# Design and Construction of Cut and Cover Road Tunnels

**Course Number:** GE-02-501

**PDH:** 3

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# Introduction to Road Tunnel Engineering and Design

## Learning Objectives

By the end of this section, you will be able to:

- **Identify** the scope and purpose of the FHWA Technical Manual for the civil elements of road tunnels.
- **Apply** conversion factors to translate design parameters between English and SI units.
- **Categorize** the sixteen technical pillars of tunnel design and construction as defined by federal guidelines.

*Executive Summary: This manual provides a single-source technical framework for the planning, design, construction, and rehabilitation of road tunnels. It focuses exclusively on civil elements, emphasizing ground-structure interaction and structural integrity. It serves as a necessary response to the increasing complexity of urban transportation and the growing reliance on underground space to preserve surface environments.*

## Engineering Conversion Standards

Professional Engineers must ensure high precision when moving between measurement systems. The following tables provide the standard multipliers for approximate conversions used in civil engineering tunnel projects.

**Table 1-1: Conversions to SI Units**

| When you know | **Multiply by** | **To find** |
|---|---|---|
| Length | | |
| inch | 25.4 | millimeter |
| foot | 0.305 | meter |

| | | |
|---|---|---|
| yard | 0.914 | meter |
| mile | 1.61 | kilometer |
| Area | | |
| square inches | 645.2 | square millimeters |
| square feet | 0.093 | square meters |
| acres | 0.405 | hectares |
| square miles | 2.59 | square kilometers |
| Volume | | |
| fluid ounces | 29.57 | milliliters |
| gallons | 3.785 | liters |
| cubic feet | 0.028 | cubic meters |
| cubic yards | 0.765 | cubic meters |

| | | |
|---|---|---|
| Mass | | |
| ounces | 28.35 | grams |
| pounds | 0.454 | kilograms |
| short tons (2000 lb) | 0.907 | megagrams (tonne) |
| Force | | |
| pound | 4.448 | Newton |
| Pressure, Stress, Modulus | | |
| pounds per square foot | 47.88 | Pascals |
| pounds per square inch | 6.895 | kiloPascals |
| Density | | |
| pounds per cubic foot | 16.019 | kilograms per cubic meter |

**Table 1-3: Conversions from SI Units**

| When you know | Multiply by | To find |
|---|---|---|
| millimeter | 0.039 | inch |
| meter | 3.28 | foot |
| meter | 1.09 | yard |
| kilometer | 0.621 | mile |
| square millimeters | 0.0016 | square inches |
| square meters | 10.764 | square feet |
| hectares | 2.47 | acres |
| square kilometers | 0.386 | square miles |
| milliliters | 0.034 | fluid ounces |
| liters | 0.264 | gallons |

| | | |
|---|---|---|
| cubic meters | 35.32 | cubic feet |
| cubic meters | 1.308 | cubic yards |
| grams | 0.035 | ounces |
| kilograms | 2.205 | pounds |
| megagrams (tonne) | 1.102 | short tons (2000 lb) |
| Newton | 0.2248 | pound |
| Pascals | 0.021 | pounds per square foot |
| kiloPascals | 0.145 | pounds per square inch |
| kilograms per cubic meter | 0.0624 | pounds per cubic foot |

Calculation Note:

For temperature sensitive design elements, use the following standard conversion:

**Celsius = 5/9 * (Fahrenheit - 32)**

**Where:**

- **Celsius** = Temperature in degrees Celsius
- **Fahrenheit** = Temperature in degrees Fahrenheit

Purchase this course to see the remainder of the technical materials.