Survivor Curves

Survivor curves are used for planning maintenance and rehabilitation alternatives on pavement networks. The construction, maintenance, and rehabilitation histories that are recorded by the state agencies are valuable sources from which to develop survivor curves. A survivor curve is a graph of probability versus time. The probability drops off with time (or traffic) from a value of 1.0 down to zero and it expresses the percentage of pavements that remain in service after a number of years (or passes of a standard load) without requiring major maintenance or rehabilitation. A typical survivor curve is shown in Figure 1. The slope of the survivor curve is the probability density of survival and is also illustrated in that figure. The probability density curve for survival may be constructed from historical data by determining the percentage of pavements that must be maintained or rehabilitated each year after its most recent major repair or new construction.

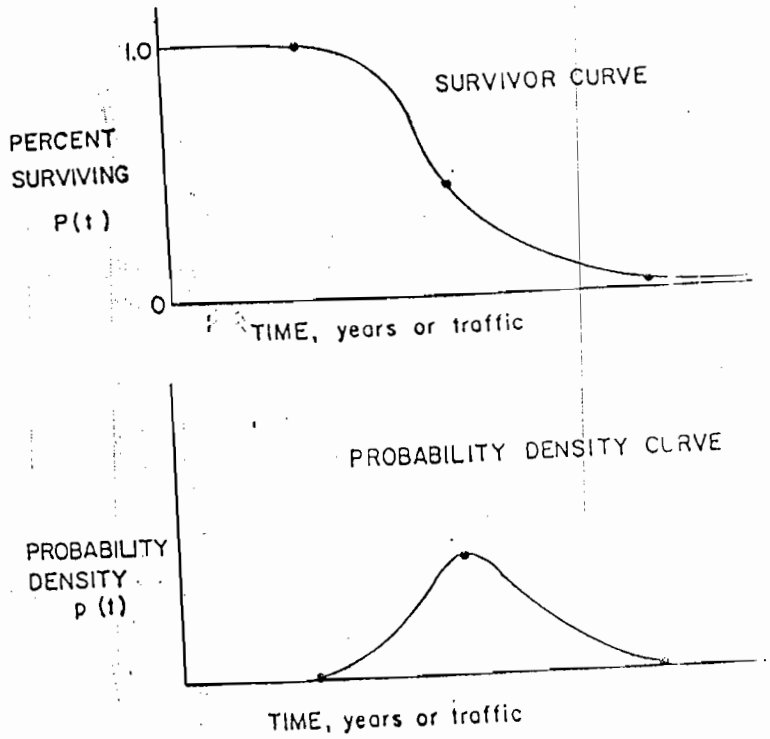

Figure 1. Survivor Curve and Probability Density Function for Survival.

A Markov transition matrix expresses the probability that a group of pavements of similar age or level of traffic will transition from one state of distress or serviceability index to another within a specified time period. The use of a Markov transition matrix implies that the following assumptions are valid:

1. There are a finite number of states of distress or serviceability index in which the pavement can be found. A "state" is a range of distress or serviceability index such as between a PSI of 4.0 and 4.2.

2. The probability of making a transition from one state to another depends only upon the present state.

3. The transition process is stationary, that is that the probability of changing from one state to another is independent of time. This assumption is a critical one for it assumes that changes in weather conditions within a planning horizon will not affect the transition probabilities. This assumption is not true, in general, for most pavement conditions.

The Markov process describes a probable "before" and "after" condition of the pavement. The "before" condition is described by probabilities that the pavement will be found in each of the assumed finite number of states as is illustrated in Figure 2. The "after" condition is described in a similar manner as illustrated in the same figure. However, the probabilities are shifted downward to lower condition states which are described by ranges of serviceability index.

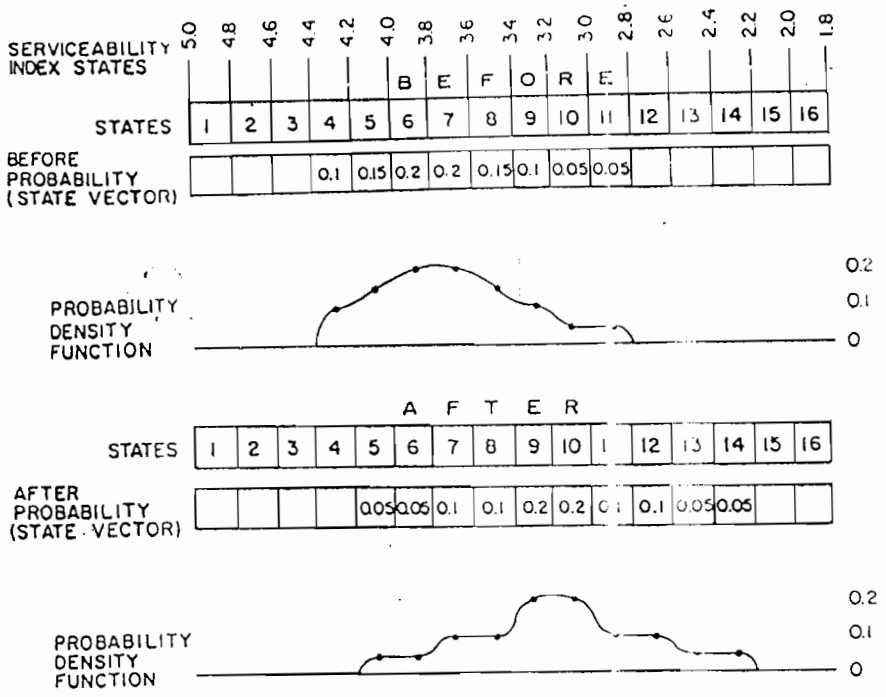

Figure 2. Before and After Serviceability Index State Vectors.

Markov transition matrices can be constructed for any process of pavement deterioration and, especially if the assumptions that are made for Markov processes are valid, they can be used reliably to simulate the overall performance of a network of pavements of similar types with similar weather and traffic patterns.