







# **XI ALACPA Seminar on Airfield Pavements**

## **IV Short Course on Airfield Pavement Maintenance**

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**Coordinator/Instructor**

**Santiago, Chile, 02 September 2014**



# **IV Short Course on Airfield Pavement Maintenance**

## **Course Outline**

**Introduction & Importance of the Subject**

**Scope of Airfield Pavement Maintenance**

**Strong & Weak Links in Pavement Maintenance**

**The (4\*W + 3\*O) Equation & Pavt. Performance**

**Pavement Types & Drainage/Wildlife Hazards**

**Types of Distresses (Flexible & Rigid Pavement)**

**Materials & Equipment for Pavt. Maintenance**

**“Don’t “Do(s)” & “Do(s)” in Pavt. Maintenance**

**Summary**





# **XI ALACPA Seminar on Airfield Pavements**

## **IV Short Course on Airfield Pavement Maintenance**

# **Part 01**

**Santiago, Chile, 02 September 2014**



# IV Short Course on Airfield Pavement Maintenance

## Introduction & Importance of the Subject

**Commercial Aviation in the USA**



**Injects 3.3 trillion US\$/year in the economy**



# **IV Short Course on Airfield Pavement Maintenance**

## **Introduction & Importance of the Subject**

**USA**

**35,000 to 40,000 flights/day**

**20.000 airports administrated by the FAA  
with annual budget around US\$16 billion**



# IV Short Course on Airfield Pavement Maintenance

## Introduction & Importance of the Subject

**Worldwide**

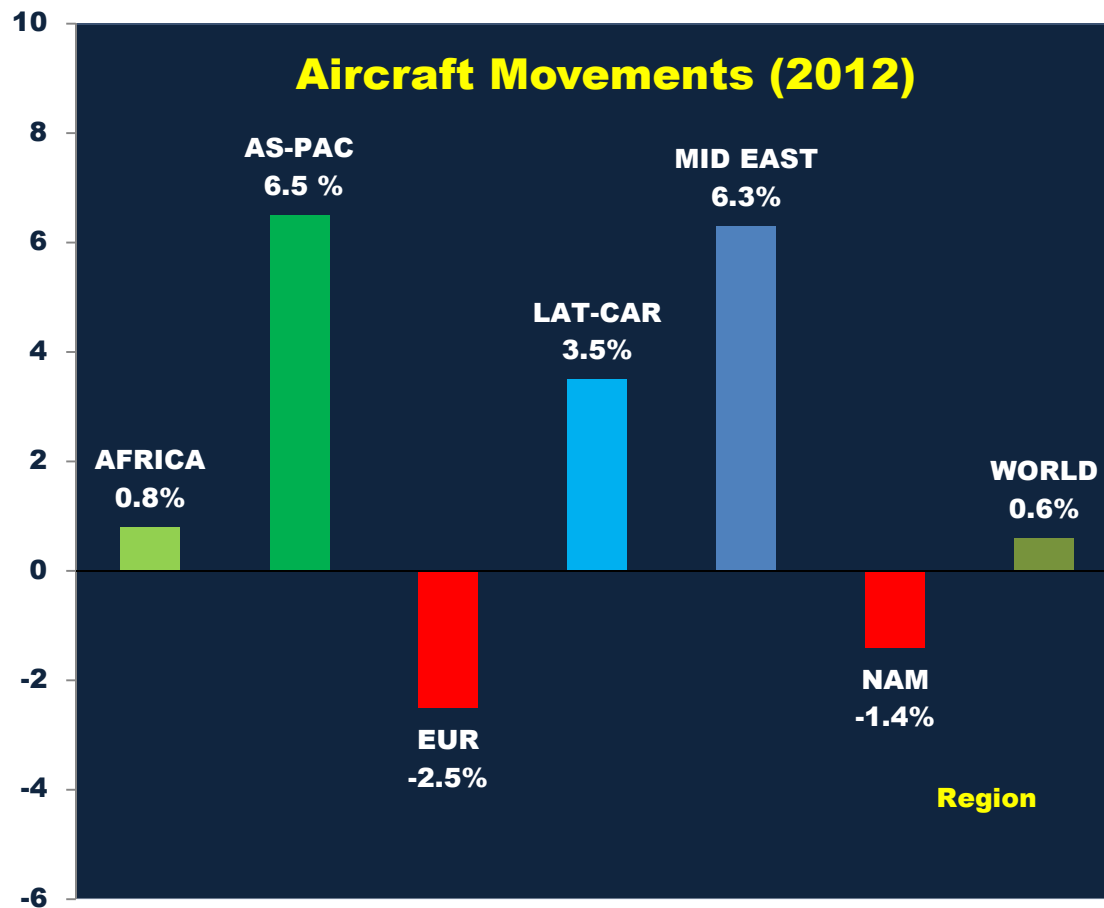
**300,000 flights/day**

**(Commercial, Charter & Cargo)**

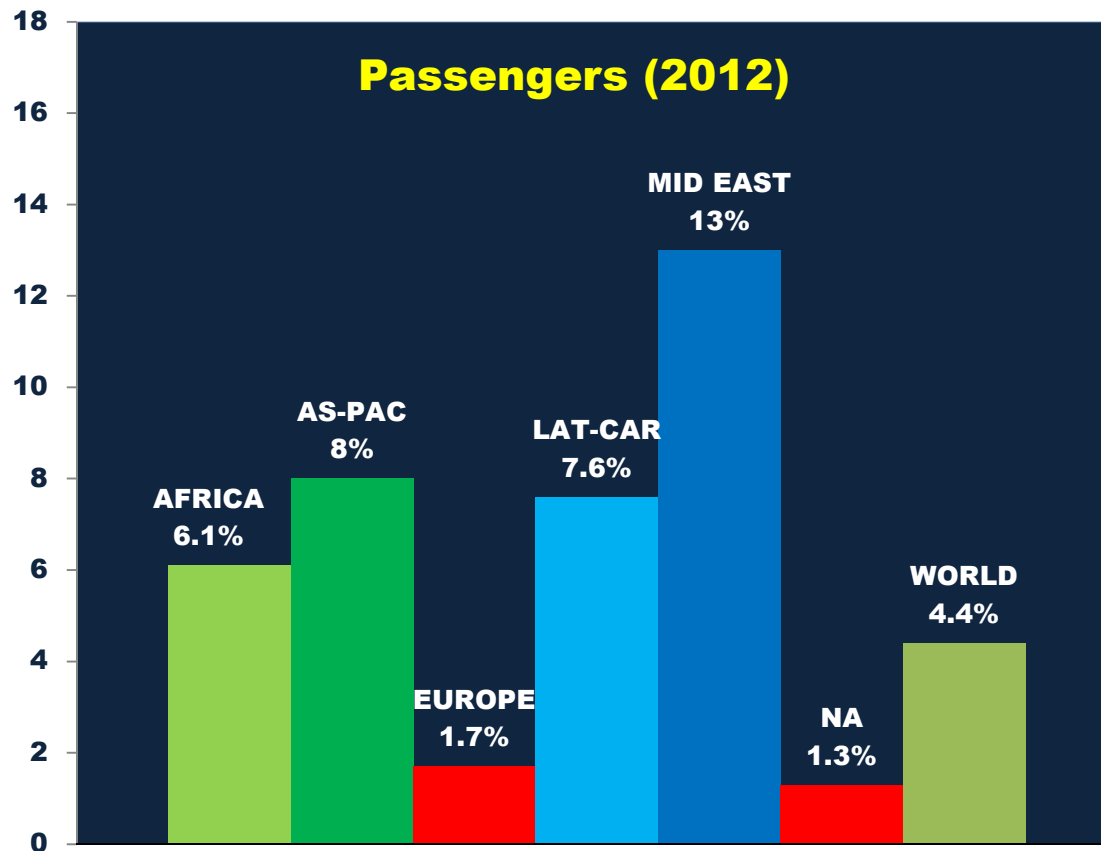
**5.7 billion passengers/2012 (↗ 4.4 %)**



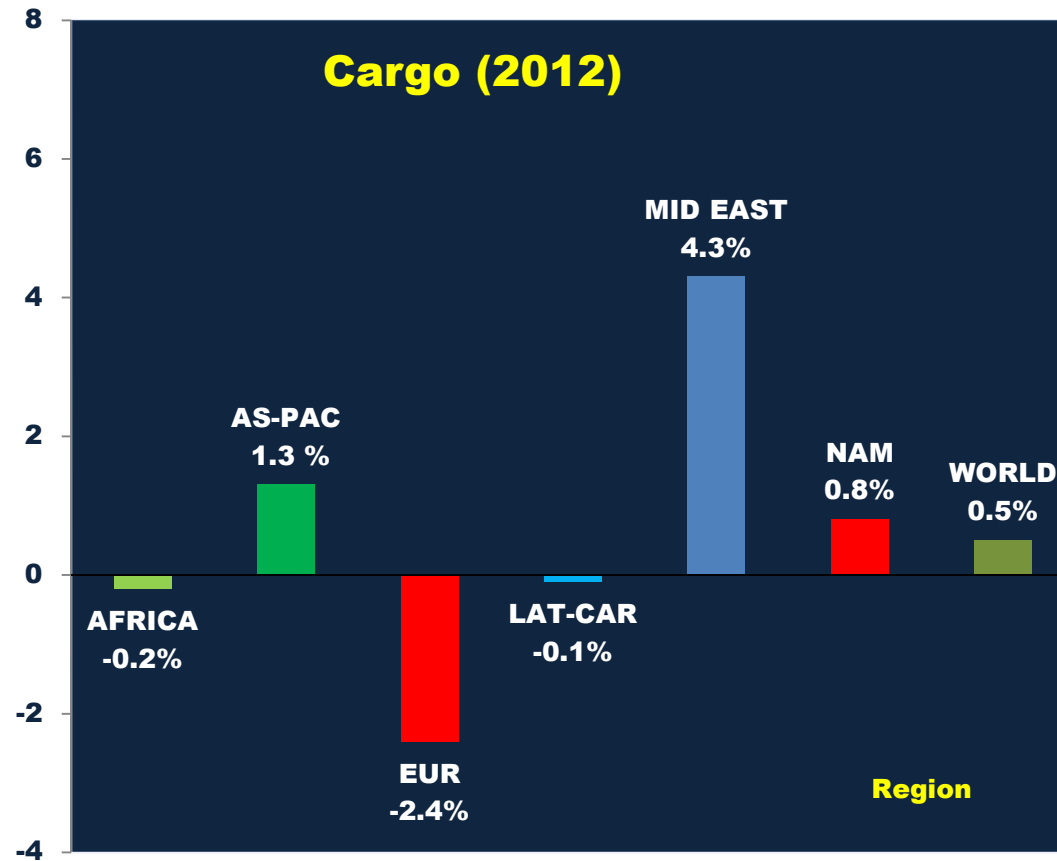
# IV Short Course on Airfield Pavement Maintenance



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# IV Short Course on Airfield Pavement Maintenance

## Introduction & Importance of the Subject

**Gatwick Airport (2013)**

**35,444,206 passengers/year**

**250,520 aircraft movements/year**

**World's busiest single-use runway**

**55 aircraft movements/hour**



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## Introduction & Importance of the Subject

**Latin America and the Caribbean**

**Forecast for 2010 to 2020:**

**Population: 590 to 652 million**

**Internal Revenue Growth: 4.2 %/year**

**Cargo: 5.7 %/year**



## **IV Short Course on Airfield Pavement Maintenance**

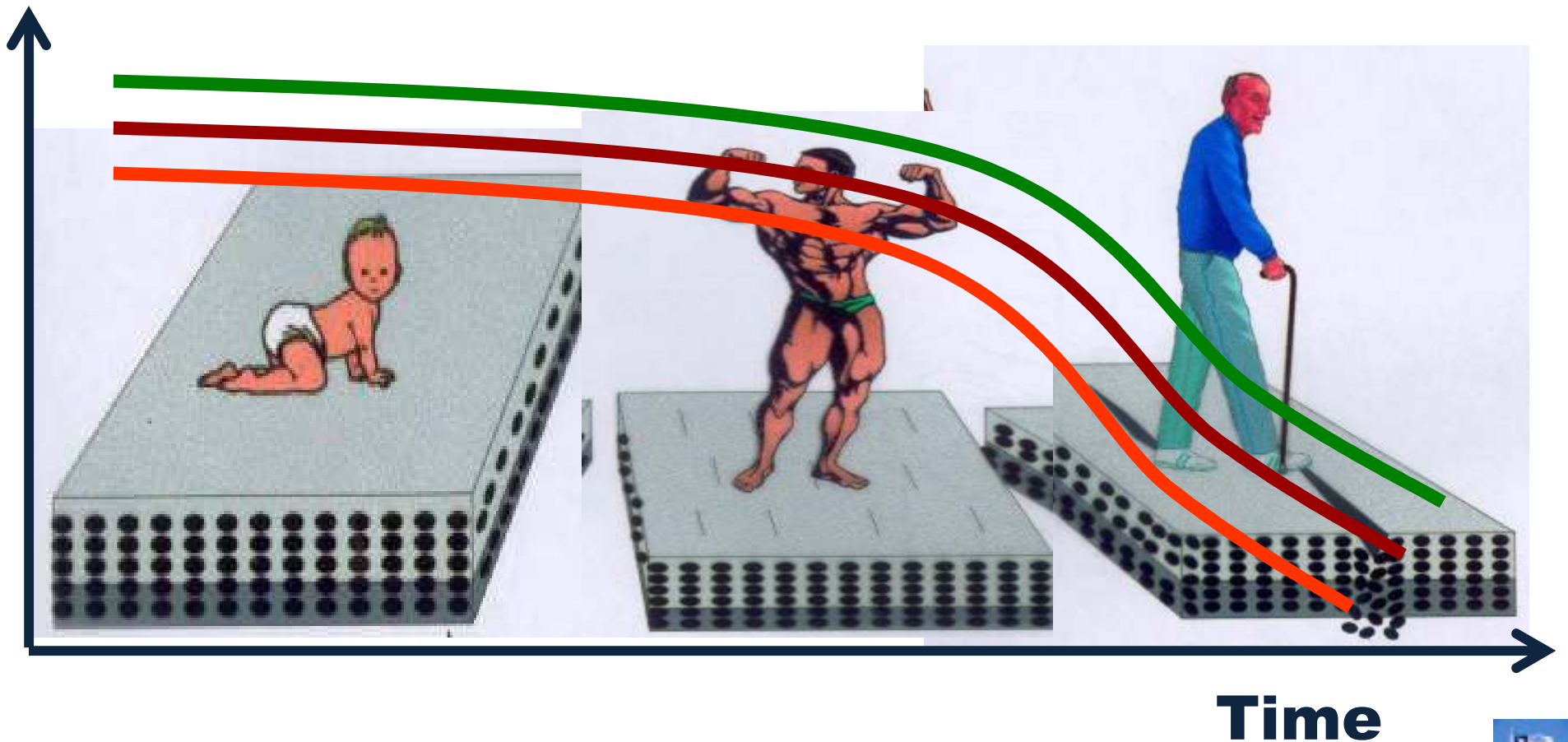
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# **Scope of Airfield Pavement Maintenance**

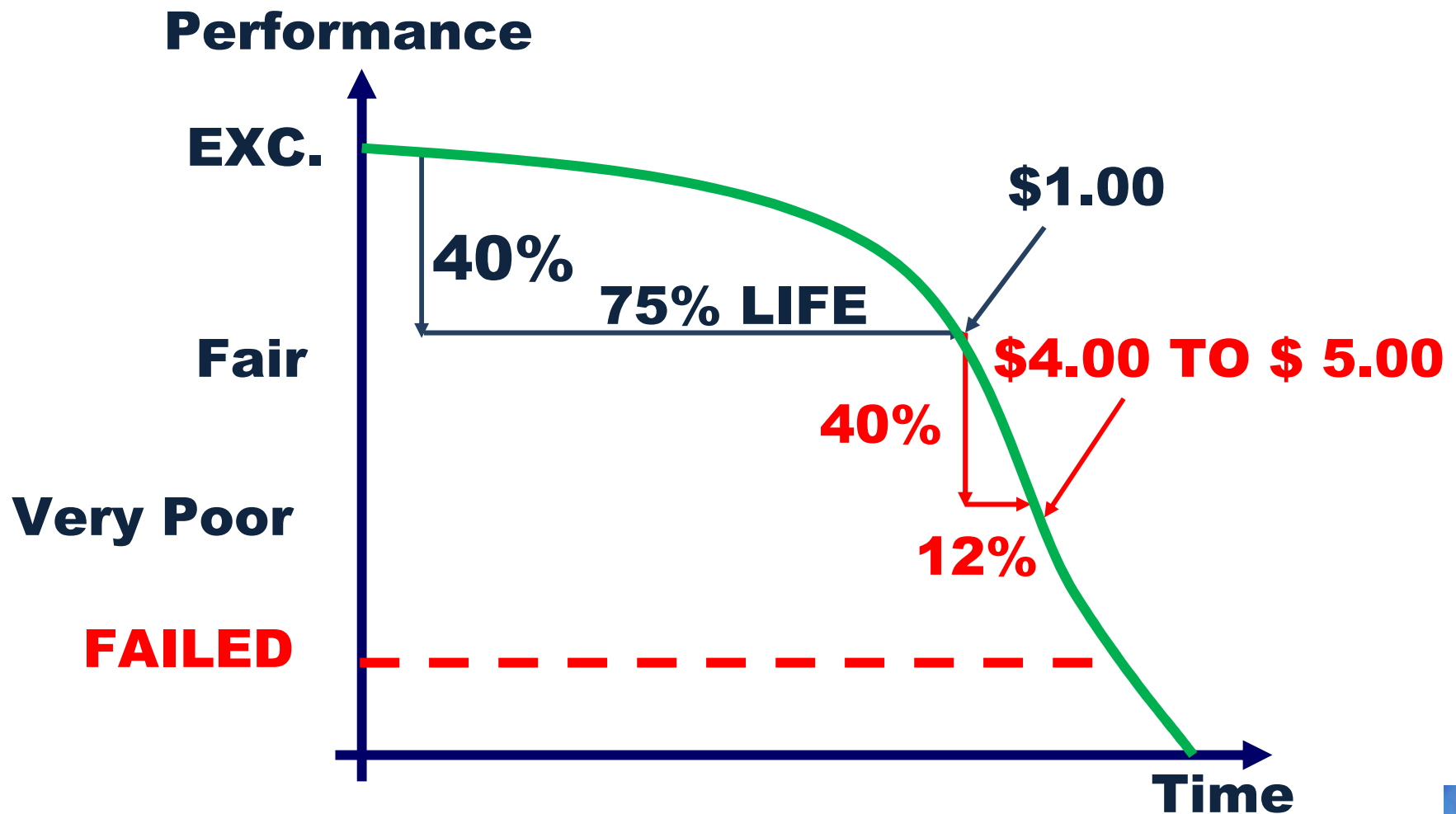


## The Normal Cycle of Life

“Quality”

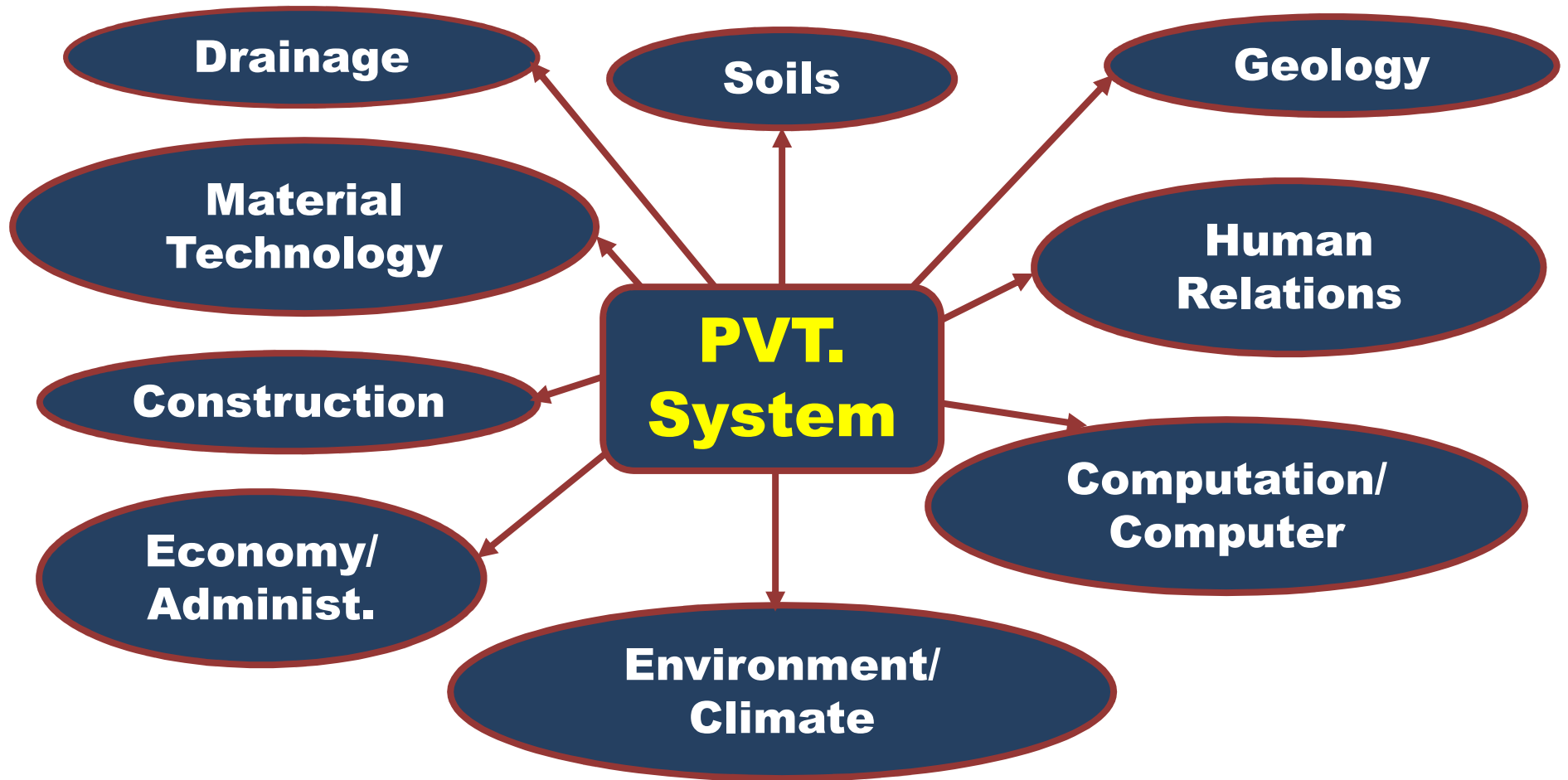


## The Normal Cycle of Life



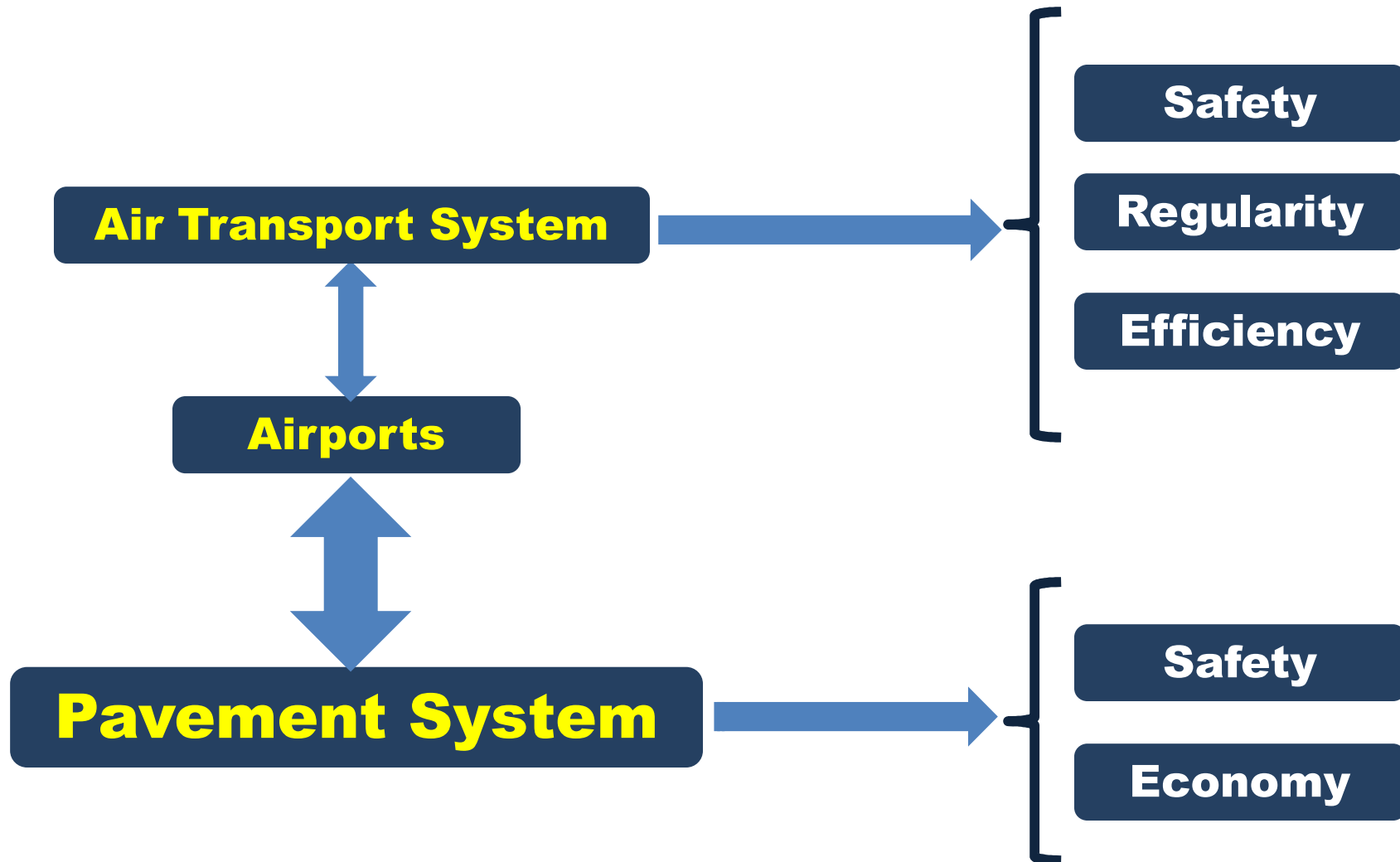
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# Pavement is a Complex System!!!



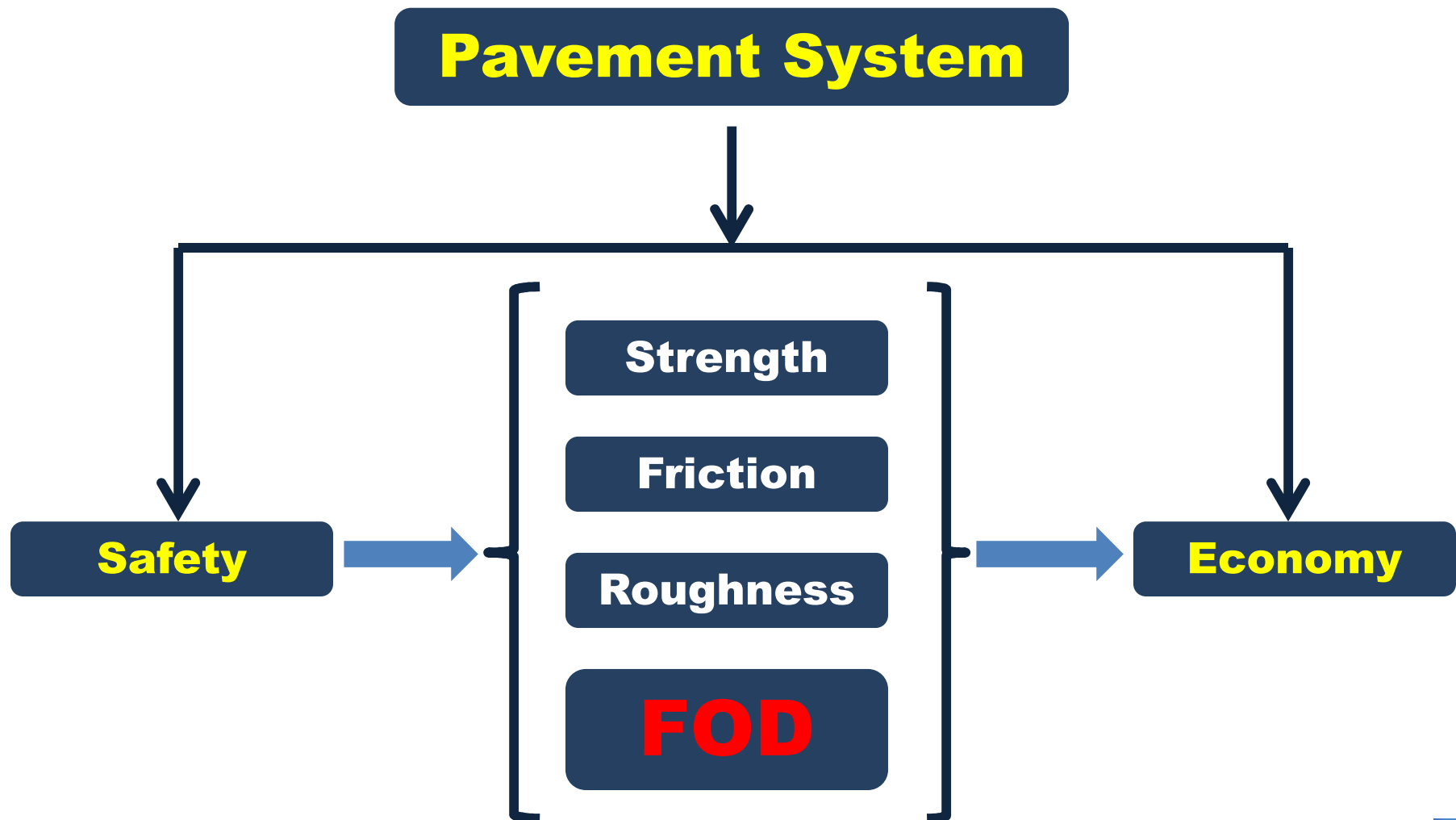
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## Pavement is Part of the Air Transport System



# IV Short Course on Airfield Pavement Maintenance

## Pavement is Part of the Air Transport System

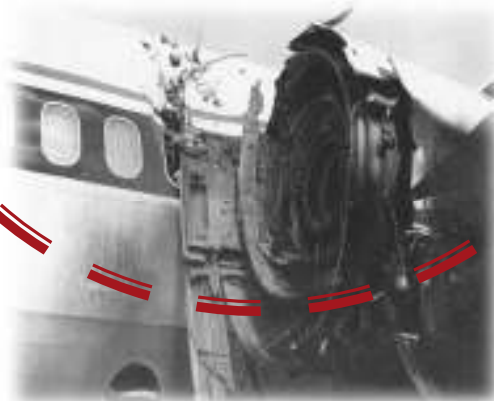


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## Pavement is Part of the Air Transport System



**FOD**



## IV Short Course on Airfield Pavement Maintenance

### Pavement is Part of the Air Transport System



## **IV Short Course on Airfield Pavement Maintenance**

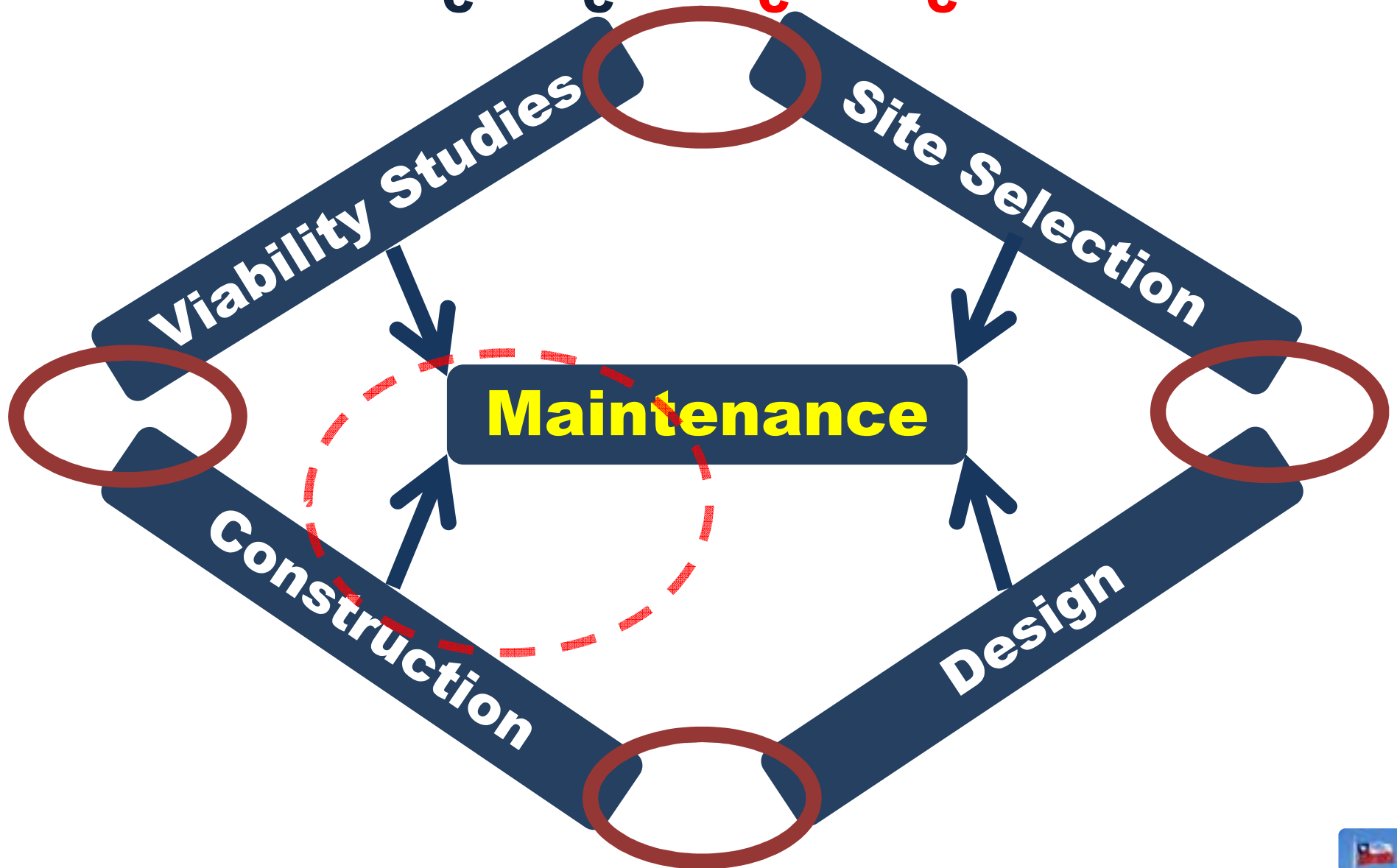
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# **Strong and Weak Links for Airfield Pavement Maintenance**



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$$T_c = I_c + M_c + U_c$$



## IV Short Course on Airfield Pavement Maintenance

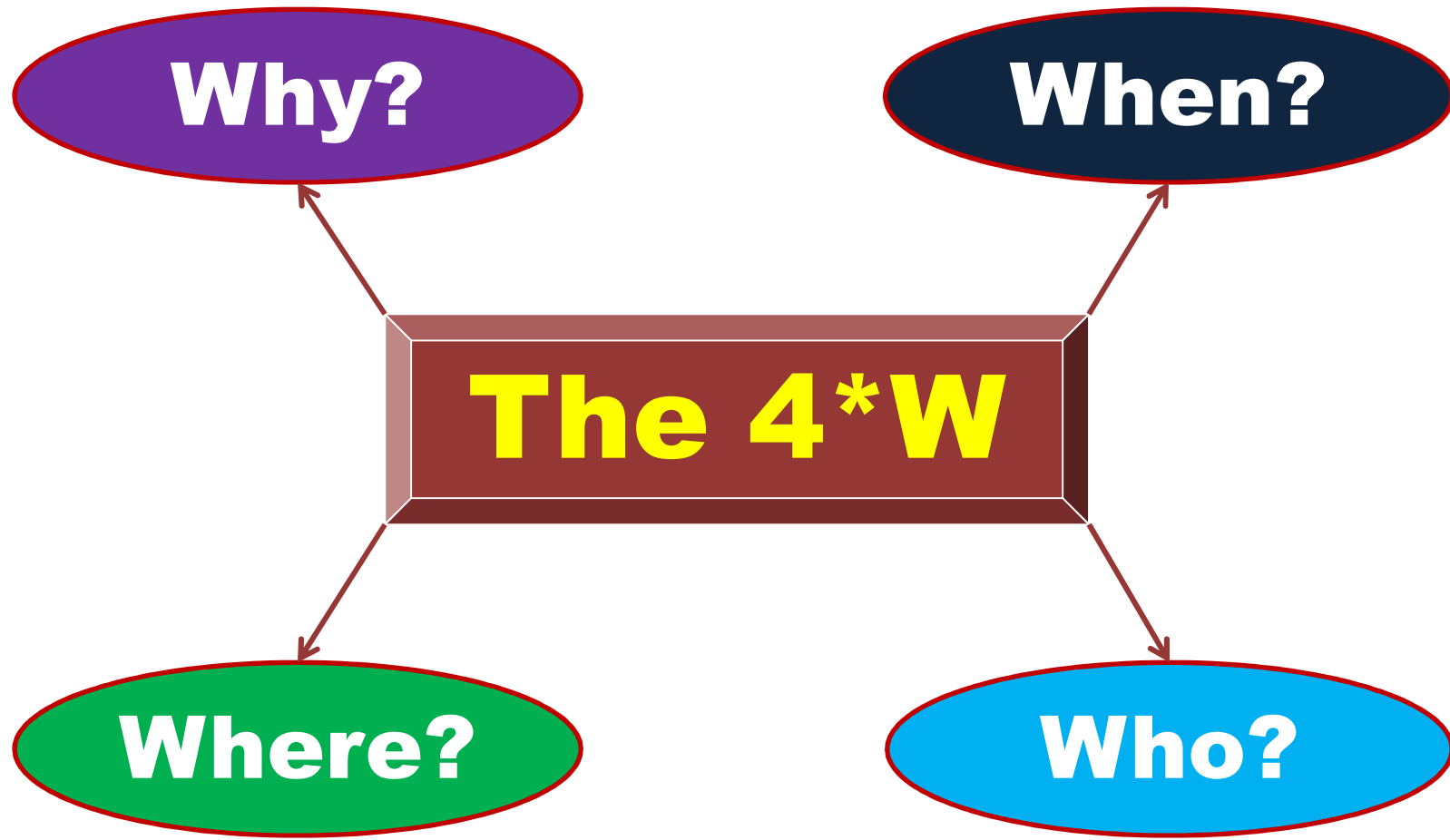
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# The $(4*W + 3*O)$ Equation & Pavement Performance



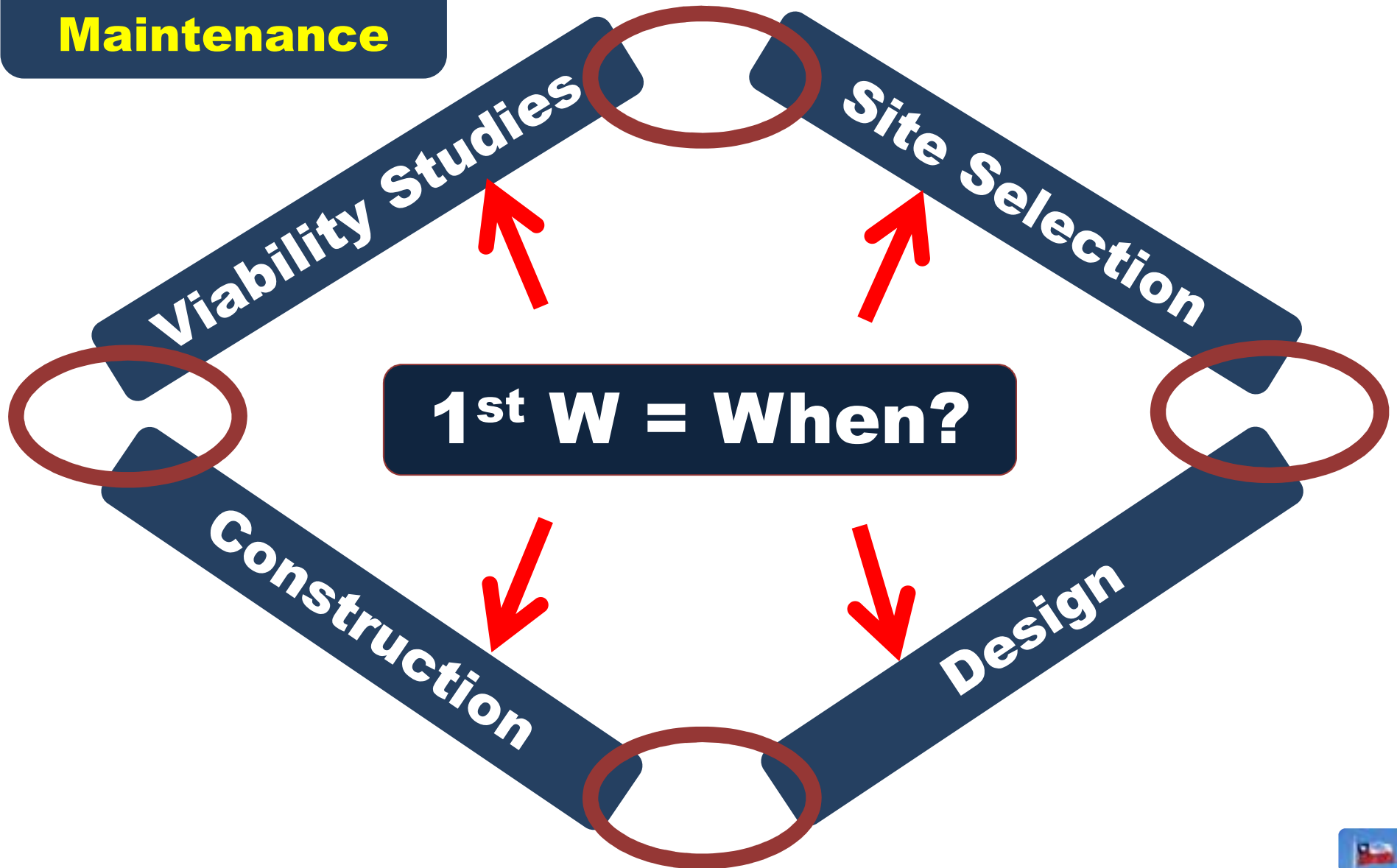
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## Pavement Maintenance



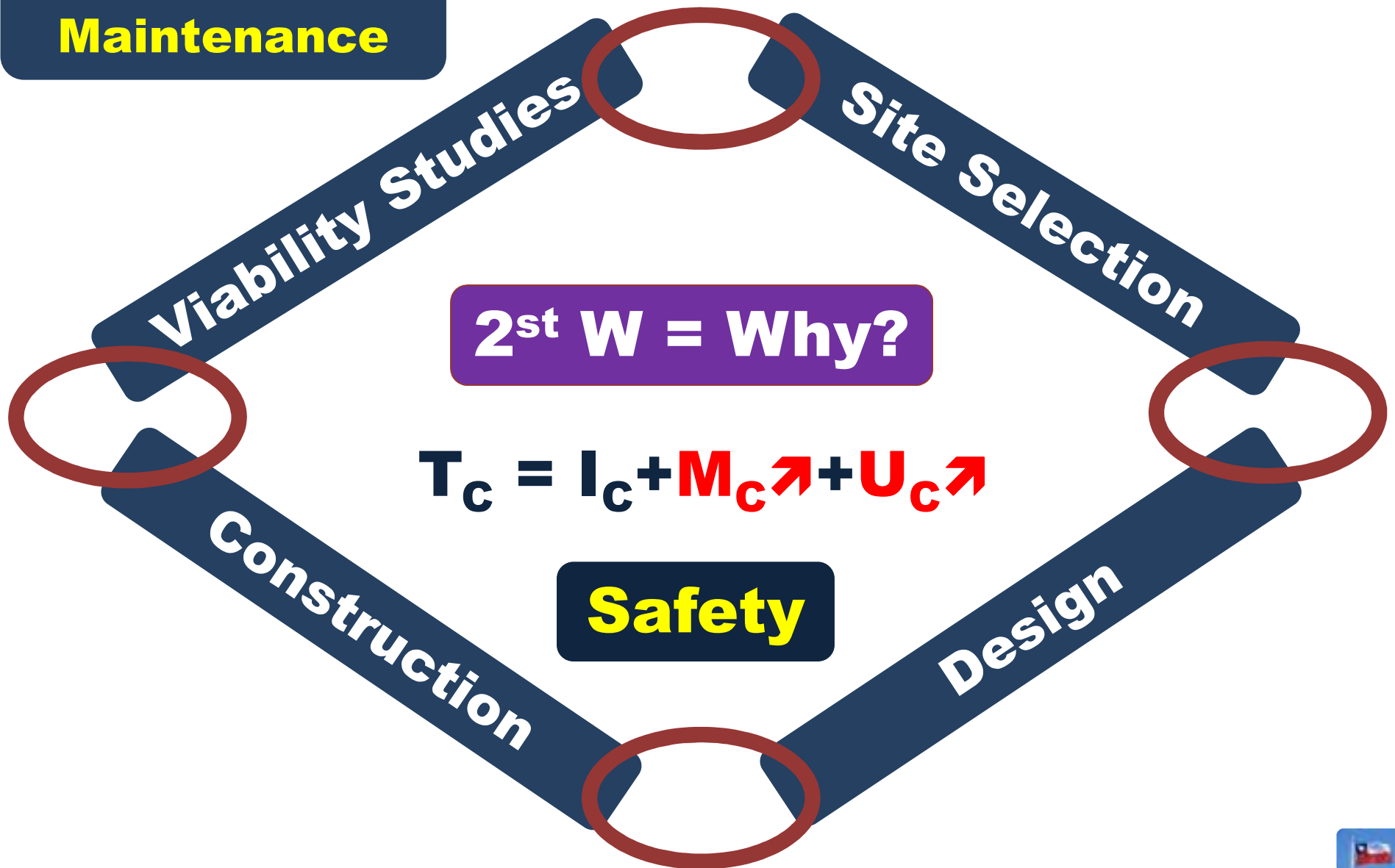
# IV Short Course on Airfield Pavement Maintenance

## Pavement Maintenance



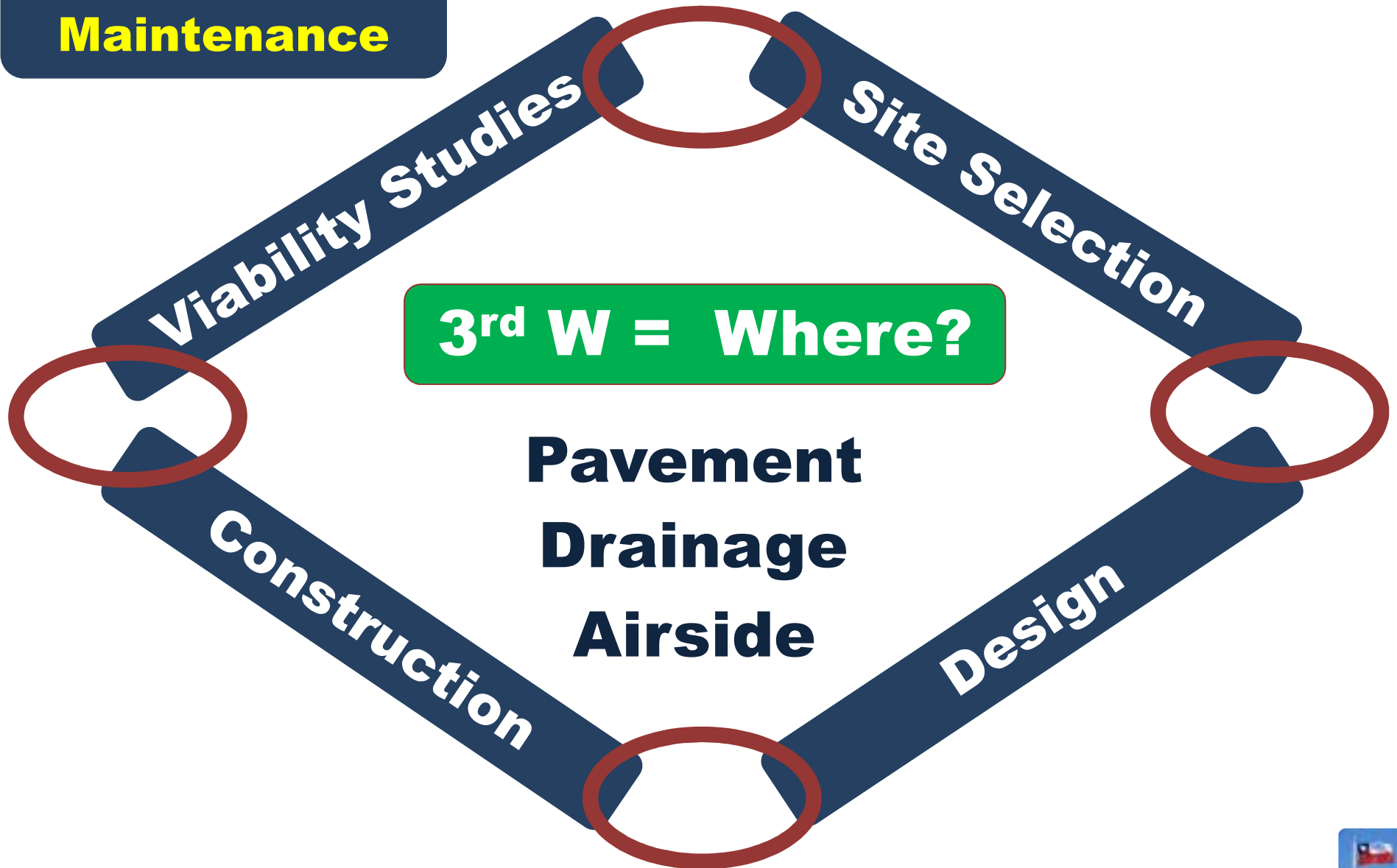
# IV Short Course on Airfield Pavement Maintenance

## Pavement Maintenance



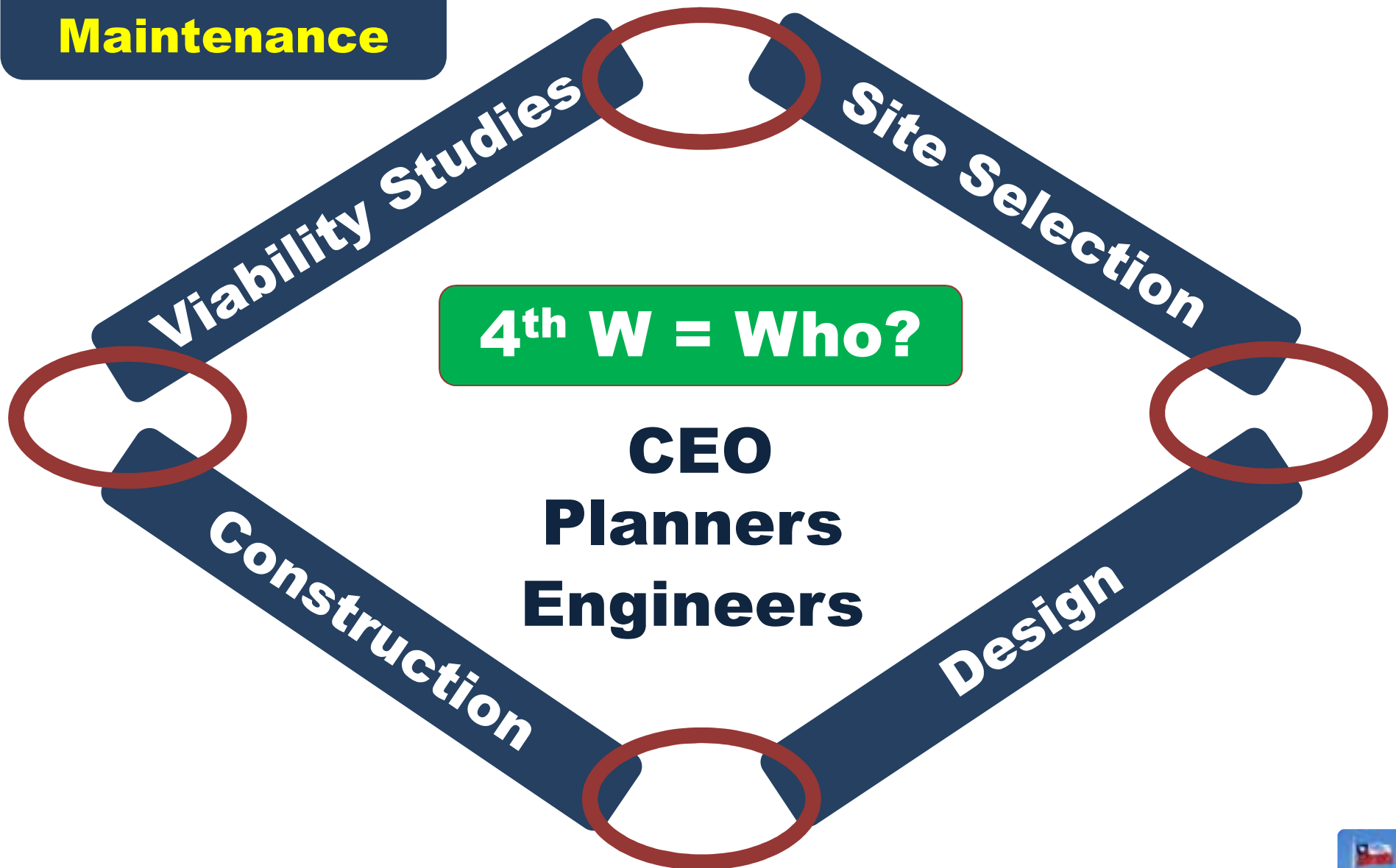
# IV Short Course on Airfield Pavement Maintenance

## Pavement Maintenance



# IV Short Course on Airfield Pavement Maintenance

## Pavement Maintenance



# IV Short Course on Airfield Pavement Maintenance

## The 3\*0

**Main Objectives for Designing and Constructing Airfield Pavements**

**1<sup>st</sup> “0” = Adequate load-carrying capacity**

**2<sup>nd</sup> “0” = Good ride quality ⇨ safe aircraft operation**

**3<sup>rd</sup> “0” = Good friction ⇨ all weather conditions**



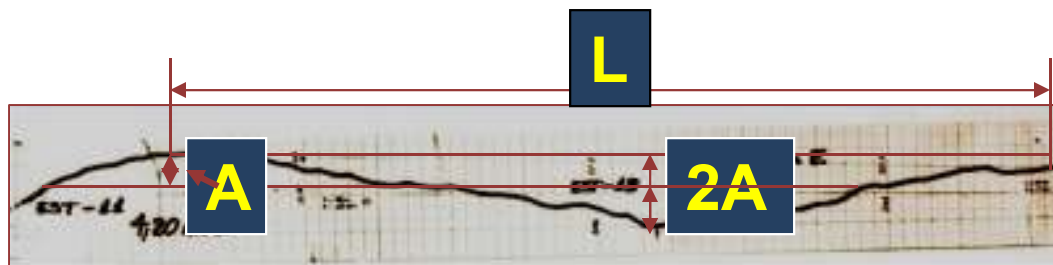
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## Understanding the First “O”



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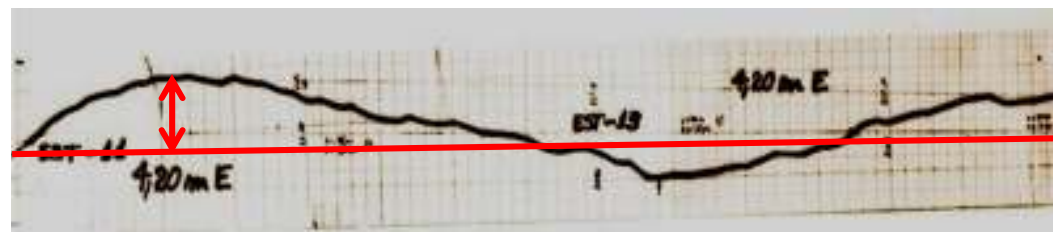
## Understanding the 2nd “O”



Before



After



[pip.rubberfeet.org](http://pip.rubberfeet.org)



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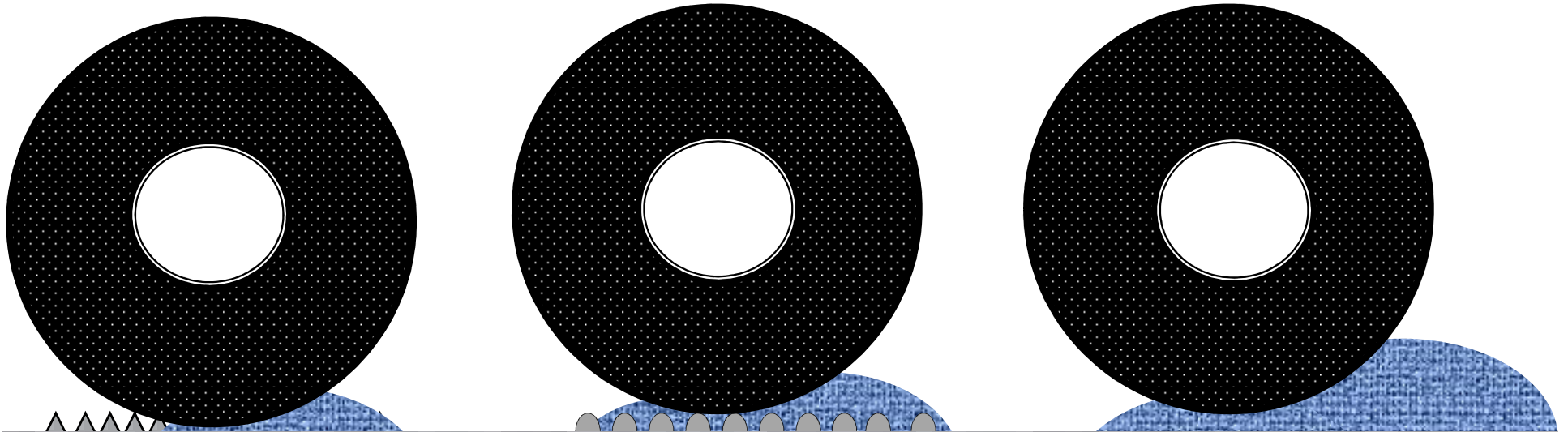
## Understanding the 3<sup>rd</sup> “O”



**Lack of Skid  
Resistance**



# Understanding the 3<sup>rd</sup> “O”

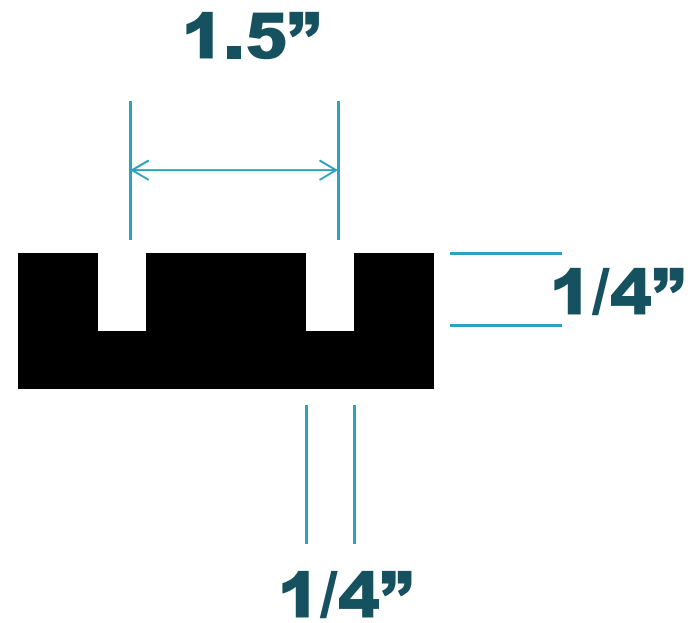


**Micro texture**

**Macro texture**

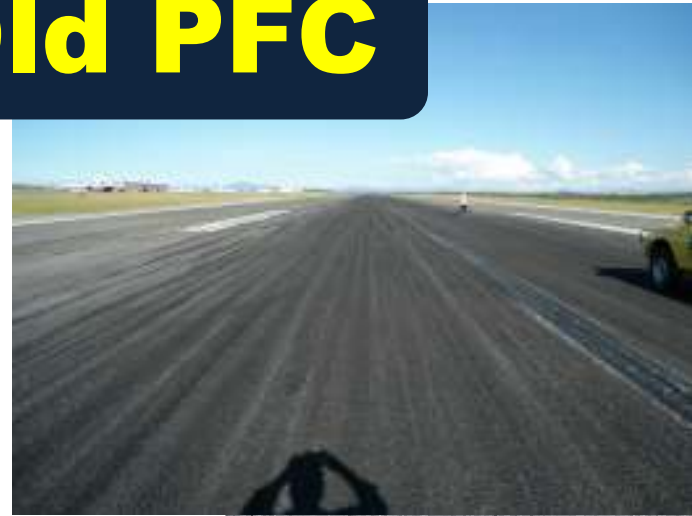


# Understanding the 3<sup>rd</sup> “0”

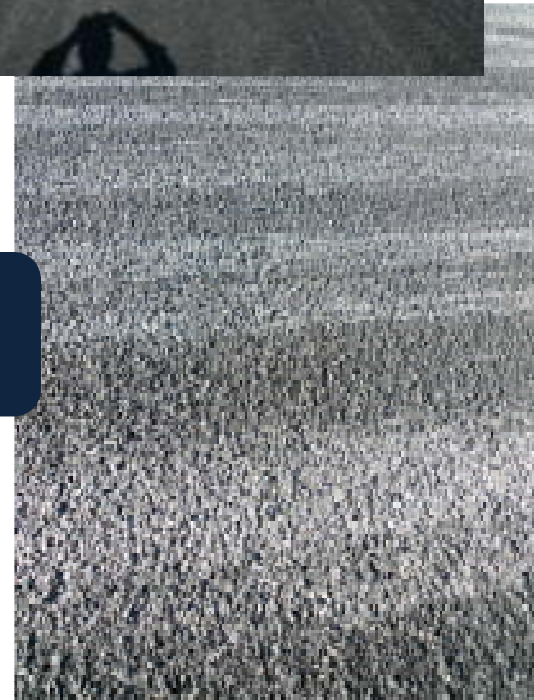


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**35-Year Old PFC**



**4\*W + 3\*O**



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## 34-Year Old SST



**B757**

**B727**

**B737**

**A320**

**A319**

**G5**



**4\*W + 3\*O**

**?**



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## Brand New Pavement



**4\*W + 3\*O**



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$4*W + 3*O$

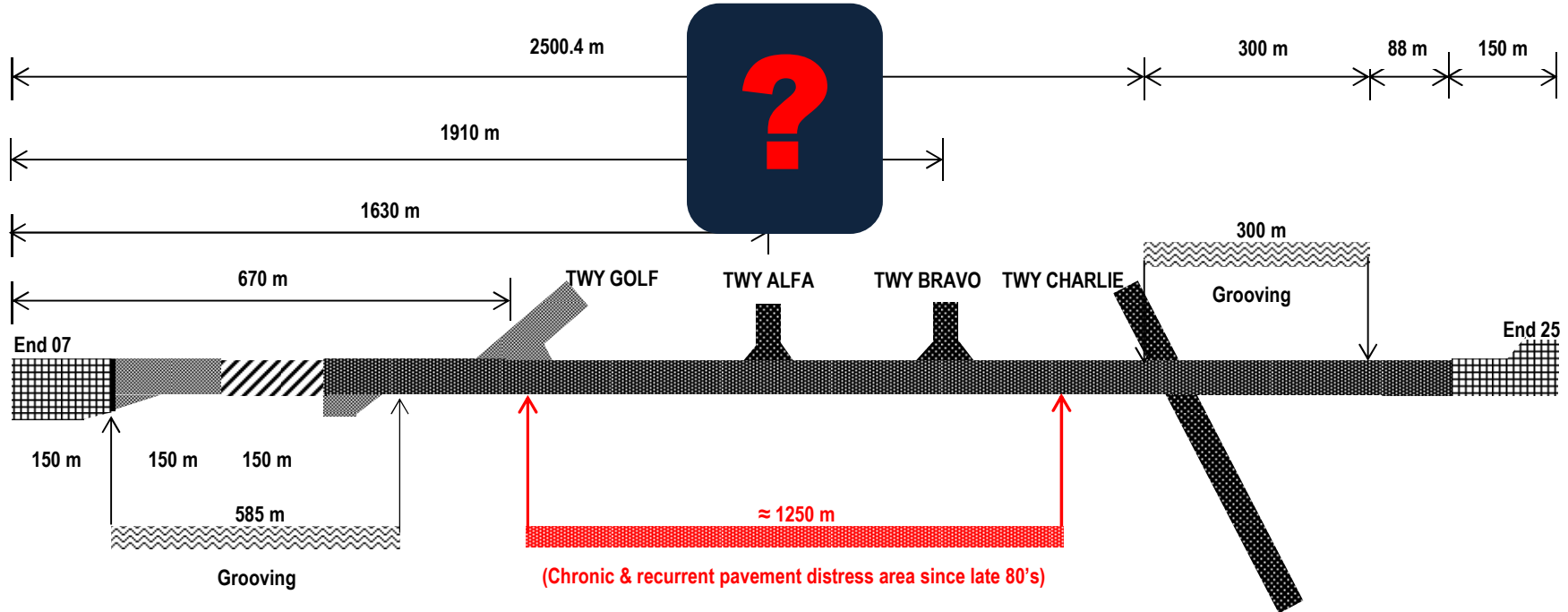
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# IV Short Course on Airfield Pavement Maintenance

**4\*W + 3\*O**

Not to scale



**“Asphalt Fragmented” (Underneath Layer)**



# IV Short Course on Airfield Pavement Maintenance



**4\*W + 3\*O**



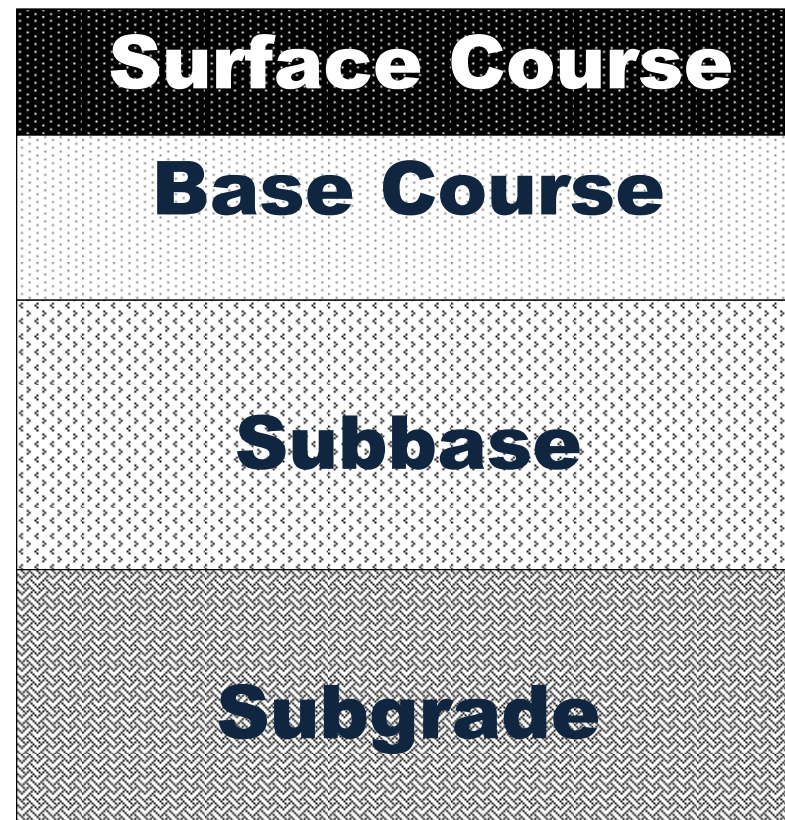
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# **Pavement Types; Drainage & Wildlife Hazards**

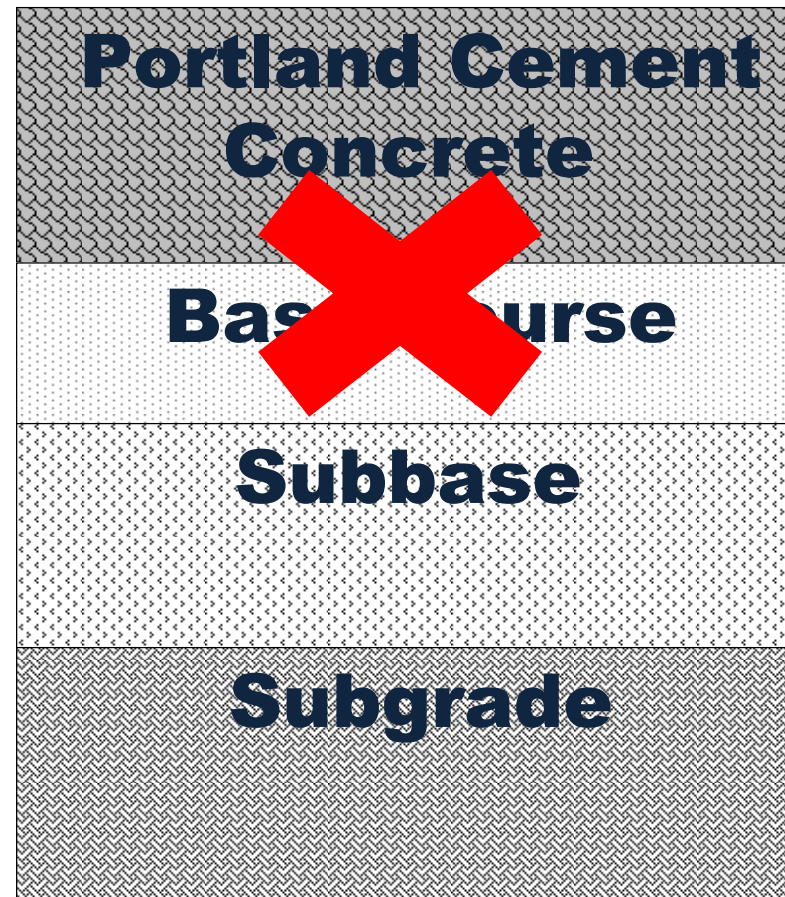


## Classical Flexible Pavement



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# Classical Rigid Pavement



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# **Drainage System**

## **Four Aspects to Focus On:**

**Surface Drainage (Surface Water Run-off)**

**Excess of Ground Water Removal**

**Lower Down Water Table**

**Control Slope Erosion**



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## Surface Drainage (Surface Water Run-Off)

### 4D for Pavement Design Success:

**Drainage**



**Drainage**

**4\*W + 3\*O**

**?**

**Drainage**



**Drainage**



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## Surface Drainage (Surface Water Run-Off)



**Transverse Slope**



**Longitudinal Slope**



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## Surface Drainage (Surface Water Run-Off)



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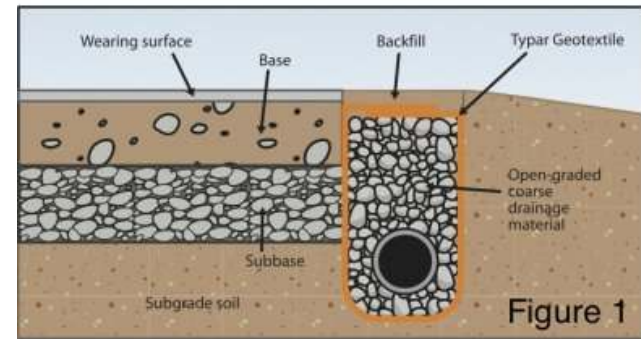
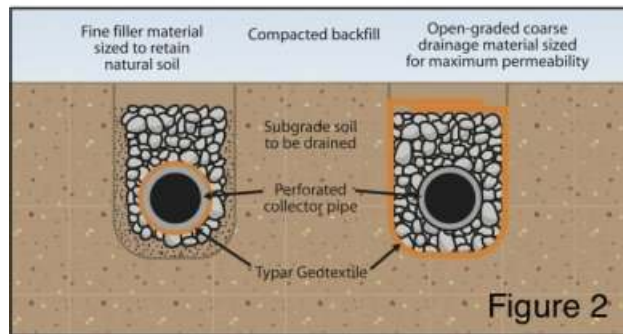
## Surface Drainage (Surface Water Run-Off)



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## Sub-Surface Drainage

### 4D for Pavement Design Success:

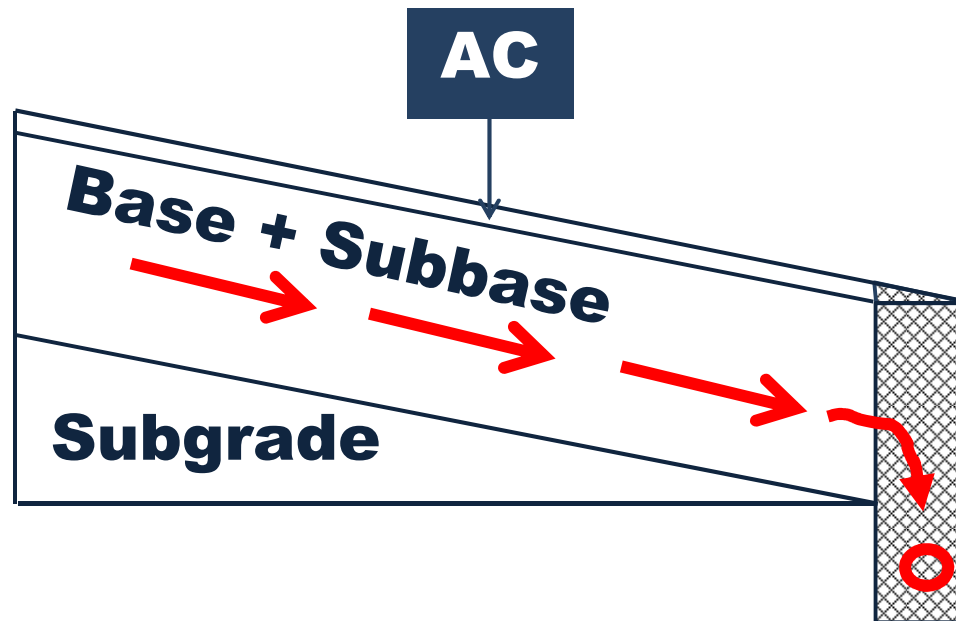


**Drainage, drainage, drainage, drainage**



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## Sub-Surface Drainage



# IV Short Course on Airfield Pavement Maintenance

## Sub-Surface Drainage



# IV Short Course on Airfield Pavement Maintenance



## Sub-Surface Drainage



## Wildlife Hazards



## IV Short Course on Airfield Pavement Maintenance

# Wildlife Hazards



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## Wildlife Hazards



## IV Short Course on Airfield Pavement Maintenance

# Control Slope Erosion

