Keys to a Healthy Road System

Good design  
+  
Quality materials 
+  
Proper construction 
+  
Appropriate use 
+  
Maintenance  
=  
LONG LIFE!
Road Design

• Can be done by private or public entity
• Based on intended use, for efficiency
  • Traffic levels
  • Truck weights
• Design based on decades of research and development work + experience
• Standardized solution optimized using safety standards, engineering, and cost information
• Standard designs exist that are part of a robust system
Design and Specifications

• USDOT – United States Department of Transportation
• National Highway Institute, Designing with Geosynthetics
• Low-Volume Roads Engineering, Best Management Practices Field Guide
• Gravel Roads Manual
Materials

- **Subgrade** – existing materials, beneath the foundation
- **Structural base** – major load carrying layer
  - Usually made of crushed stone
    - Strong
    - Permeable
  - Thickness depends mainly on support needs
- **Driving surface** – smooth top surface
  - Can be made of unbound or bound materials
  - Requires maintenance to ensure long-term performance
- **Other**
  - Geosynthetics
  - Admixtures (lime, cement, etc.)
  - Dust palliatives
Materials Standards

- **Quality**
  - Particle-size distribution (ASTM D6913)
  - Fines content (ASTM D1140)
  - Fractured face count (ASTM D5821)
  - Classification (ASTM D2487, AASHTO M145)
  - Durability (ASTM C5353, AASHTO T96)

- **Strength**
  - CBR (ASTM D1883)
  - Stiffness (AASHTO T307 – Resilient Modulus)
  - Shear strength (AASHTO T236)

- **Permeability** (ASTM D2434, AASHTO T215)

- **Compaction**
  - Proctor (ASTM D1557)
  - Density measurement during construction (ASTM D6938)

- **Thickness**
Construction

Need a **system** in place to ensure quality materials because the design is based on a certain properties of the individual components of construction

Step 1 – Evaluate field conditions of construction site
Step 2 – Find material sources for construction
Step 3 – Evaluate properties of material sources
Step 4 – Create design based on available conditions and materials
Step 5 – Construction
Step 6 – Inspect construction to ensure meeting minimum requirements (quality, dimensions, etc.)

- Inspectors have authority to reject construction based on their independent evaluation
- Penalties can be applied if minimums are not met
Construction

• If the quality of the construction does not meet the minimum quality of the individual components of the design then the performance of the system will be jeopardized
  • Time and resources will be wasted
  • Service will be compromised
  • Longevity of the roadway will be negatively affected

• Contractor should take pride in their work!
Appropriate Use

• Truck weight limits and tire pressures
• Adjustments to these limits based on seasonal strength changes
• Enforcement based on permitting process
• Penalties for noncompliance to fund road repair and construction
• Educate trucking industry
Maintenance

- Periodic performance monitoring to assess condition
- Proactive maintenance is proven to be more cost effective
- Materials used to maintain roads also need to be tested and proven
  - Meet minimum standards
  - Be installed/constructed correctly
Standards Development Process

• Participation by variety of parties
  – Practitioners / users
  – Manufacturers
  – Researchers
  – Quality assurance testing
• Open forum for discussion
• Consensus
• Process creates opportunity to collaborate and build trust
Road Building Standards

- **ASTM International** – American Society for Testing and Materials
- **AASHTO** – American Association of State Highway Transportation Officials
- **ISO** – International Standards Organization
- **ASCE** – American Society of Civil Engineers
- **URi** – Unpaved Roads Institute
- **GSI** – Geosynthetics Institute
Demonstrate Success

- Conduct small pilot projects
- Inform managers of successful processes
- Train staff
Materials Testing

• Ensure materials meet standards
• Evaluate properties of materials made or constructed on site
  • concrete
  • soil
Inspection and Enforcement

• Ensuring that work is done according to design and construction is critical
• Need backing from officials, law, public
• Rewards for good work
• Penalties for poor work
Benefits of Standards for Roads

1. Standards help ensure good performance
   – Predictable performance helps planning and design efforts
   – Helps managers select the best option
   – Provides the best resource for the traveling public

2. Standards development process creates opportunity to collaborate, and helps build trust

3. Good performance results in a strong economy
   – Save money
   – Save time
   – Save limited resources

HEALTHY ROADS = HEALTHY ECONOMY
TRI ENVIRONMENTAL

- Geosynthetics and Geotechnical Testing Services
- Erosion Control Materials Testing and Analysis
- Liner Integrity Survey/Leak Detection
- Protective Clothing Testing and Certification
- Independent Sampling Auditing Services
- Methane and Water Vapor Barrier Testing and Certification
- Pipe Testing

tri-env.com

Texas Research International, Inc.

tri-intl.com
General Types of Testing

- Materials QA
- Performance Testing
- Product comparisons
- Forensics
HDPE, PVC, PP Pipe

Geosynthetic Reinforcement

RECPs
TRI Trafficking Test Center

Geosynthetic-reinforced subgrade and base course, over range of subgrade strengths, both paved and unpaved surfaces
Accelerated Pavement Testing Lab

TRI Accelerated Pavement Tester

Controlled Indoor Testing Facilities
TRI Training Courses
Services Provided

- In-plant sampling/field inspection
- Conformance/verification
- Performance investigation/confirmation
- Geotechnical services
- Reduction factor characterization
- Leak location / live survey services
- Forensic and durability evaluations
- Testing equipment
- Technical / consulting support services
  - Specification review
  - Design support and review
  - Literature surveys
  - Training / education