

TCM February 2009

Performance Specifications



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Performance Specifications

The Journey – The Future

History Journey

Performance Specifications

Focus on Roles and
Responsibilities



Performance Specifications

The Journey – The Future

- Specifications that describe how the finished product should perform over time [TRB ec074]
- ...states requirements in terms of the required results with criteria for verifying compliance, but without stating the methods for achieving the required results. [Dept. of Defense].

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20's and 30's – Warranties

- First quality system was ... a Warranty program
- Many proprietary, patented products
- No specification books
- No established test procedures

PRODUCT FOCUS

DID THE PRODUCT MEET PERFORMANCE REQUIREMENTS?

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"What principally determines the nature of Pavements? Though there be many requisites of a good pavement, yet the more essential of these are determined by the unchangeable nature of the horse and the shape of his foot, together with the indispensable circular form of the wagon wheel; and the fact, that both foot and wheel are unavoidably shod and bound with iron. Hence, any pavement, whatever be the mode of its construction and nature of its materials, to be philosophically adapted, must supply, at least, the following indispensable qualities:

It must afford and maintain an *even and flat surface* for foot and wheel, and yet, provide a *sure foot-hold* for horses. It must be *firm and hard* to resist the action of iron shoes and tires; and yet, it *must not possess that rock-like solidity* which renders the resistance *too shocking to the horse, and the noise of the horse and vehicle too deafening to man.*

These, and other considerations of less importance, such as cost, cleanliness, durability, etc., will be discussed somewhat in detail, as we pass on."

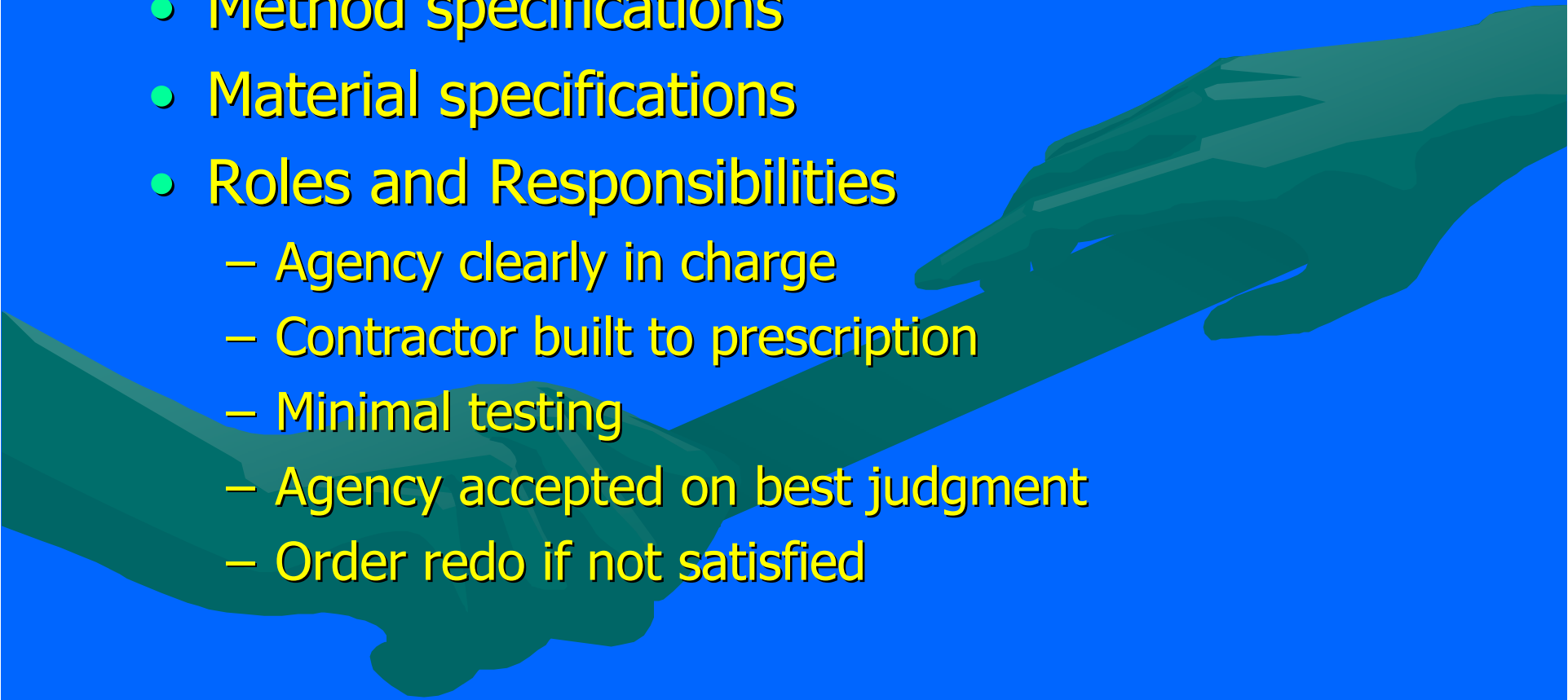
THE NICOLSON PAVEMENT, AND PAVEMENTS GENERALLY, BY FRANK G. JOHNSON

Any pavement that greatly increases the destruction of shoe, horse, vehicle, ease, comfort and convenience is not economical, though it cost nothing and last forever.

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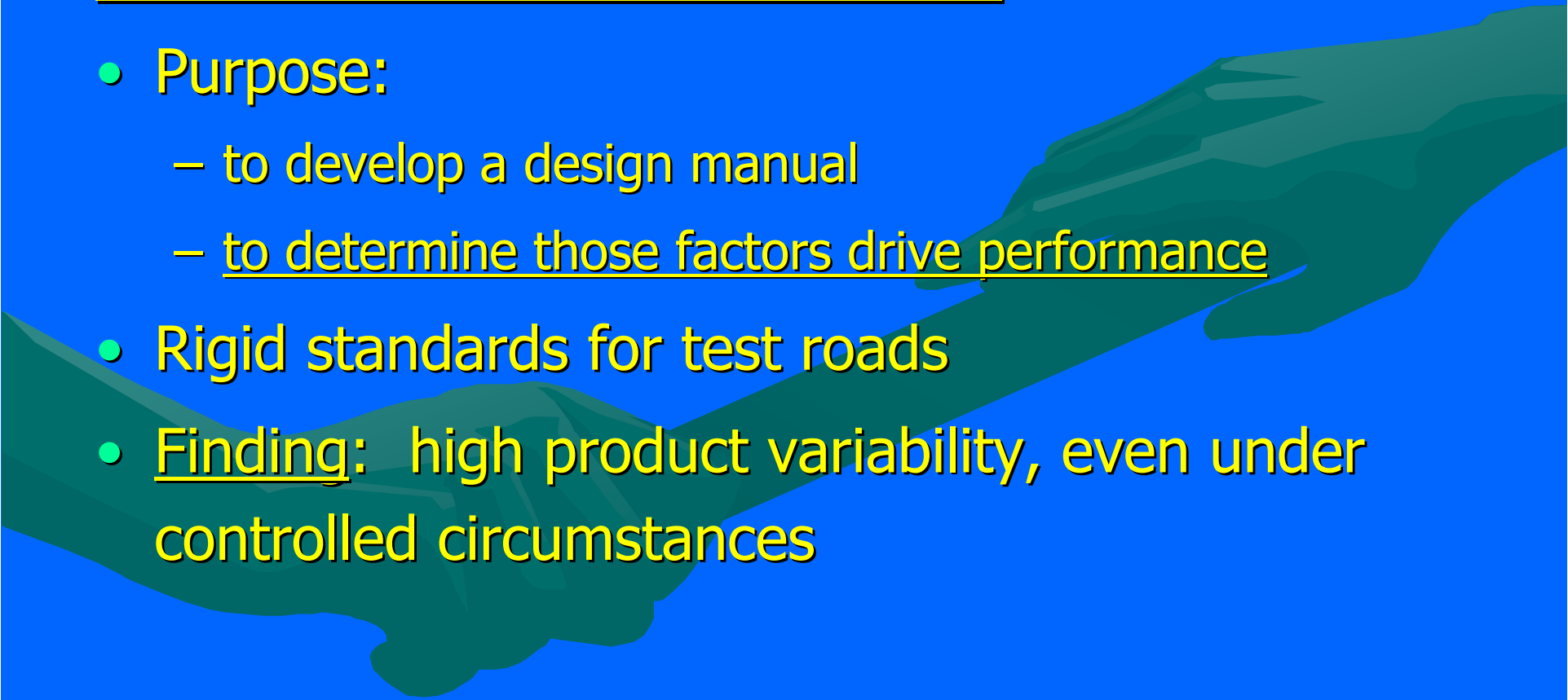
30's - 60's Methods

- Method specifications
 - Material specifications
 - Roles and Responsibilities
 - Agency clearly in charge
 - Contractor built to prescription
 - Minimal testing
 - Agency accepted on best judgment
 - Order redo if not satisfied
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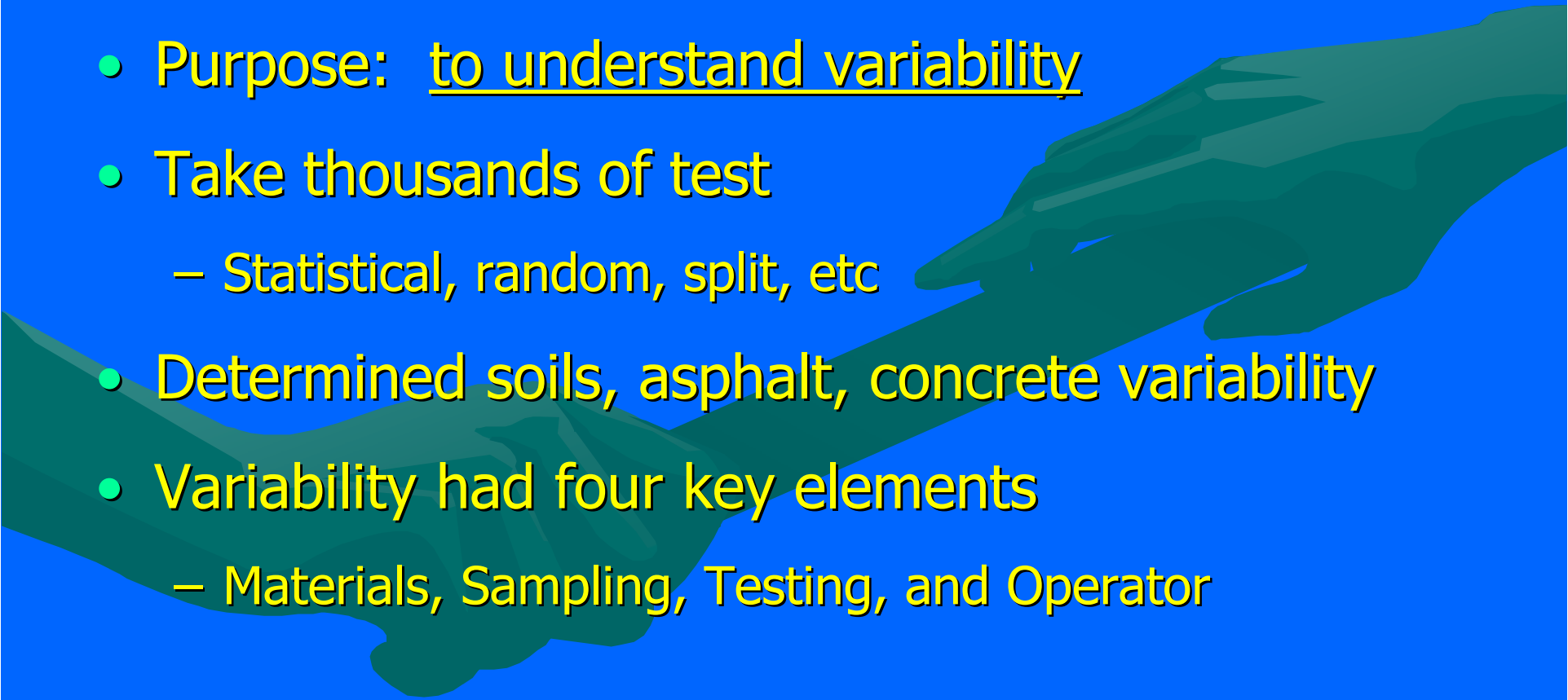
60's - 70's AASHO Road Test

- Purpose:
 - to develop a design manual
 - to determine those factors drive performance
 - Rigid standards for test roads
 - Finding: high product variability, even under controlled circumstances
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60's - 70's BPR Variability Study

- Purpose: to understand variability
 - Take thousands of test
 - Statistical, random, split, etc
 - Determined soils, asphalt, concrete variability
 - Variability had four key elements
 - Materials, Sampling, Testing, and Operator
- 

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60's - 70's Applying Variability

- Wide variety of sampling and testing
 - Take one test, if pass, OK.
 - Take one test, if fail, take another. If pass, OK
 - Take a couple of tests was the norm.

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60's - 70's National Investigation (Blatnik)

- Not so kind to our industry
 - Failing or lacking material traceability
 - Failing tests not recorded or resolved
 - No criteria for 'reasonable close conformity'
 - No State uniformity
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60's - 70's Applying Variability

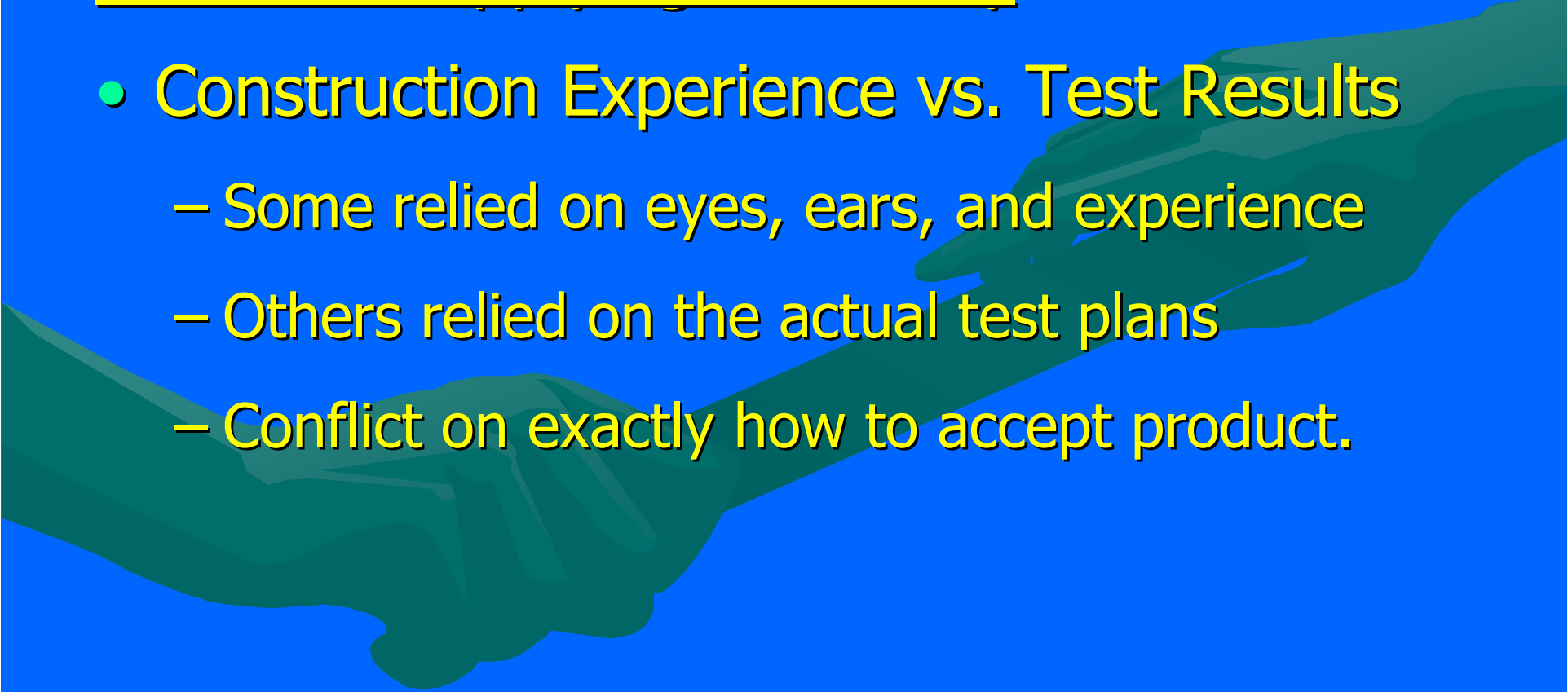
- Purpose: to define "reasonable close conformity"
- Develop testing tolerances
 - Air: $\pm 1/2\%$
 - Compressive strength: $\pm 45\text{psi}$
 - Flexural strength: $\pm 45\text{ psi}$

And things started to get complicated.

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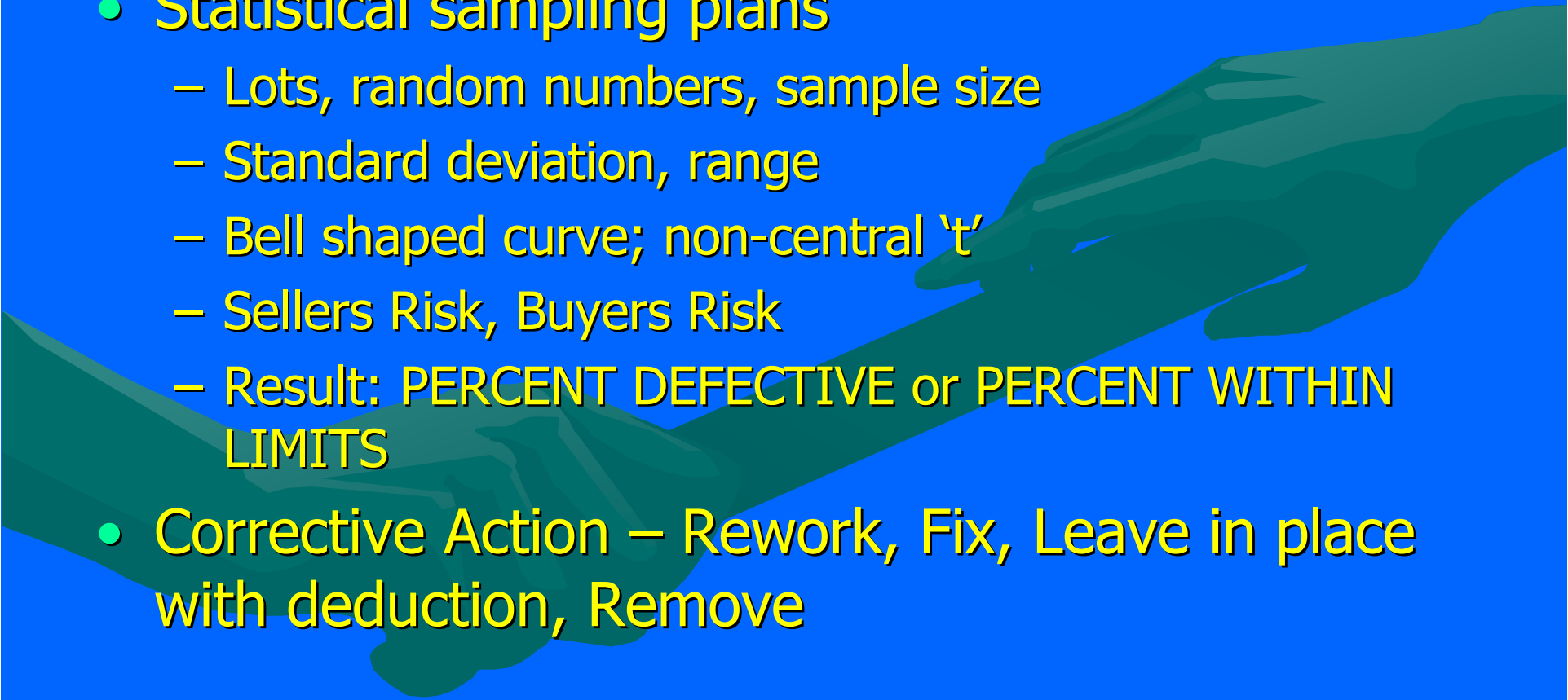
60's - 70's Applying Variability

- Construction Experience vs. Test Results
 - Some relied on eyes, ears, and experience
 - Others relied on the actual test plans
 - Conflict on exactly how to accept product.
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60's - 70's Highway Application

- Statistical sampling plans
 - Lots, random numbers, sample size
 - Standard deviation, range
 - Bell shaped curve; non-central 't'
 - Sellers Risk, Buyers Risk
 - Result: PERCENT DEFECTIVE or PERCENT WITHIN LIMITS
 - Corrective Action – Rework, Fix, Leave in place with deduction, Remove
- 

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80's - Back at the Highway Ranch

- Major breakthrough - incentives
- Highly controversial - more than 100% pay.
- But they worked.
- And they softened the one-sided negativity
of the statistical specifications.



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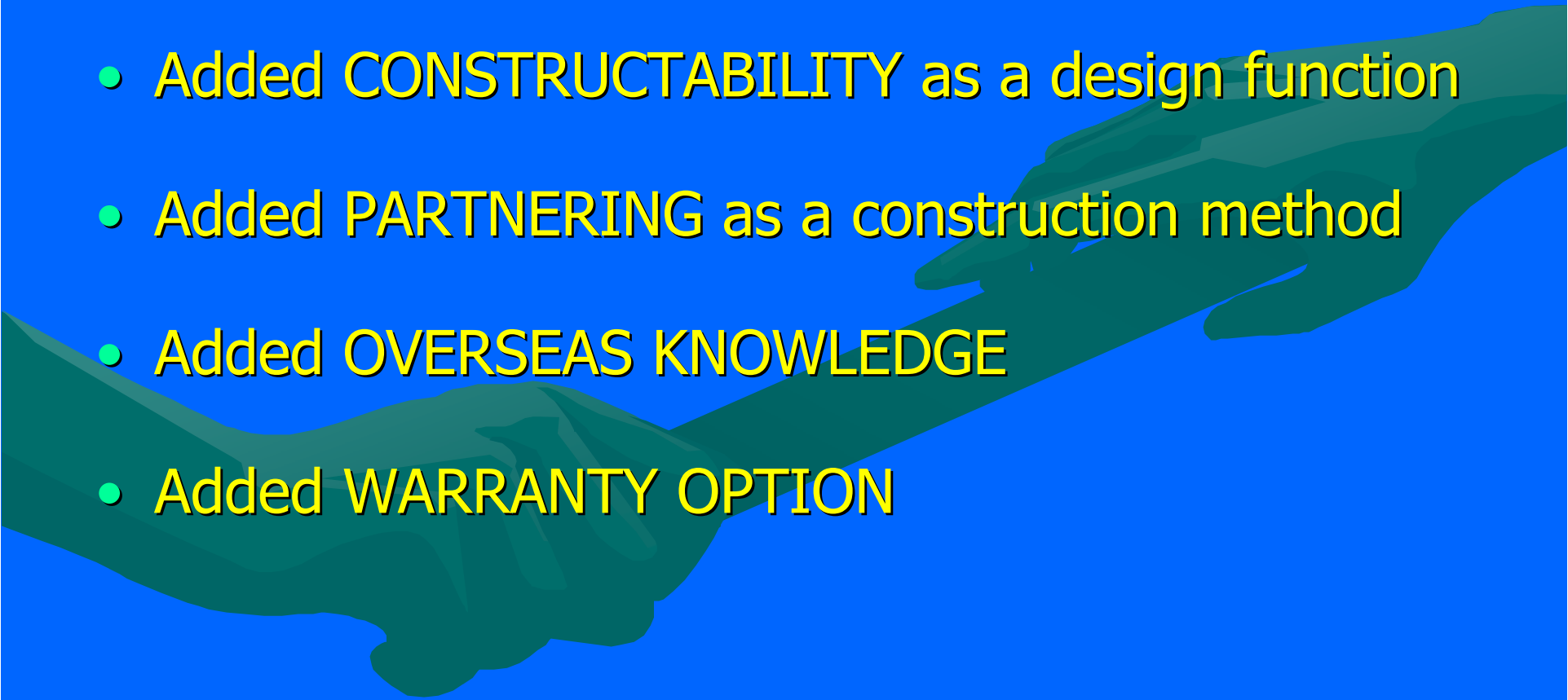
90's - New Era

- More Complexity
 - Movement to end result, statistically based specs.
 - Added Contractor Quality Control, Mix Design etc.
 - Movement to innovative contracting
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90's - New Era

- Added CONSTRUCTABILITY as a design function
 - Added PARTNERING as a construction method
 - Added OVERSEAS KNOWLEDGE
 - Added WARRANTY OPTION
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00's – Accelerated Construction

- Accelerate Construction Technology Transfer
 - Alternate Contracting (Design / Build)
 - Performance Management
 - TRB's Study on Rapid Renewal
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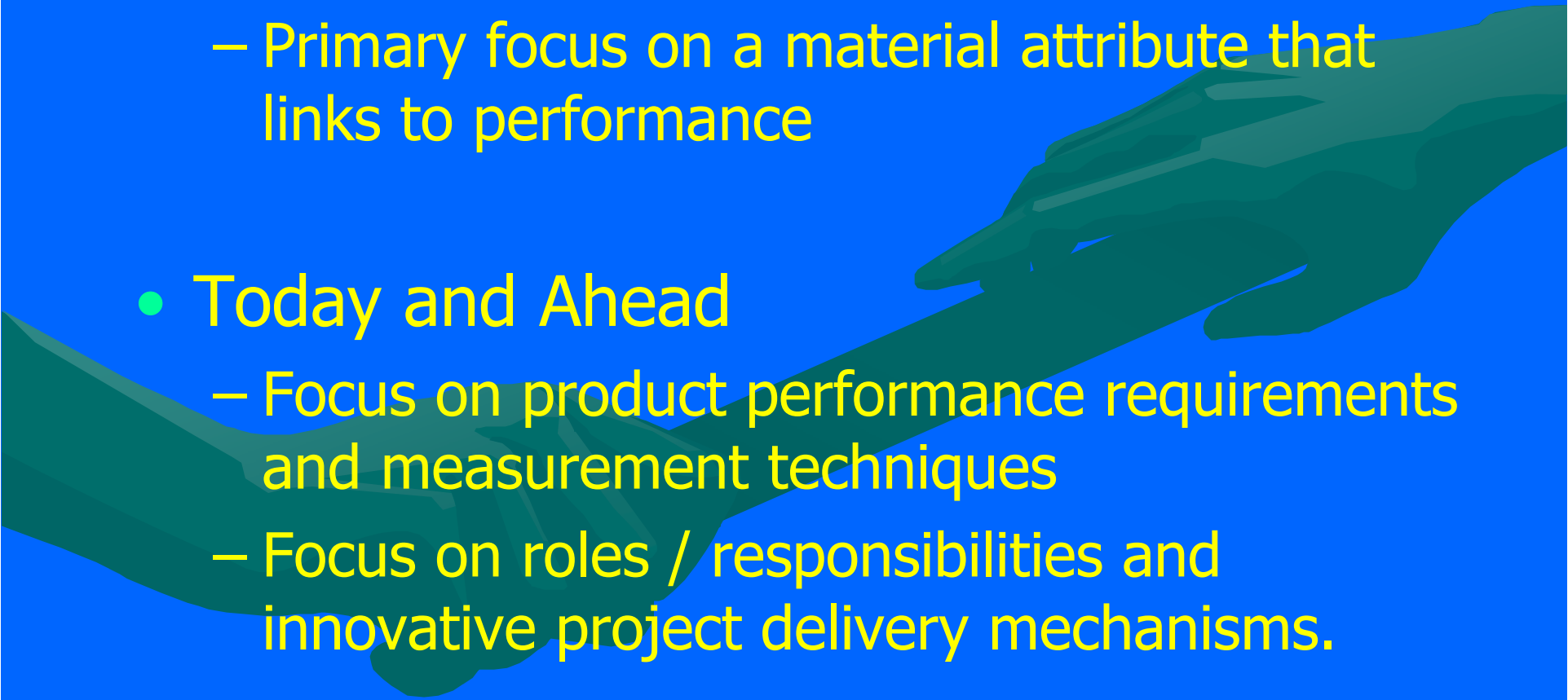
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SHRP II Performance Specifications for Rapid Renewal

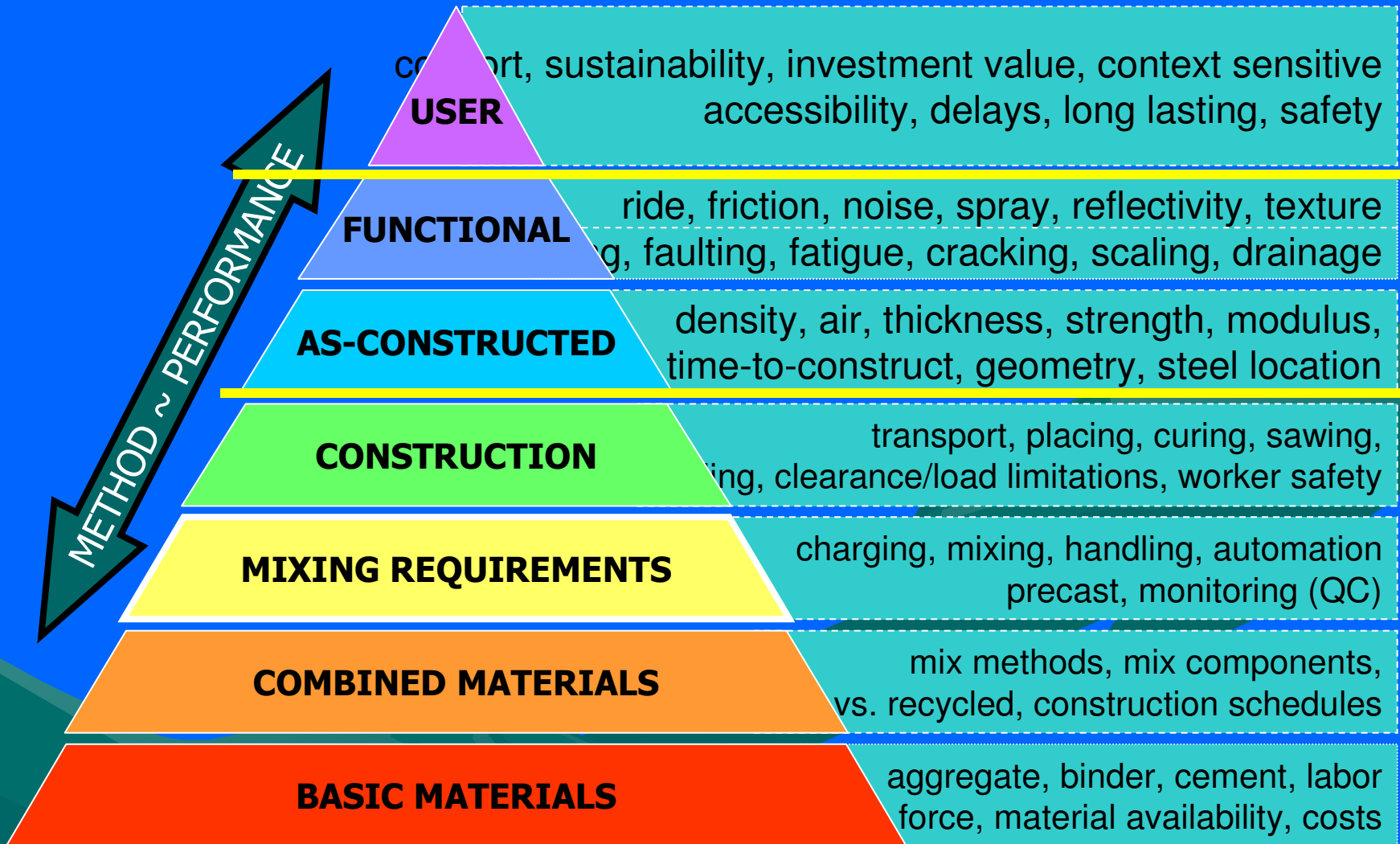
- High Speed
- Minimal Disruption
- Design Life

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- Heretofore,
 - Primary focus on a material attribute that links to performance
 - Today and Ahead
 - Focus on product performance requirements and measurement techniques
 - Focus on roles / responsibilities and innovative project delivery mechanisms.
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Pyramid of Performance



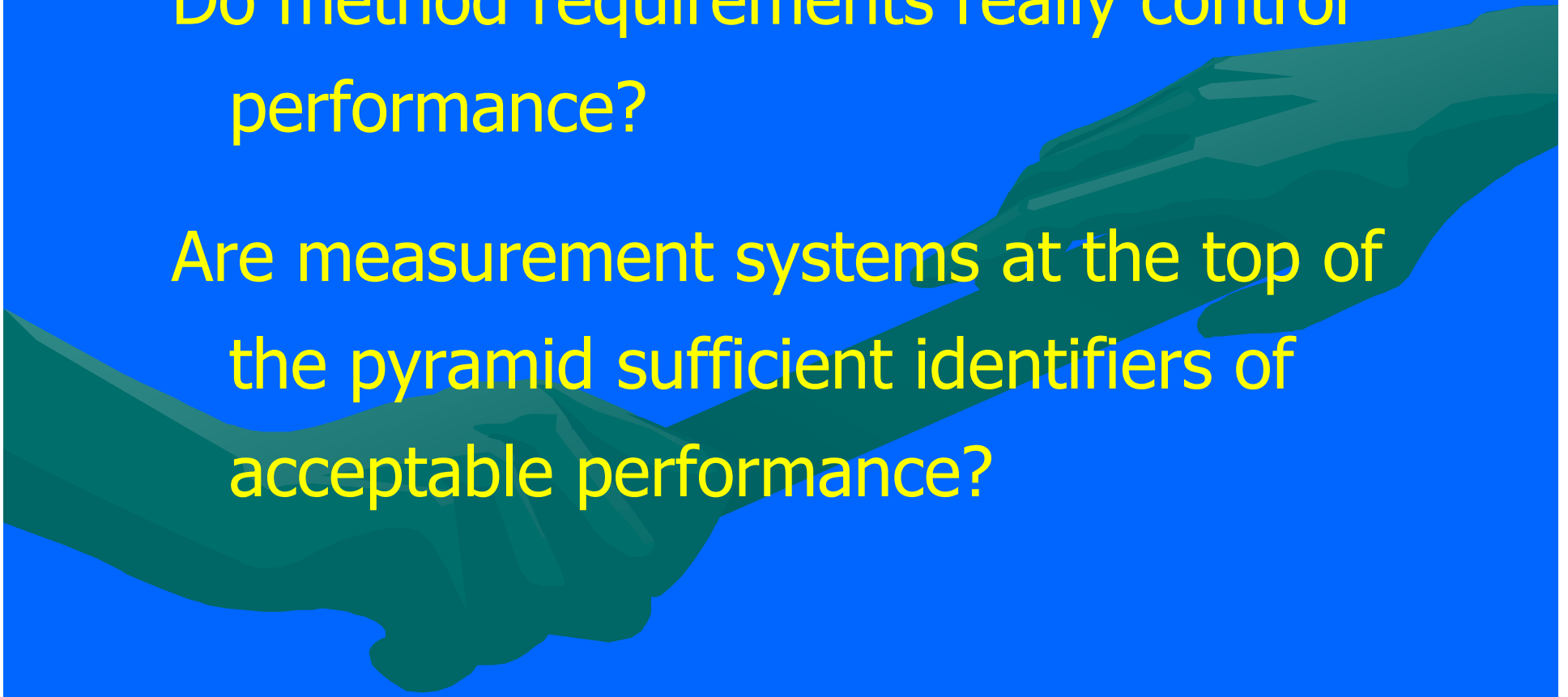
PS: Redefines Roles and Responsibilities

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Do method requirements really control performance?

Are measurement systems at the top of the pyramid sufficient identifiers of acceptable performance?



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Seasonal Weather Constraints

Daily Weather Constraints

Lift Thickness

Speed Limitations

Mixing Properties

Source Material Selection

Equipment Requirements

Transport Requirements

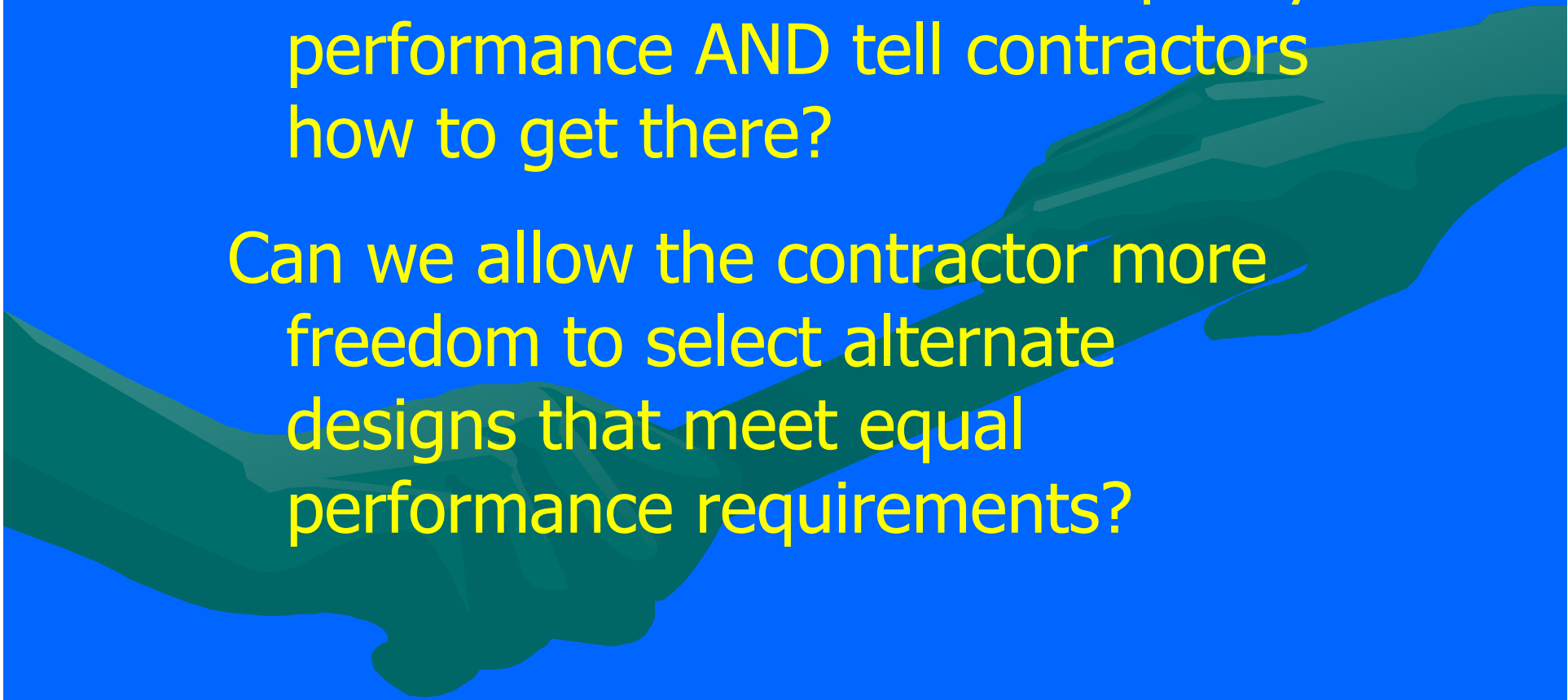
Consolidation Requirements

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Are there times that owners specify performance AND tell contractors how to get there?

Can we allow the contractor more freedom to select alternate designs that meet equal performance requirements?



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Question

Is a blend of both method and performance requirements within one specification possible?

Answer

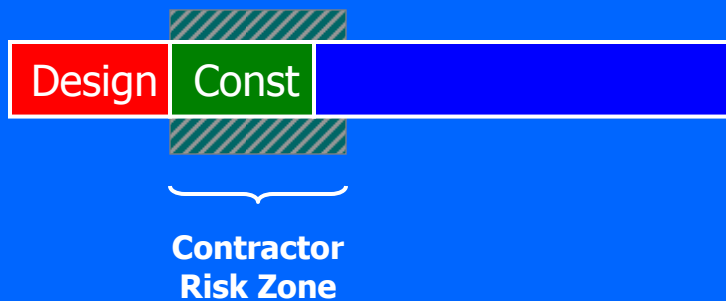
Yes is it both possible and probable.

For example, we don't have performance techniques to detect potential long term durability problems (alkali-silica reactivity, for example) OR we don't know how to measure a property during construction (pore pressure in soils, for example).

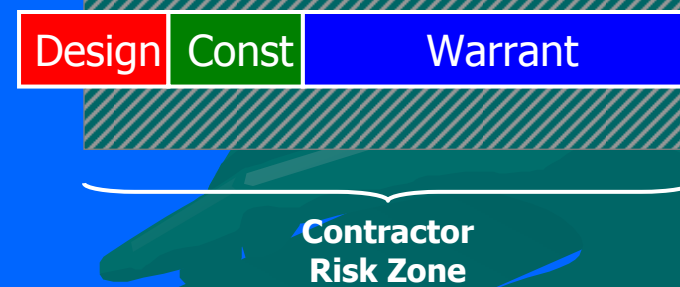
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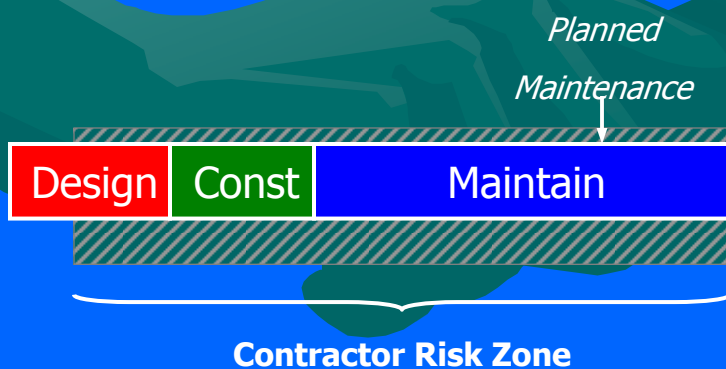
Design-Bid-Build



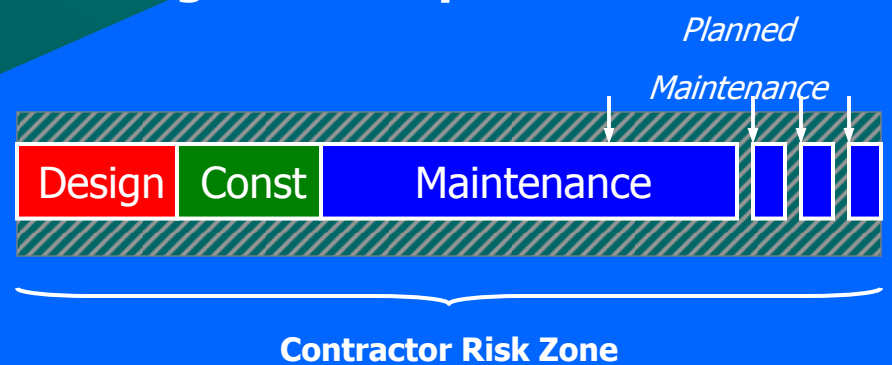
D-B w/Warranty



D-B w/Maintain

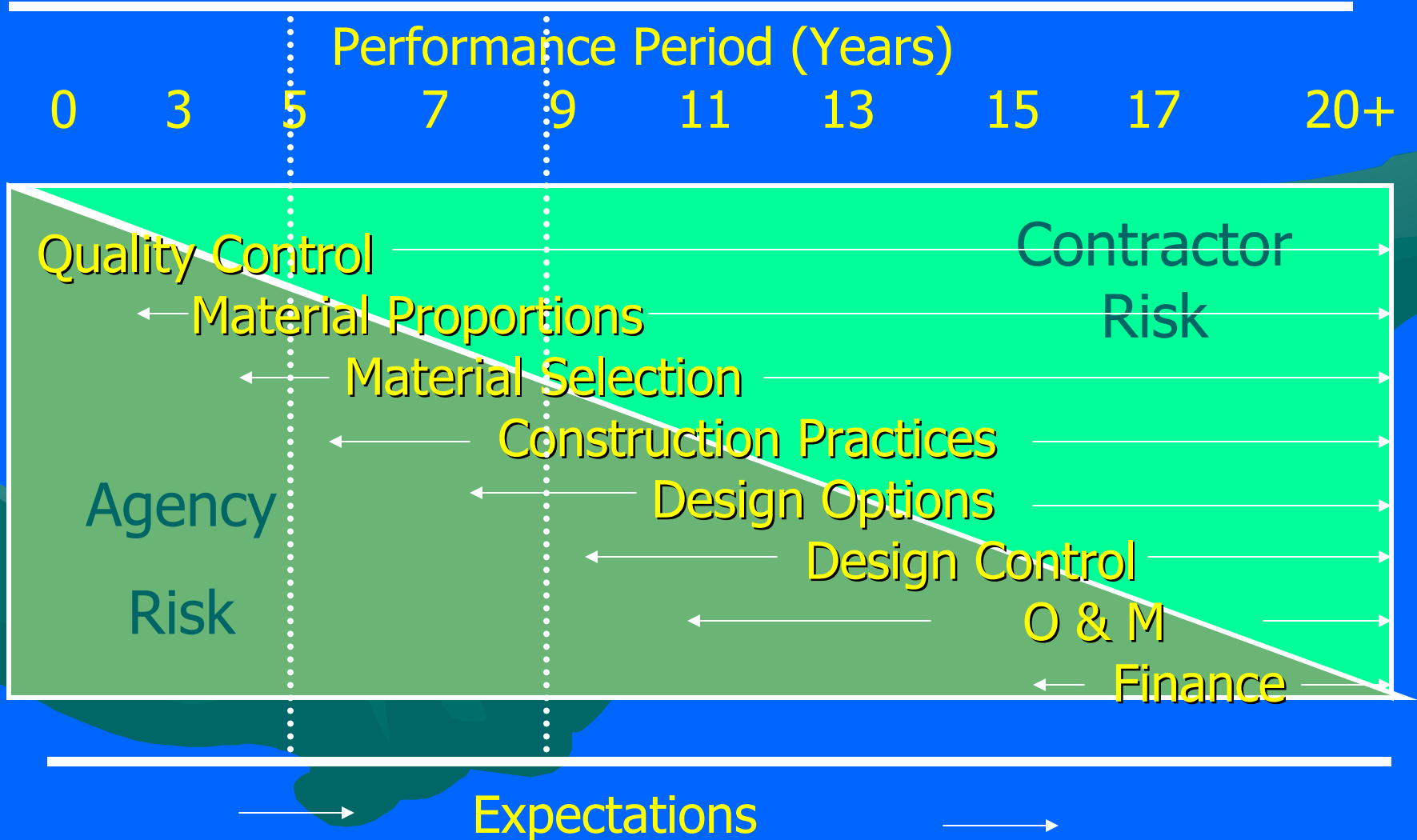


Design-Build-Operate-Maintain



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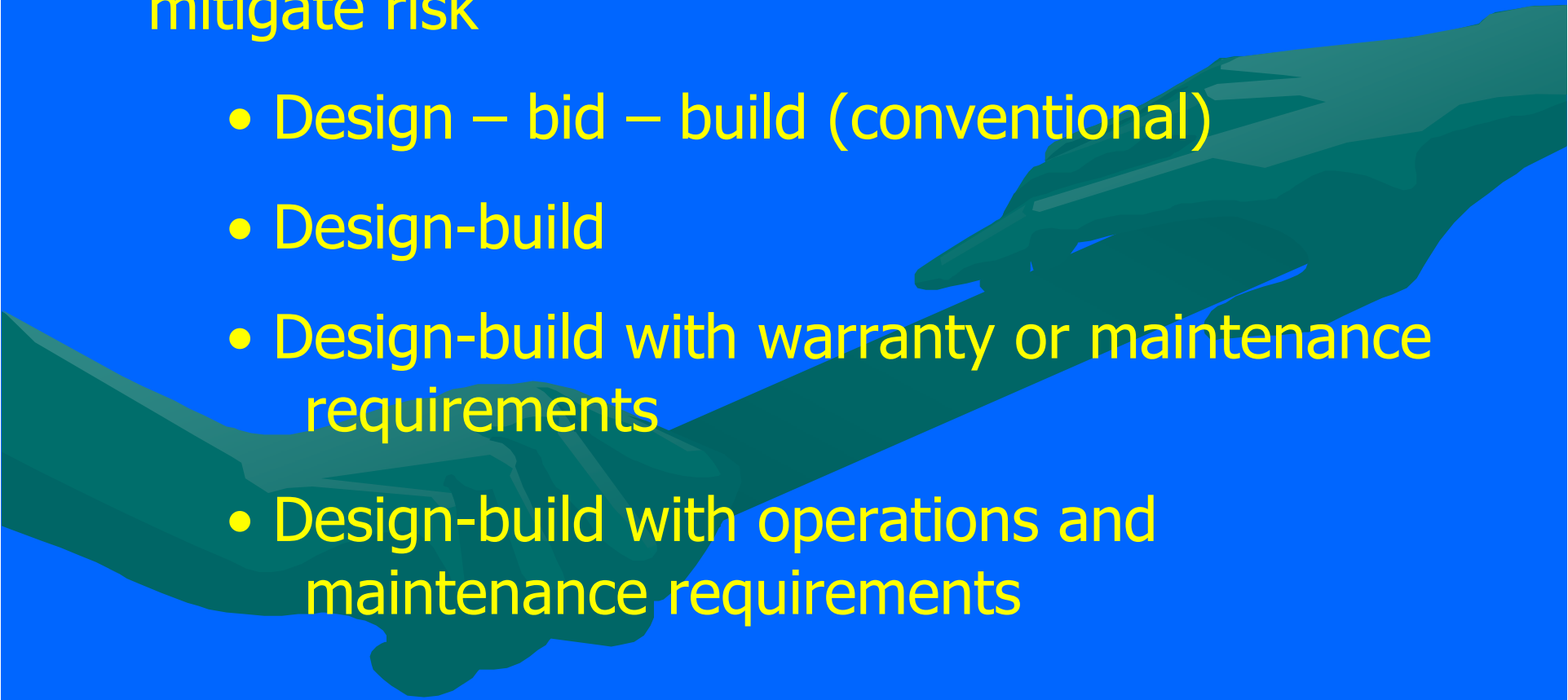
Develop risk register

- Allocate risk to each party for technical requirements
- Assess technical elements of program (pyramid evaluation)
- Determine high/medium/low risk

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Determine whether contracting techniques mitigate risk

- Design – bid – build (conventional)
 - Design-build
 - Design-build with warranty or maintenance requirements
 - Design-build with operations and maintenance requirements
- 

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Product Group

- Pavements
- Bridges
- Geotech

Service Group

- Traffic Mgt
- Quality Mgt
- Public Relations



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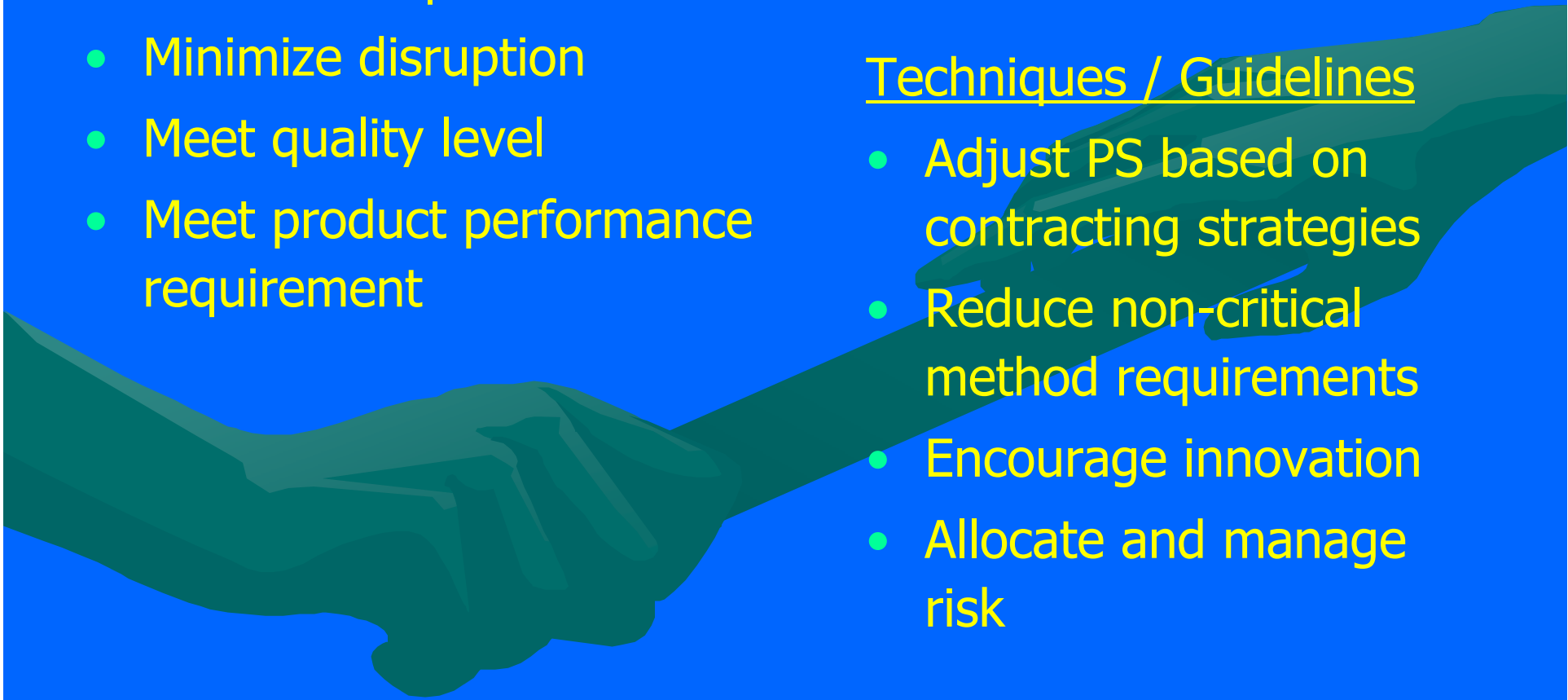
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Goals

- Reduce completion time
- Minimize disruption
- Meet quality level
- Meet product performance requirement

Techniques / Guidelines

- Adjust PS based on contracting strategies
- Reduce non-critical method requirements
- Encourage innovation
- Allocate and manage risk



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Thank you.

