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Development of a decision making tool for freight transport in the UAE

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Content

1. Introduction
2. Freight Model Approach
3. Forecast Scenarios and Results
4. Summary

The UAE National Transport Plan (NTP)



Project:

> The UAE National Transport Plan

Tasks

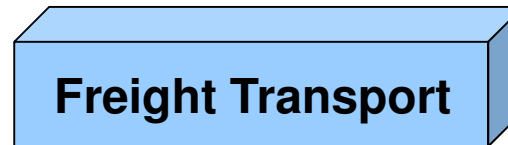
- > Analysis of current performance of transport system
- > Development of national transport planning objectives
- > Development of strategies, actions, measures
- > Forecast scenarios (different measures and growth scenarios)
- > Analyse impacts of measures in these scenarios
- > Calculation of (multimodal) commodity flows, handling volumes, shifting potentials



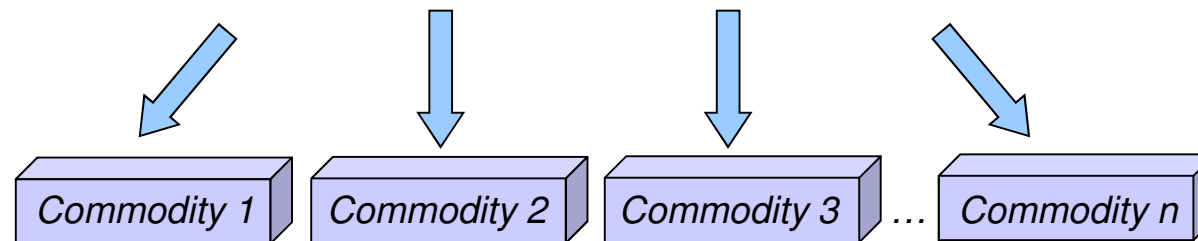
Key Component

- > Development of national transport model (passenger and freight traffic)

Disaggregation to Commodities

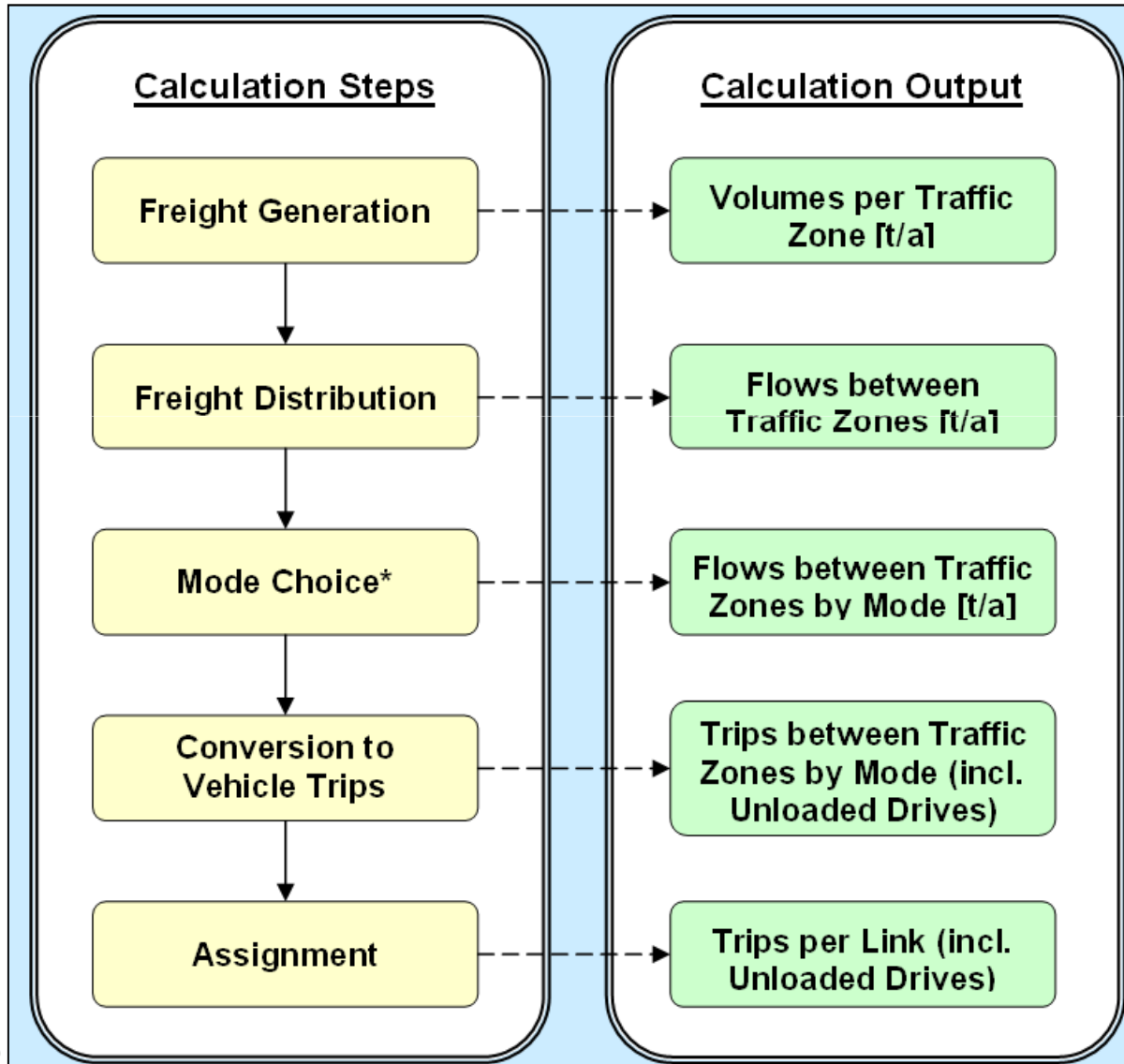


- > Transportation of goods from origin to destination
- > Complex and heterogenous composition



- > Segmentation in commodities / commodity groups
- > Differentiated generation, distribution, mode choice for each commodity

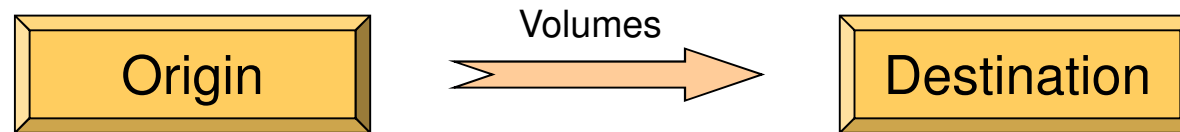
Modelling Steps



*) not applied in base year model

Modelling Steps – Freight Generation

For each commodity



$$\sum Volumes_o = \sum Volumes_D$$

$$\underline{\text{Local Production}} + \text{Import} = \underline{\text{Local Consumption}} + \text{Export}$$

- > **Determination of generators per traffic zone**
- > **Different generators depending on commodity group and origin/destination**
 - > Inhabitants • rates (e.g. sewage)
 - > Area • rates (e.g. agricultural products)
 - > Factory input / output (e.g. cement)
 - > Construction sites (e.g. concrete)

Calculation Steps – Freight Distribution

For each commodity separately

> Results from Freight Generation Calculation

- > Generated origin volumes per traffic zone [t/a]
- > Generated destination volumes per traffic zone [t/a]

> Distribution Calculation

- > Calculation of commodity flows between traffic zones [t/a]
- > Gravity model
- > No modal differentiation

Calculation Steps – Mode Choice

For each commodity separately

> Results from Freight Generation Calculation

- > Commodity flows between traffic zones [t/a]

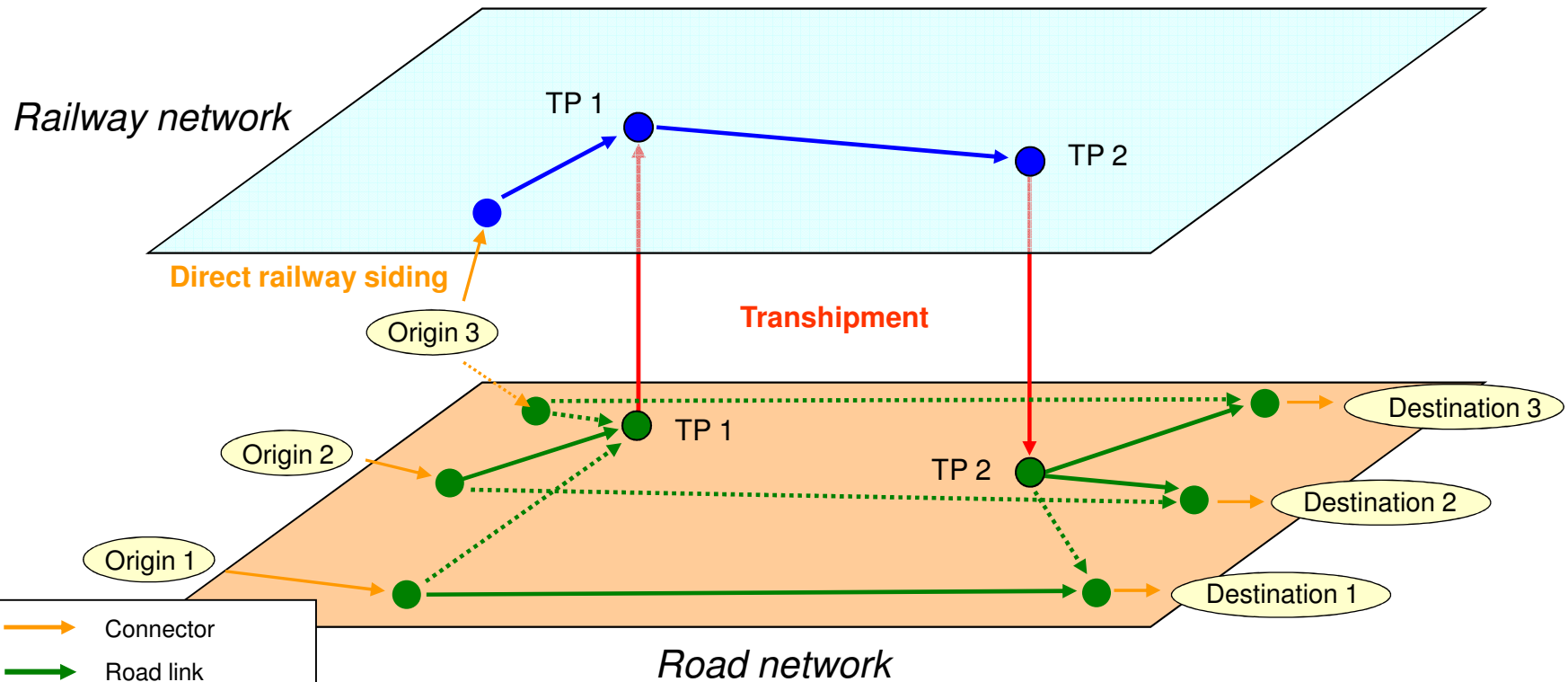
> Assignment of Commodity Flows to (multimodal) Network

- > Simultaneous route & mode choice based on cost functions
- > Most cost efficient route chosen for each OD relation
- > Result: commodity flows by mode [t/a]
- > Considered modes:
 - > Road (LGV, HGV)
 - > Railway
 - > Coastal Shipping
- > Consideration of logistic systems
 - > Same transport costs for commodities with similar transport and handling characteristics

Calculation Steps – Mode Choice

Network Supply

- > Multimodal networks and transshipment points (TP)
- > Parameterisation of networks (cost functions)



Calculation Steps – Conversion Tons → Vehicle Trips

For each commodity

- > **Results from Mode Choice Calculation**

- > commodity flows by mode between traffic zones [t/a]

- > **Conversion of commodity ton flows to vehicle trips**

- > Based on average load factors per vehicle type
- > Additional calculation of unloaded drives
- > Result: Trip matrices by mode

Modelling Steps – Assignment

- > **Final Assignment of (modal) trip matrices**
 - > Together with trip matrices of private transport model
 - > Results:
 - > Link volumes [vehicles per day / per hour]
 - > Percentage of HGV on roads

Base Year Results

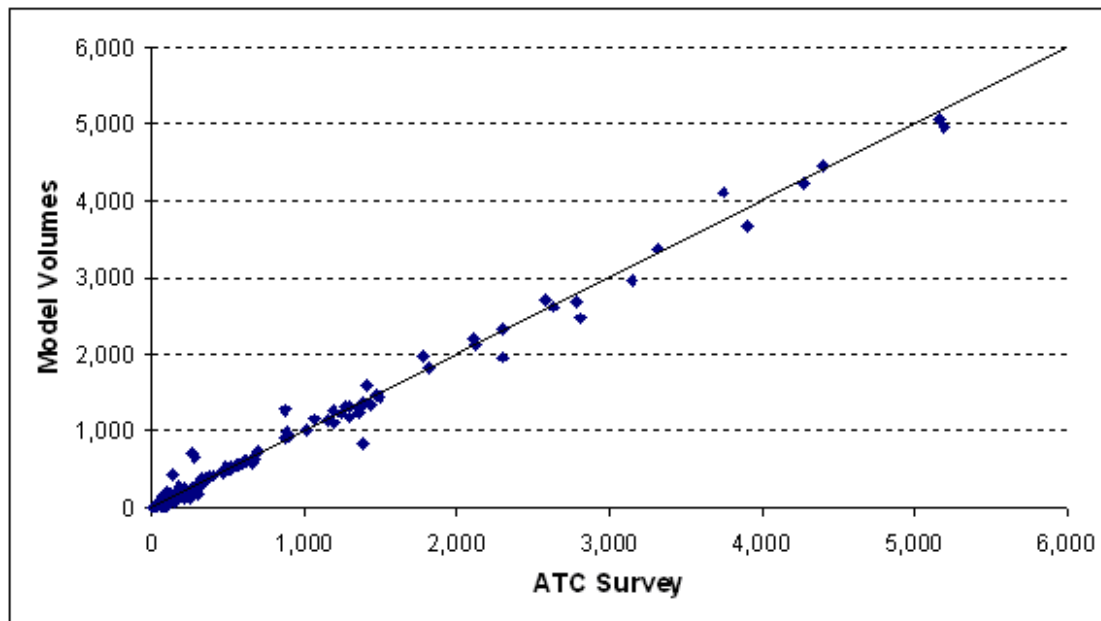
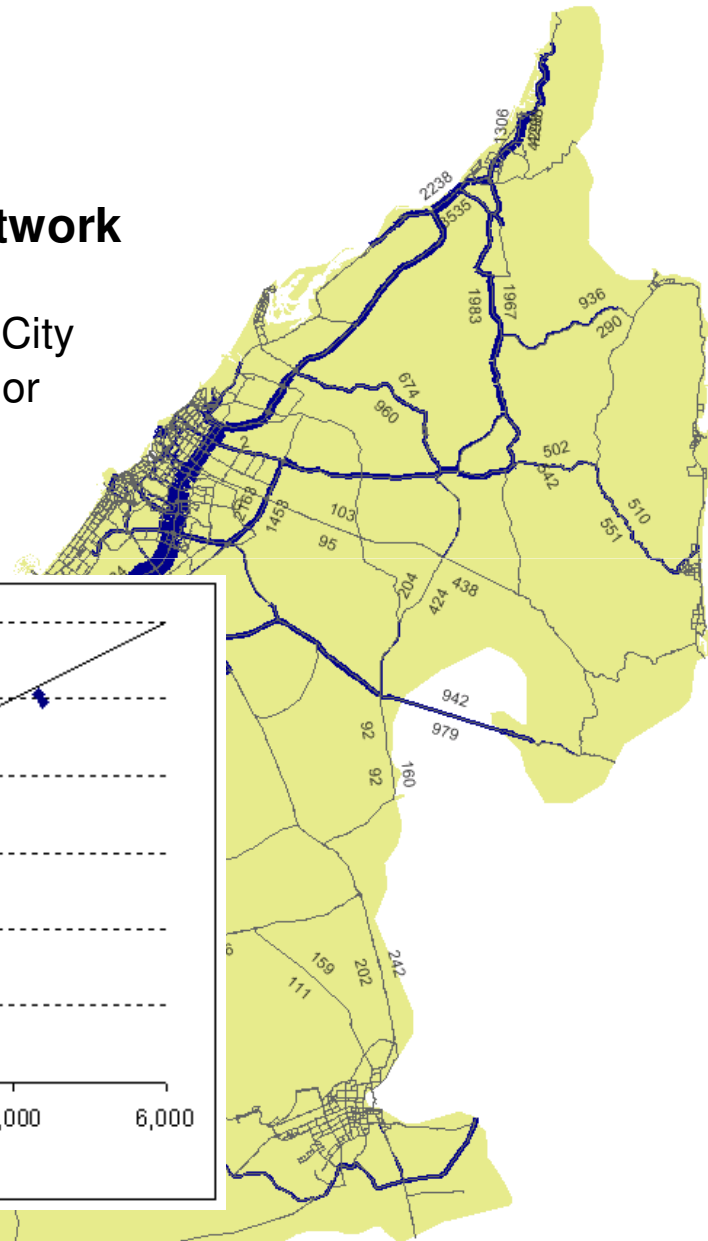
Results from Freight Model

- > Truck volumes on strategic road network
 - > HGV / LGV
 - > 24h / peak hour
- > Desire lines of inter-emirate volume flows
- > Freight volumes by commodity
- > Trip length distribution by commodity

Base Year Results

HGV Volumes on the Strategic Road Network

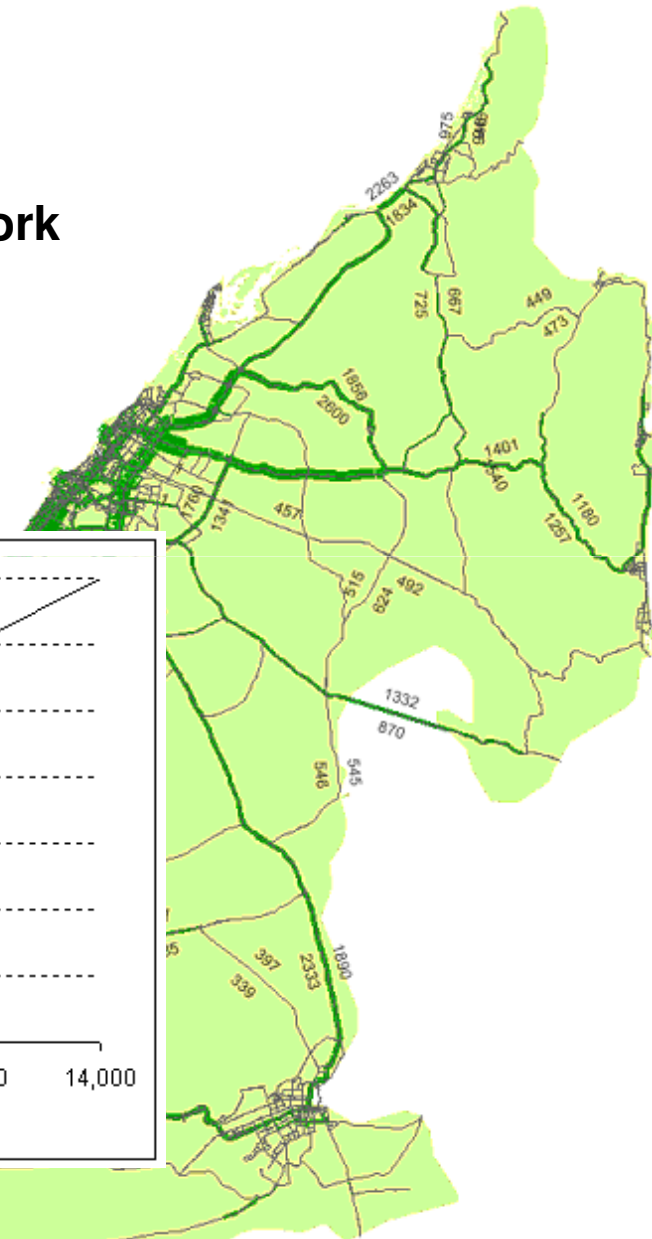
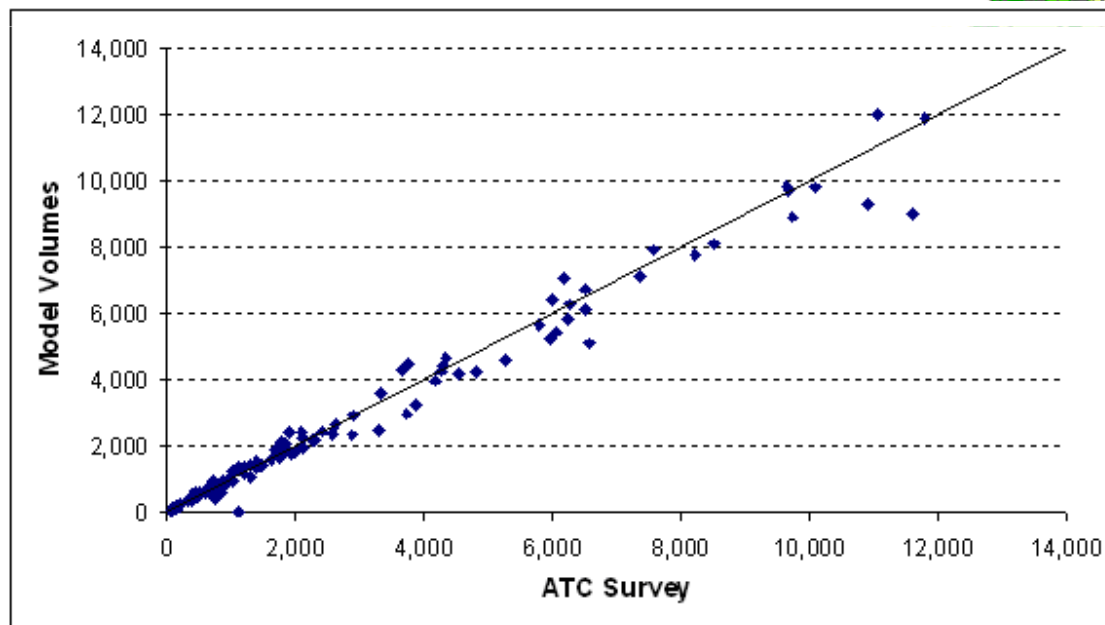
- > Highest volumes on E11 south of Abu Dhabi City
- > Significant volumes on the north-south corridor
- > E88/E89, RAK



Base Year Results

LGV Volumes on the Strategic Road Network

- > Highest volumes on E11
- > Significant volumes on the north-south corridor



Forecast Scenarios

1. Do Minimum Scenario

only road network extensions

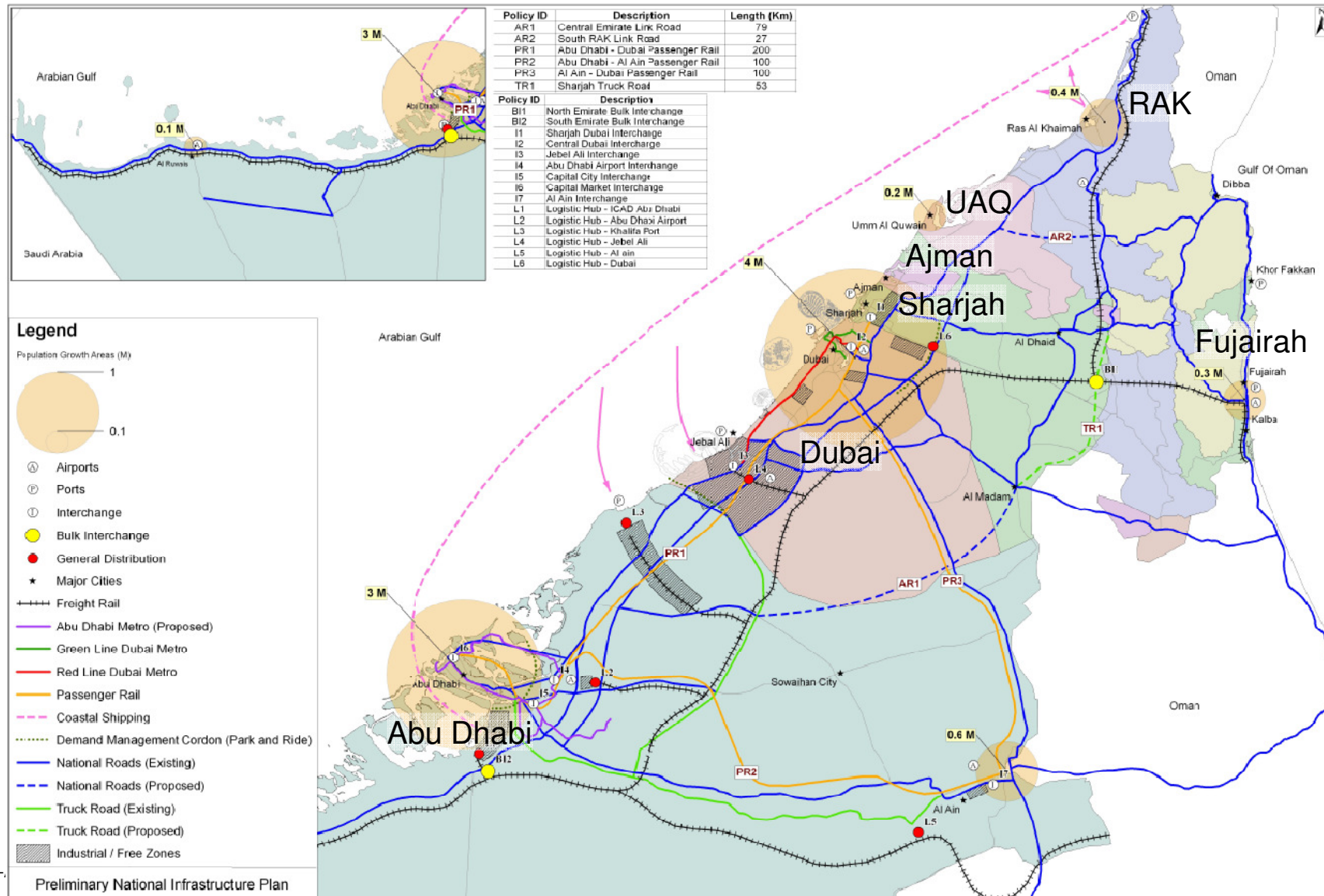
2. Rail Scenario

additional introduction of freight railway

3. Rail&Ship Scenario

additional introduction of coastal shipping connections

UAE National Transport Plan (NTP)



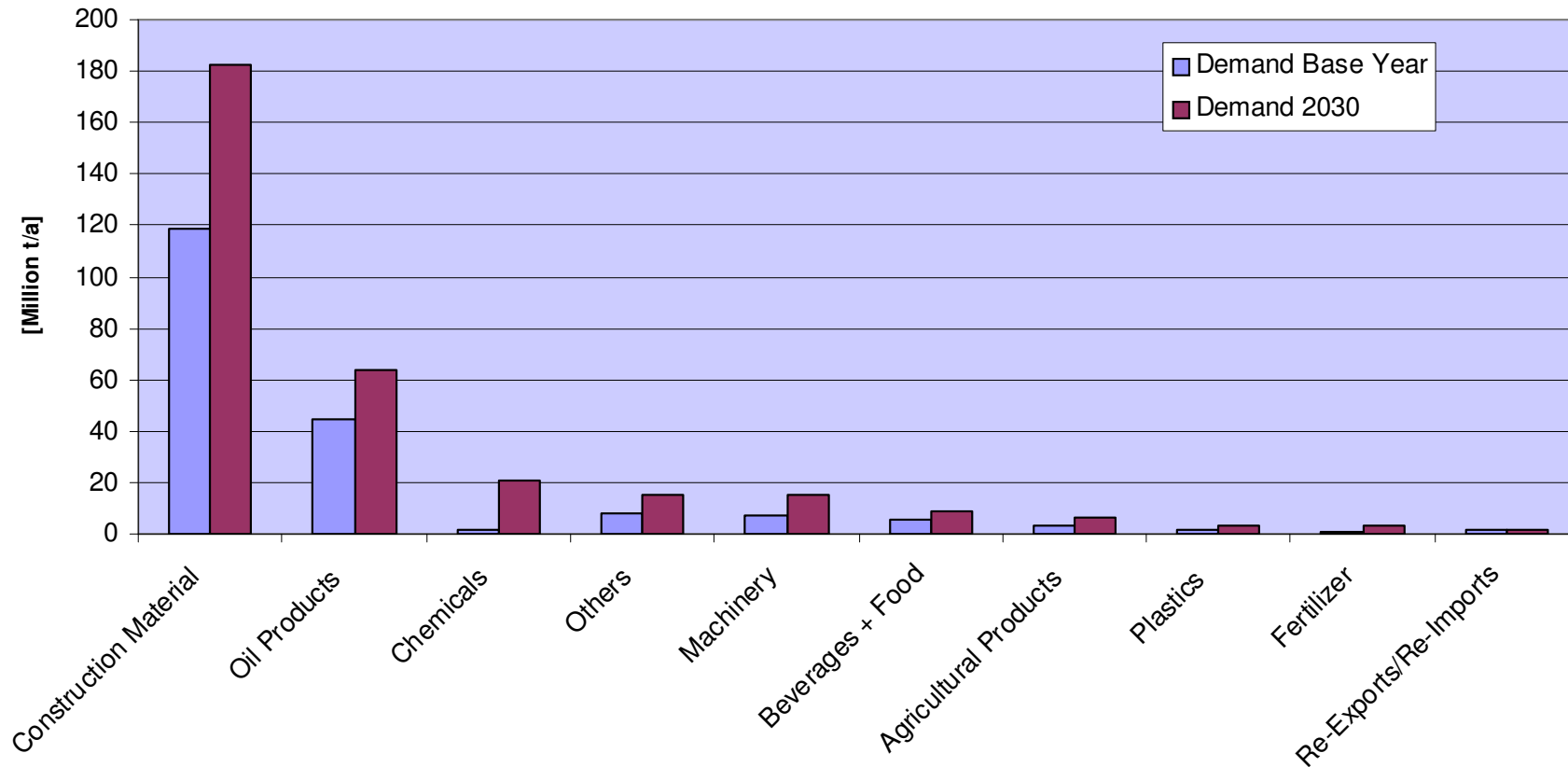
Land Use Data Input

- > Population and employment development until 2030

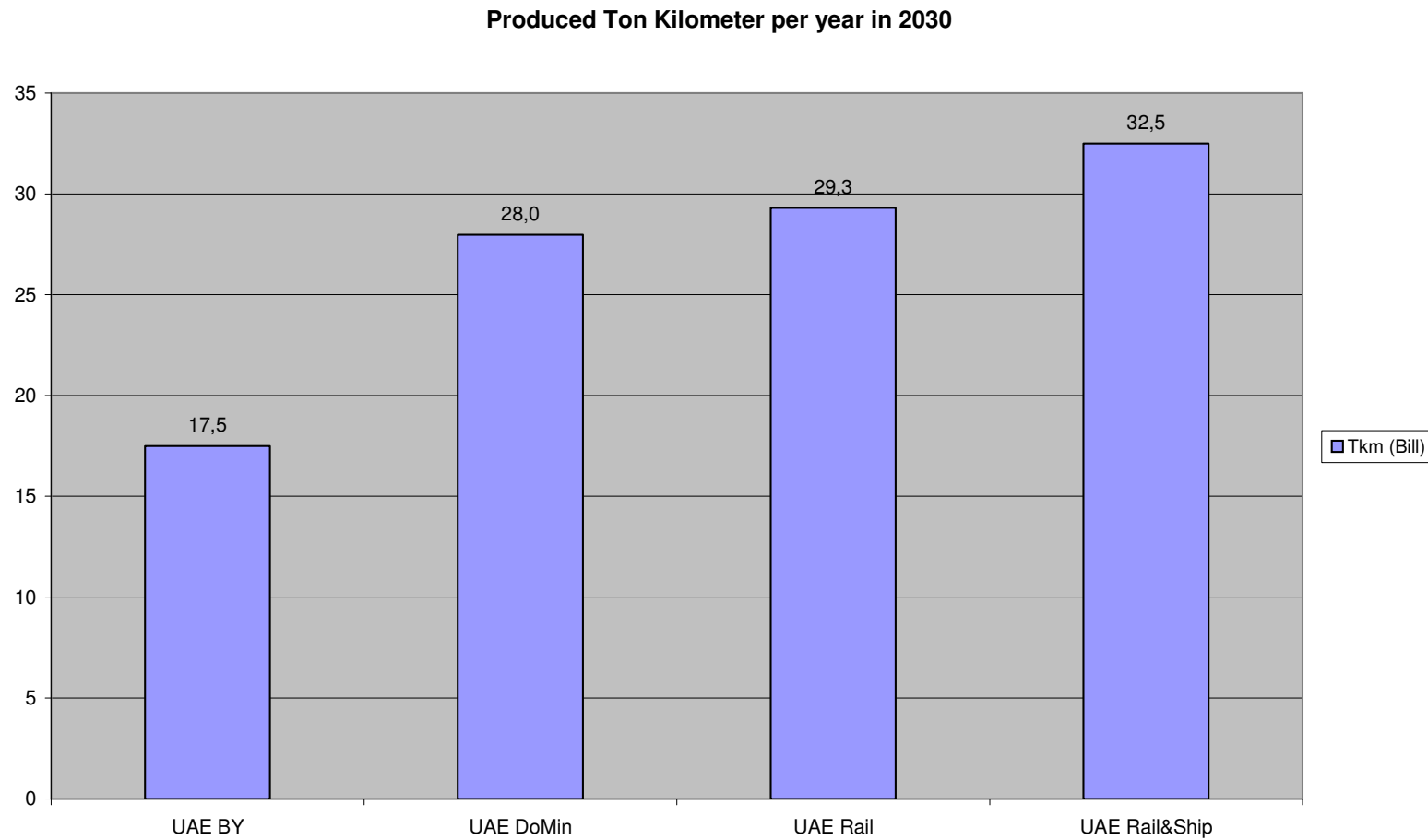


- > Development of industrial sector (production growth, new developments)
- > Proposed construction activities
- > Infrastructure developments

Development of Total Demand by Commodity Group

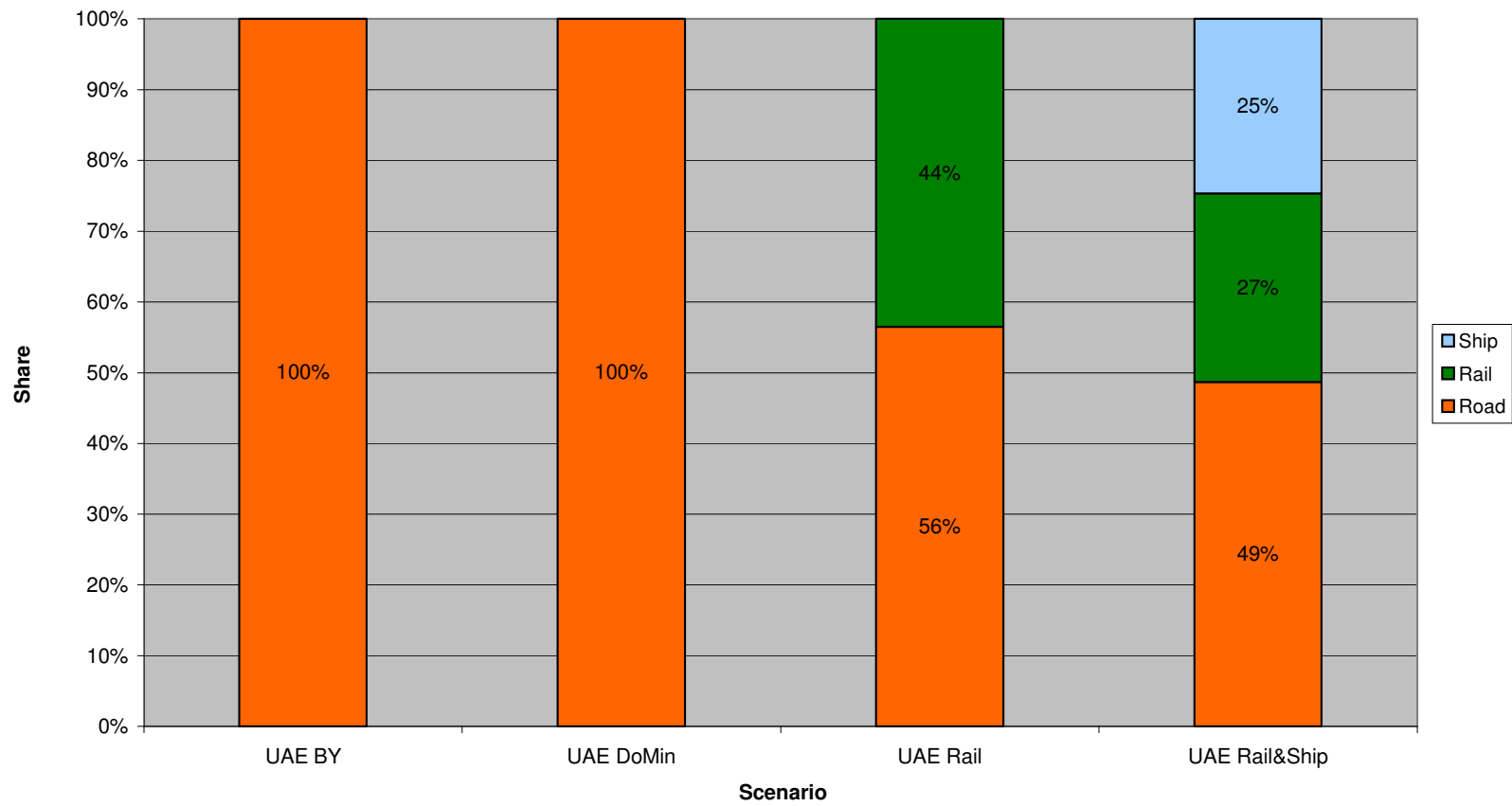


Development of Ton Kilometer



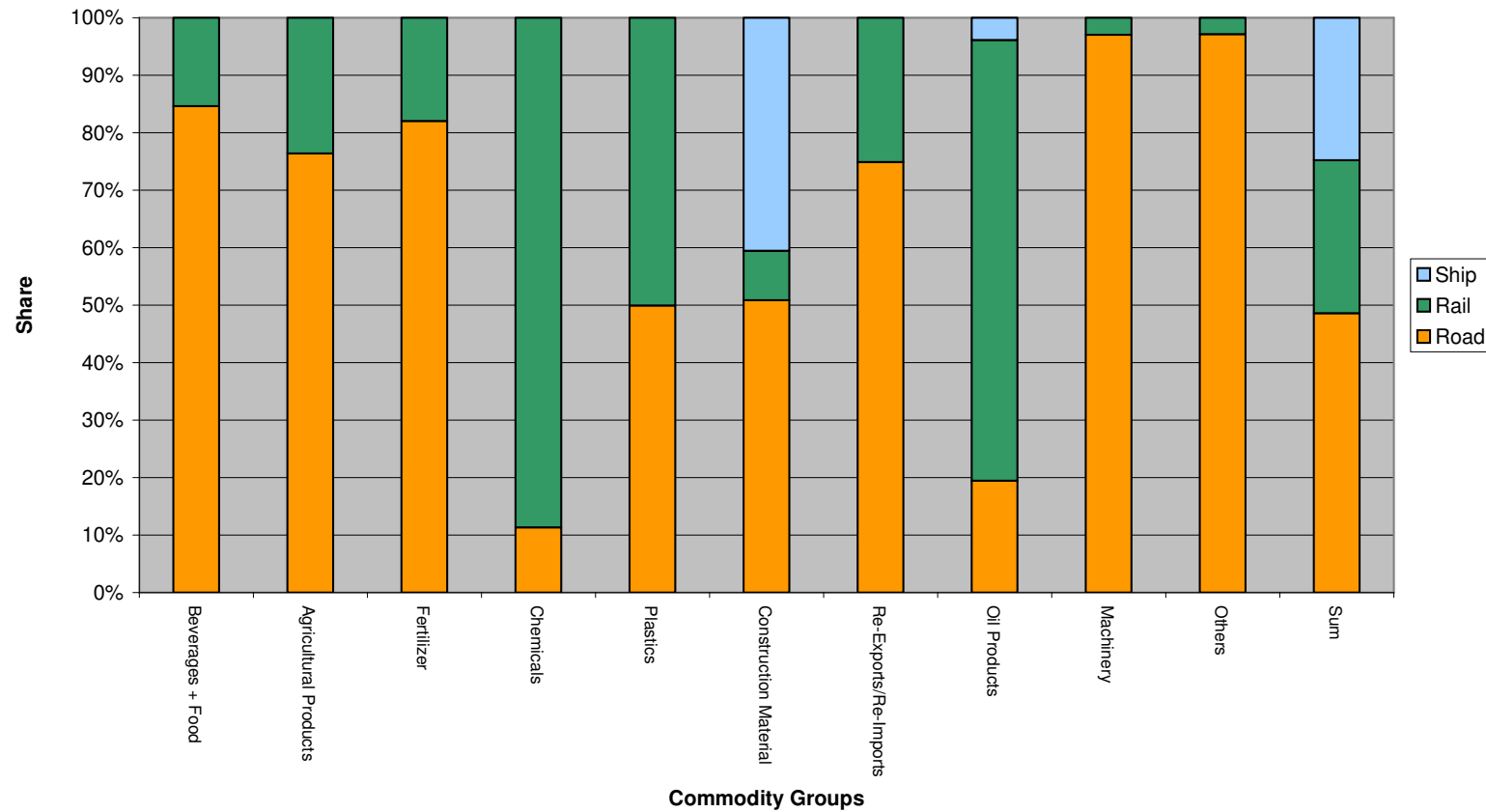
Modal Split

Ton Kilometer Split

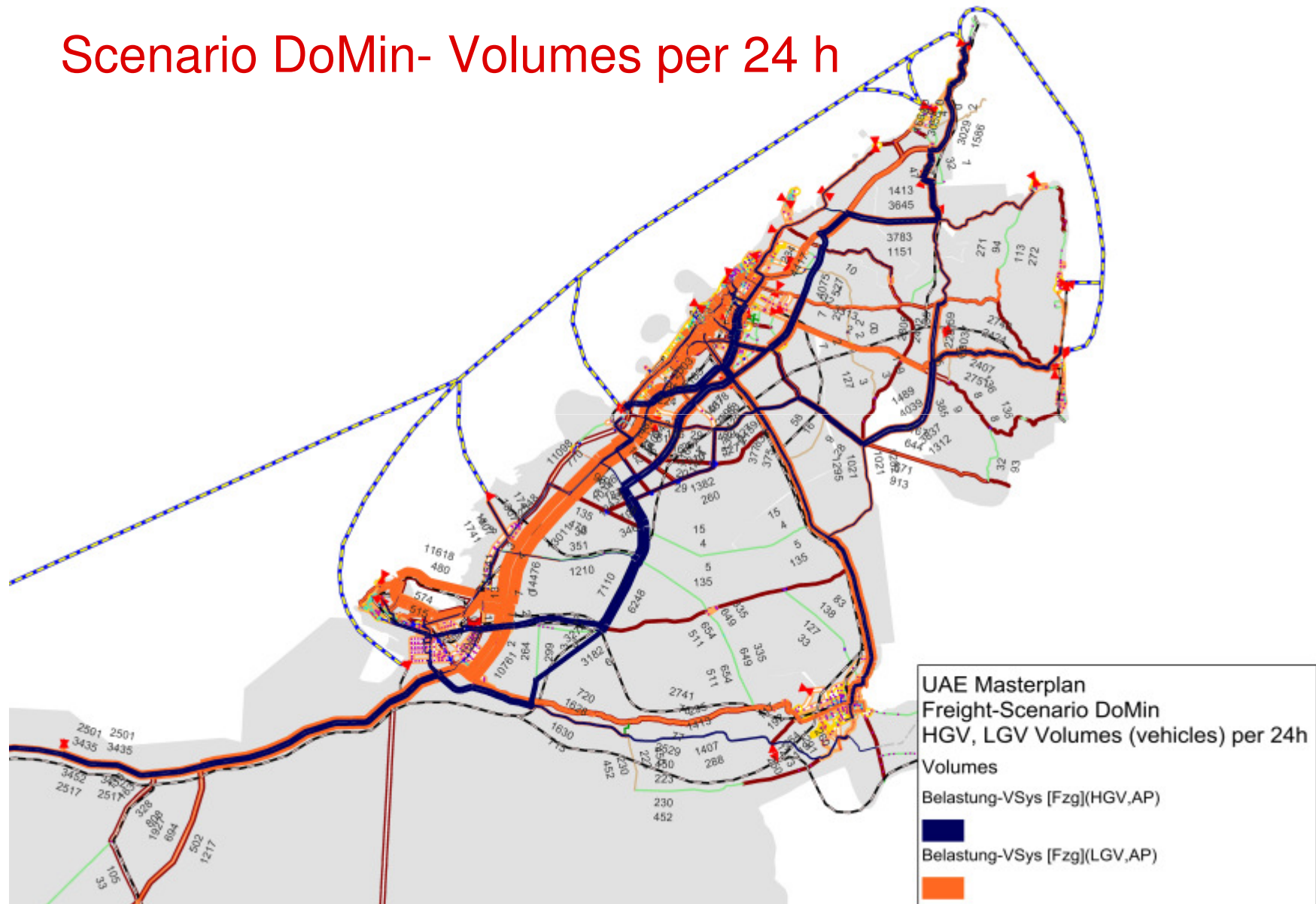


Modal Split per Commodity group – Rail&Ship Scenario

Modal Split (TKm) - Scenario Rail&Ship



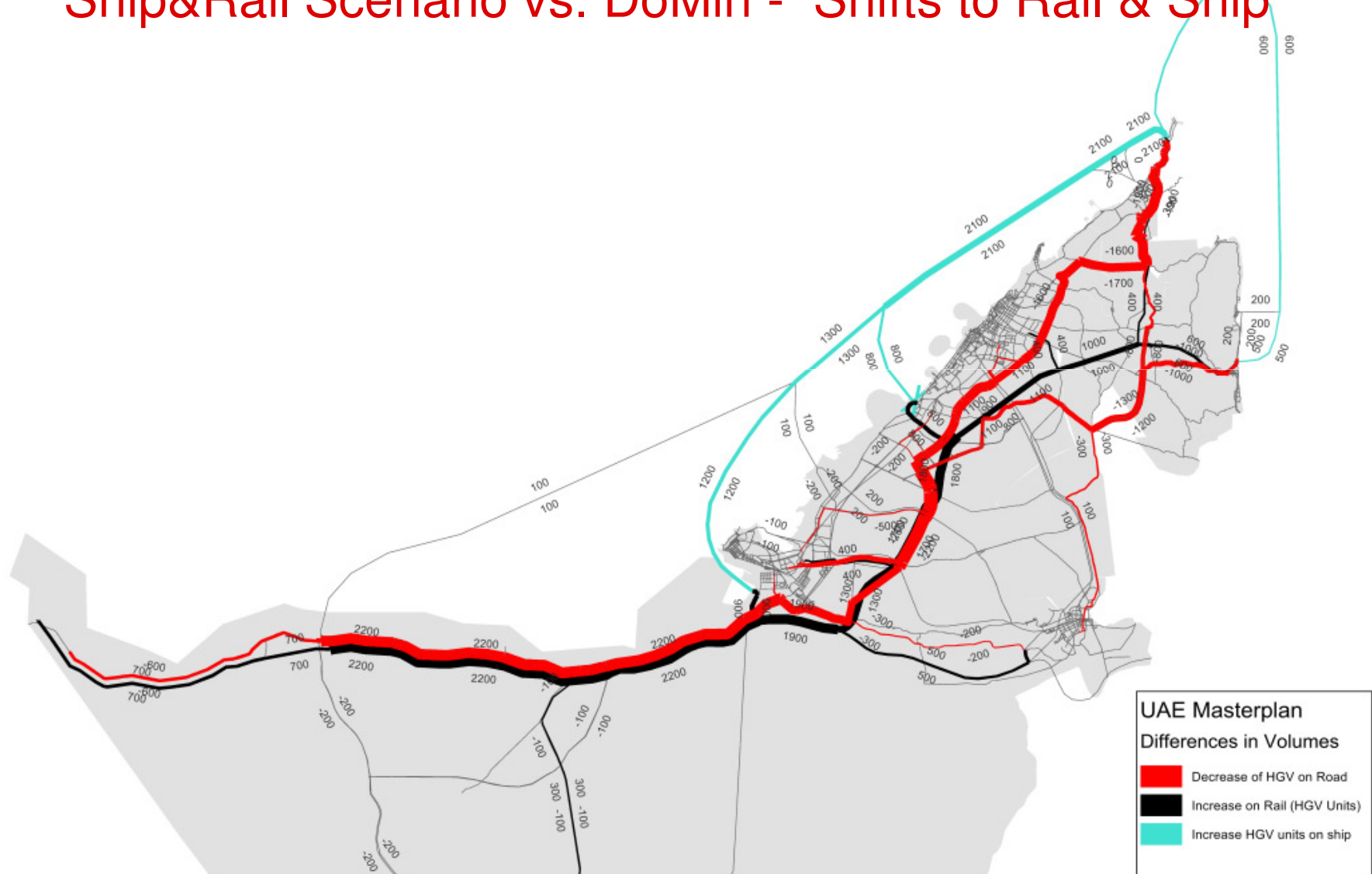
Scenario DoMin- Volumes per 24 h



Rail Scenario vs. DoMin - Shifts to Rail



Ship&Rail Scenario vs. DoMin - Shifts to Rail & Ship



Summary

Freight Model Approach

- > First freight transport model for the UAE
- > Innovative approach considering
 - > different transport modes
 - > separate commodities and their transport characteristics and affinities (costs)
- > Detailed description of freight transport processes
- > Successful application as powerful decision support tool for transport planning decisions now and in future

Forecast Results

- > High increase of transport volumes until 2030
- > Construction material as dominating commodity group
- > Do Minimum Scenario not capable for future demand
- > Shifts from road to rail and ship especially for bulk and construction material (over long distances)
- > Significant reduction of road traffic due to rail and shipping connections

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Thank You

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