附錄1

The Bridges

Planning, Design, Construction and Maintenance

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NATURAL DISASTERS

- Natural Disaster Hotspots: A Global Risk Analysis(The World Bank, 2005)
- Taiwan Major Natural Disasters:
  - Typhoons
  - Earthquakes
  - Landslide

SAFE Taiwan

Symbiosis with the Environment

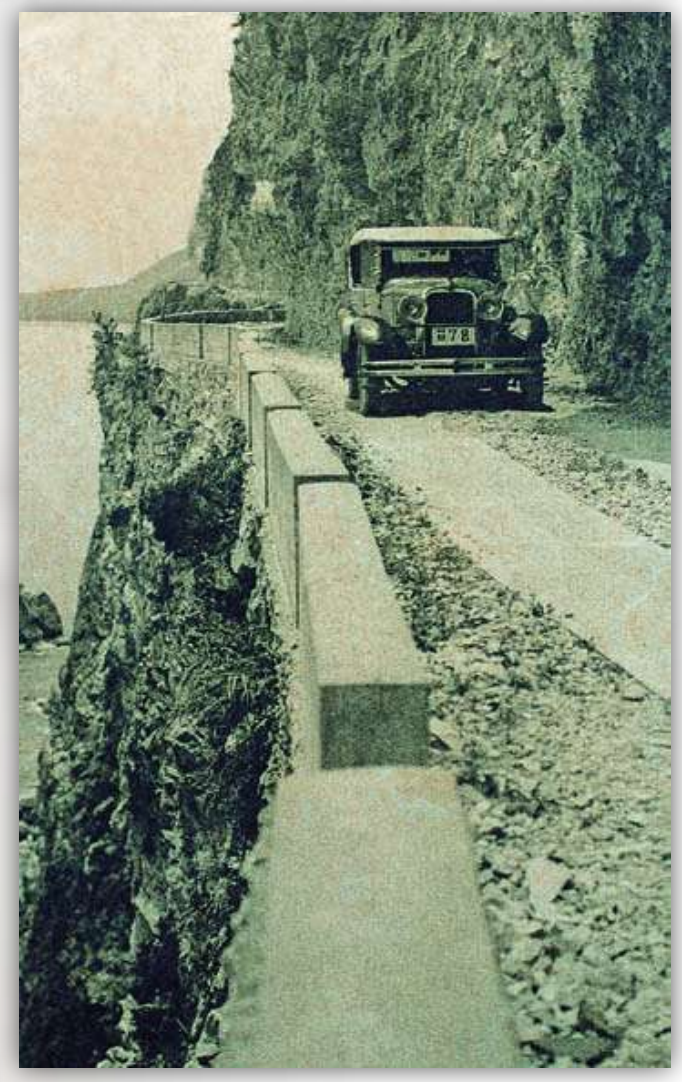
Smart

Advanced

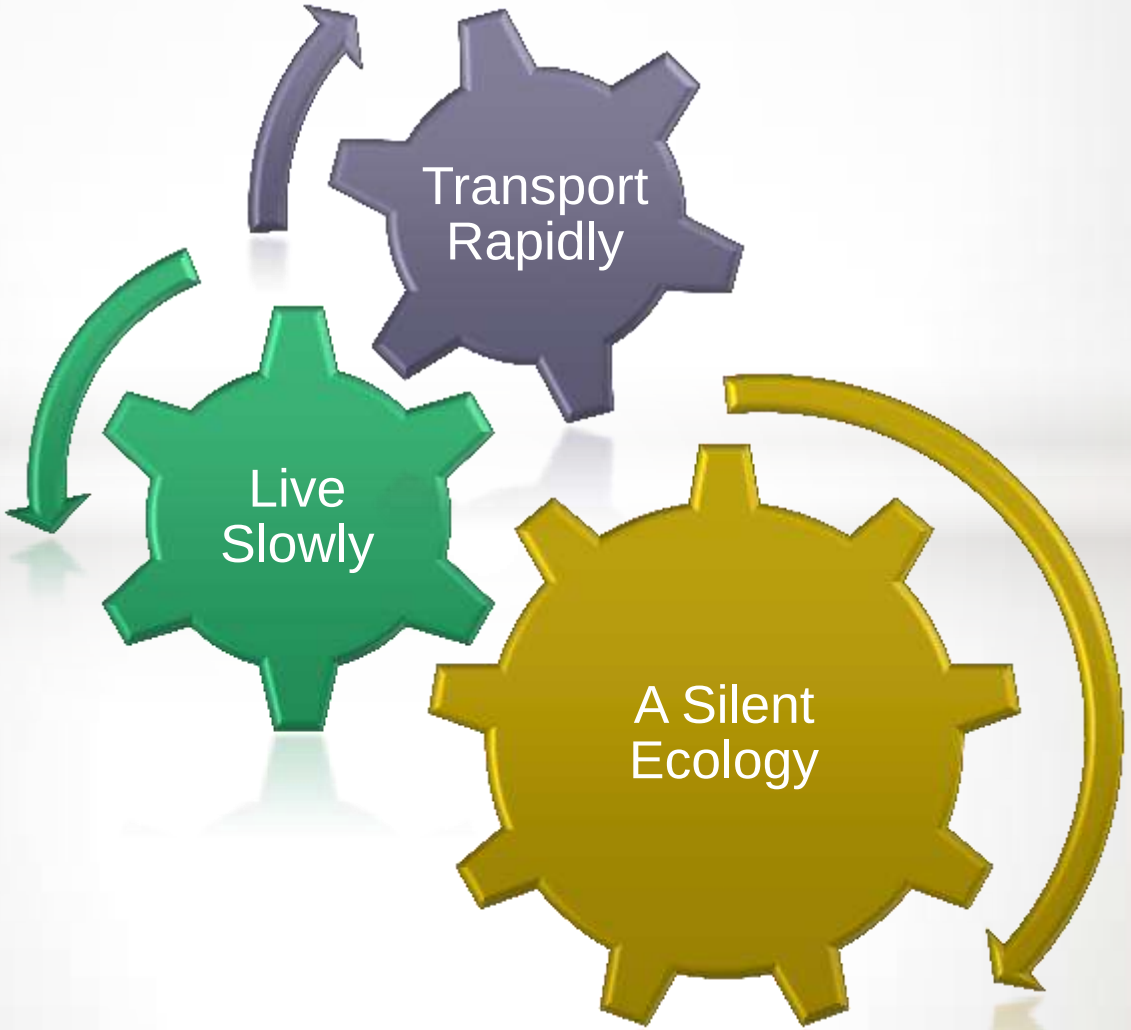
Friendly

Ecological

ZERO-BASED THINKING



HIGHWAY DEVELOPMENTS



COUNTERMEASURES OF ENVIRONMENTAL AND ECOLOGICAL PROTECTION

- **Avoidance**

  Bypassing the Habitats of Wildlife

- **Reducing**

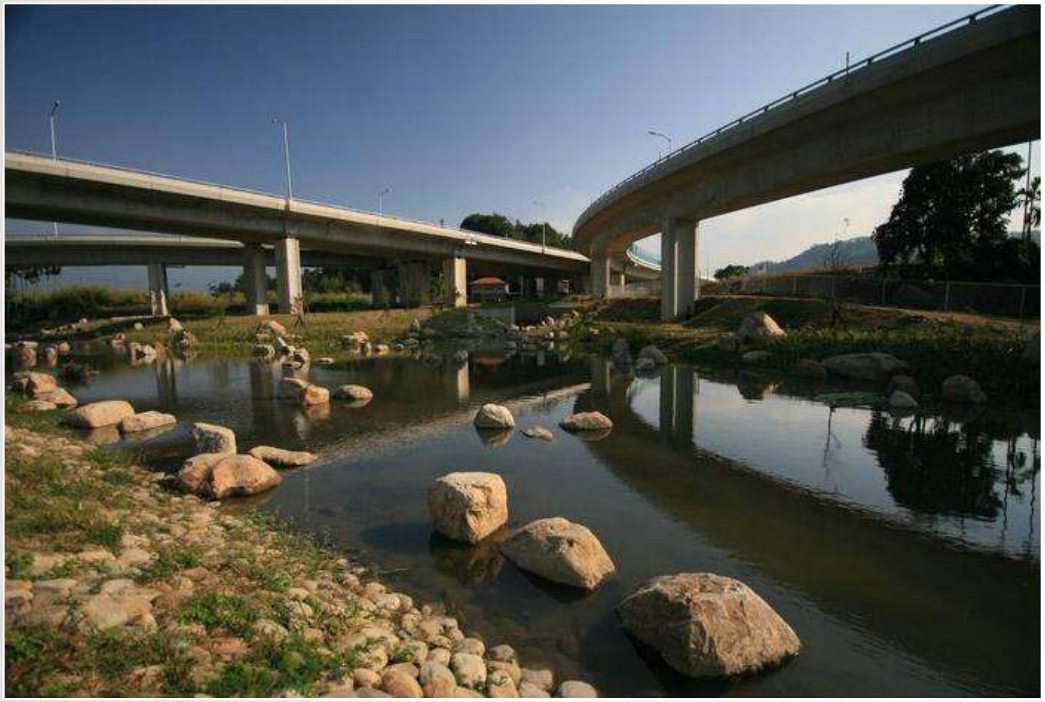
  No Construction Work in Breeding Season

- **Habitat Offset**

  Building Another Habitat for Compensation

ECOLOGICAL POOLS

ECOLOGICAL POOLS



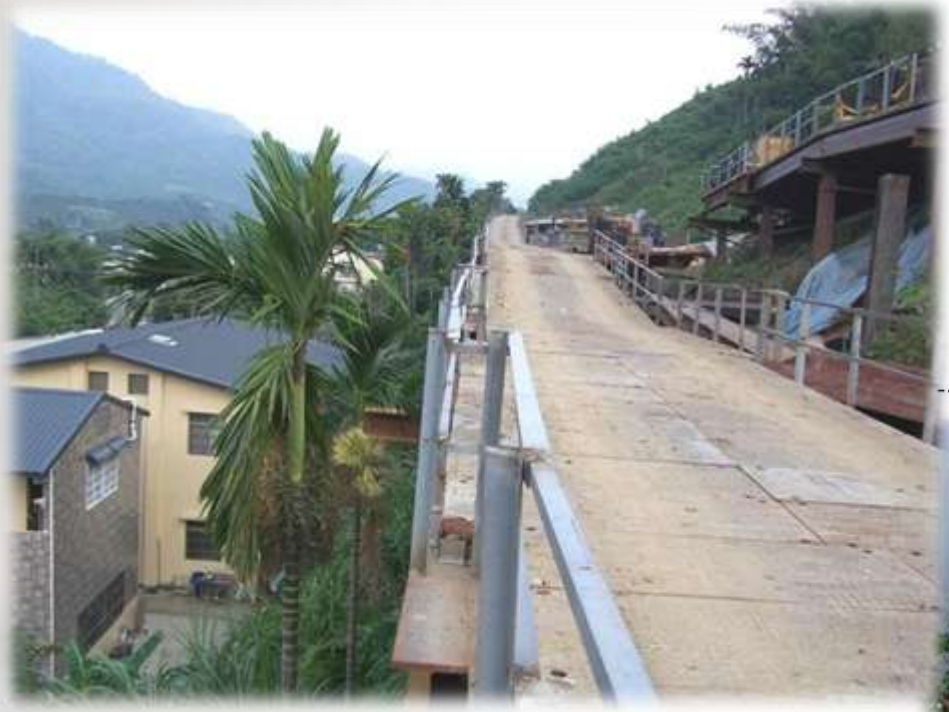
TRANSPARENT BARRIERS

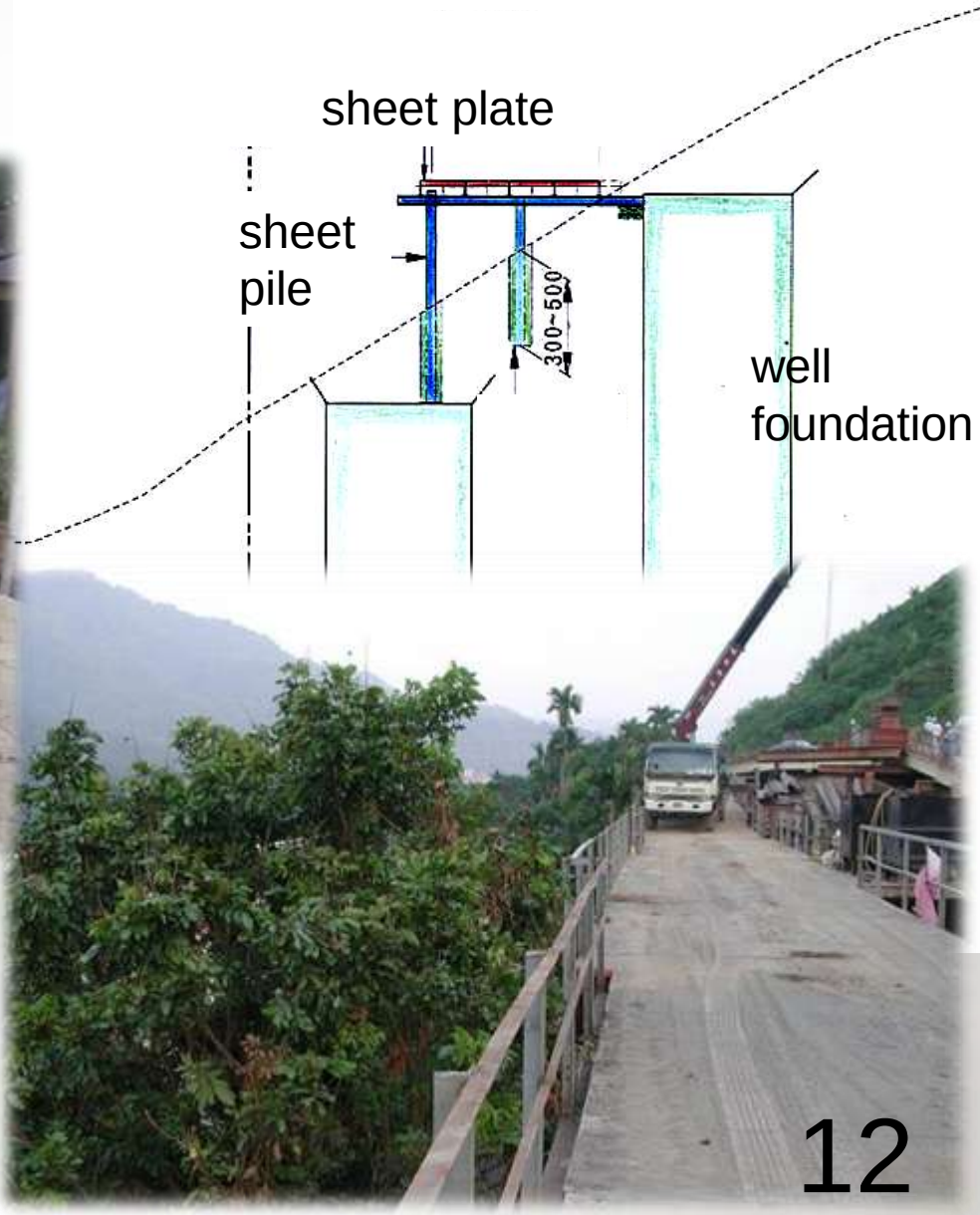
GREEN CONSTRUCTION

- Well foundation
- Temporary steel bridge / sidewalk
- Reduce cutting
- Shorten the ecological recovery period after construction
- Fill the highway embankment from tunnel drilling debris

WELL FOUNDATION

TEMPORARY STEEL BRIDGES



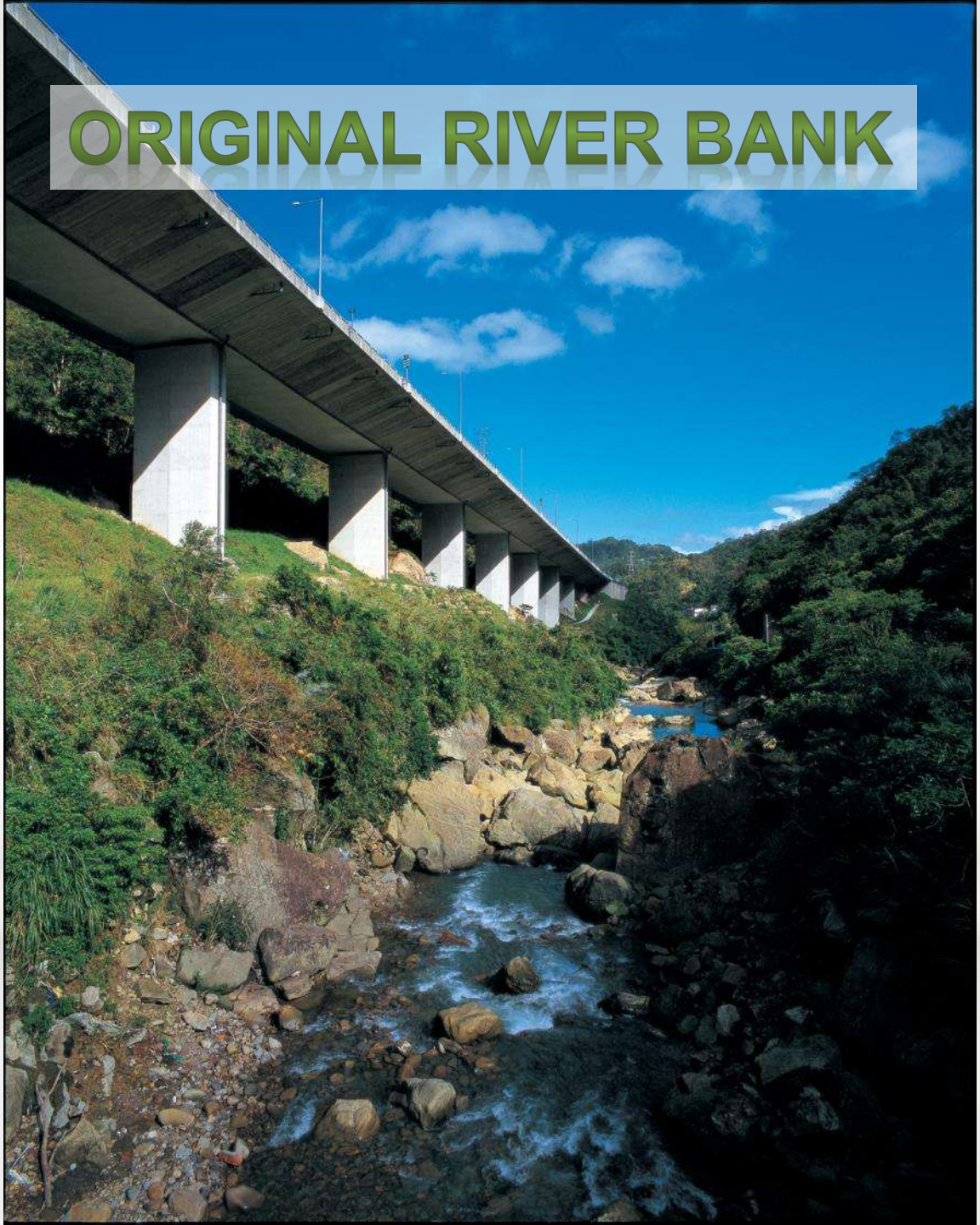


BEFORE

Temporary Steel Bridges
&
Advanced Shoring
Methods

AFTER

One year later

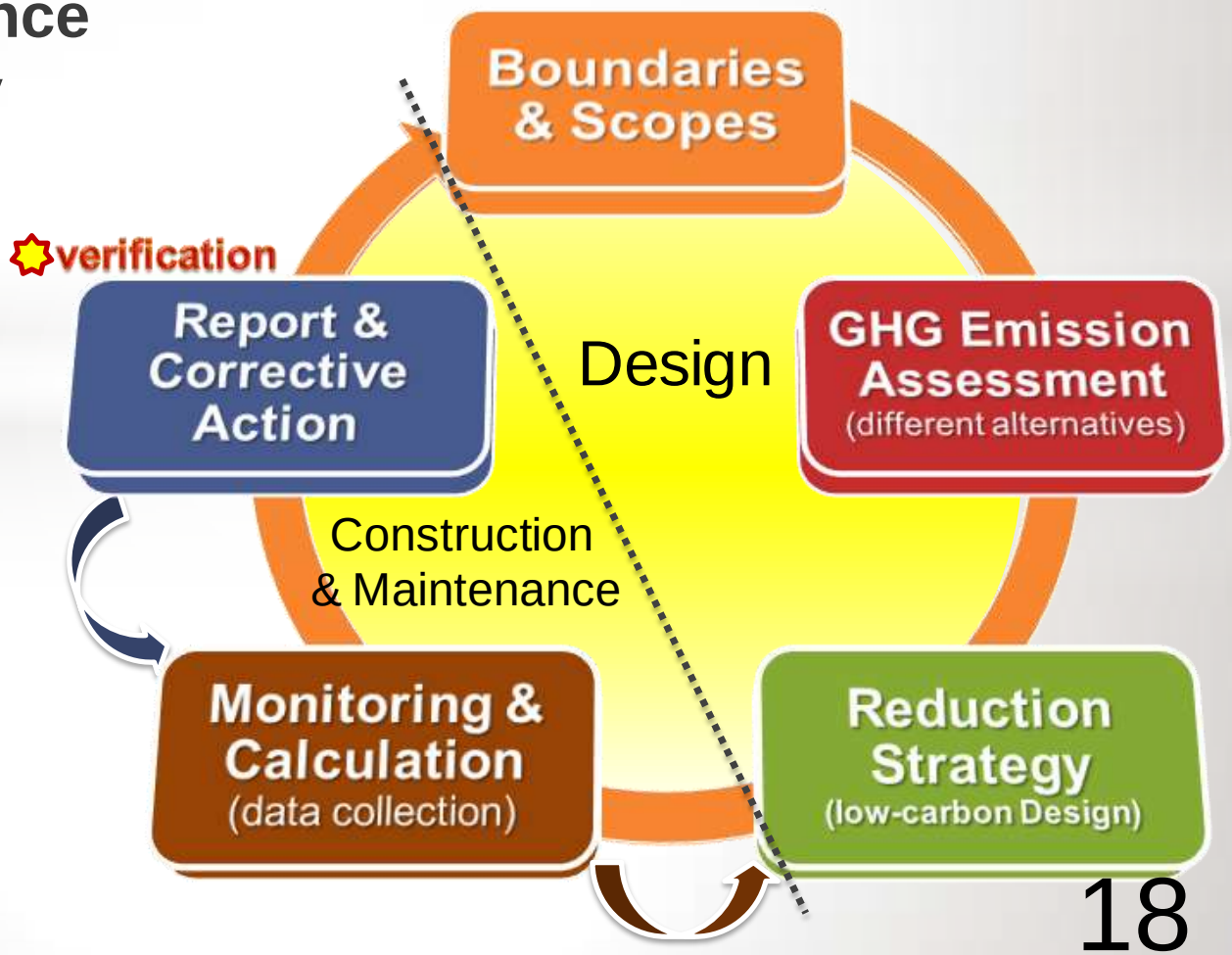

ORIGINAL RIVER BANK


INTACT SLOPE
可文中 攝影

PRESERVATION OF ARCHAEOLOGICAL SITES

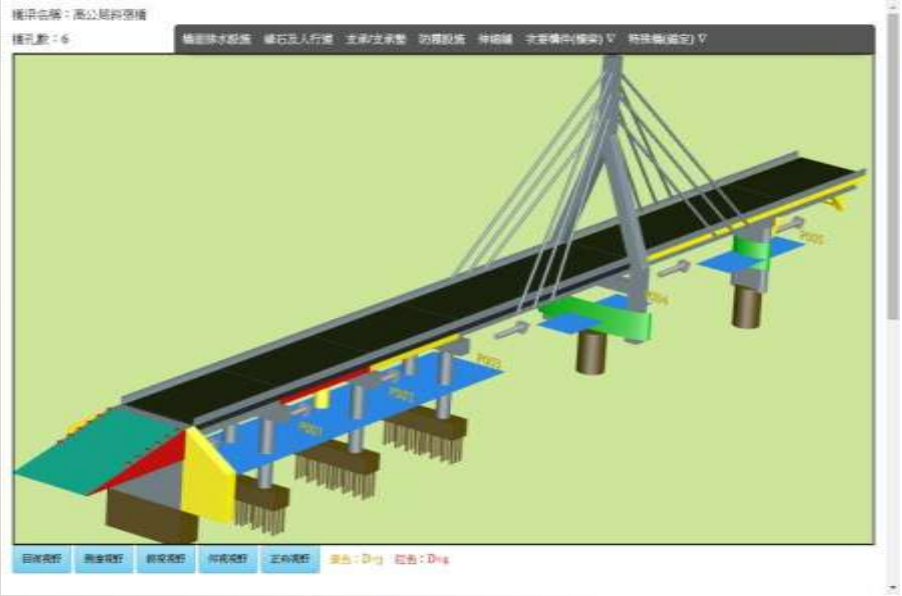
CARBON EMISSION MANAGEMENT

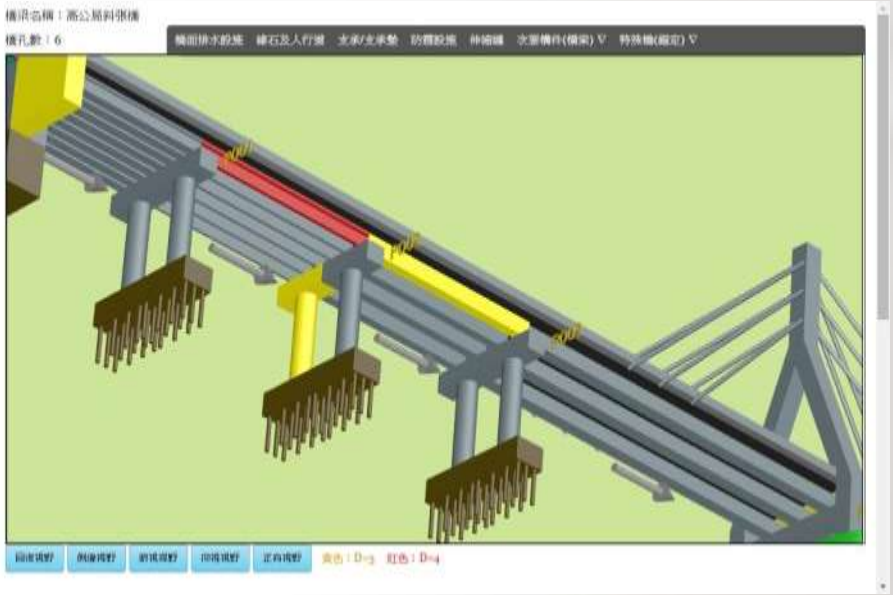
- **Material Selection**
- **Waste Avoidance**
- **Least Delivery**



INVENTORY & MANAGEMENT SYSTEM

- **Taiwan Bridge Management System (TBMS, since 2000)**
- **Taiwan Bridge Management System II: (TBMS 2, developing)**





SEISMIC SCENARIOS

- **Taiwan Earthquake Loss Estimation System (TELES)**
  - **Seismic Scenario Simulation**
  - **Seismic Risk Assessment**
  - **Early Seismic Loss Estimation**

REHABILITATION OF THE AGED BRIDGES

Three Major Categories

- Severely Damaged or Collapsed
- Widening
- Seismic Retrofit

BRIDGE SEISMIC RETROFIT

In 1999, Chi-Chi Earthquake (M_L=7.3) caused many bridges to collapse:

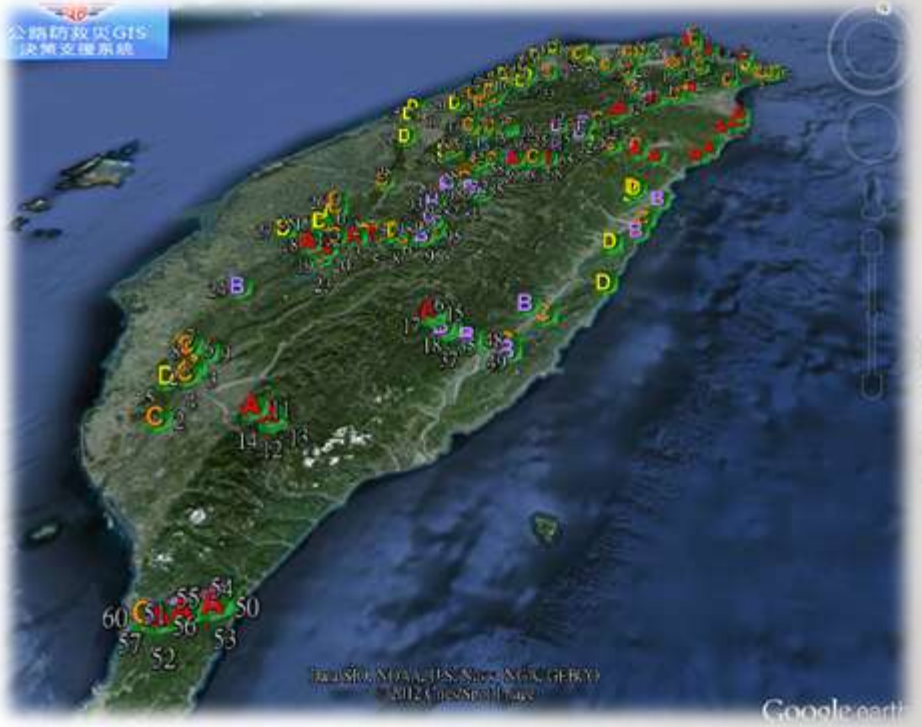
- **Revised Seismic Design Code**
- **Seismic Performance Concepts –**
  - **Zero damage during frequent earthquakes**
  - **Reparable damages after moderate earthquakes**
  - **No collapse in the case of extreme earthquakes**

CATCHMENT RISK MANAGEMENT

- **Rainfall Thresholds**
  - **By lessons learned from previous extreme hazard threats**
- **Watershed Management for Bridges**
  - **3-hour early warning**
- **Three Levels of Responding**
  - **Early warning**
  - **Warning**
  - **Action**

PROACTIVE DISASTER PREVENTION AND EARLY WARNING SYSTEM

- High vulnerability to potential damage
- Unique characterization in Geographic conditions
- Disaster prevention map



CONCLUSIONS

Planning, design, construction and maintenance are based on a bridge's life cycle:

- **Zero-based thinking**
- **Environmentally and ecologically friendly design**
- **Green construction**
- **Inventory management and sustainable maintenance**
- **Proactive hazard prevention and responses**

Have a good day!