline treating program, started in 1982 (3). This approach can be used for other maintenance techniques as well, such as internal treatment of fir or cedar poles.

The first step was to ask ourselves, "How does one show on paper a good economic justification for expenditures on maintenance of a pole population from rot infestation?" That is, gut feeling supported by field checks is not a good enough justification for approval for large sums of monies to be released annually.

The approach taken was through the use of statistics and population survivor and retirement forecasting (3).
This is a fairly rational approach and can be augmented with the use of IOWA Type Survivor Curves (4).

There are a family of survivor curves developed in 1935 by IOWA State College of Agriculture and Mechanic Arts. These curves show the expected percent survivors of a population over time (Figure 1). They were first used by our Utility on pole populations in 1975 to provide a budget forecast for pole replacements for a 20 year period (5).

Our Utility has since developed a computer program which uses a survivor curve to calculate expected retirements of a population over time. To do this, it is necessary to know how many of a particular pole type were installed in the various years. The computer program takes the data on installations and calculates the expected retirements for any given year from the time of installation. That is, a retirement distribution curve is established (Figure 2).

From past experience and a common sense point of view, one can see that Figures 1 and 2 are the types of distributions applicable to a pole population for survivors and retirements (Figures 1 and 2).
In the early years of a pole plant, low numbers of replacements take place due to a number of causes other than rot (mechanical, lightning, fire, accidents, etc.). However, as a plant approaches the point where the effectiveness of preservatives have substantially diminished or the resistance to rot decreases substantially, more retirements occur. It is toward the end of the expected pole plant life that the greatest number of retirements occur where rot becomes the main causal agent. This of course would be the picture of a pole population distribution which obtained no "in-service" maintenance work and was allowed to die.
On the other hand, if one were to do maintenance at the correct time, the survivor distribution curve could be drastically altered with the shift in life expectancy (Figure 3). The economics of this aspect will hit home to a manager.

The ability to predict pole retirements or survivors is extremely useful to a pole maintenance person as it allows him to now calculate costs associated with a "do nothing" approach or with the "do maintenance approach". He can now show both sides of the coin.

Future replacement cost can be established by applying compound interest to today's known replacement cost for a particular size of pole. These future replacement costs can then be multiplied by the forecasted retirements to establish a predicted cost of not maintaining the plant.

To establish the other side of the coin - maintaining the plant- one must establish the cost of doing the maintenance over the recommended time period and then show the results in reduced retirements and drastically reduced future costs for pole replacements.

A cost/benefit analysis is also very useful in showing the advantage of maintenance whether groundline or internal treatment. There are several ways to do this. For example, we used the following formula for a time period until 2002 to show the savings associated with groundline treating 250,000 poles:

$$\text{Savings (2002 dollars)} = \frac{\text{Cost of No Mtce.} - \text{Cost of Mtce.}}{\text{Survivors with Mtce. by 2002} - \text{Survivors with No Mtce. by 2002}}$$

For example, discounting the dollar figure from the above formula, back to 1982, the savings in 1982 dollars to Manitoba Hydro to groundline treat a rural distribution pole was $132.84. This was based on the assumption that a groundline treatment would extend the life of a pole in Manitoba by 15 years. Past experience has shown this life extension to be realistic. This is

certainly good economic justification for a groundline treating program.
I must point out, however, that all this statistical and economic analysis must be supported by physical proof of a problem. That is, a pole maintenance person must be aware of his pole plant condition and recommend maintenance at the correct time. It is at the time of the first indication of preservatives reaching threshold values that remedial in-service maintenance should be recommended. To wait until a rot problem is present is in effect waiting too long. It can be a difficult thing to convince management that a maintenance program is required when physical field evidence of a problem is lacking. That is why management must be informed as to the mechanics of pole plant deterioration.

CONCLUSIONS

From available Canadian literature plus the current interests of Canadian utilities and CEA in remedial in-service treatments of poles, it becomes apparent that utilities not currently undertaking planned pole maintenance programs, will need to do so in the near future. The use of statistical analysis and basic economic theories can be an invaluable tool in evaluating the need for and the timing of large in-service pole maintenance programs. If a pole maintenance person is not knowledgeable in these areas, then he/she should tap the resources of economists and statisticians which are probably present in other departments of their utility. With the high replacement costs of today and the future, one cannot afford to sit and watch a pole plant deteriorate. Proper maintenance will also go a long way in ensuring future pole supplies for all Canadian utilities.

REFERENCES

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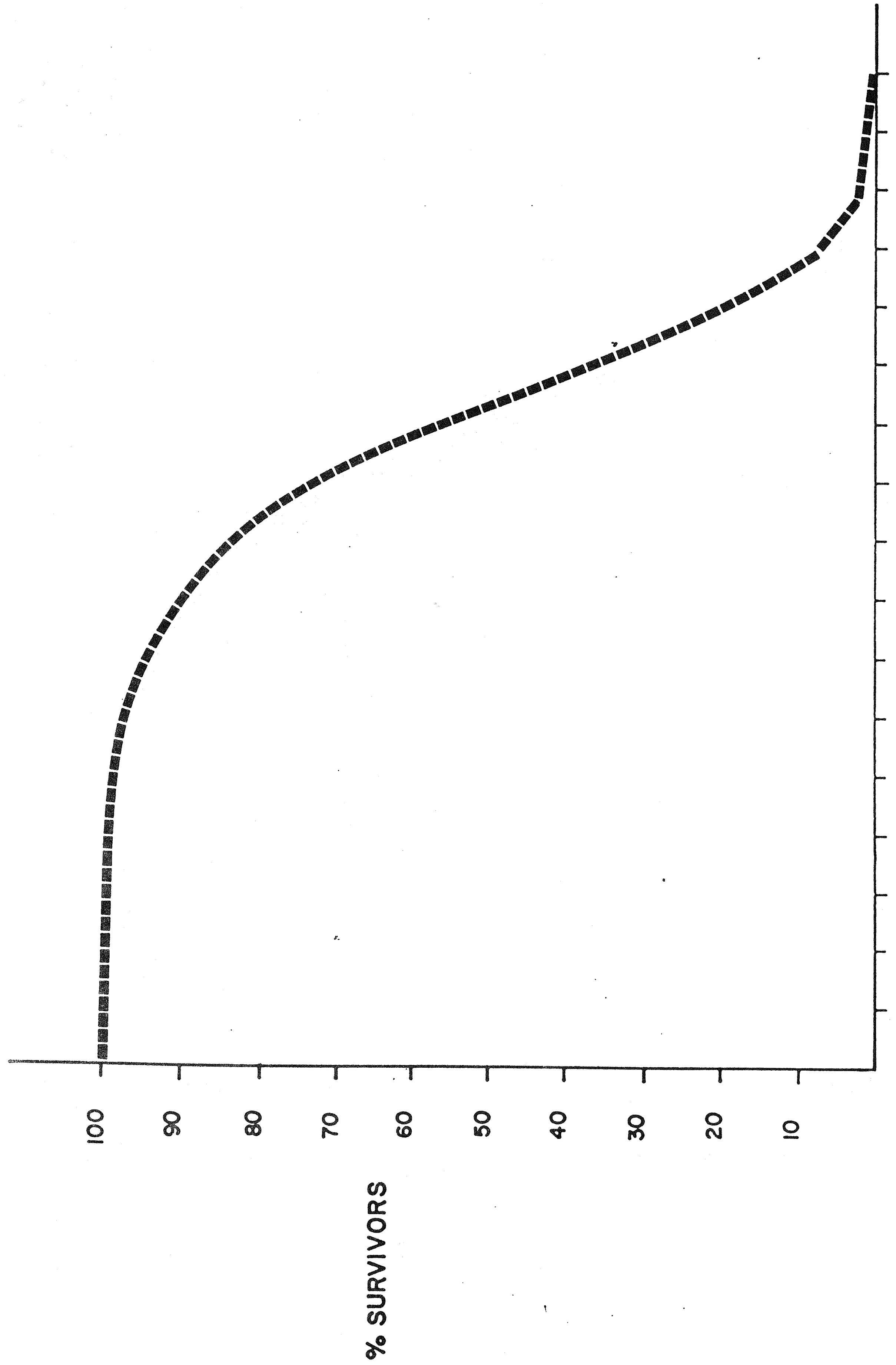

FIG. 1 R4-IOWA SURVIVOR TYPE CURVE
43 YEAR AVERAGE LIFE

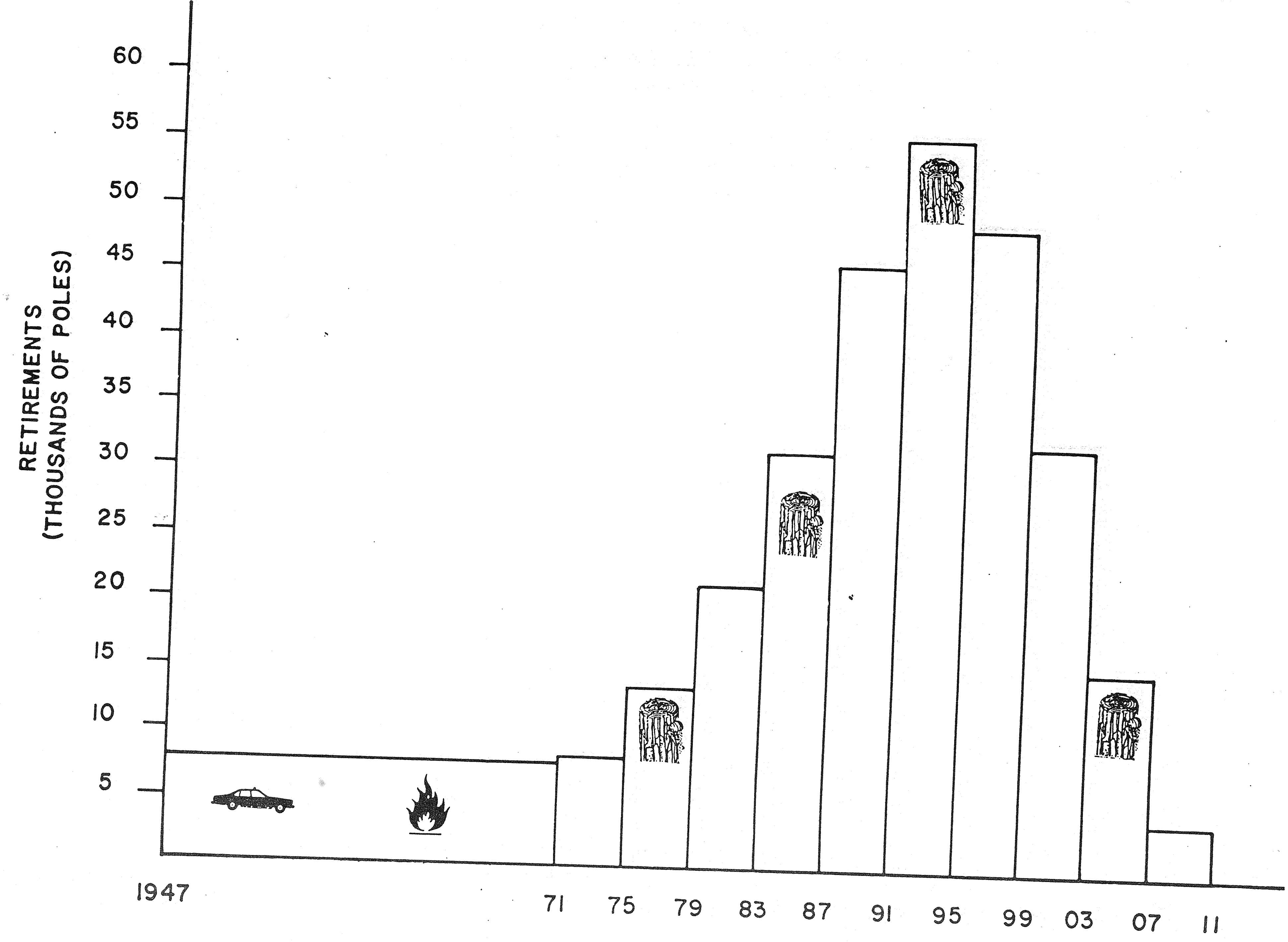

FIG. 2 POLE RETIREMENTS FORCASTS BASED ON R4-IOWA CURVE 43 YEAR AVERAGE LIFE

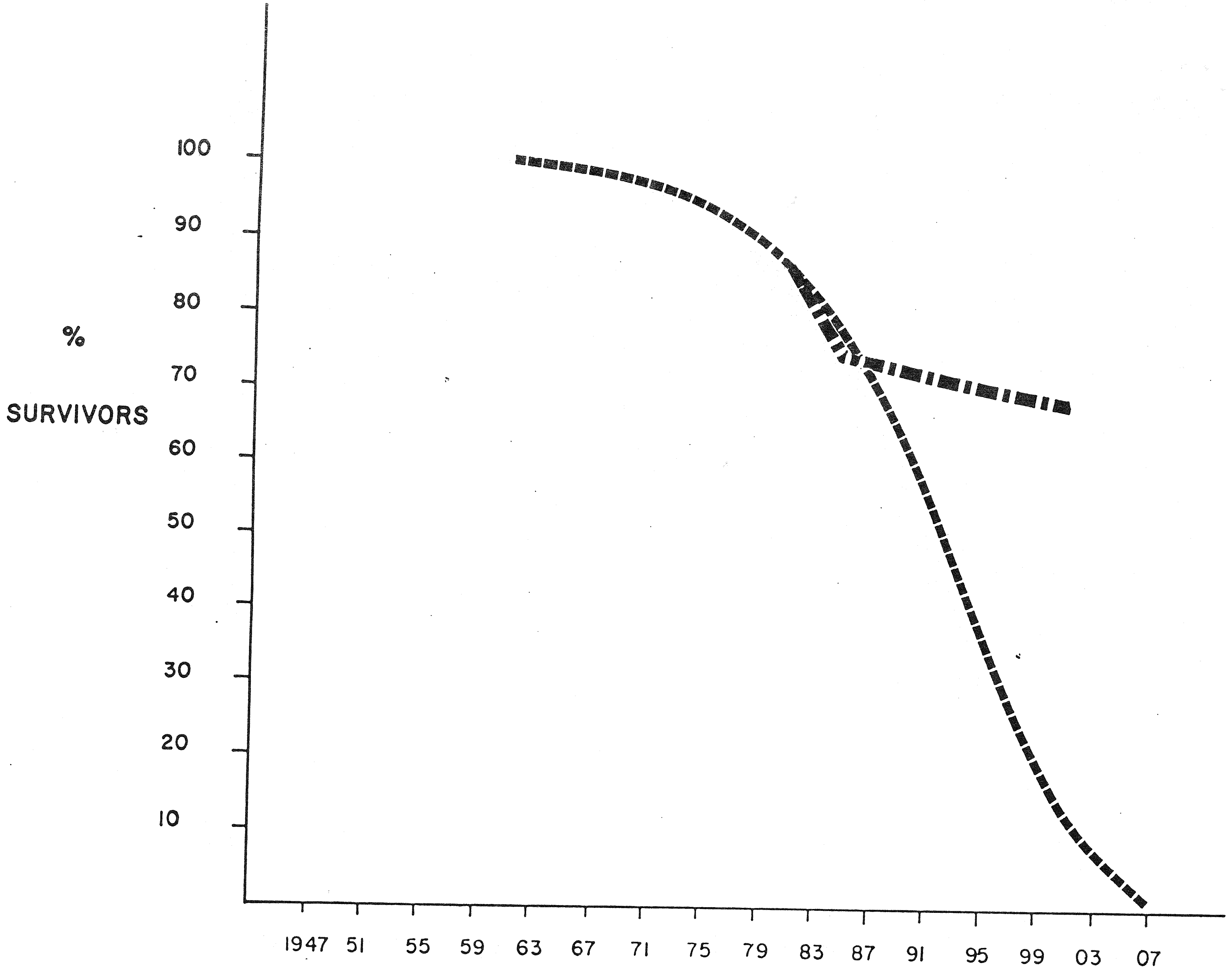

FIG. 3 CHANGE IN R4-IOWA SURVIVOR CURVE-43 YEAR AVERAGE LIFE WHEN G.L.T. IS CARRIED OUT