Transportation Engineering in China

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Richter 2003
Background:
- More than 5,000 years history
- 1.3 billion population
- Nearly 10,000,000 km², 30% cultivatable
- 70% is Mountain, 90% cities in mountain areas

Transportation related:
- More than 4 million km paved road network
- Freeway network totally 80,000km (50,000 mile)
- 130,000km (81,000 mile) freeway in 2020
- 50,000km (31,200 mile) High-speed railway system travelling in 350km/h (220 mile/h) is constructing, 10,000km (62,500 mile) already in service
- 400+ airports, totally 800-1000 in 2030
- 413 + harbors, 31,000+ anchorage, 2.6 billion tons delivery
National freeway network
Freeway

- Toll at varies rates, e.g. 0.12$/mile for < 7 persons
- >=4 lanes, 1 lane=3.75m (=12.5 feet)
- Design speed 120km/h (=75 mile/h)
- Fair good condition with good maintenance
Grade separated by different ways
Design load = 10 tons per axle
95%+ are asphalt paved with a 15 years life span
80cm thick with bound base usually
400+ airports now
250 billion investment
totally 800-1000 in 2020
High speed railway
travel speed 350km/h (=220mile/h) & 300Km/h (=187mile/h)
50,000km (31,200mile) High-speed railway system finished in 2020
10,000km (62,500mile) already in service
Connection:
Combination of Airport, Fast railway station, Urban metro station, Bus station, Parking system and freeway
Shanghai Hongqiao Connection:
2 terminal buildings, with 2 runways, 200+ airlines
1 fast railway station, 3 fast railways with 60 platforms
3 freeways,
3 urban express ways
4 Parking buildings, with 3100 positions
4 metro lines,
54 bus lines,
2000 taxi at service
Shanghai
Shanghai

Biggest city of China

Biggest harbor in the world
SHANGHAI

Modern City
Chinese Folks
Without Night
Beijing
Beijing

North

Great wall
North

Xiang Mount
North

Summer Palace
North-east

Jilin Province
North-west

Mongolia Highland
Ningxia Desert
West

Xinjiang

新 疆
Tibet
South-west

Hometown of Panda
South-west

Sichuan

Yuanyang
Guangxi

Guangxi 广西

South-west

 Guilin
South

Hainan

Sanya
South-east

Wuyi Mount

Fujian

福建
• Differences of areas:
  • Climates
    • temperature, moisture, precipitation…
  • Geological condition
    • desert, frozen soil, soft clay…
  • Traffic volume
    • Heavy duty up to 1~2billion ESAL

• Demands nowadays:
  • Rapid
    • Highway in 40~90Km/h
    • Freeway in 80~120km/h
    • Metro in 30~60km/h
    • Railway in 150~250km/m
    • High-speed railway in 300~400km/h
    • Airplane in 800~1000km/h
  • Safe
    • Public safety
    • Driver and passenger safety
  • Comfortable
    • Even
    • Skip resistance
  • Intelligent
    • ITS (Intelligent Transportation System)
  • Environmental
    • Energy consume
    • Exhaust
    • Recycling
We are trying to build a Rapid Public Transportation System to cover the whole country.

**Constructions in the next 5 years**

- 1000 billion CN¥ (160 billion US$) in Freeways
- 500 billion CN¥ (80 billion US$) in high-speed railways
- 300 billion CN¥ (48 billion US$) in harbors
- 100 billion CN¥ (16 billion US$) in airports
- Uncountable in city metro system
- Uncountable in Urbanization
Tongji University since 1907
Transportation Engineering College

- Road & Airport Engineering Department
- Traffic Engineering Department
- Railway Engineering Department
- Logistics Department
- Information of Transport Department
Faculties
35 Professors
50+ Associate Professors
100+ lecturers

Students
900+ undergraduates
500+ graduates
170+ Ph. D. Candidates

Equipped with
Key Laboratory on road and traffic engineering of Education Ministry
Key Laboratory on Railway Engineering of the State
Drive Behavior Simulator

- 5 million US$ investment
- Trace the react of driver
- Testify the alternatives of design
APT

- 5 million US$
- Mmls-6 for field
- Mmls-3 for full-scale
- Simulate the truck
- In deferent load
- In deferent speed
- In deferent tire
- In deferent temp.
- ......
High Resolution Micro focus 3D-CT System
- Detect ability < 500 nm
- Micro structure analysis
- Defect analysis
MTS
Material Test System
- Max. Load 10 tons
- Dynamic in sin, cos, ……types
- temp. controlled
- Trace in high efficiency
SHRP- DSR/BBT/RT/DT
SHRP-GCM, APA, PAV
My department research on:

- Pavement design methods
  - Asphalt concrete pavement design
  - Portland Cement Concrete Pavement Design
  - The Over layer Design
  - The Performance Based design
- Subgrade design
- Alignment design
- Safety evaluation
- Asphalt material design
- PMS development based on GIS and Internet
Personal research & interests

- **Asphalt Pavement design methods**
  - Rheological Rutting Predict Models
  - Traffic Parameters
  - Environment Factors
  - Performance Evaluation
  - Reliability of the Pavement
  - Mechanics with FEM

- **HMA design**
  - Properties evaluation
  - Porous Asphalt
  - Porous Bound Base

- **Modified Bitumen**

- **Alignment design**
1. Asphalt pavement
2. FEM analysis
3. Distribution of shear stress
4. Changes with the base modules

Max shear stress (MPa)

Normal stress (MPa)

Base modules

Base modules
Thank you!

谢谢！

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