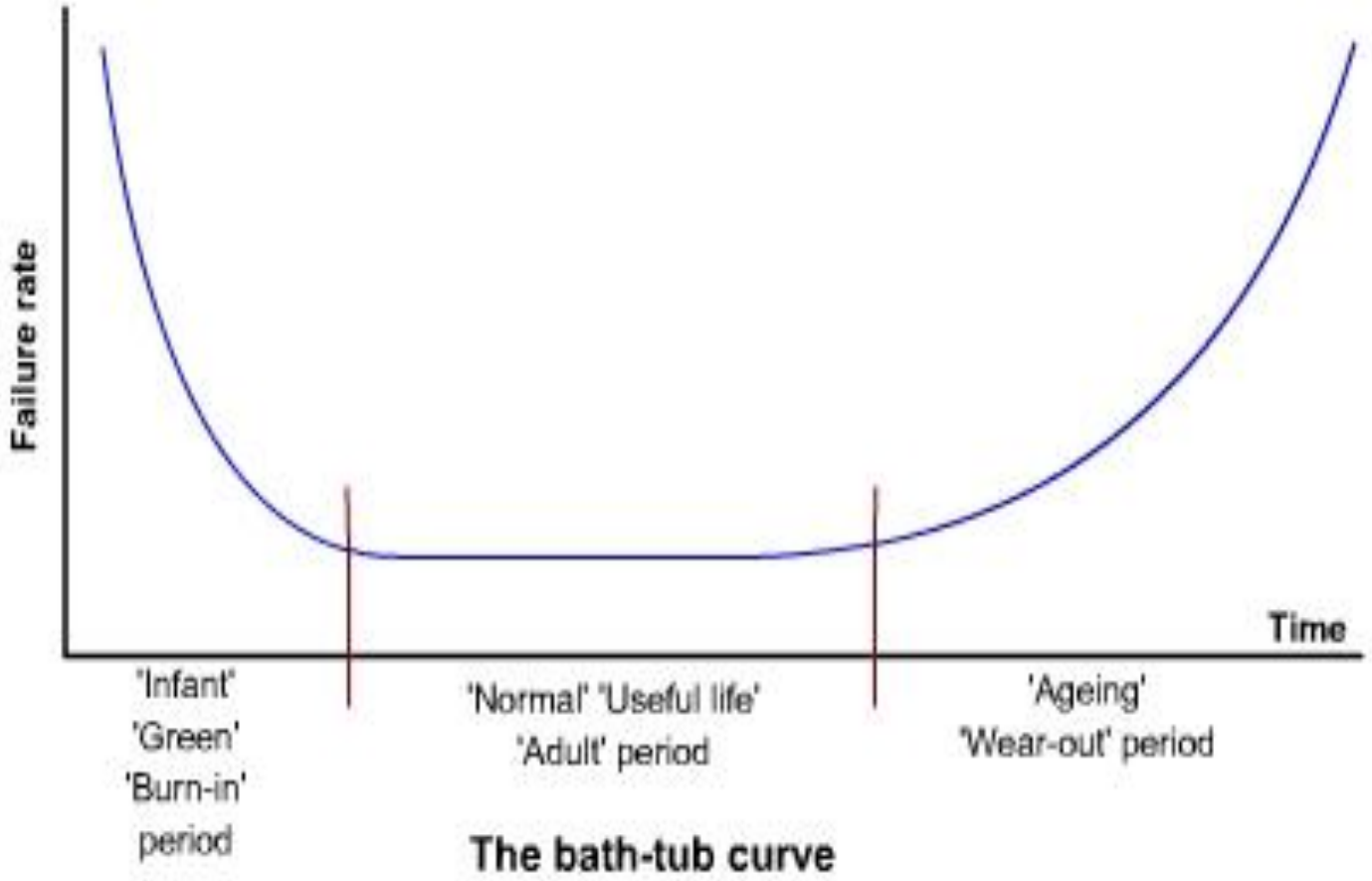
TE 4225

Bath Tub Curve

(Failure Pattern)

Bath Tub Curve

Graph Important



The bath-tub curve

Bath Tub Curve

- Infant / Green / Debugging / Burn-in-period: Many components fail very soon after they are put into service. Failures within this period are caused by defects and poor design that cause an item to be legitimately bad. These are called infant mortality failures and the failure rate in this period is relatively high. Good system vendors will perform an operation called "burn in" where they put together and test a system for several days to try to weed out these types of problems so the customer doesn't see them.

Bath Tub Curve

- Chance failure / Normal Operating Life: If a component does not fail within its infancy, it will generally tend to remain trouble-free over its operating lifetime. The failure rate during this period is typically quite low. This phase, in which the failure rate is constant, typically represents the useful life of the product.

Bath Tub Curve

- Wear out / Ageing: After a component reaches a certain age, it enters the period where it begins to wear out, and failures start to increase. The period where failures start to increase is called the wear out phase of component life.

Problem (Previous)

Assume we have an automobile that is operating in its mature phase and has the following failure history:

- Time to failure (hours): 100-800-1280-2600
- The MTBF is given by: [100+800+1280+2600] / 4 = 1195 hours/failure
- This gives a constant failure rate of, $\lambda = 1 / 1195 = 0.000836$ failures/hour.

a) What reliability can be expected from the automobile after 40, 200, 1000, and 5000 hours?

Solution:

Using expression $R(t) = 1 - F(t) = 1 - \int_0^t e^{-\lambda t} dt = e^{-\lambda t}$

$$R(40) = e^{-0.000836 \times 40} = 0.97 = 97\%$$

t-hours	40	200	1000	5000
Reliability	97%	84.6%	43.4%	1.5%

b) Assume a minimum reliability of 0.9 can be accepted from the automobile, at what point would a service be required?

$$t = \frac{\ln R(t)}{-\lambda}$$

$$t = \frac{\ln(0.90)}{-0.000836} = 126 \text{ hours}$$

Thus, the automobile needs servicing every 126 hours to keep a minimum reliability of 0.9