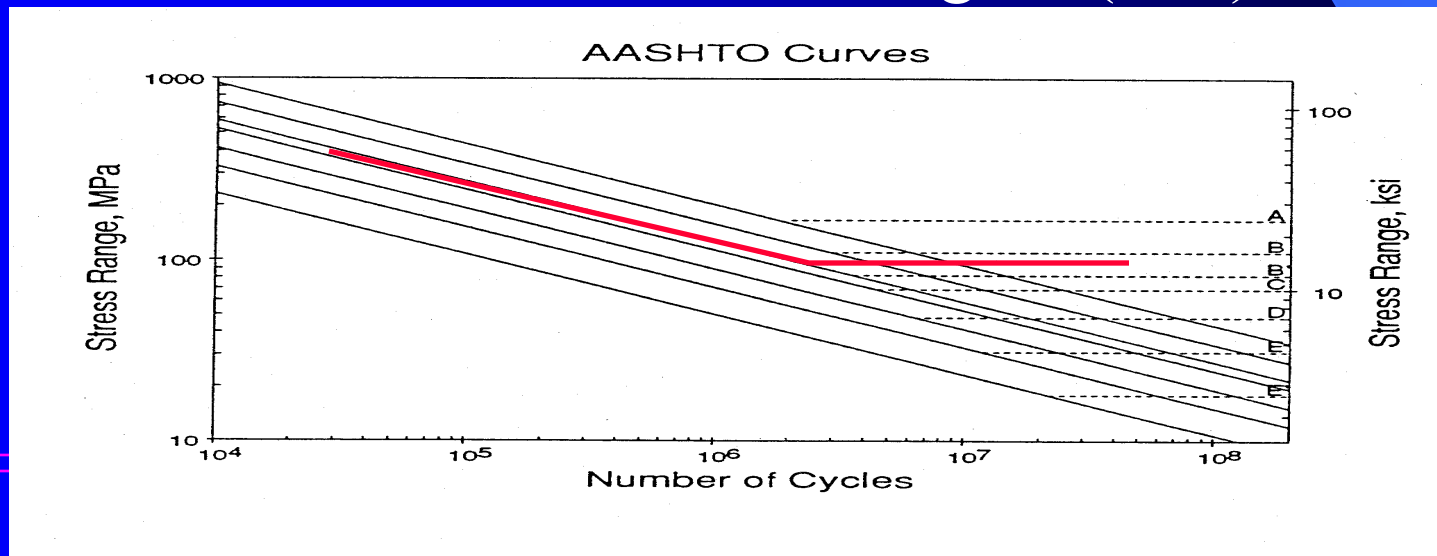


AASHTO LRFD - Fatigue Design

Two Categories

- **Infinite Life** - Maximum applied stress range = (2x Effective stress Range) < Constant-amplitude fatigue threshold = $(\Delta F)_n$
- **Finite Life** - Effective stress range < $(A/N)^{1/3}$



AASHTO LRFD 4th Ed. 2007

Fatigue Design

Design Criteria

$$\gamma(\Delta f) \leq (\Delta F)_n$$

γ = load factor (0.75) – (Means HS15)

(Δf) = live load stress range

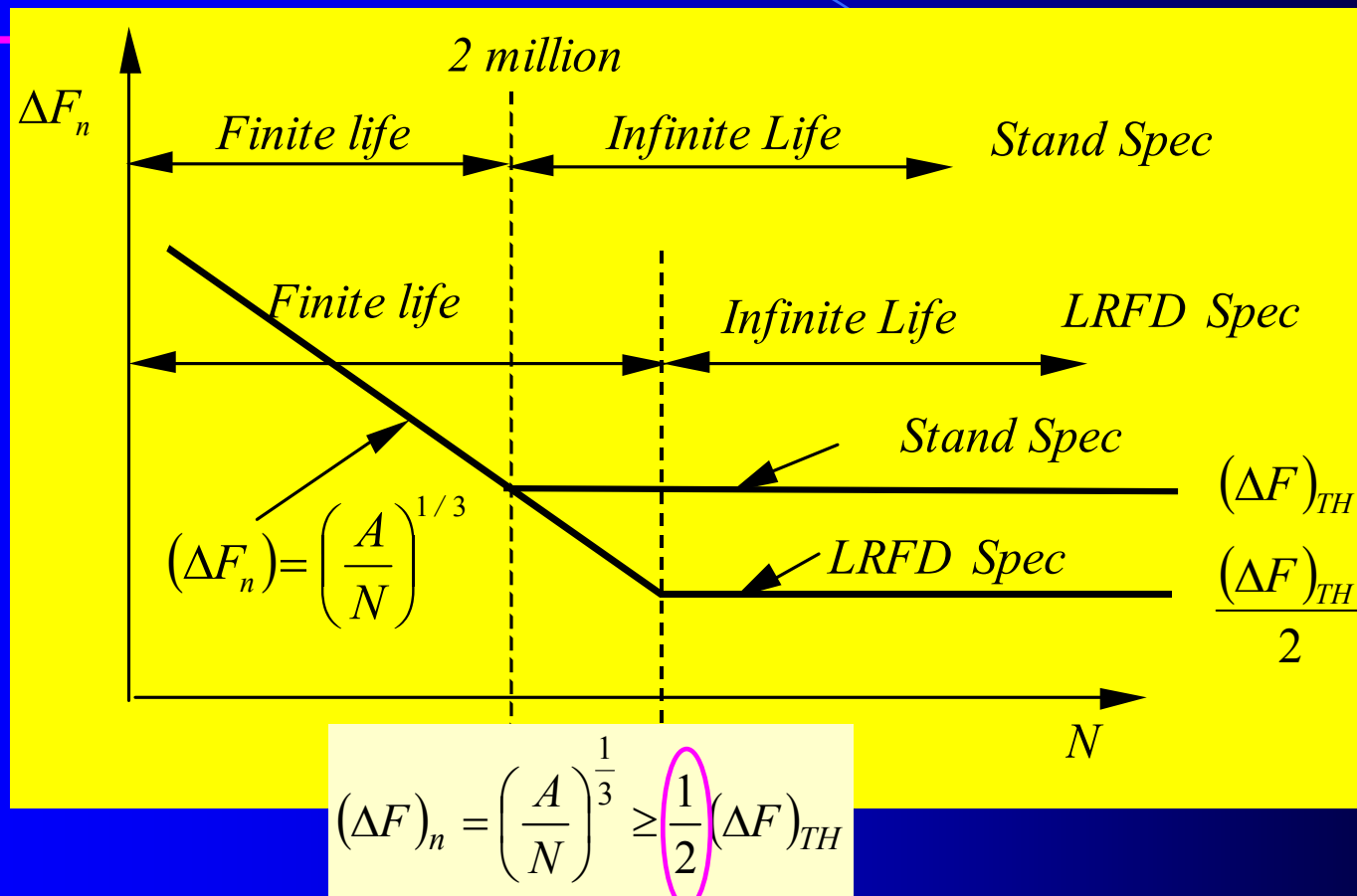
$(\Delta F)_n$ = nominal fatigue resistance

$$(\Delta F)_n = \left(\frac{A}{N} \right)^{\frac{1}{3}} \geq \frac{1}{2} (\Delta F)_{TH}$$

in which

$$N = (365)(75)_n (ADTT)_{SL}$$

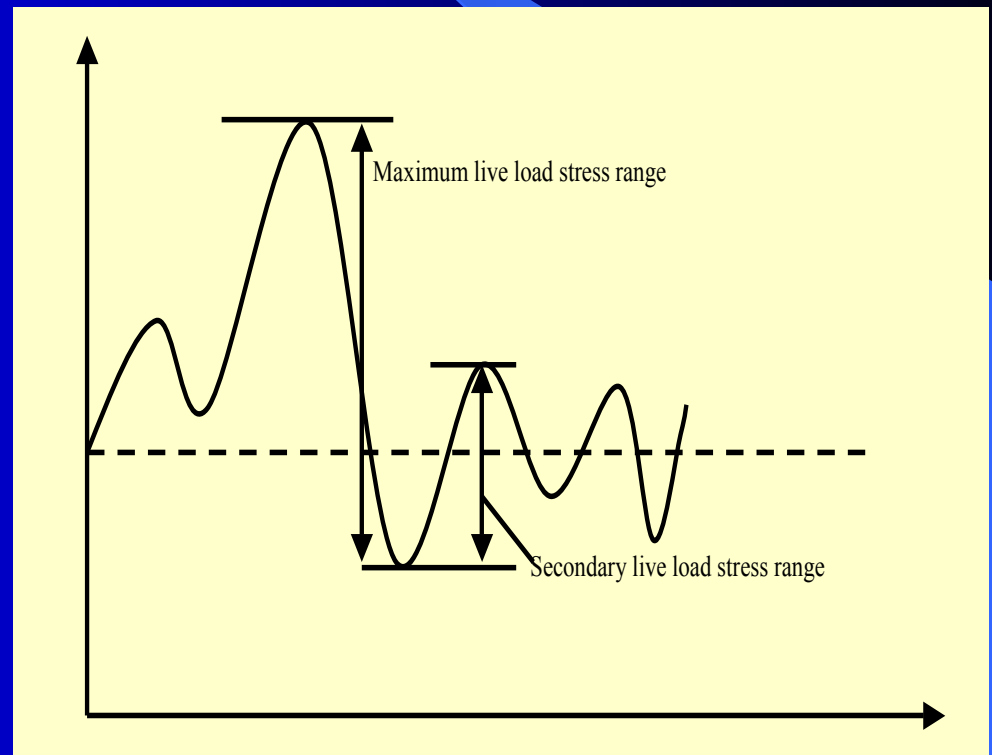
AASHTO LRFD Vs. Standard



Fatigue Resistance vs. Number of Cycles

Stress Cycles per Truck Passage

- **ASTM E-1049 - Rainflow Method**
- **Standard Practices for Cycle Counting in Fatigue Analysis**



Stress Cycle - P9 Fatigue Truck Simple Span

- **Span length 20-40 ft.**
Cycles varies between **1.00 and 2.59**
- **Span length larger than 40 ft. cycles varies from 1.0**
- **Recommend**
Span > 40 ft. – Use 1.0
Span < 40 ft. – Use 2.0

Span Length (ft)	Cycles
20	2.59
40	1.0
80	1.0
160	1.0
200	1.0
280	1.0

Stress Cycles -P9 Fatigue Truck Continuous Span at Support

- Span length 20-40 ft.
Cycles varies between
1.00 and 1.96
- Span length larger than
40 ft. cycles varies from
1.0 – 1.21
- Recommend
Span > 40 ft. – Use 1.2
Span < 40 ft. – Use 2.0

Span Length (ft)	Cycles
20	1.96
40	1.0
80	1.0
160	1.04
200	1.10
240	1.16
280	1.21

Stress Cycles per Truck Passage

Cycles Per HS20 Fatigue Truck Passage

	Span Length (ft)	
	>40	<=40
Simple Span	1.00	2.00
Continuous Spans		
Near Support	1.50	2.00
Elsewhere	1.00	2.00
Cantilever	5.00	5.00
Trusses	1.00	1.00
Transverse Members	1.00	2.00

Cycles Per Fatigue Permit Truck Passage

	Span Length (ft)	
	>40	<=40
Simple Span	1.00	2.00
Continuous Spans		
Near Support	1.20	2.00
Elsewhere	1.00	2.00
Cantilever	5.00	5.00
Trusses	1.00	1.00
Transverse Members	1.00	2.00