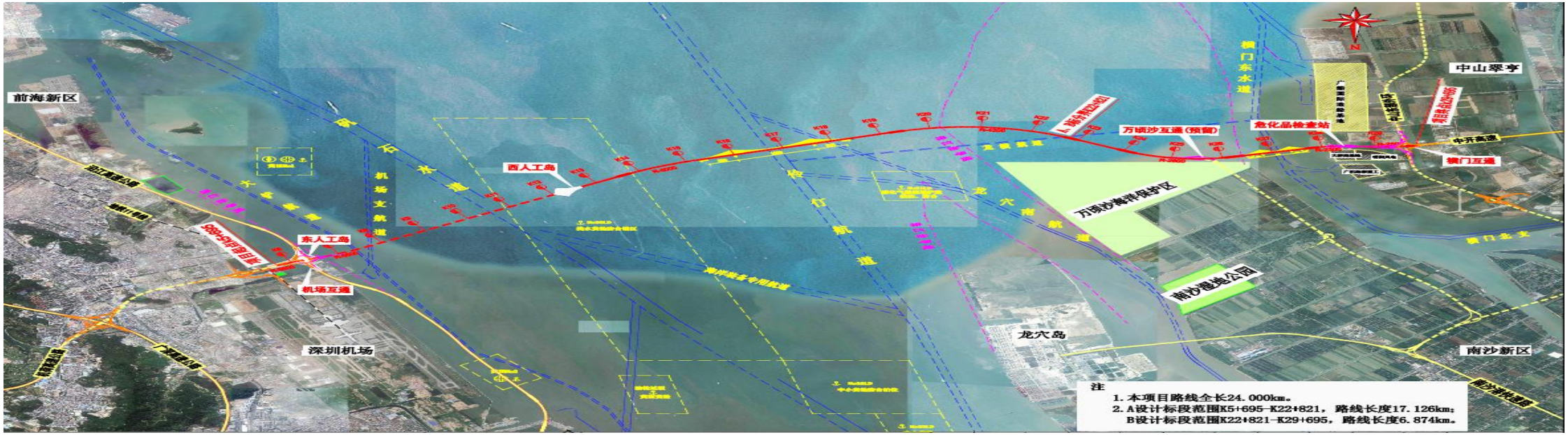
Study on **Framework** of Traffic Operational Safety Assurance Program and Real-time Crash Risk **Prediction Model** of Shenzhen-Zhongshan Corridor



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FIRESEEDSNORTH INFRASTRUCTURE

Outline

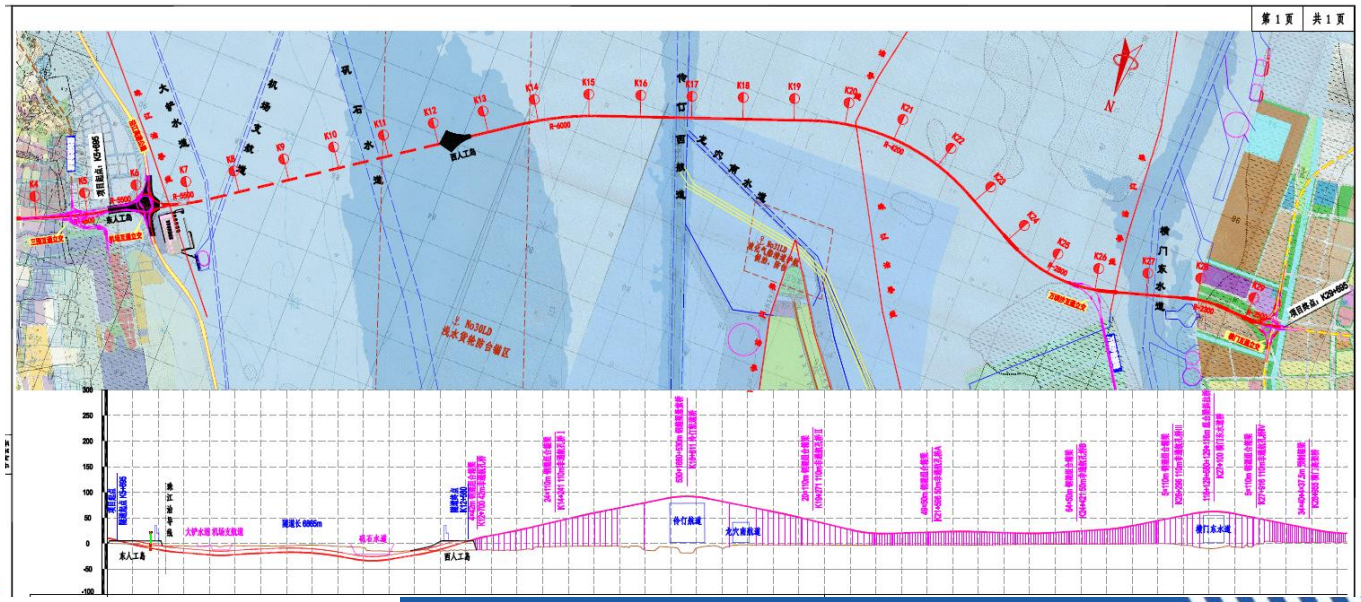
1. Background of the “Mega” corridor

A 24-km long corridor across the sea outfall of Pearl River, Guangdong Province (close to Hong Kong), combined with 2 man-made islands, a tunnel, and a bridge

Directly connecting two major cities: Shenzhen (pop: 11.4 m) and Zhongshan (pop: 3.1 m)

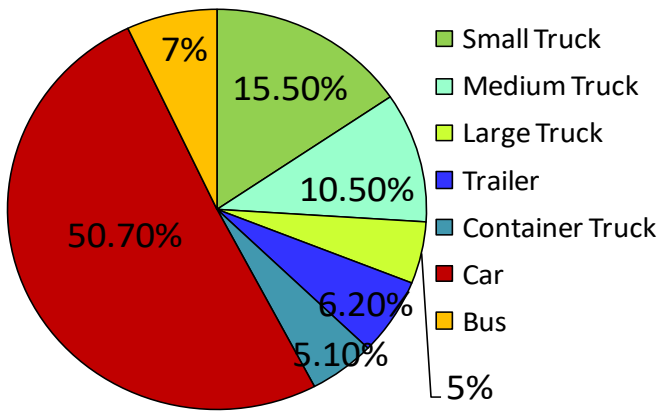
- **Current stage: detail design**
- **Construction time period: 2017-2024**

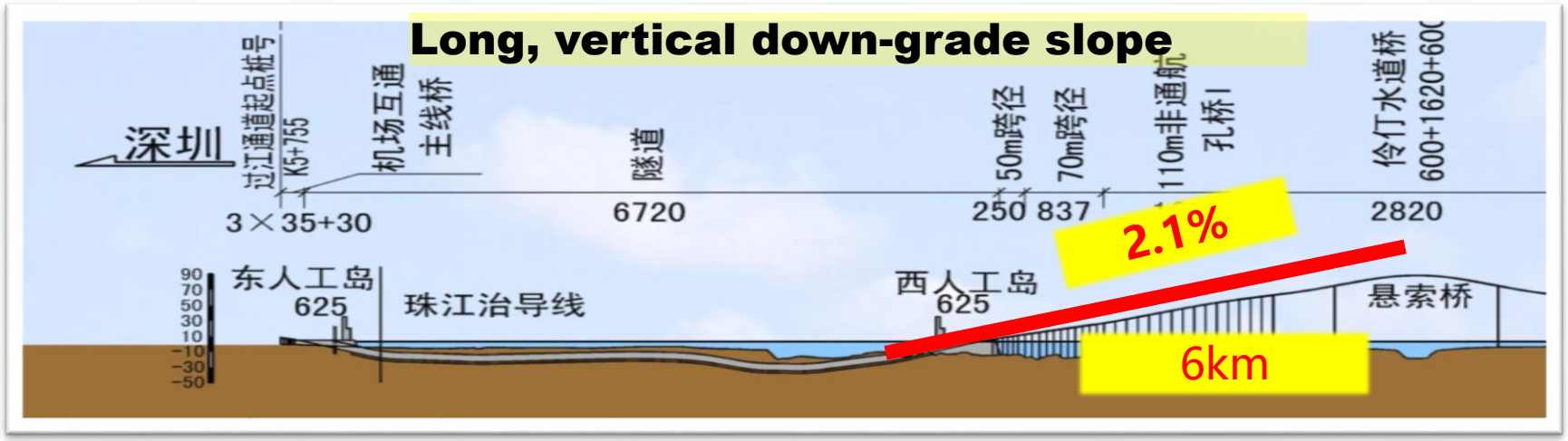
- **Tunnel section: 6865 m**
- **Bridge section: 17054 m**
- **8-lane roadway**
- **Design speed = 100km/h**
- **Horizontal min R = 2300m**
- **Vertical min R = 16000m**
- **Max slope = 2.98%**



2. Major Road Safety Concerns

- > 90k pcu/d
- ≈50% trucks
- high % of dangerous goods and over-sized vehicles





R&D on an operational safety assurance program

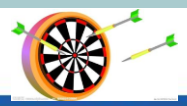
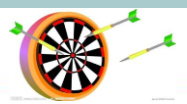
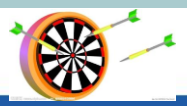
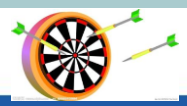
Part 3

Framework of Traffic Operational Safety Assurance Program

Project: Traffic Operational Safety Assurance and Emergent Response of Shen-Zhong Corridor

Main Goal: mitigate operational safety concerns

Sub-project 1: Management of dangerous goods freight	Sub-project 2: Ventilation and fire control system	Sub-project 3: Traffic operational management, control and safety	Sub-project 4: Emergent response and rescue
Target: Dangerous Goods	**Target: Ventilation & Fire**	**Target: Safety & Control**	**Target: Response & Rescue**

3.2 The Safety Program to Be Developed

Sub-project 3: Traffic operational management, control and safety						
Topic 1: Road safety evaluation by simulation with the driving simulator	**Topic 2:** Advanced illumination and safety	**Topic 3:** Intelligent traffic operational management and control	**Topic 4:** Traffic signs and guidance system inside underground interchange	**Topic 5:** Solutions against severe weather	**Topic 6:** R & D on an advanced video and sound incident detection system	**Topic 7:** The traffic operational safety manual

A safety assurance program with ATM measures

Road
- Geometry
- Infrastructure
- Lane config.

Incident
- Crash
- Emergency
- Events

Data Source
- Veh. detect.
- Toll
- Surveillance
- Weather

System

Risk Evaluation

Risk Map

High risk site

Manage & Control Modules

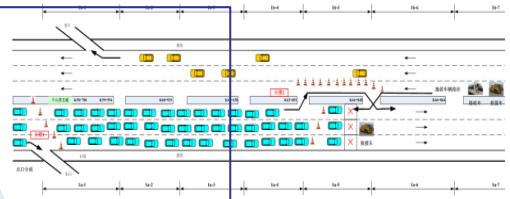
Lane Management

Speed Control

Traffic Organization

Manage, Control and Info.

Traffic Organization



Other Deliver Strategy

Web Radio Navigator APP

Design Optimization

1. Control, message devices
2. Lane config. and signs

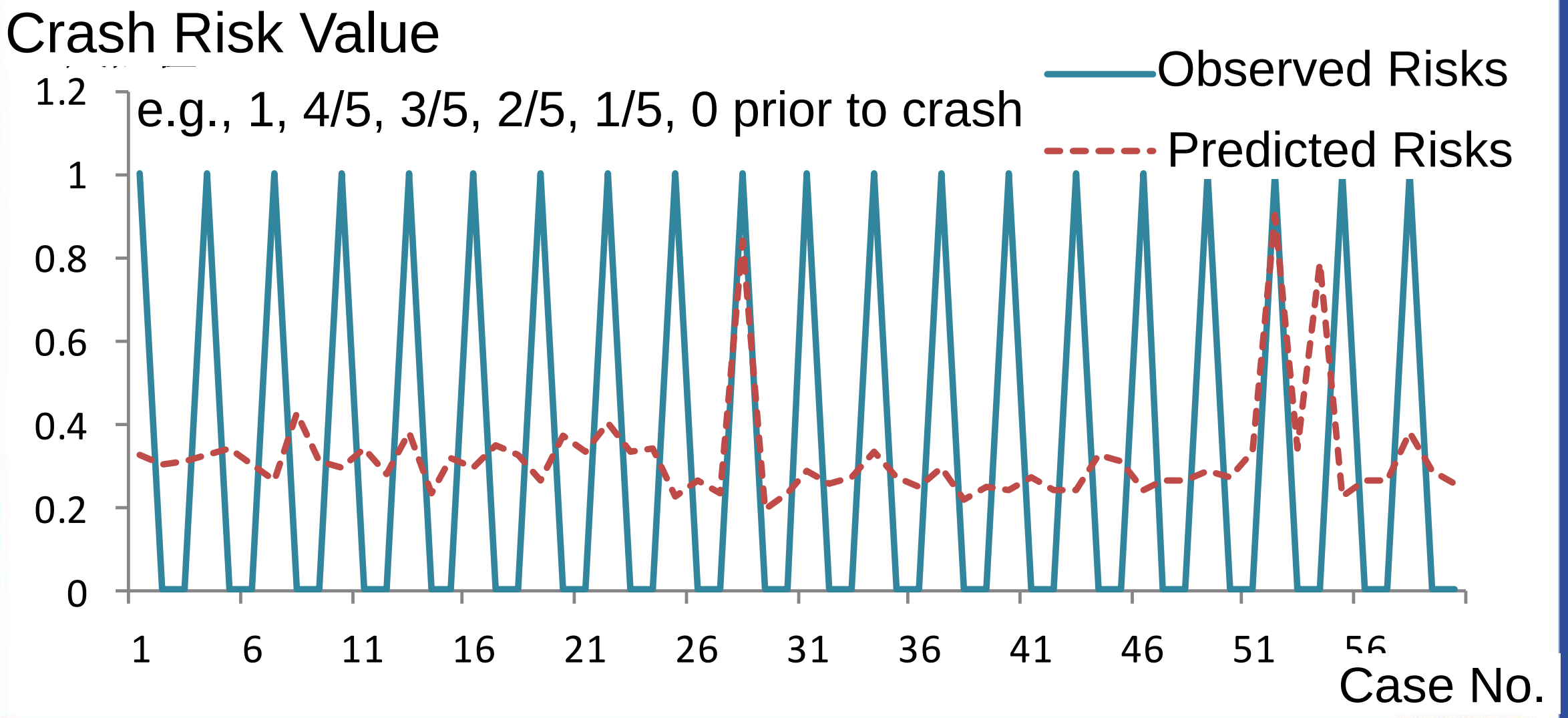
Transition Page

Part 4

Real-time Crash Risk Prediction Model

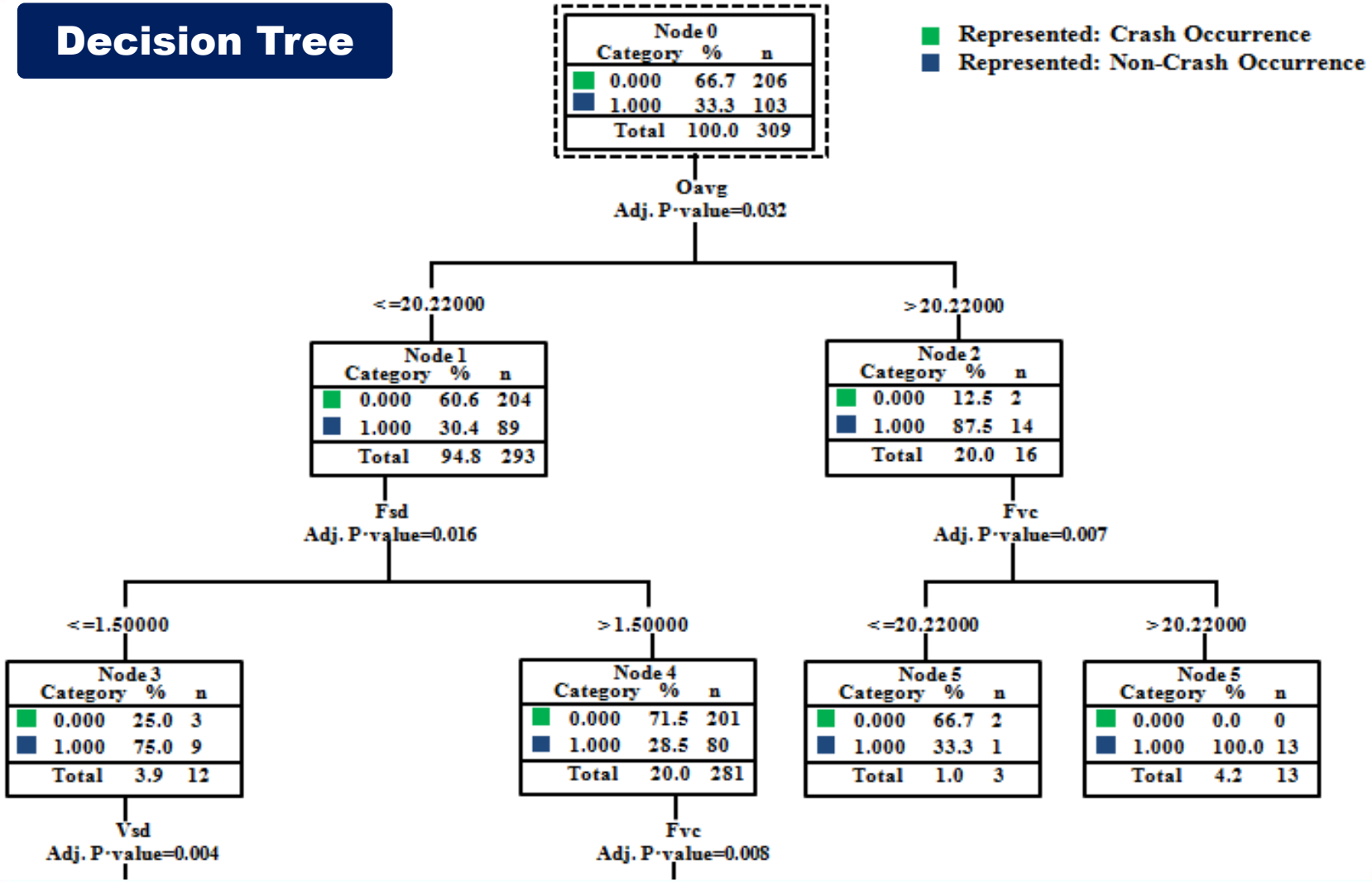
2-step mechanism: step 1 - identify major contributors to risk, step 2 - input major contributors into model to predict risks.

4.1 Defining Risk & Identifying Main Factors



4.1 Defining Risk & Identifying Main Factors

Decision Tree



Main Traffic Flow Factors Identified

O_{avg}→

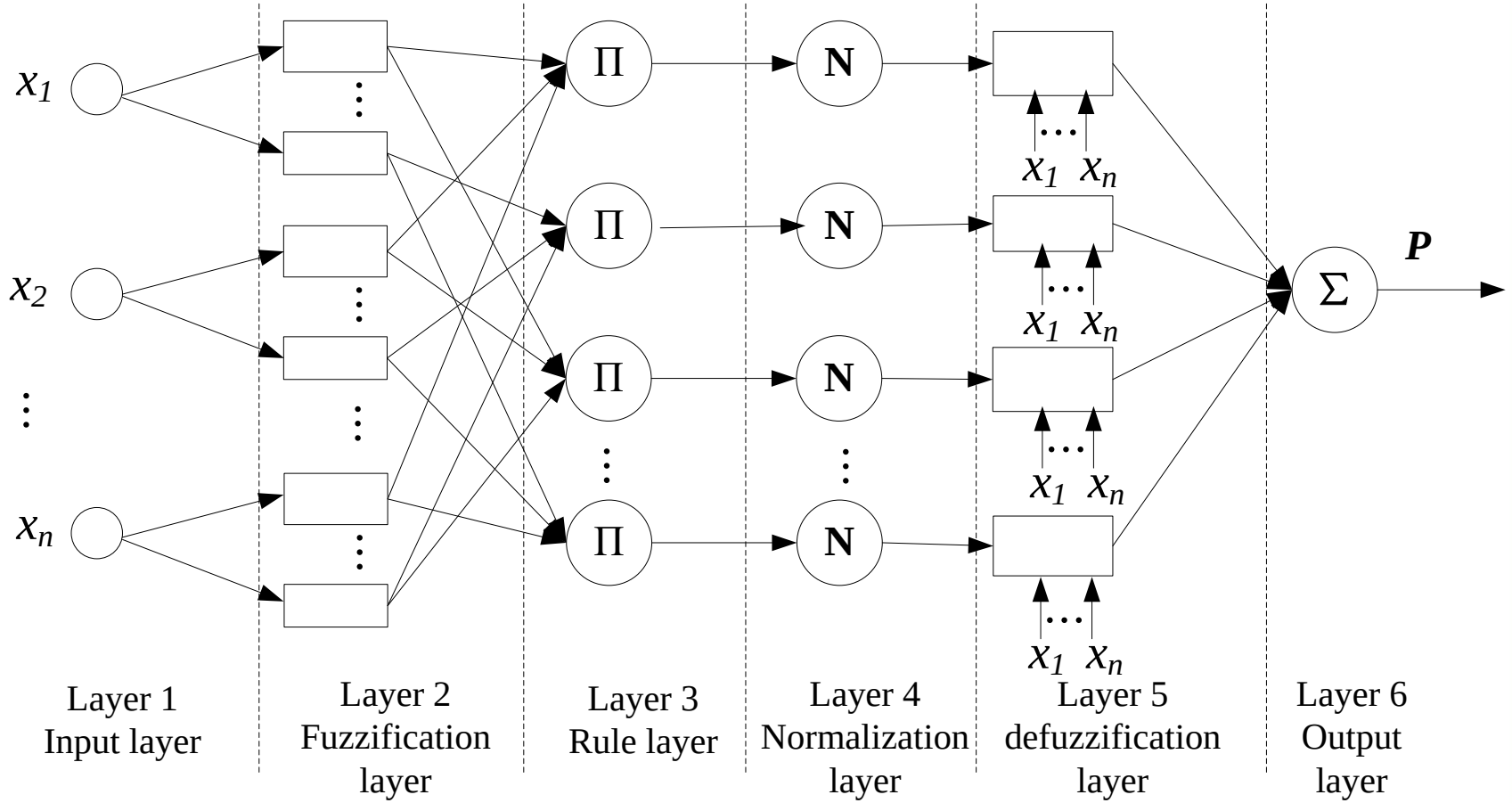
F_{sd}→

F_{vc}→

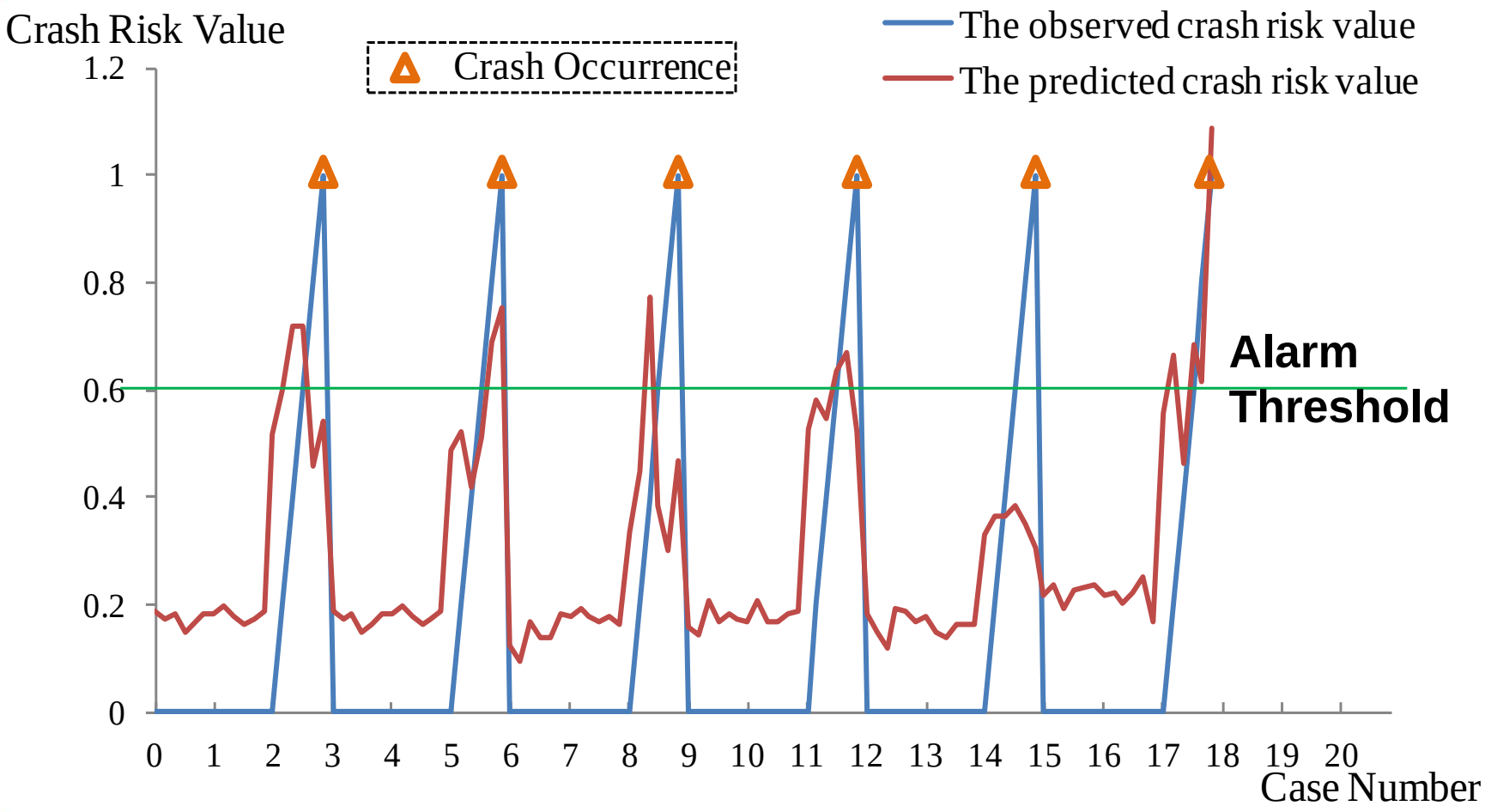
V_{avg}→

V_{sd}

Structure of Adaptive Neuro-Fuzzy Inference System (ANFIS)



4.3 Model Results



13 out of 20 crashes were correctly alarmed (accuracy rate=65.0%)

3 of 40 non-crash cases were predicted as "crash"(false alarm rate=7.5%)

5. Discussion and Conclusions

- safety concerns were accurately captured
- The safety assurance program was accepted by the designer
  - changeable lane configuration signs
  - variable posted speed limit signs
  - facility provisions to fulfill incident traffic organization
- Alarm accuracy rate (65%) and false alarm rate (7.5%) are acceptable for engineering practices
- Further indications for next step mitigations

5. Discussion and Conclusions (continued)

- Both alarm accuracy and false alarm rates can be further improved
- To be trained and calibrated by real Shen-Zhong Corridor traffic data during its operation
- Develop a user-friendly software to run risk model

R&D on Program of Real-time Crash Risk Prediction

R&D of Real-time crash risk prediction and visualization program based on open source tools MySQL、Python、Baidu Map (under construction)

THANK YOU!