TRANSPORT KNOWLEDGE SEMINAR SERIES #1

Forecasting the Future of Transport with the Strategic Investment for Transport (SIFT) Initiative

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Outlines of Presentation

- SIFT (Strategic Investment for Transport) Initiative Background (Kuancheng Huang)
- Modeling Principles and Model Implementation (Len Johnston)
- Pilot GIS Platform (Chihyu Lee)
- Illustrative Example for Model Application (Kuancheng Huang)
- Question and Answer
- Concluding Remarks (Kuancheng Huang)

ADB SIFT STRATEGIC INVESTMENT FOR TRANSPORT

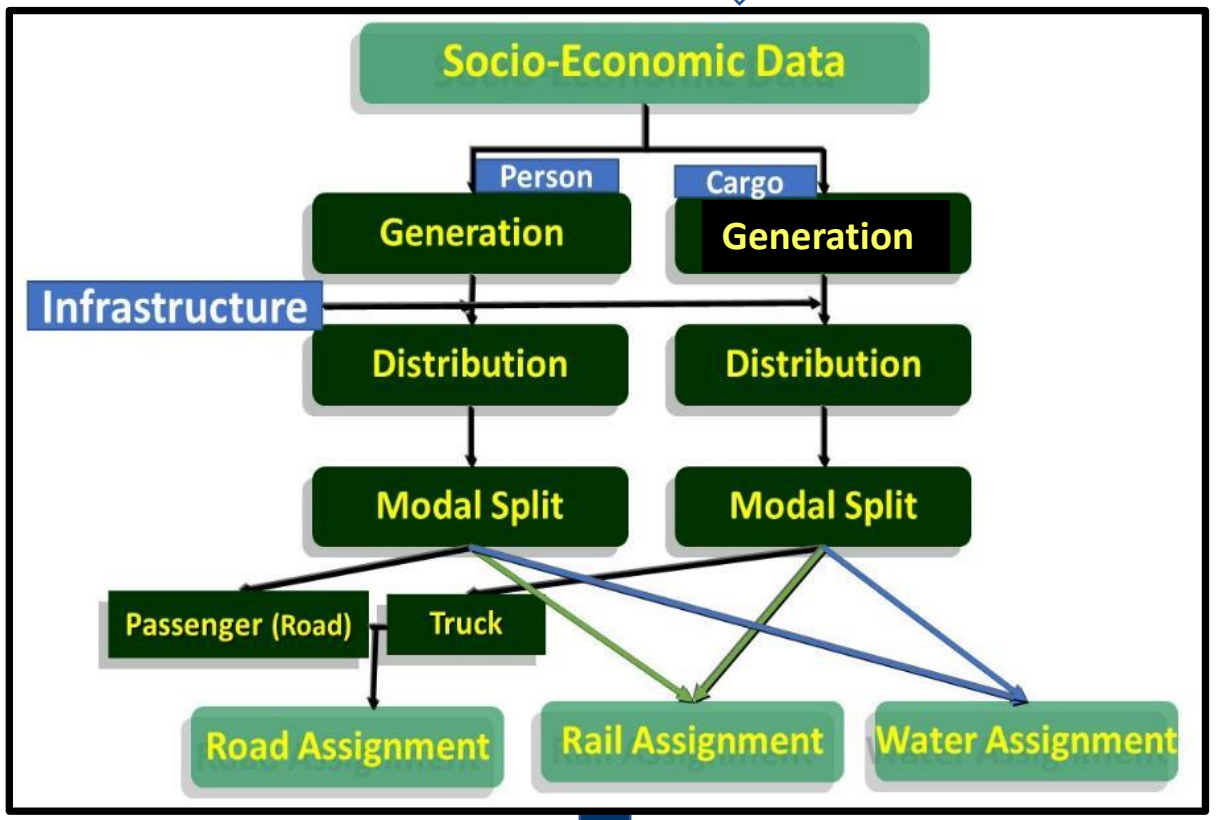
Introduction to Strategic Transport Planning

Human Activates

↓

Transport Demand

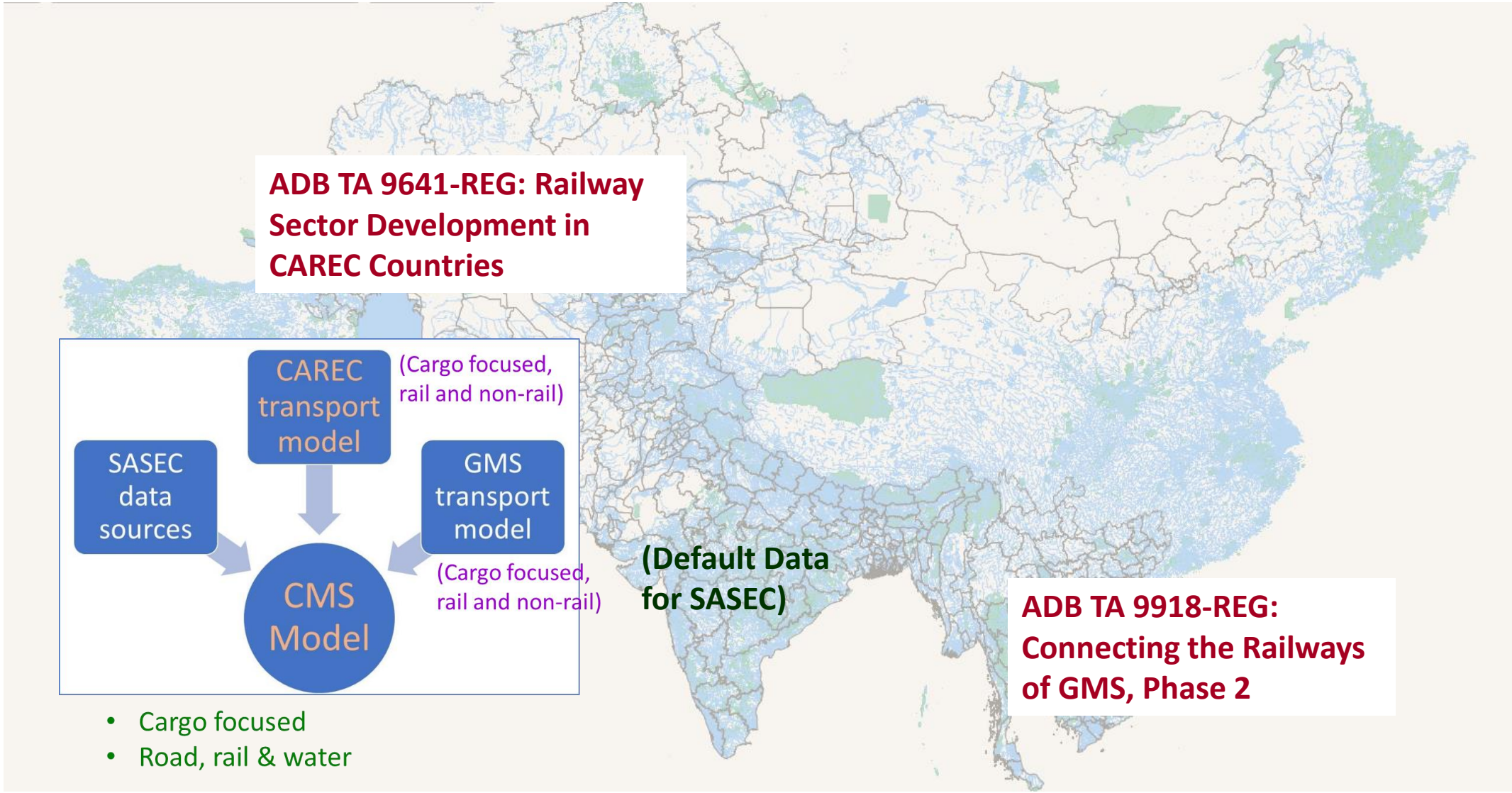
INPUT: GDP, Population, Transport Networks, Transport Cost & Time (and trade, traffic counts etc.)



OUTPUT: Simulated Flows on Transport Networks

3

History and Coverage of Pilot SIFT Model

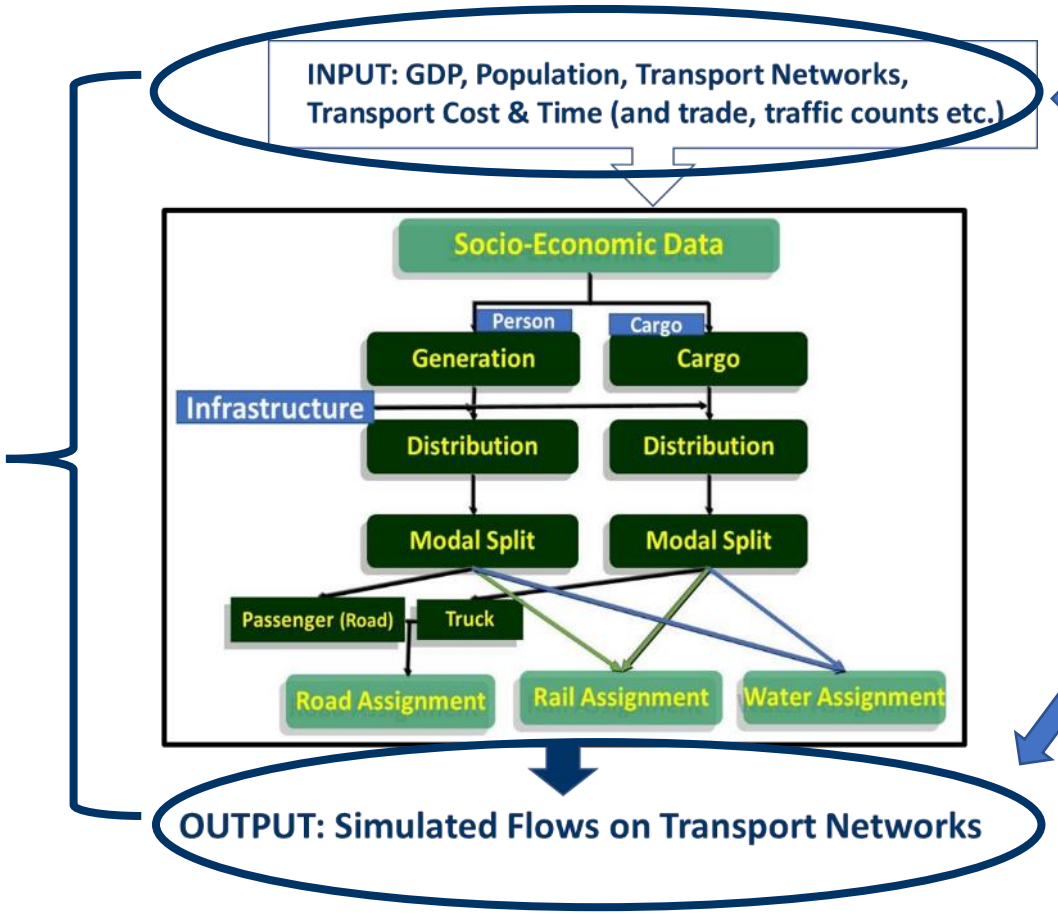


4

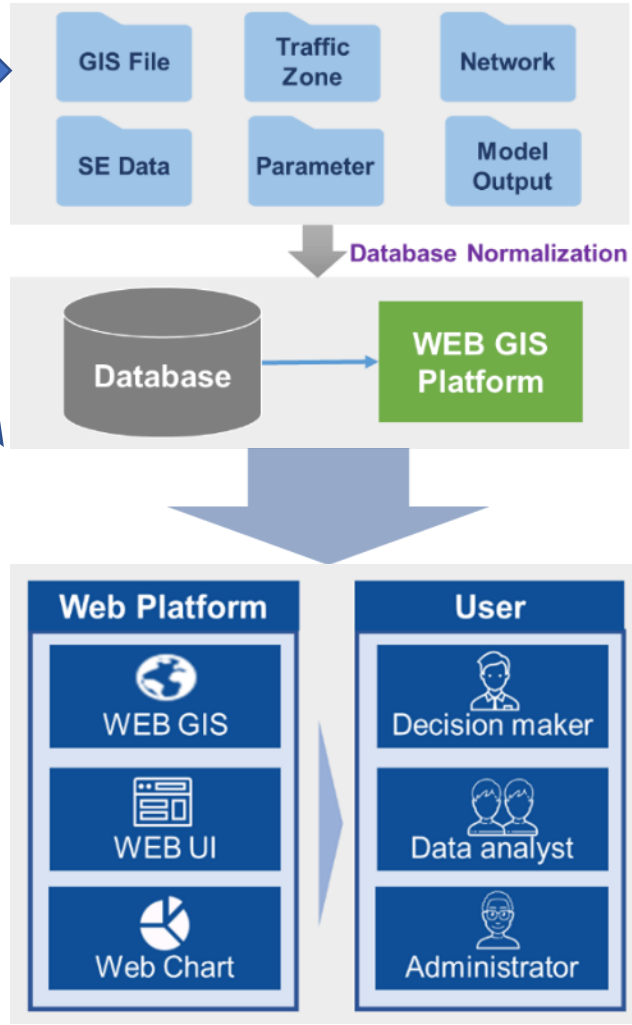
Components and Objective of SIFT Initiative

Investments (and policies) are analyzed by manipulating the inputs and evaluating the associated outputs.

Planning Models



Database & GIS



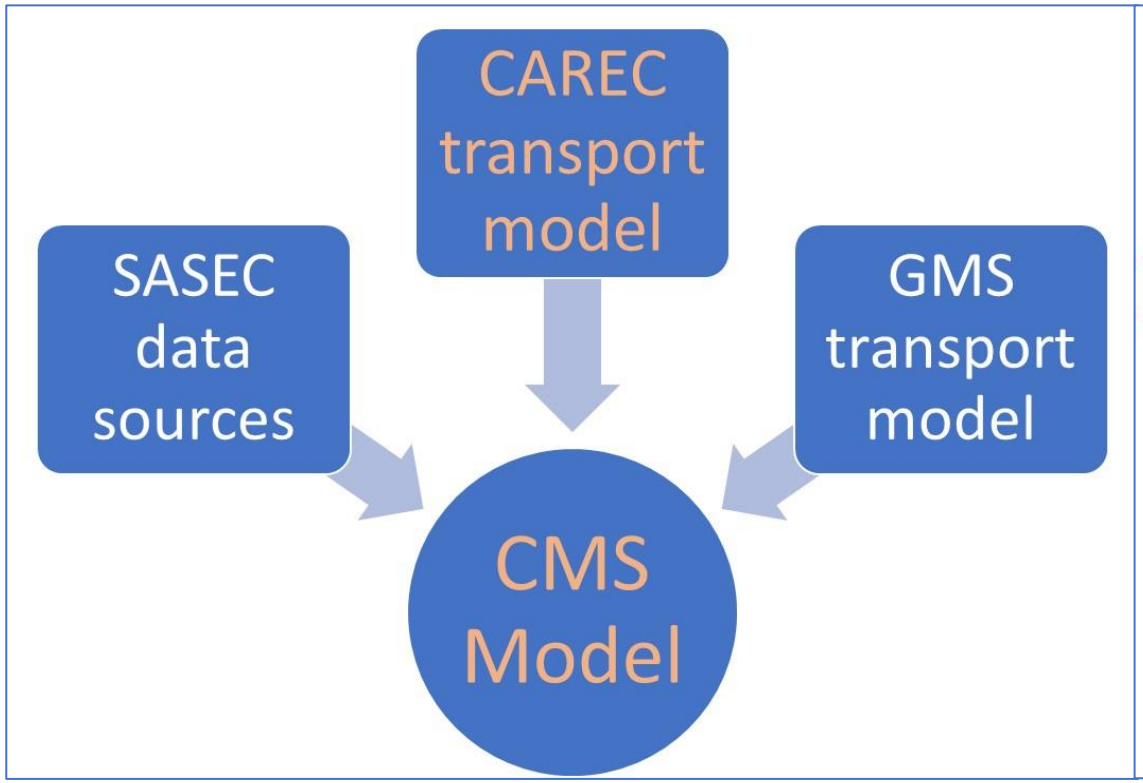
Decision Support Analyses

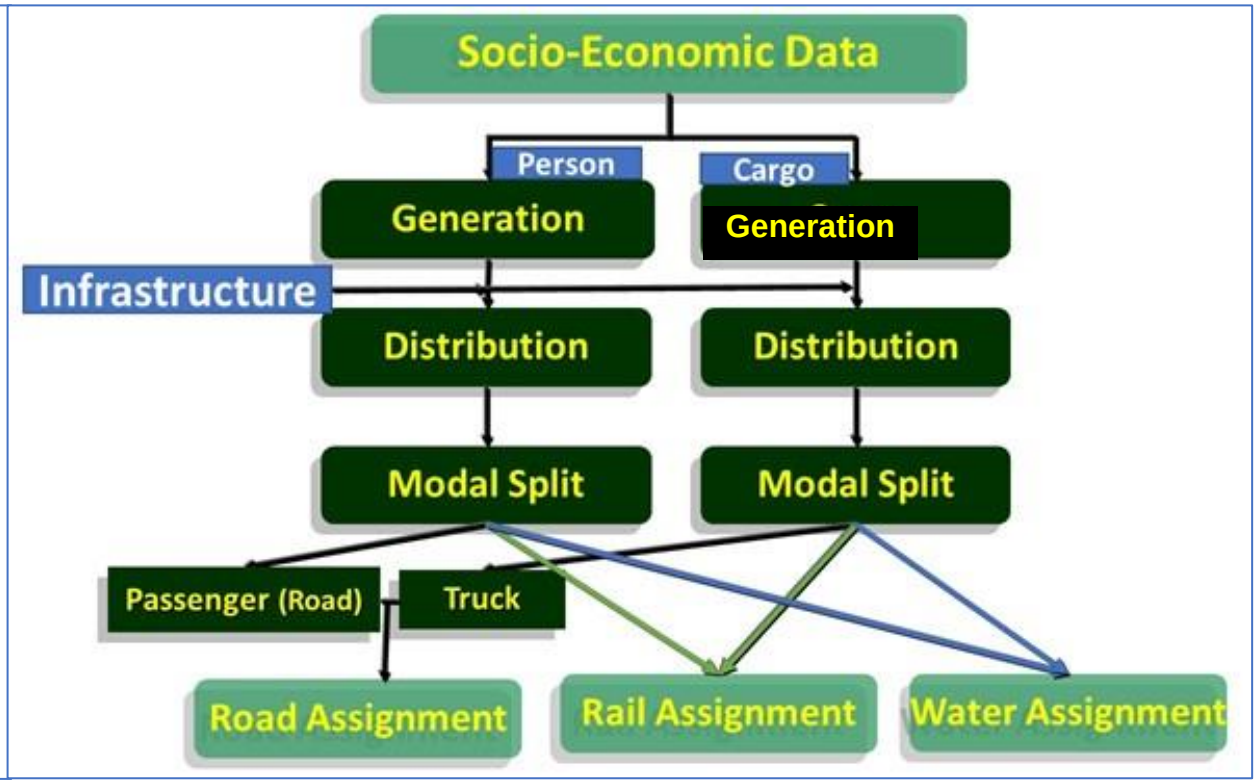
Introduction to the First Release of SIFT Model

- Model Structure
- Geographic Extent
- Socio Economic Module
- Basic Planning data
- Zoning System
- Validation

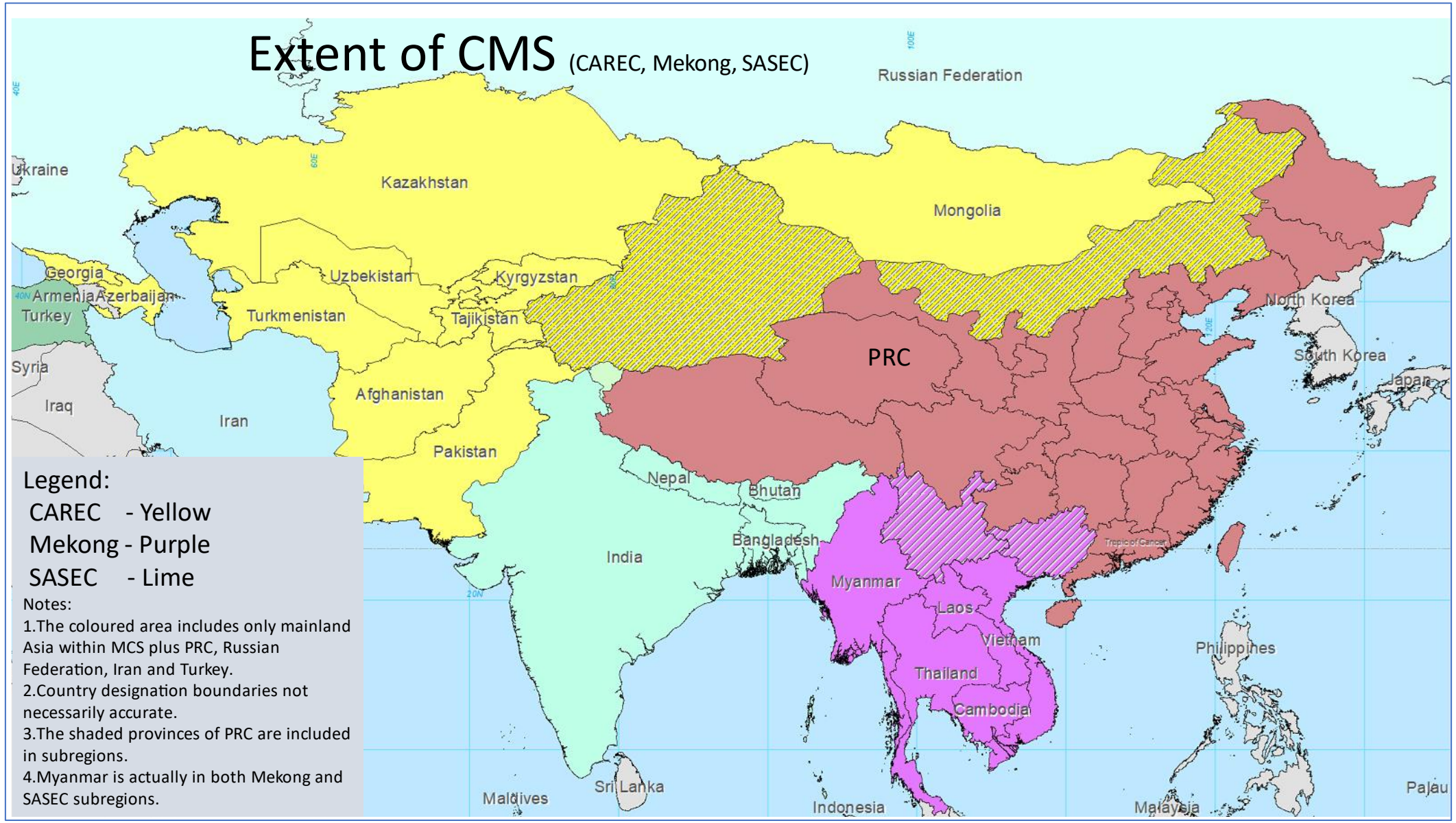
ADB SIFT STRATEGIC INVESTMENT FOR TRANSPORT

Overall Model Structure & Modelling Steps

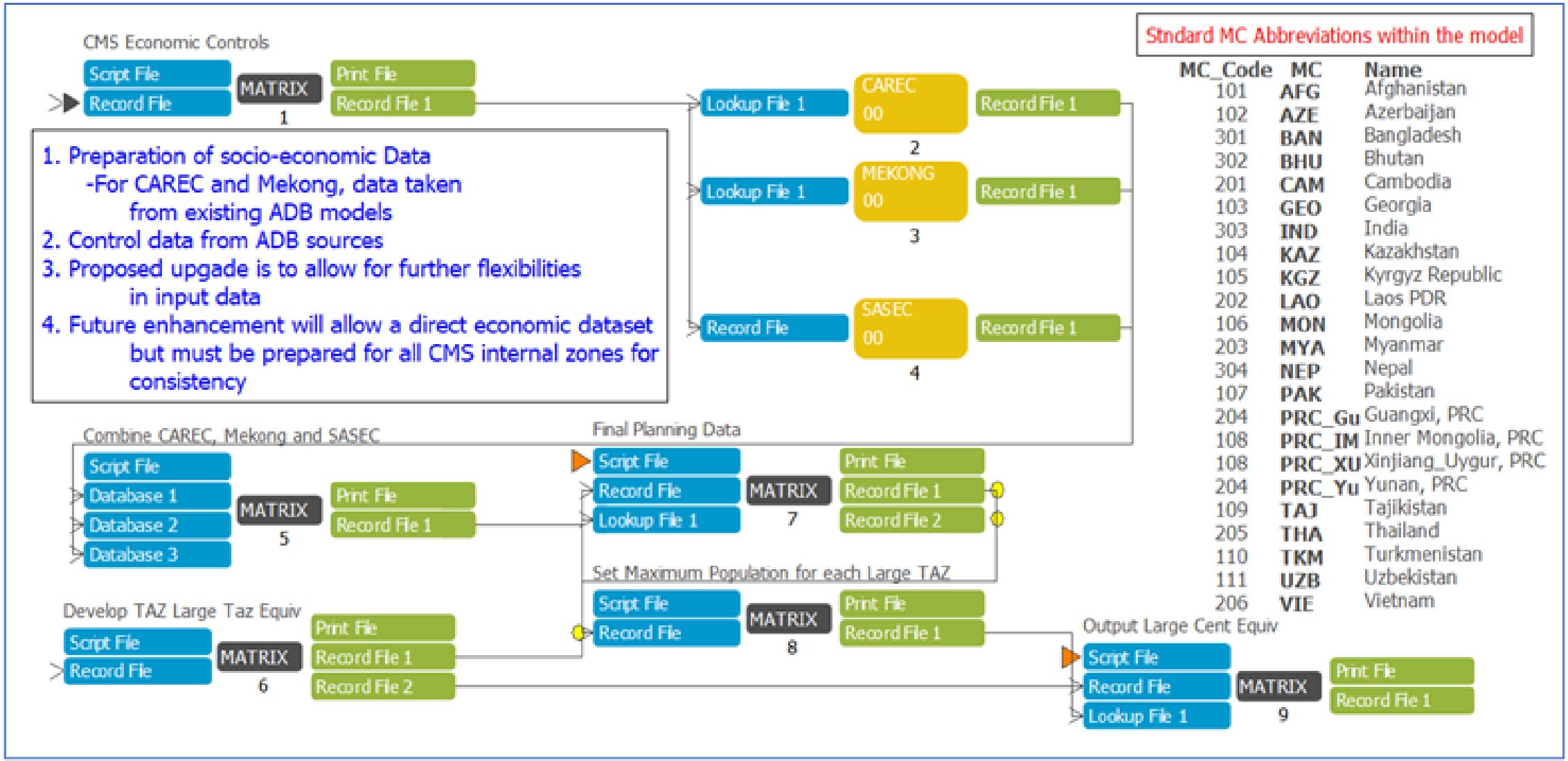




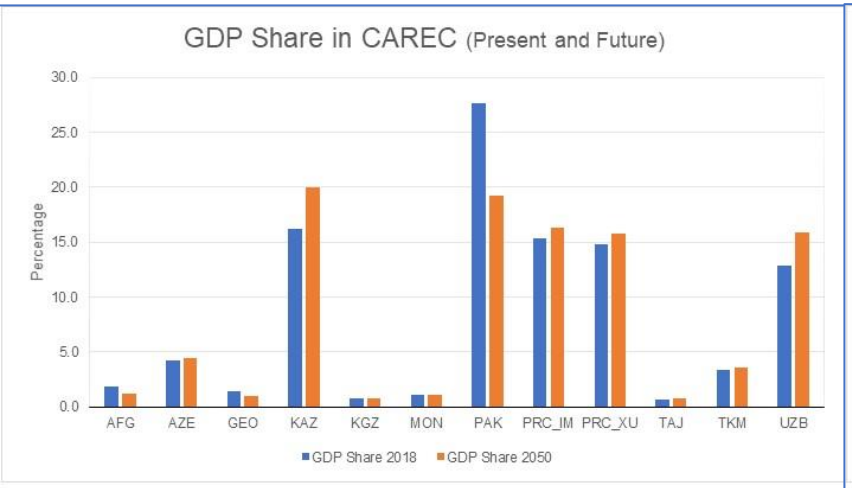
GEOGRAPHIC EXTENT

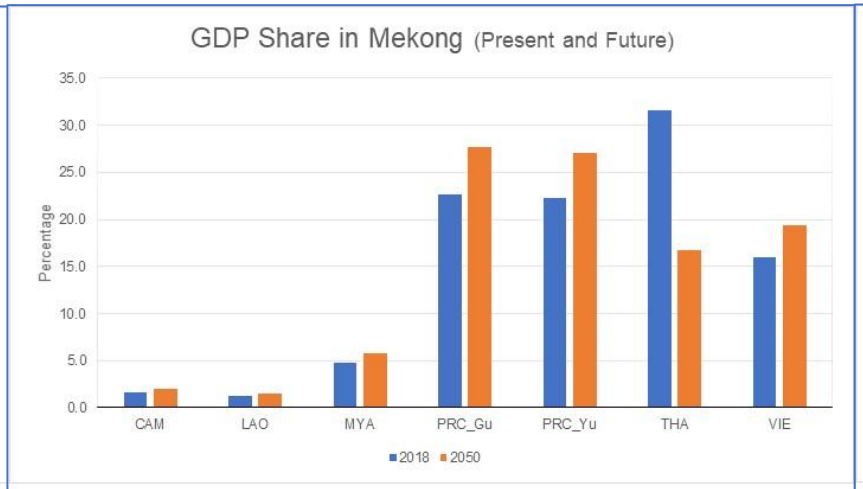


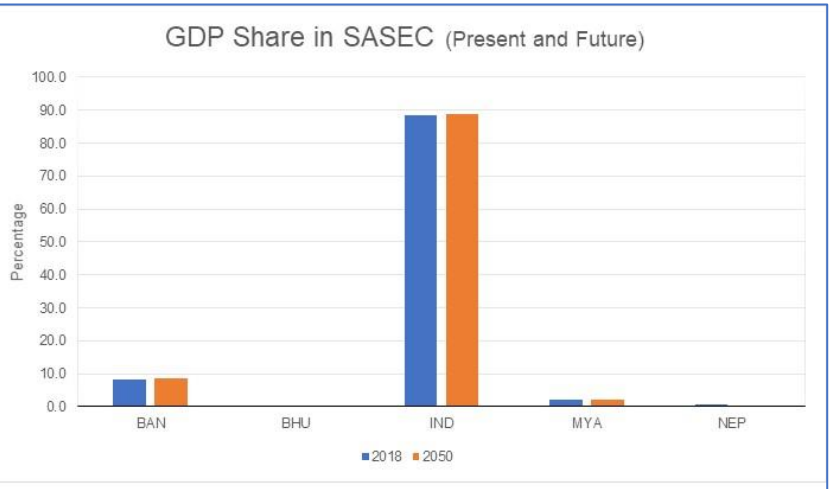
SOCIO-ECONOMIC MODULE IN RELEASE I

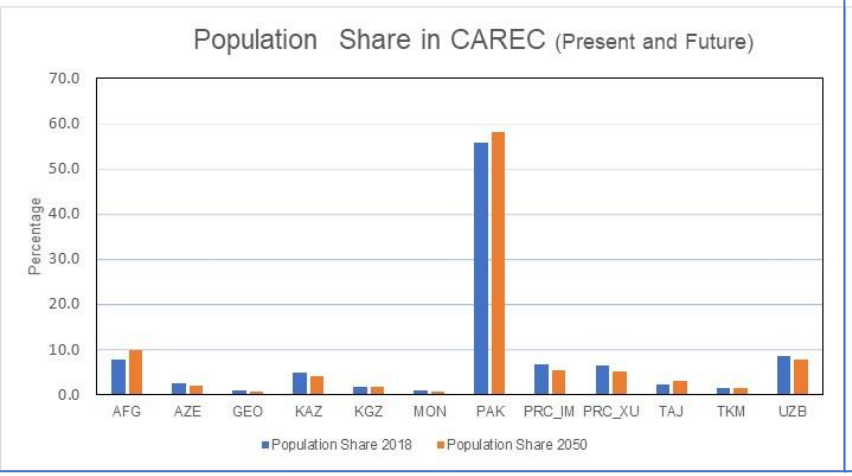


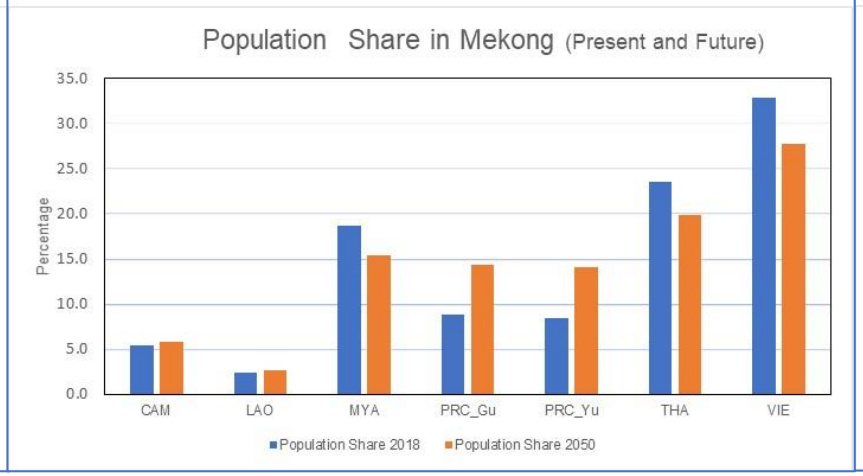
SOCIO-ECONOMIC DISTRIBUTIONS

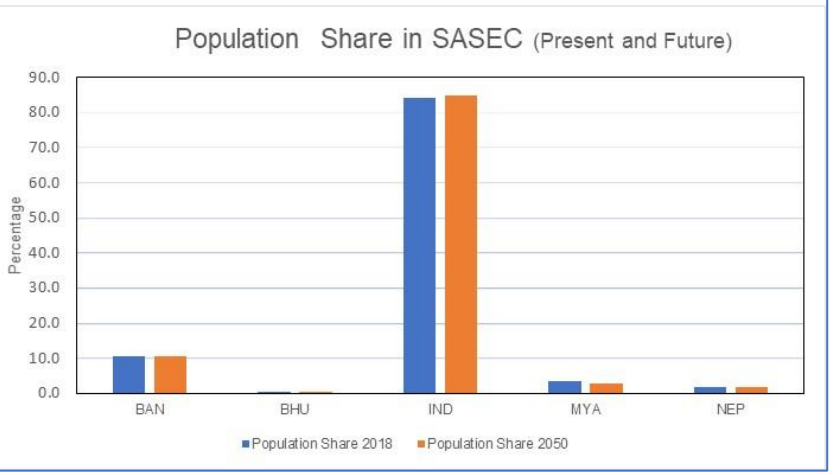




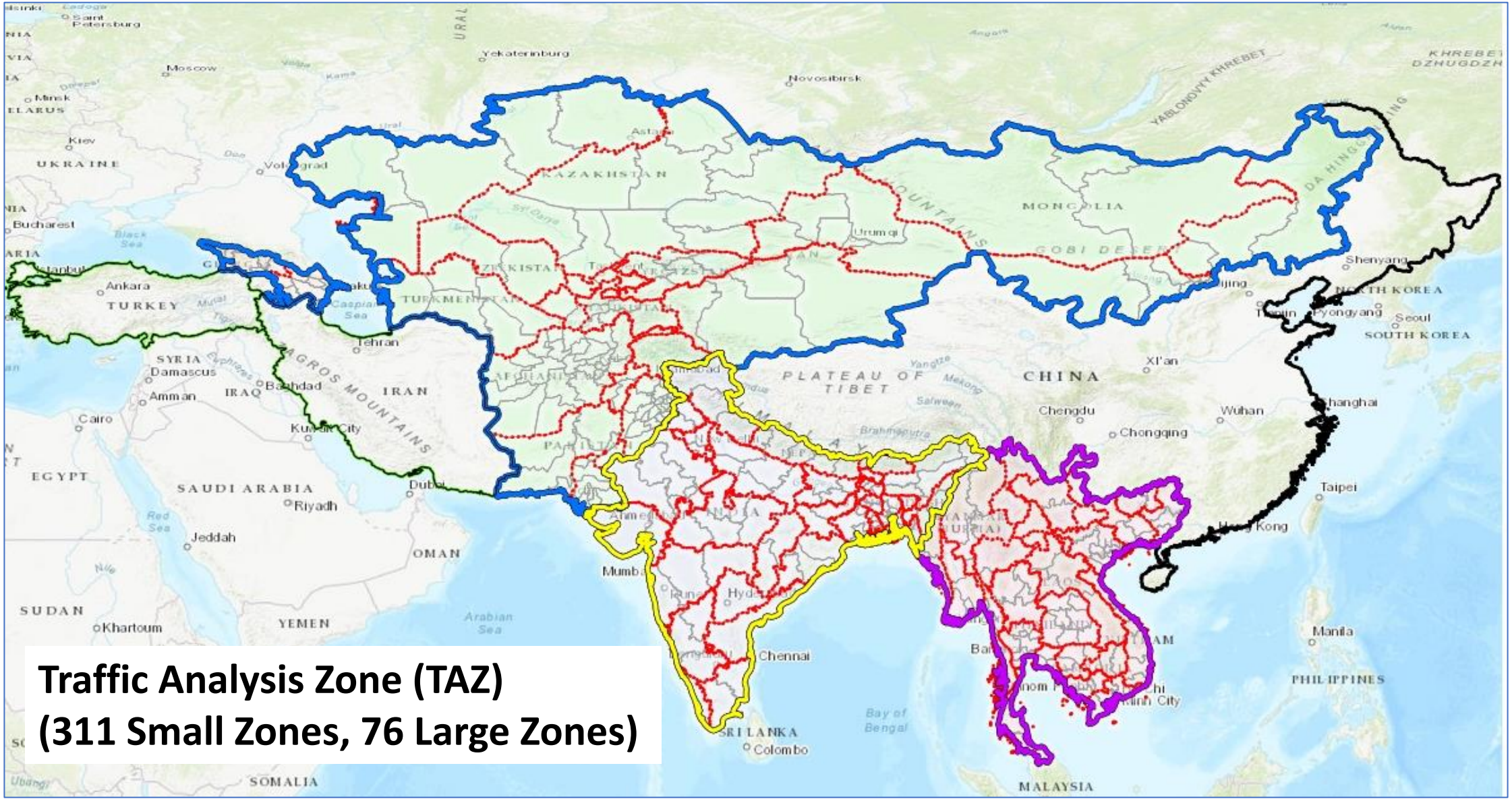




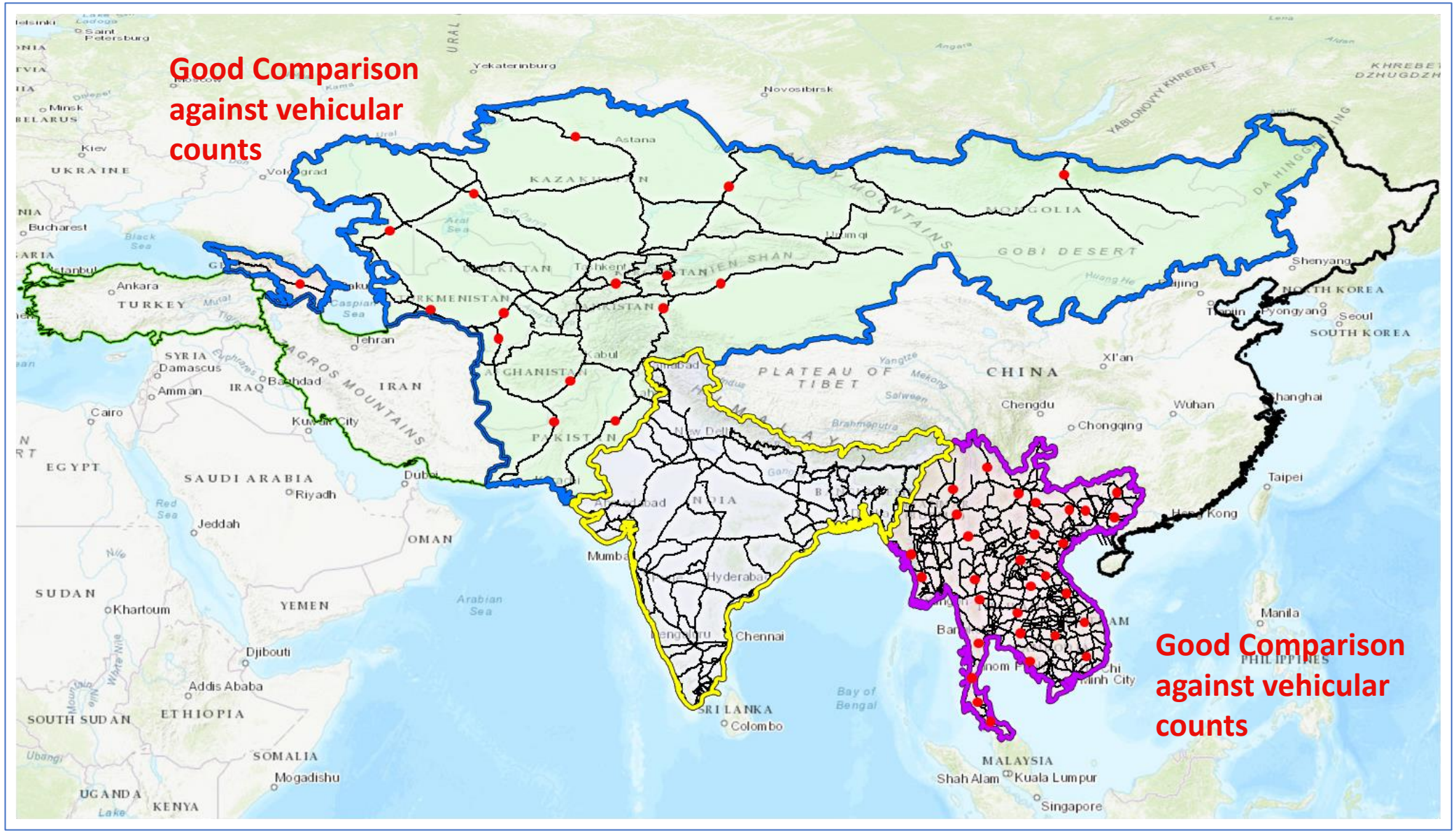




ZONING SYSTEM



Comparison with Observed Data

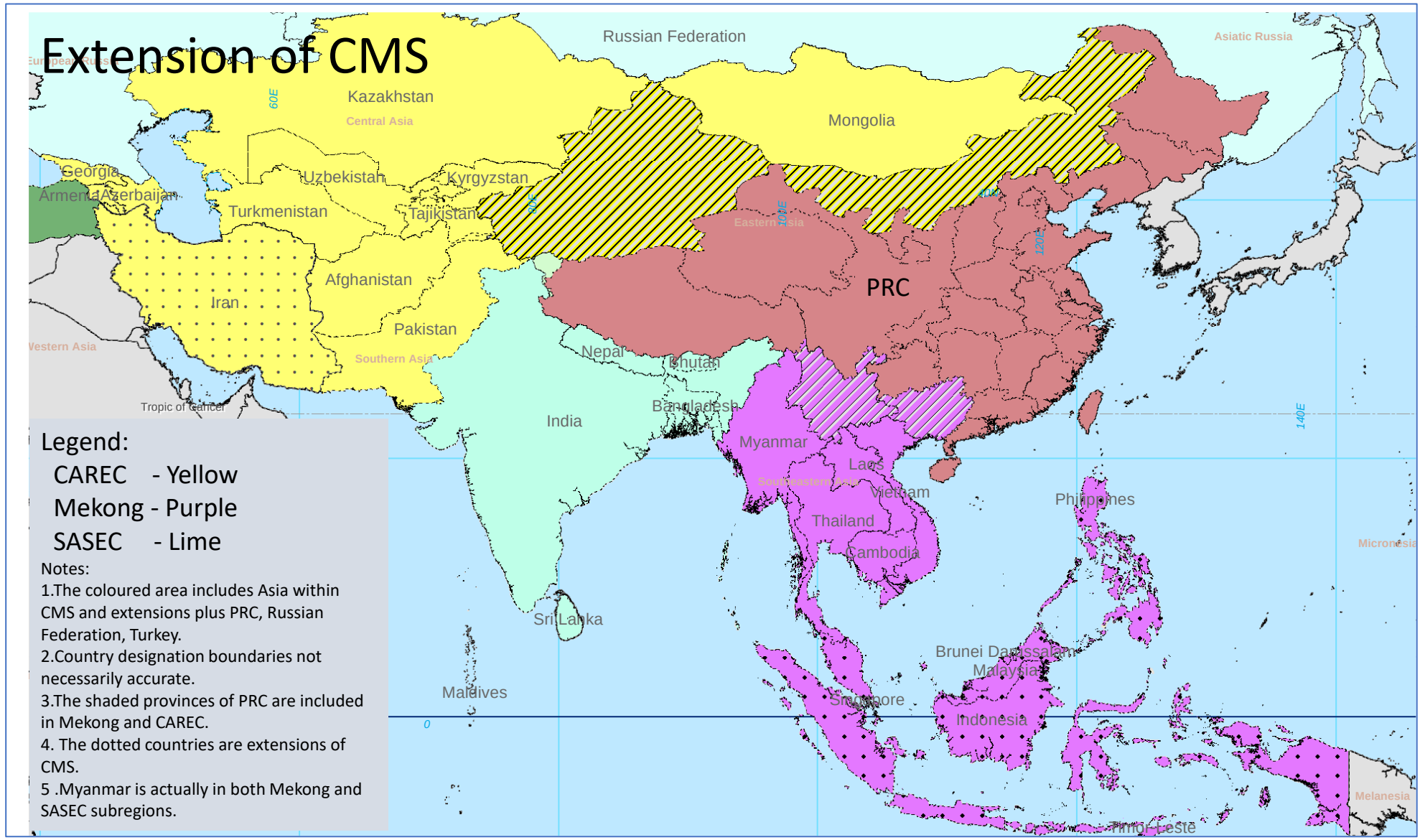


SOURCE OF DATA FOR SASEC

- Key Economic Indicators from ADB
  - Control totals plus historical trends
  - Secondary Control Data
    - //statisticstimes.com/economy/gdp-of-indian-states.php
- Network and Zone Boundaries
    - https://www.diva-gis.org/gdata
    - Also see Appendix B of report for agglomeration of districts
- Equation Parameters based on weighted averages

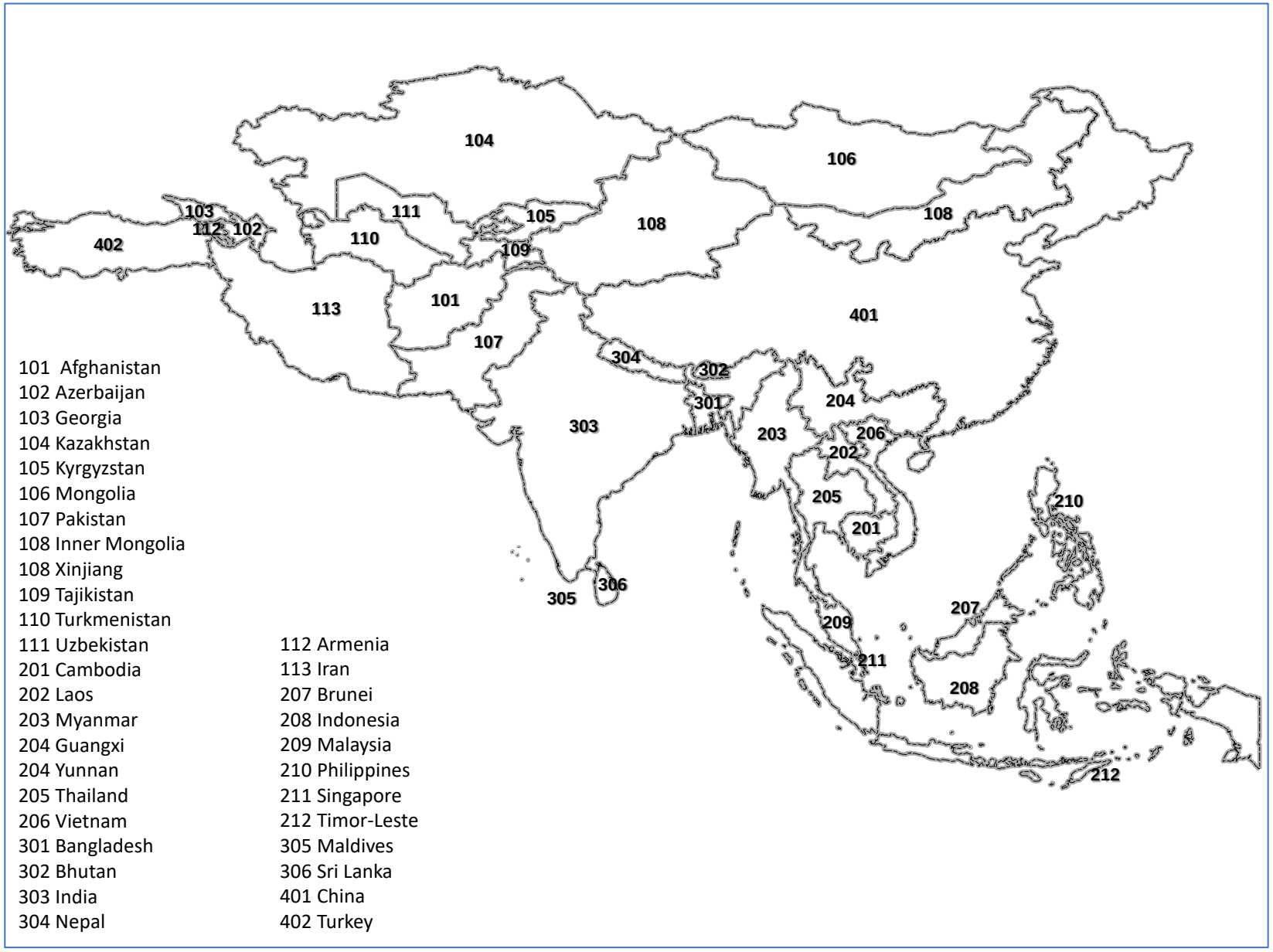
- All are variable inputs that can be modified if better data sets available.

GEOGRAPHIC EXTENT OF SECOND RELEASE



Inception Report has been prepared and will concentrate on geographic extent and upgrading of validation where data is available.

EXTENDED MC DESIGNATION



101 Afghanistan
102 Azerbaijan
103 Georgia
104 Kazakhstan
105 Kyrgyzstan
106 Mongolia
107 Pakistan
108 Inner Mongolia
108 Xinjiang
109 Tajikistan
110 Turkmenistan
111 Uzbekistan
201 Cambodia
202 Laos
203 Myanmar
204 Guangxi
204 Yunnan
205 Thailand
206 Vietnam
301 Bangladesh
302 Bhutan
303 India
304 Nepal

112 Armenia
113 Iran
207 Brunei
208 Indonesia
209 Malaysia
210 Philippines
211 Singapore
212 Timor-Leste
305 Maldives
306 Sri Lanka
401 China
402 Turkey

MC Summary of Release II

Name	MC	MC Code	CAREC	Mekong	SASEC	CWRD	SARD	SERD
Afghanistan	AFG	104	Yes			Yes		
Azerbaijan	AZE	105	Yes			Yes		
Georgia	GEO	106	Yes			Yes		
Kazakhstan	KAZ	107	Yes			Yes		
Kyrgyz Republic	KGZ	108	Yes			Yes		
Mongolia	MON	108	Yes					
Pakistan	PAK	109	Yes			Yes		
Autonomous Region of Inner Mongolia within the People's Republic of China	PRC_CAREC	110	Yes					
Autonomous Region of Xinjiang within the People's Republic of China	PRC_CAREC	111	Yes					
Tajikistan	TAJ	201	Yes			Yes		
Turkmenistan	TKM	202	Yes			Yes		
Uzbekistan	UZB	203	Yes			Yes		
Cambodia	CAM	204		Yes				Yes
Lao People's Democratic Republic	LAO	204		Yes				Yes
Myanmar	MYA	205		Yes	Yes			Yes
Province of Guangxi within the People's Republic of China	PRC_Mekong	206		Yes				
Province of Yunnan within the People's Republic of China	PRC_Mekong	301		Yes				
Thailand	THA	302		Yes				Yes
Vietnam	VIE	303		Yes				Yes
Bangladesh	BAN	304			Yes		Yes	
Bhutan	BHU	112			Yes		Yes	
India	IND	113			Yes		Yes	
Nepal	NEP	207			Yes		Yes	
Armenia	ARM	208	Extended			Yes		
Iran	IRN	209	Extended					
Brunei	BRU	210		Extended				Yes
Indonesia	INO	211		Extended				Yes
Malaysia	MAL	212		Extended				Yes
Philippines	PHI	305		Extended				Yes
Singapore	SIN	306		Extended				Yes
Timor-Leste	TIM	104		Extended				Yes
Maldives	MLD	105			Extended		Yes	
Sri Lanka	SRL	106			Extended		Yes	

Release II results in an Increase of

Area - 26 %

Population - 23 %

GDP - 44 %

Model Structure and Building Software Tool

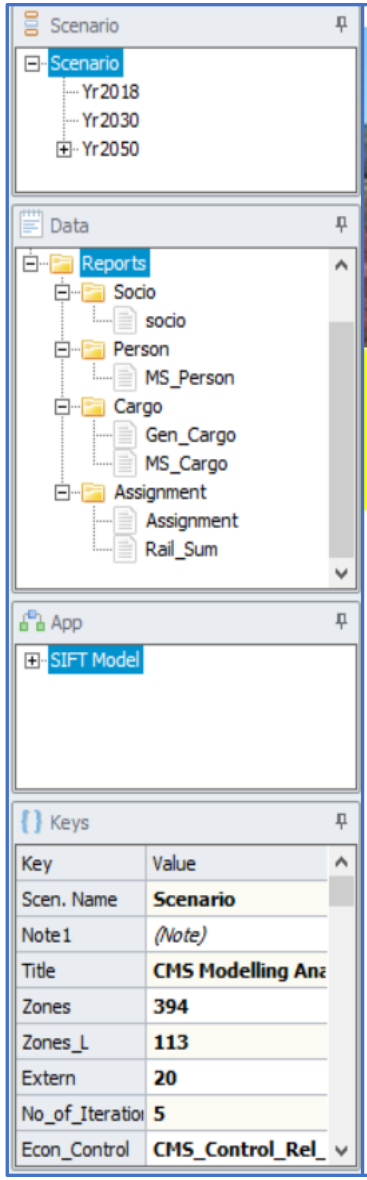
CAREC
Greater Mekong Subregion
SASEC
INCORPORATING CWRD, SERD AND SARD

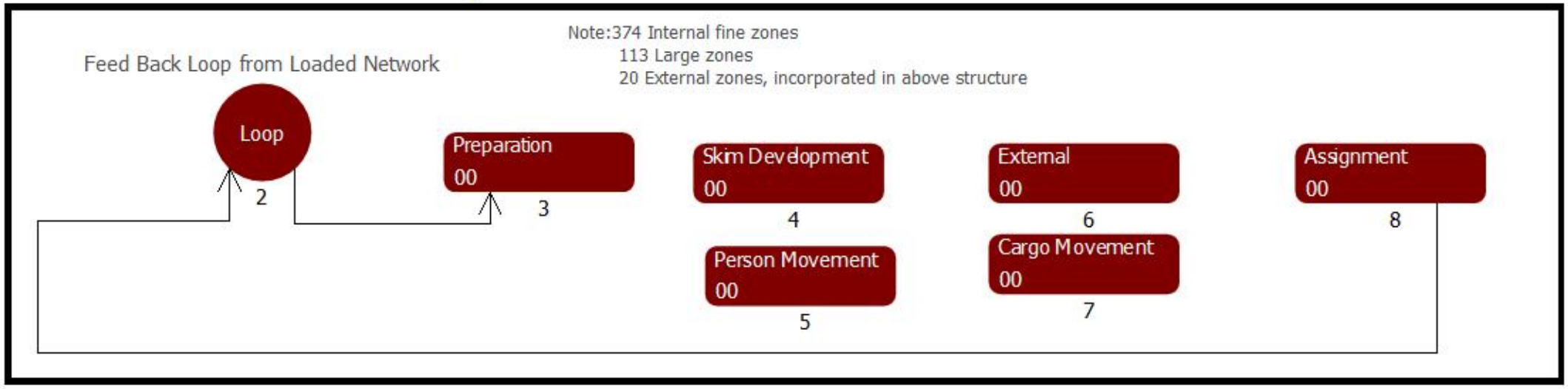
STRATEGIC INVESTMENTS FOR TRANSPORT (THE SIFT MODEL)

INCORPORATING THE CMS MODEL

Release I (CMS) --- December, 2020

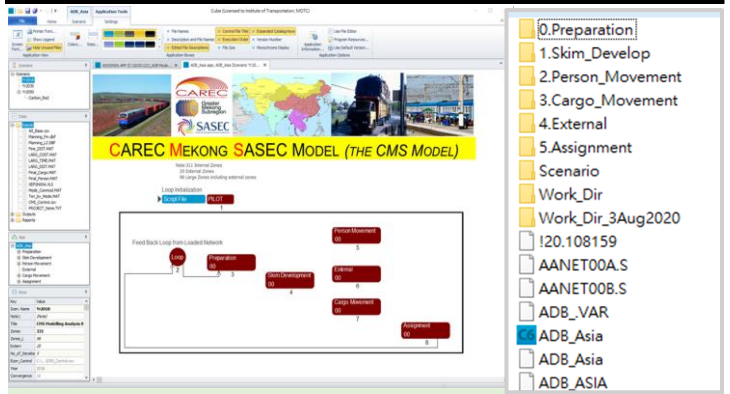
Release II --- October, 2021





SUPPORTING DATABASE & GIS PROJECT ROADMAP

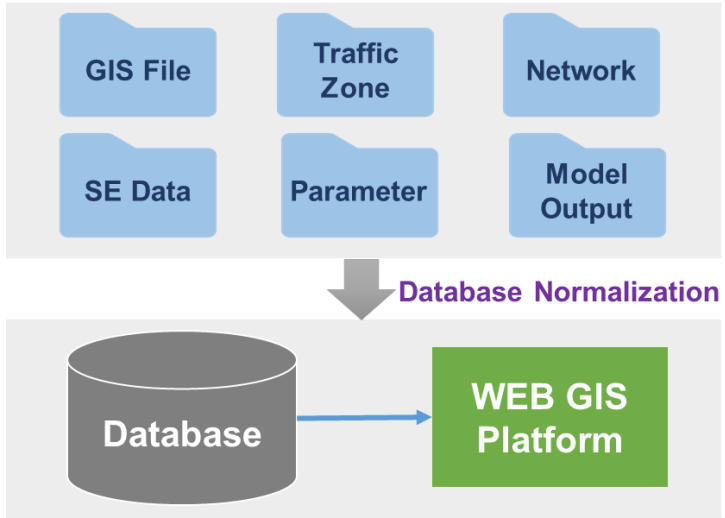
Current Issues



CMS Model is built by CUBE which has 35 folders, 1,209 files.

The main issues when integrating data are the **differences** in software packages and programming languages, the **conversions of input data and parameter**.
The incapability of data compatibility and circulation is due to the **differences in definitions and formats of model data and the differences of coordinates**.

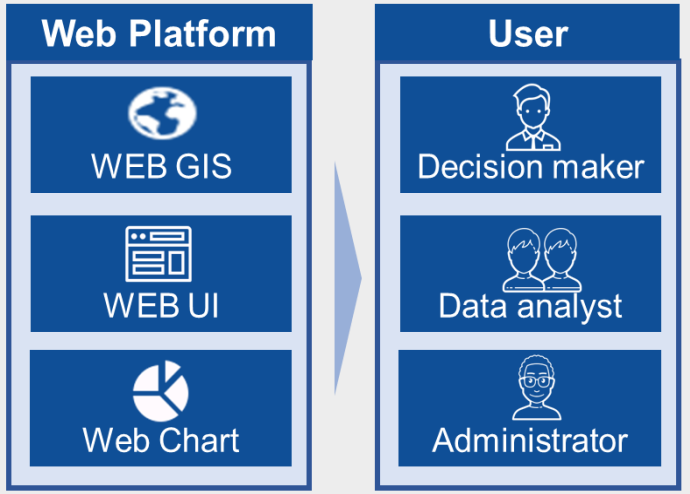
Work Plan



The Project is to

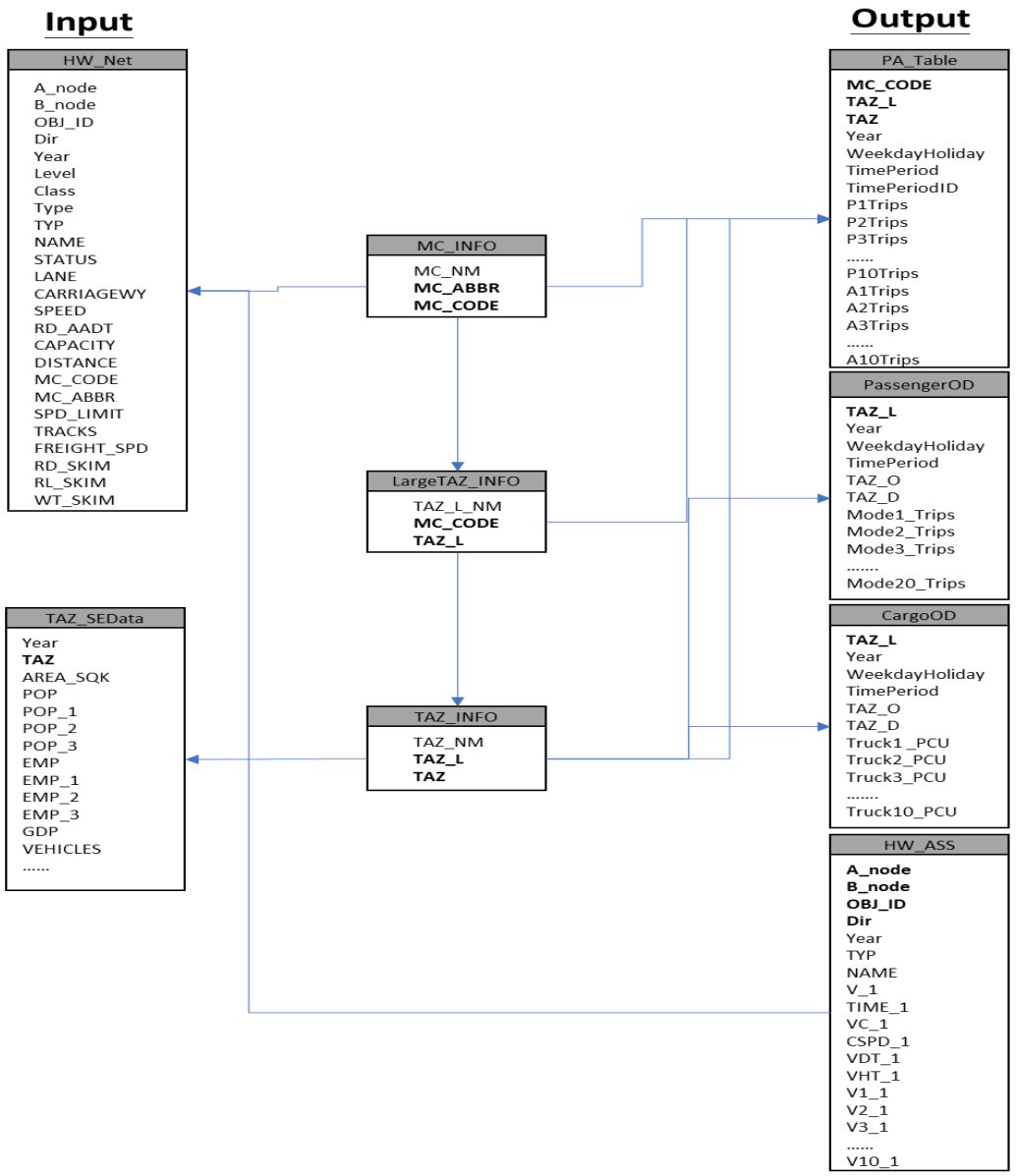
1. **Summarize and organize the information** provided by ADB
2. **Normalize the database tables** based on the results of the data summary
3. **Import such data into the database for storage and display of basic visual images** using the Web GIS platform

Future Expansion



Which could be carried out with separate assignments and tenders will be on **system improvement and expansion** tailored for **additional requirements and different system users** such as local decision makers, ADB data analysts, system administrators, etc.

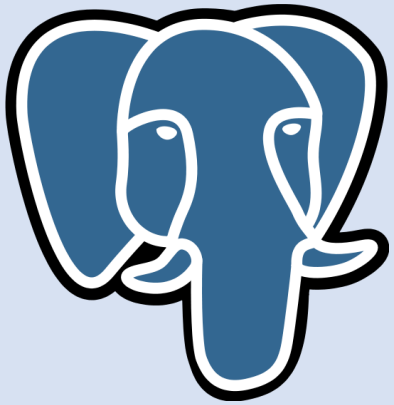
DATABASE: ENTITY RELATIONSHIP DIAGRAM



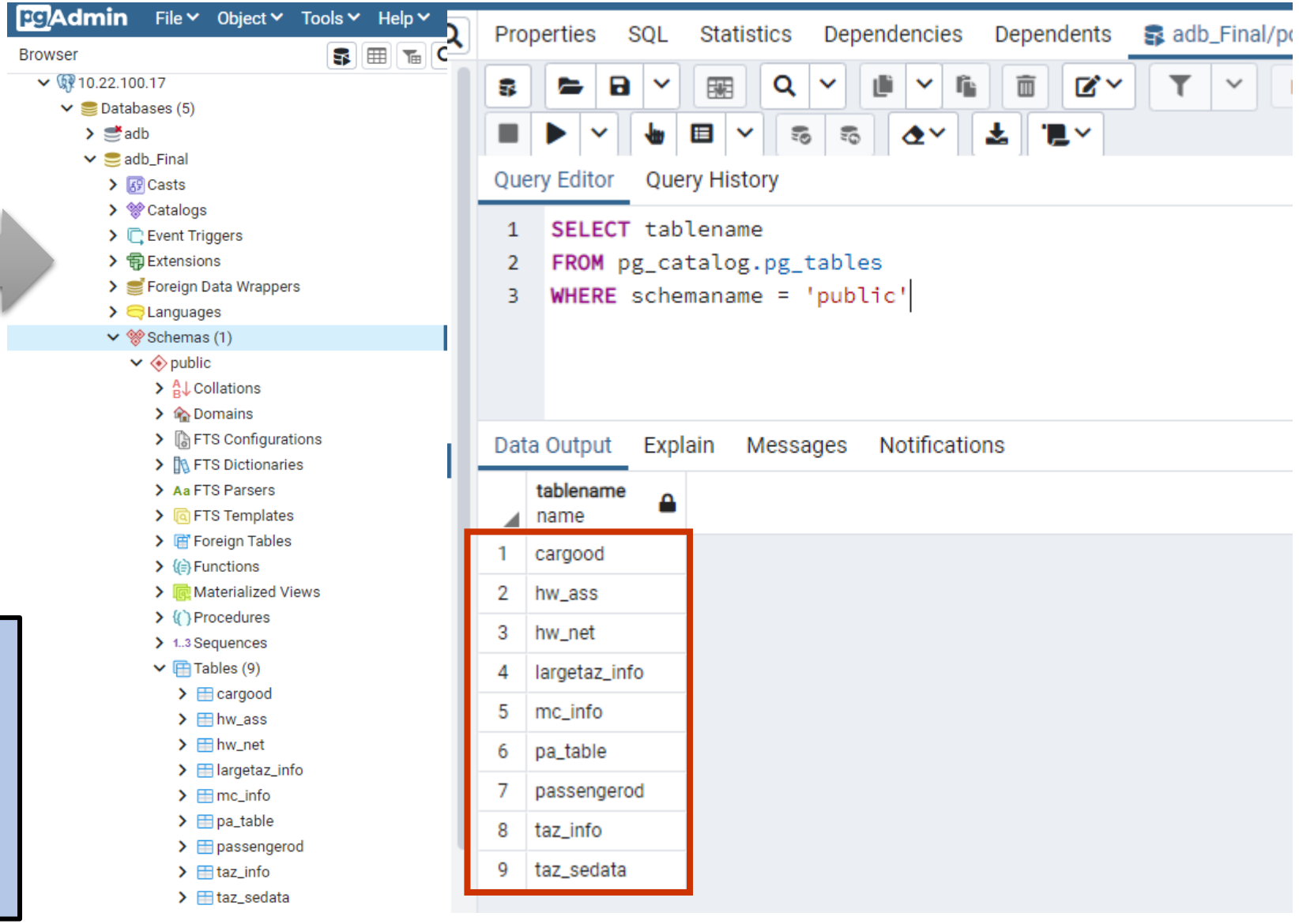
ID	Table Name	Table Description
1	HW_Net	Highway Network Link Table
2	MC_INFO	Member Country Code Table
3	LargeTAZ_INFO	Large Traffic Analysis Zone Code Table
4	TAZ_INFO	Traffic Analysis Zone Code Table
5	TAZ_SEData	Socio-Economic Information of Traffic Analysis Zone
6	PA_Table	Trip Production-Attraction Table
7	PassengerOD	Passenger OD Matrix
8	CargoOD	Cargo OD Matrix
9	HW_ASS	Highway Assignment Output

Database System Implementation - Tables in Database

PostgreSQL



The World's Most Advanced Open Source Relational Database



GIS PLATFORM

Front-end

Interactive functions

- Zoom in/out
- Panning
- Info popup
- Static map production
- Data download

Thematic maps

- The Density of Population
- The density of employed population
- Gross domestic product
- Transport network
- Trip Generation and Attraction
- Desire line cargo
- Desire line passenger
- Desire line commodity
- Road Segment Speed
- Volume to capacity (V/C) ratio
- Traffic Volume

Back-end

Account management

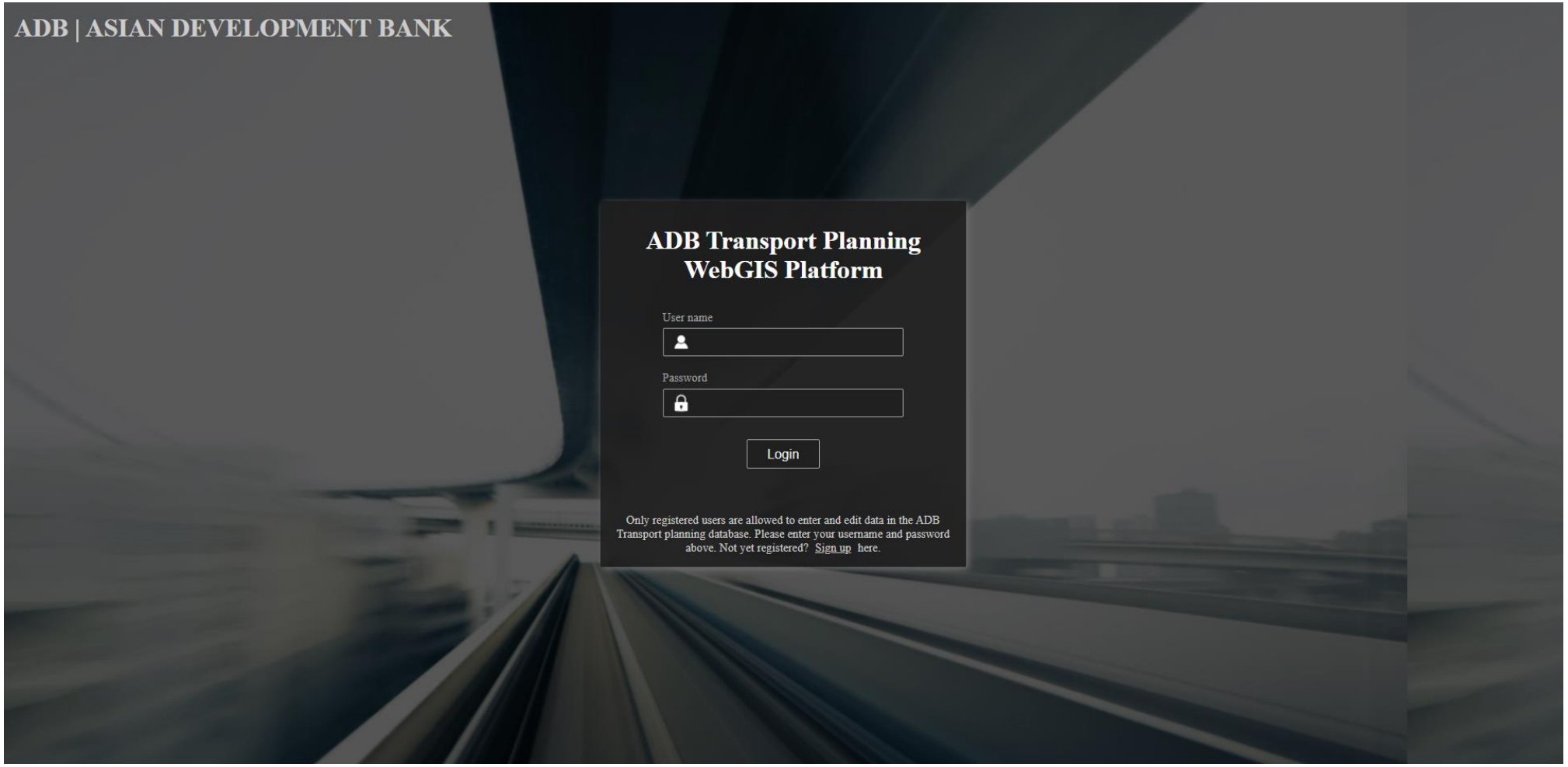
- Login page
- Add user
- Delete user
- Edit account

Data Management

- Upload data
- Delete data
- Version control

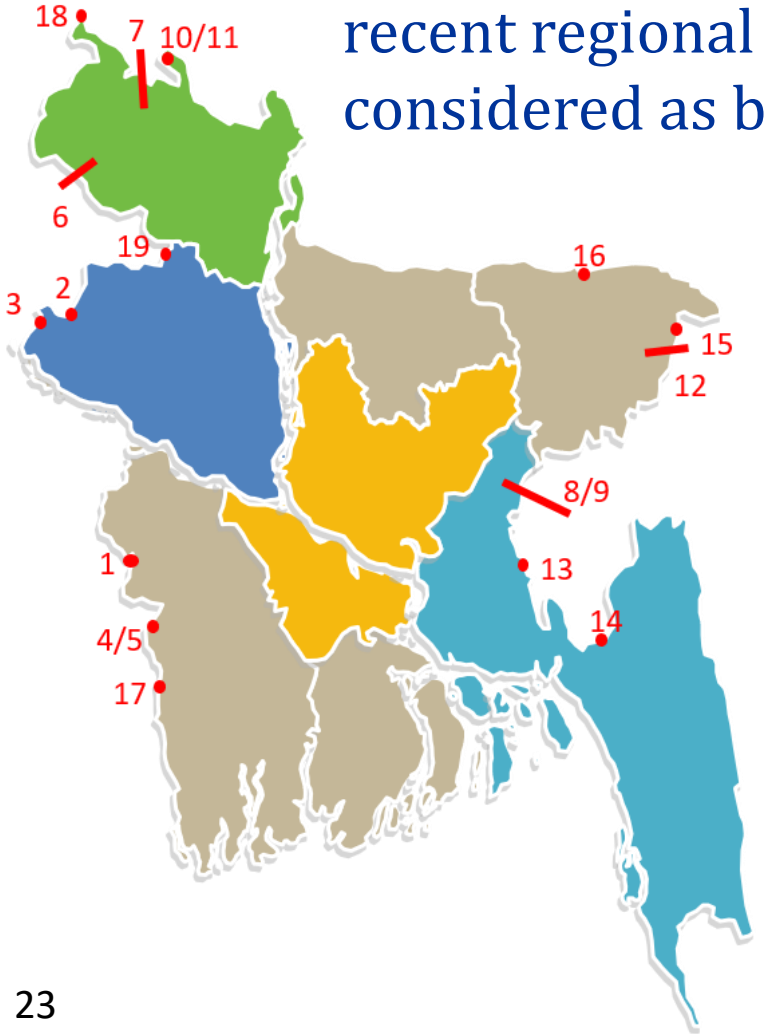
FRONT-END LOGIN PAGE

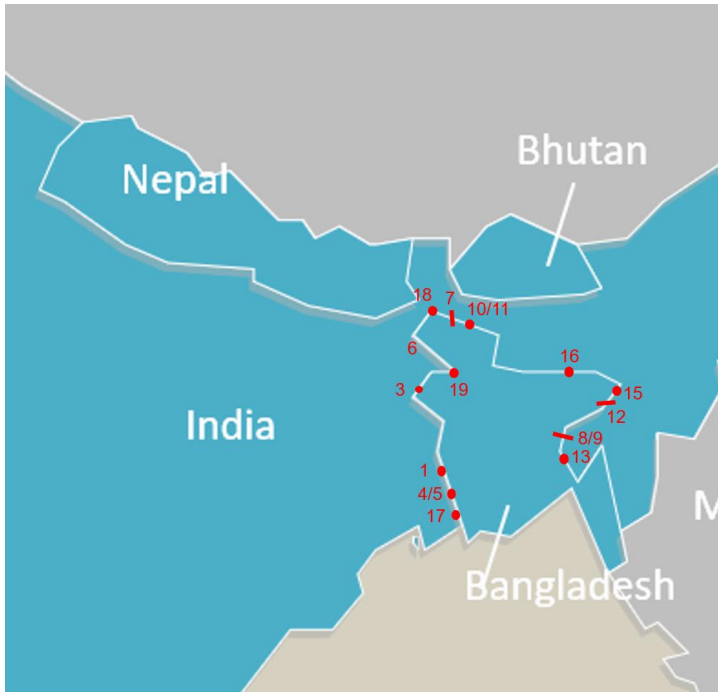
- Only registered users are allowed to access the system.
- Sign up via the post-event survey email.



Illustrative Example for Model Application

- Focus - Bangladesh in the BBIN area
- 19 decision cross-border points, from recent regional cooperation programs, are considered as binary (0-1) decisions.





#	India	Bangladesh	Mode
1	Gede	Darshana	Railway
2	Singhabad	Rohanpur	Railway
3	Mahadipur	Sonamasjid	Road
4	Petrapole	Benapole	Railway
5	Petrapole	Benapole	Road
6	Radhikapur	Birol	Railway
7	Haldibari	Chilihati	Railway
8	Agartala	Akhaura	Railway
9	Agartala	Akhaura	Road
10	Changrabandha	Burimari	Railway
11	Changrabandha	Burimari	Road
12	Mahishasan	Shahbazpur	Railway
13	Srimantpur (Tripura)	Bibirbazar	Road
14	Sabroom	Ramgarh	Road
15	Sutarkandi	Sheola	Road
16	Dawki	Tamabil	Road
17	Ghojadanga	Bhomra	Road
18	Fulbari	Banglabandha	Road
19	Balurghat	Hili	Road

Link Characteristics Changes due to Investment

Cross-border points	Customs Facilities	Land Ports	Access Roads	Railway Cargo Facilities
Road	DO	DO	DO	
Rail	DO			DO

Cross-border points	Additional capacity	Cargo clearance time reduction
Road	√	√
Rail		√

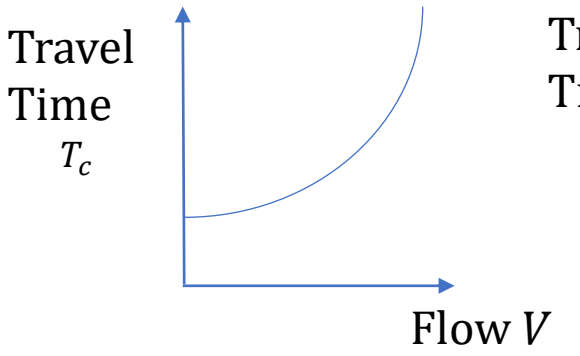
Fixed border crossing time

	Before	After
NO eCustom	18hrs	8hrs
eCustom	2hrs	0.5hrs

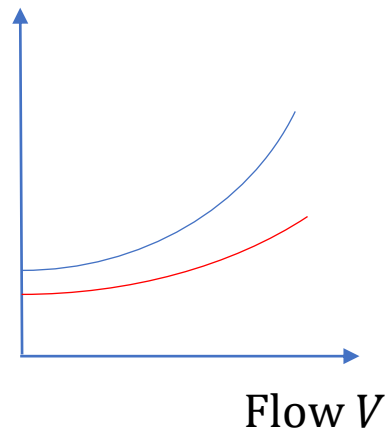
Link cost function

$$T_c = T_0 * \left[1 + 0.15\left(\frac{V}{C_0 + C_{add} * y_a}\right)^4\right] + time_a * y_a$$

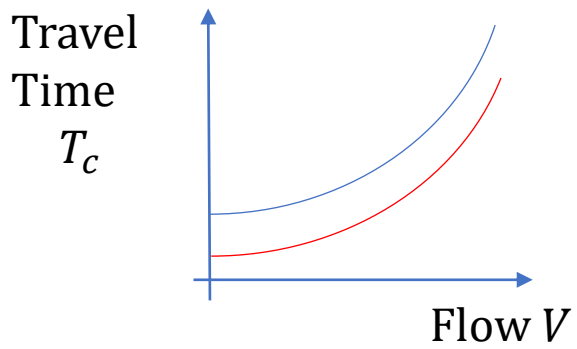
General



Road



Rail



BI-LEVEL PROGRAMMING STRUCTURE

Upper-level

Search the investment combinations by **the knapsack problem** to maximize the benefit, given budget limitation.

Lower-level

A combined modal split-user equilibrium model under multimodal multicommodity consideration.

Objective

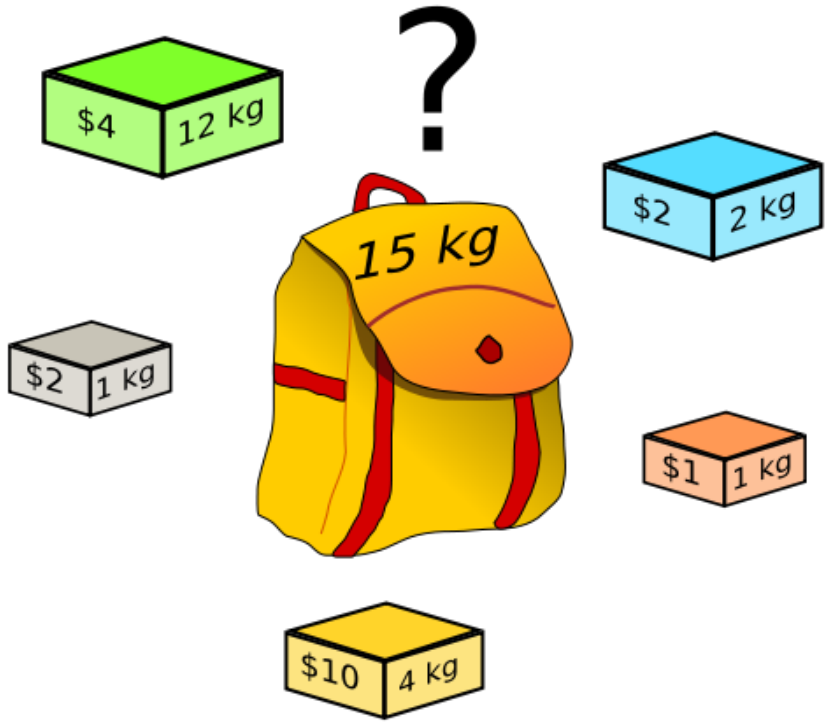
MAX. Benefit = reduced travel time by implementing the investment decision

Based on the "**time value**" of all links

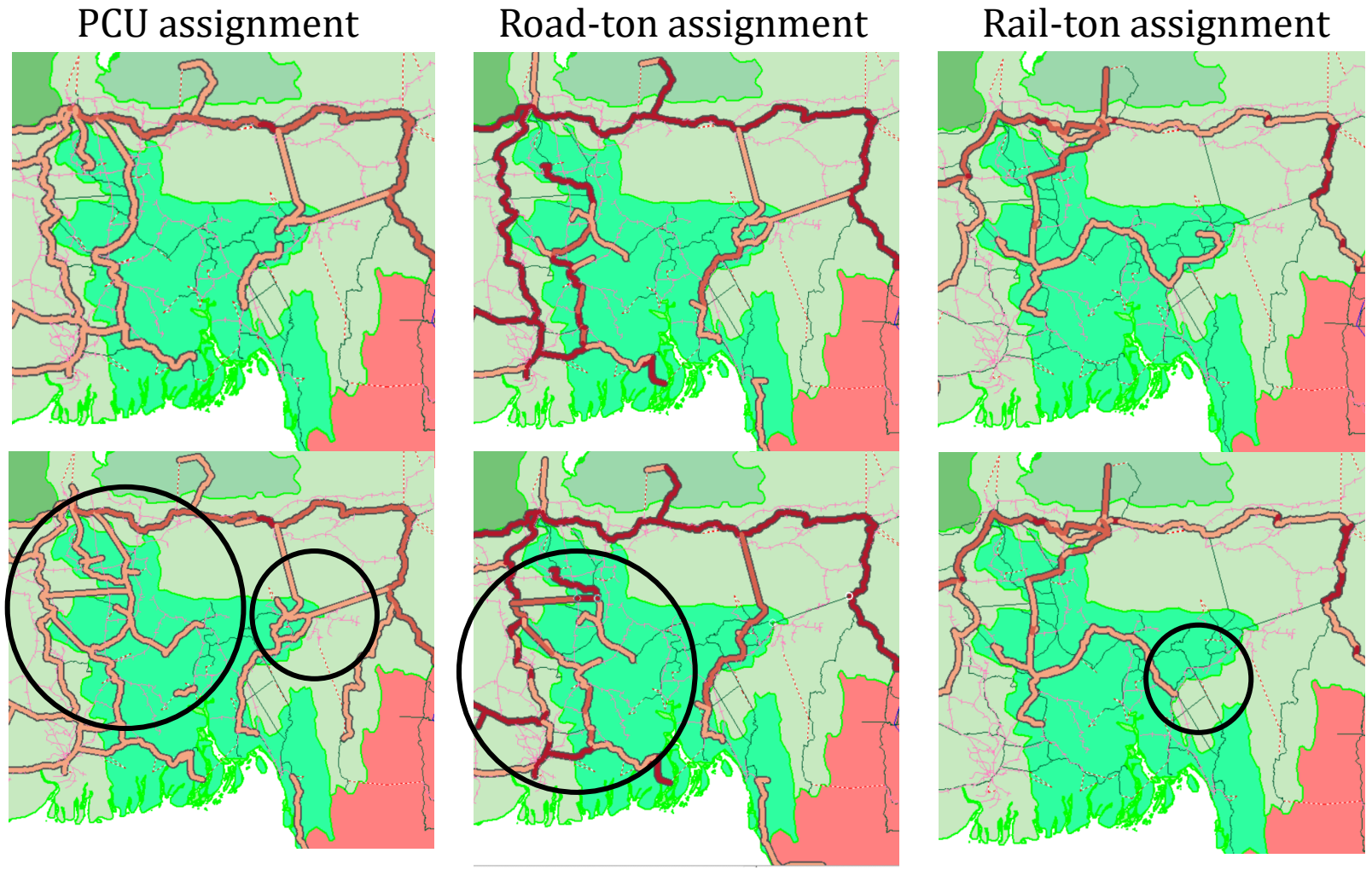
Time value items

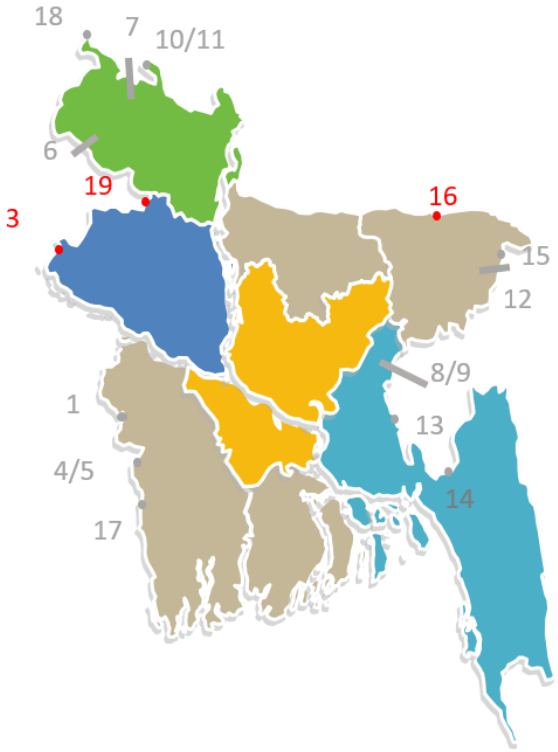
- By person (min)
- By vehicle: car/bus/truck (min)
- Cargo by vehicle: truck/train

Knapsack Problem (KP) Concept



- **No e-customs & Low budget (three points allowed)**





Volume>10000

Volume>50000

Volume>100000

Thank you for your attention!

Question and Answer

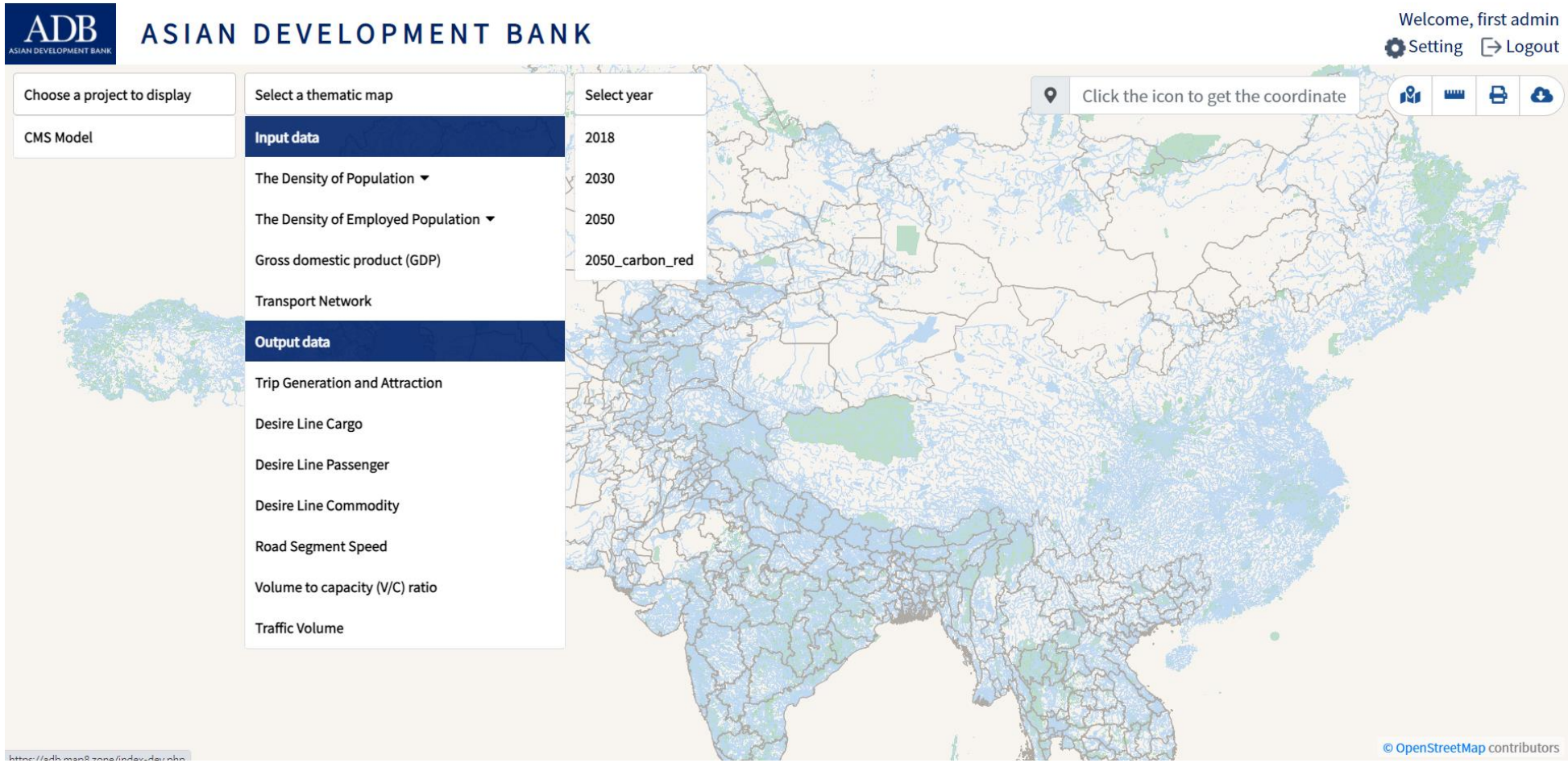
THEMATIC MAP SELECTION

- Thematic map:

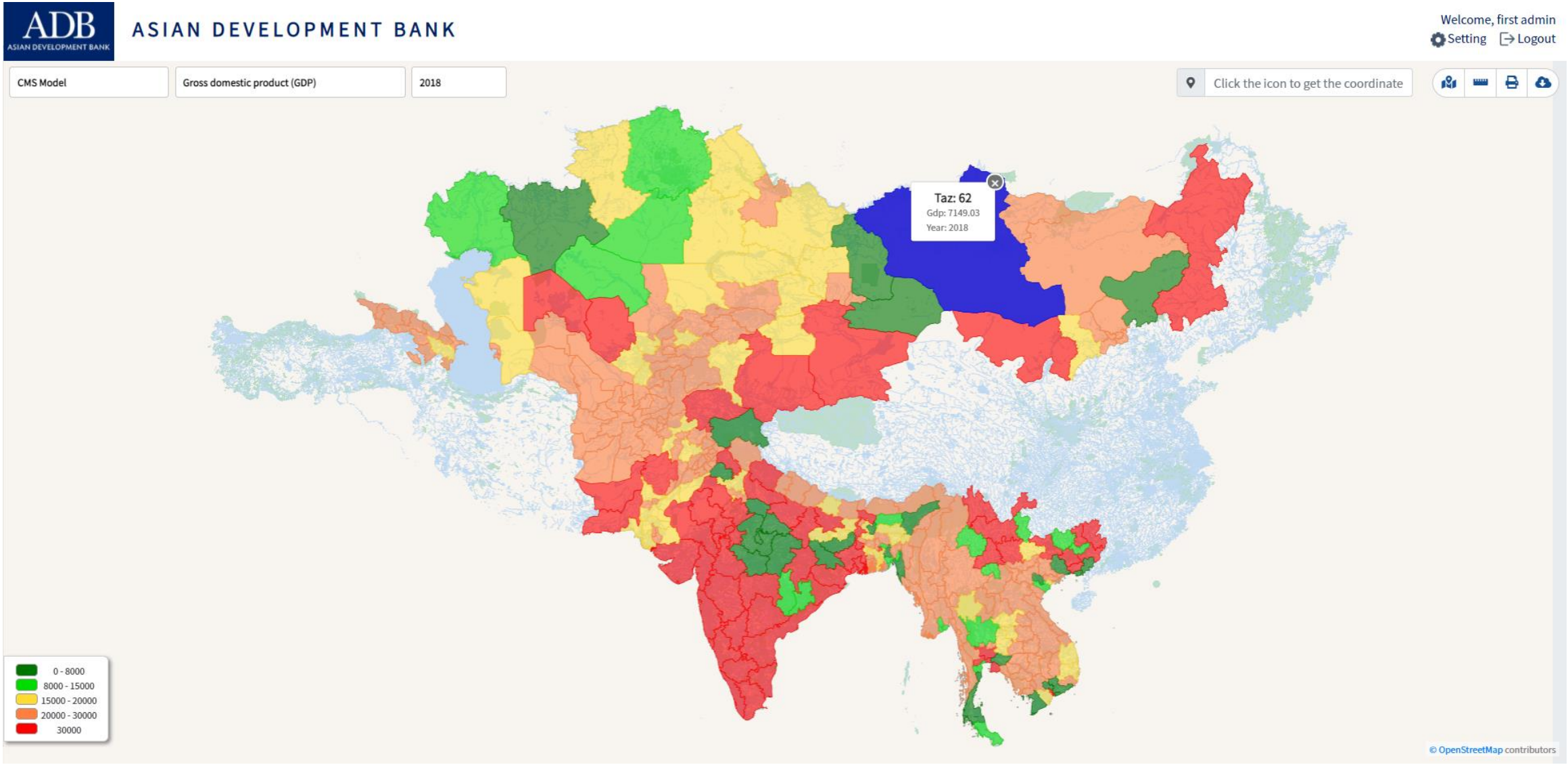
  a.Input data: **The density of population**; **The density of employed; Gross domestic product (GDP); Transport network**

  b.Output data: **Trip generation and attraction; Desire line cargo; Desire line passenger; Desire line commodity; Road segment speed; Volume to capacity (v/c) ratio; Traffic volume**

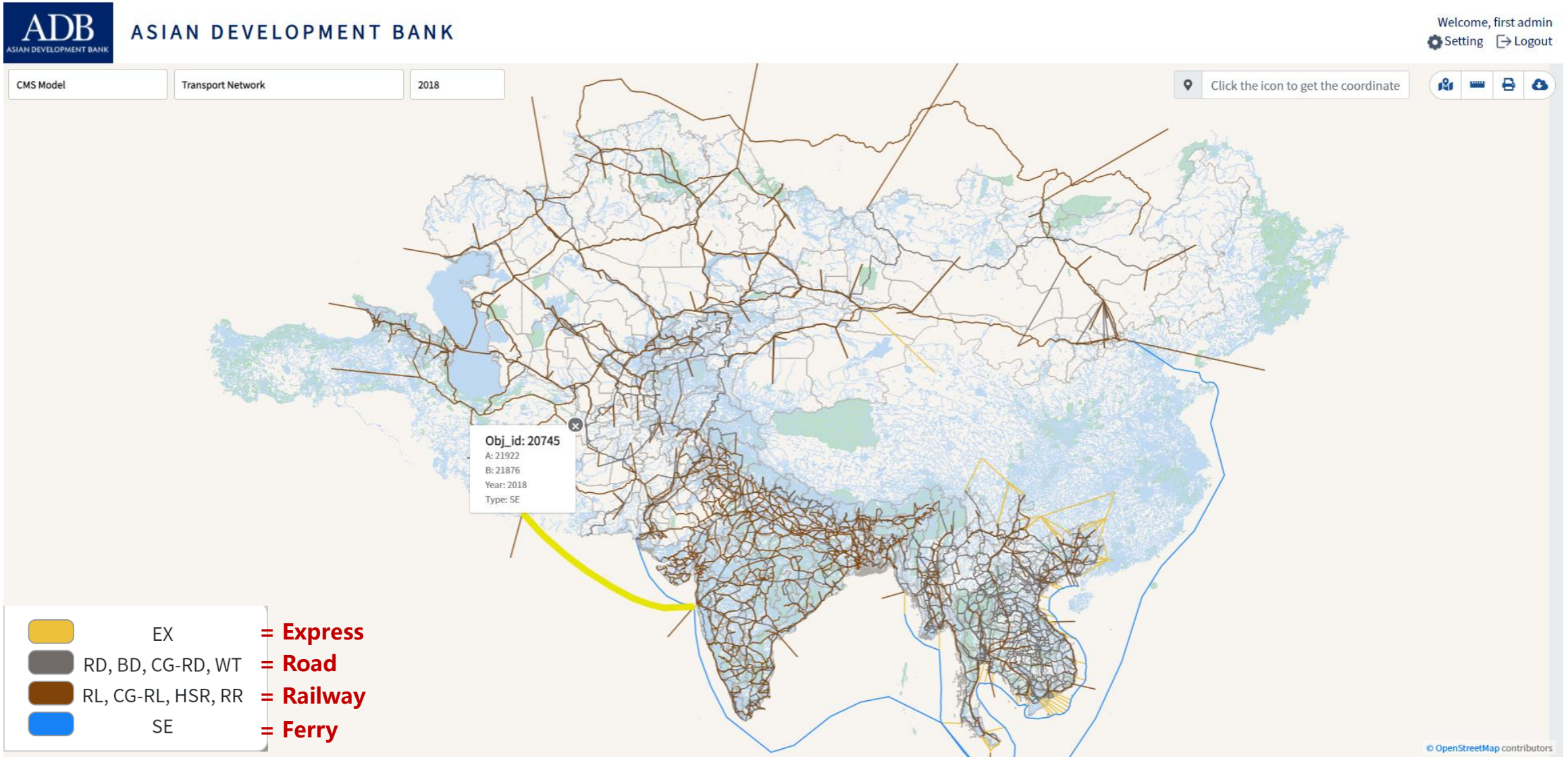
- Year: 2018/2030/2050/2050_carbon_red



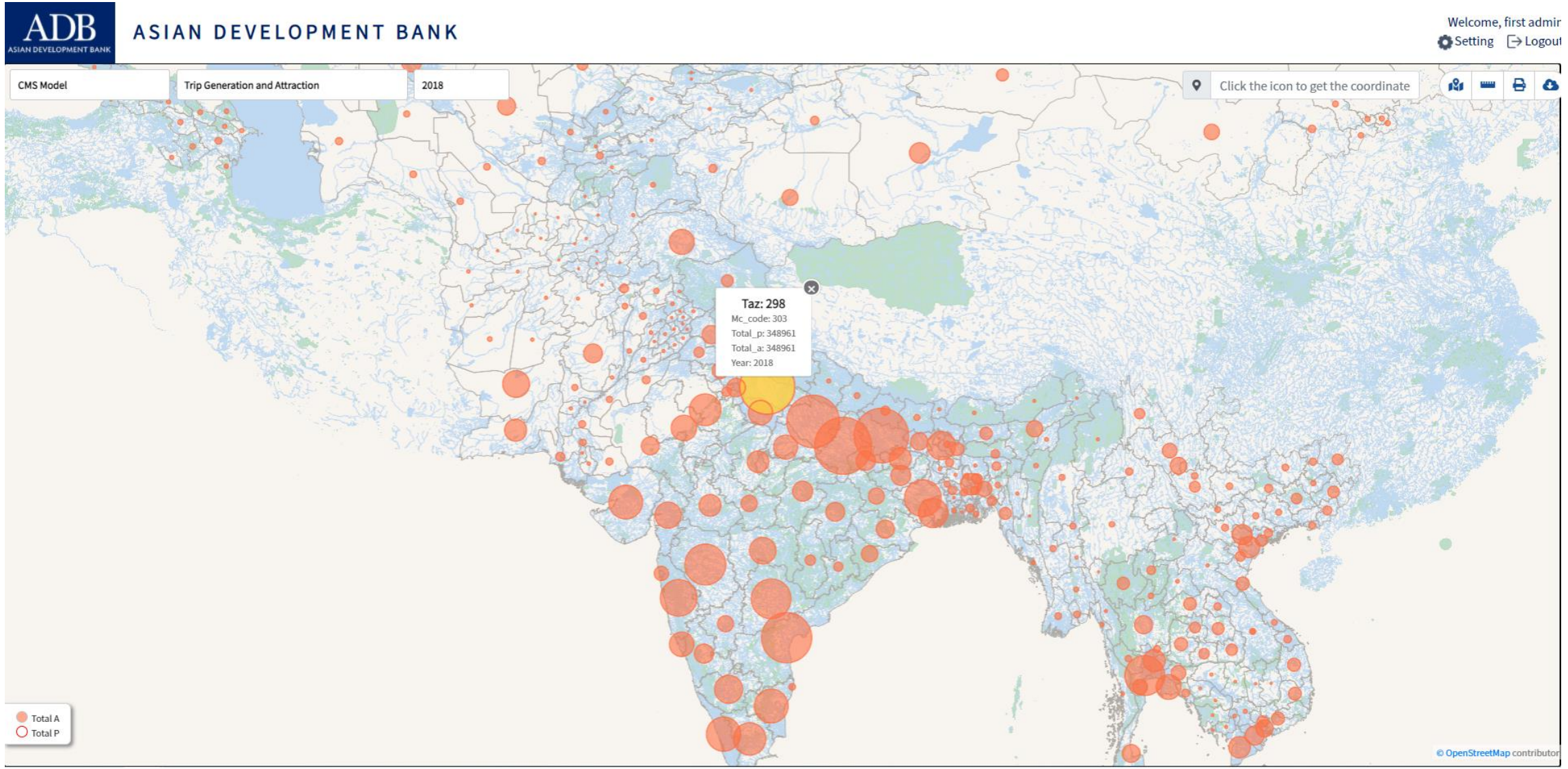
THEMATIC MAP – GROSS DOMESTIC PRODUCT (GDP)



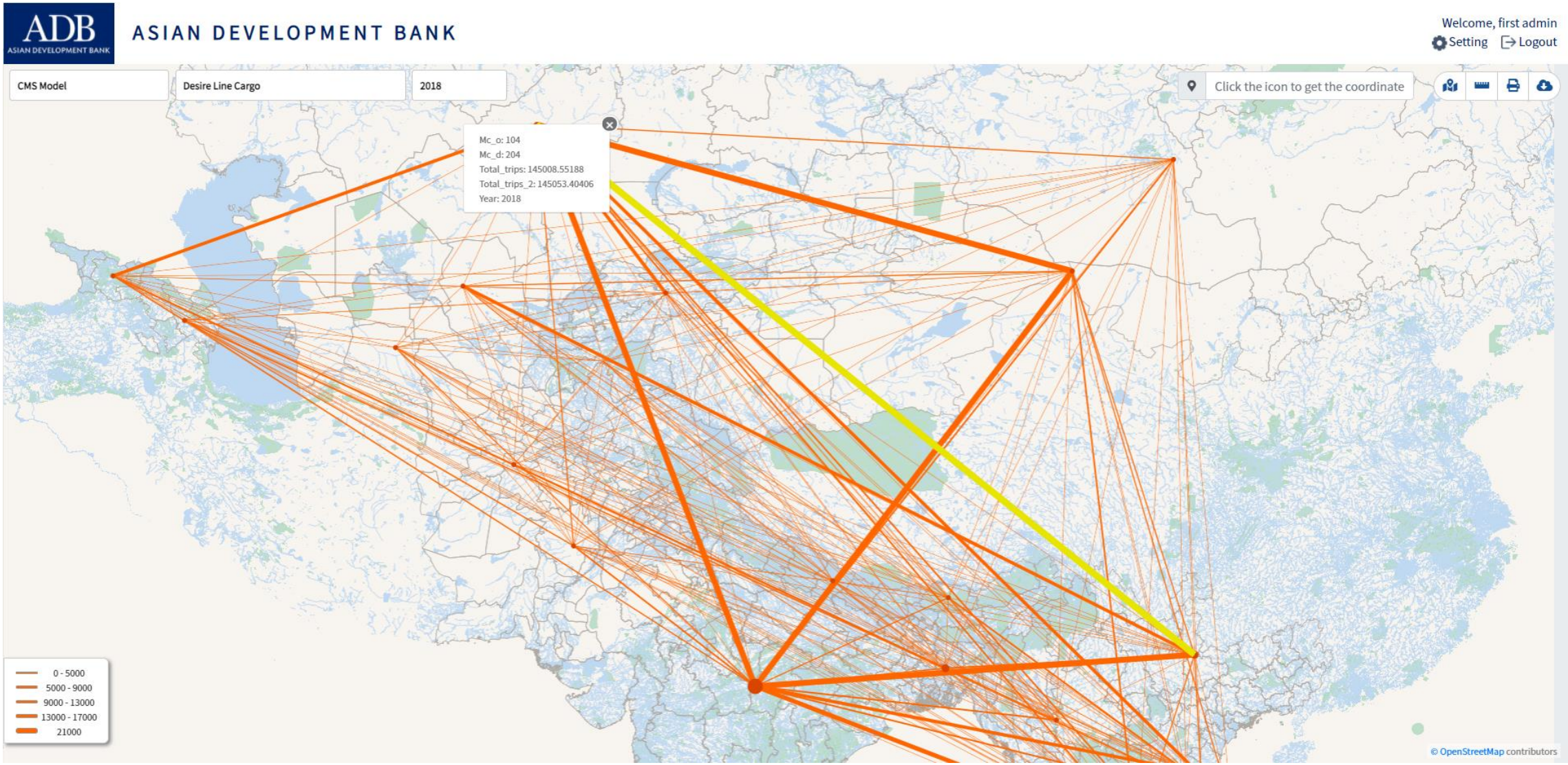
THEMATIC MAP – TRANSPORT NETWORK



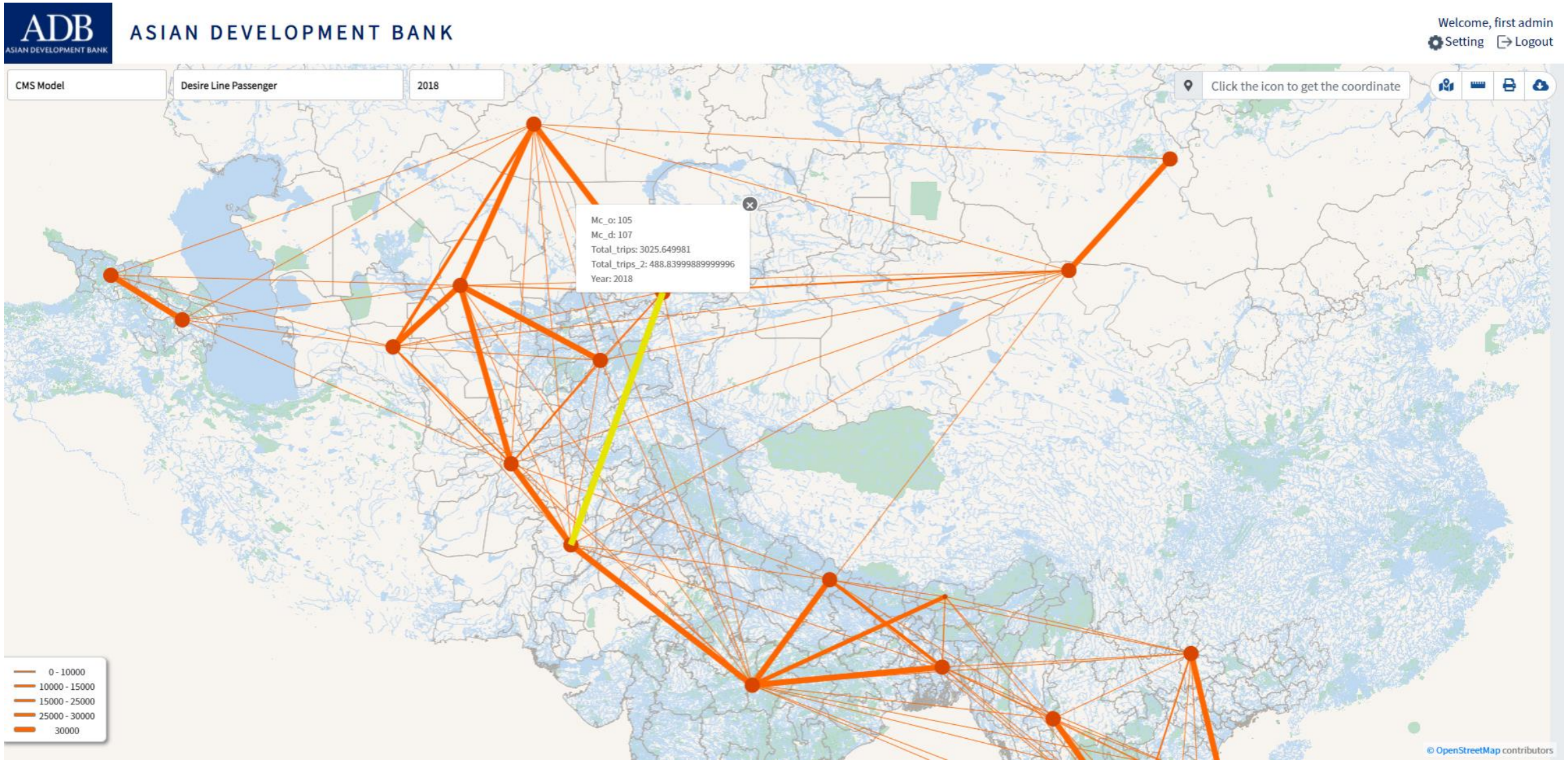
THEMATIC MAP – TRIP GENERATION (TRIP PRODUCTION AND ATTRACTION)



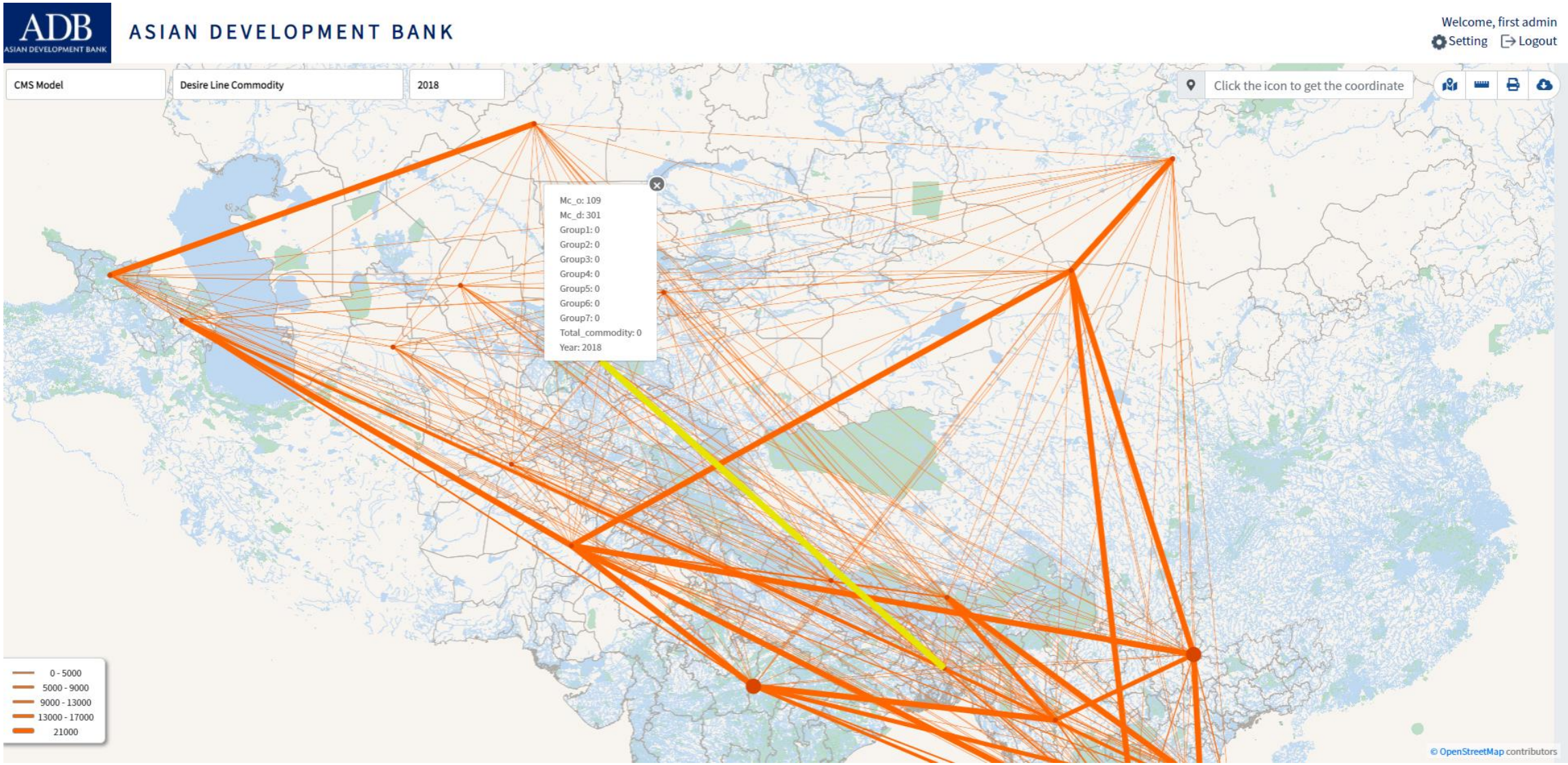
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR CARGO DEMAND



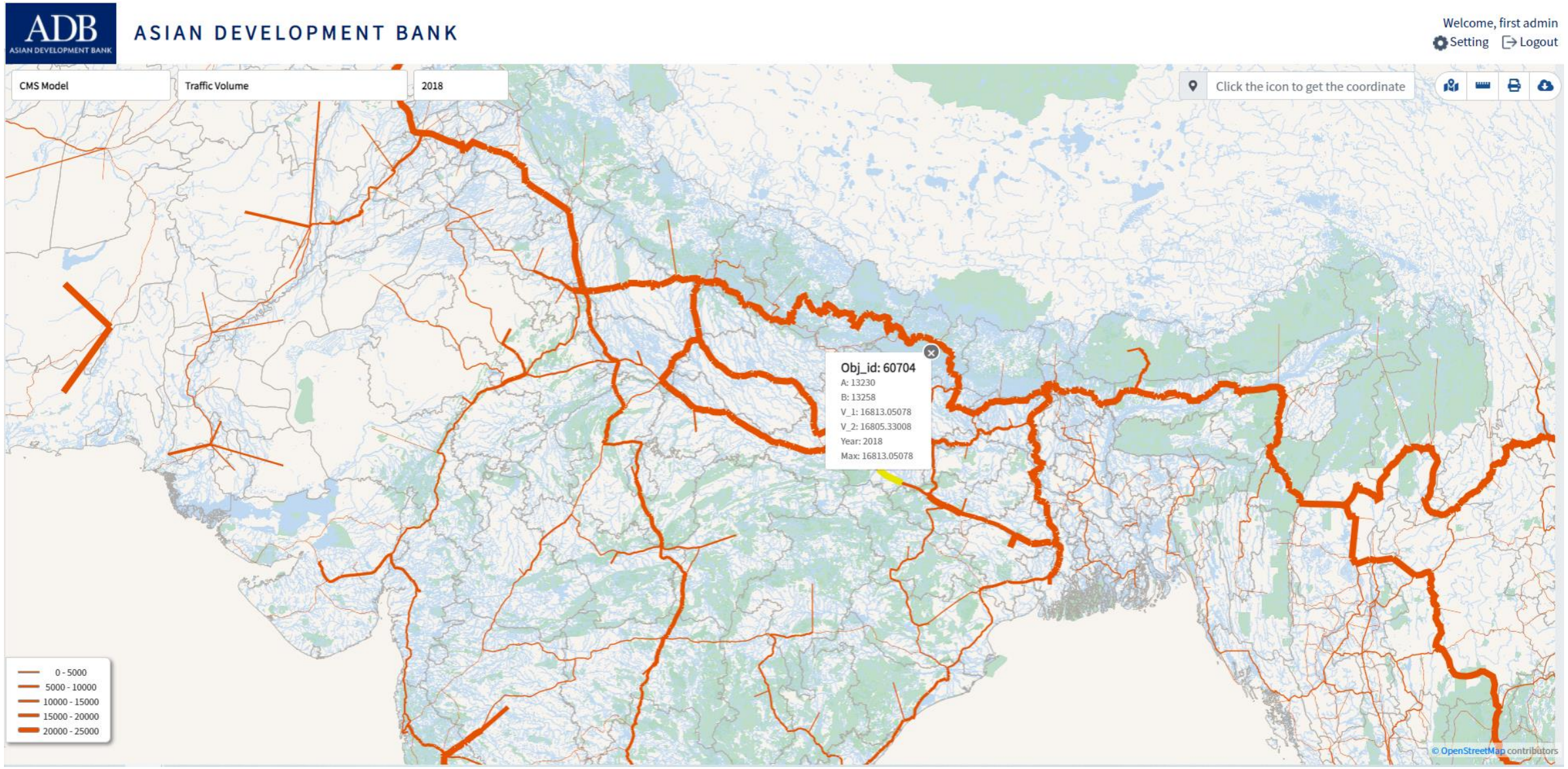
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR PASSENGER DEMAND



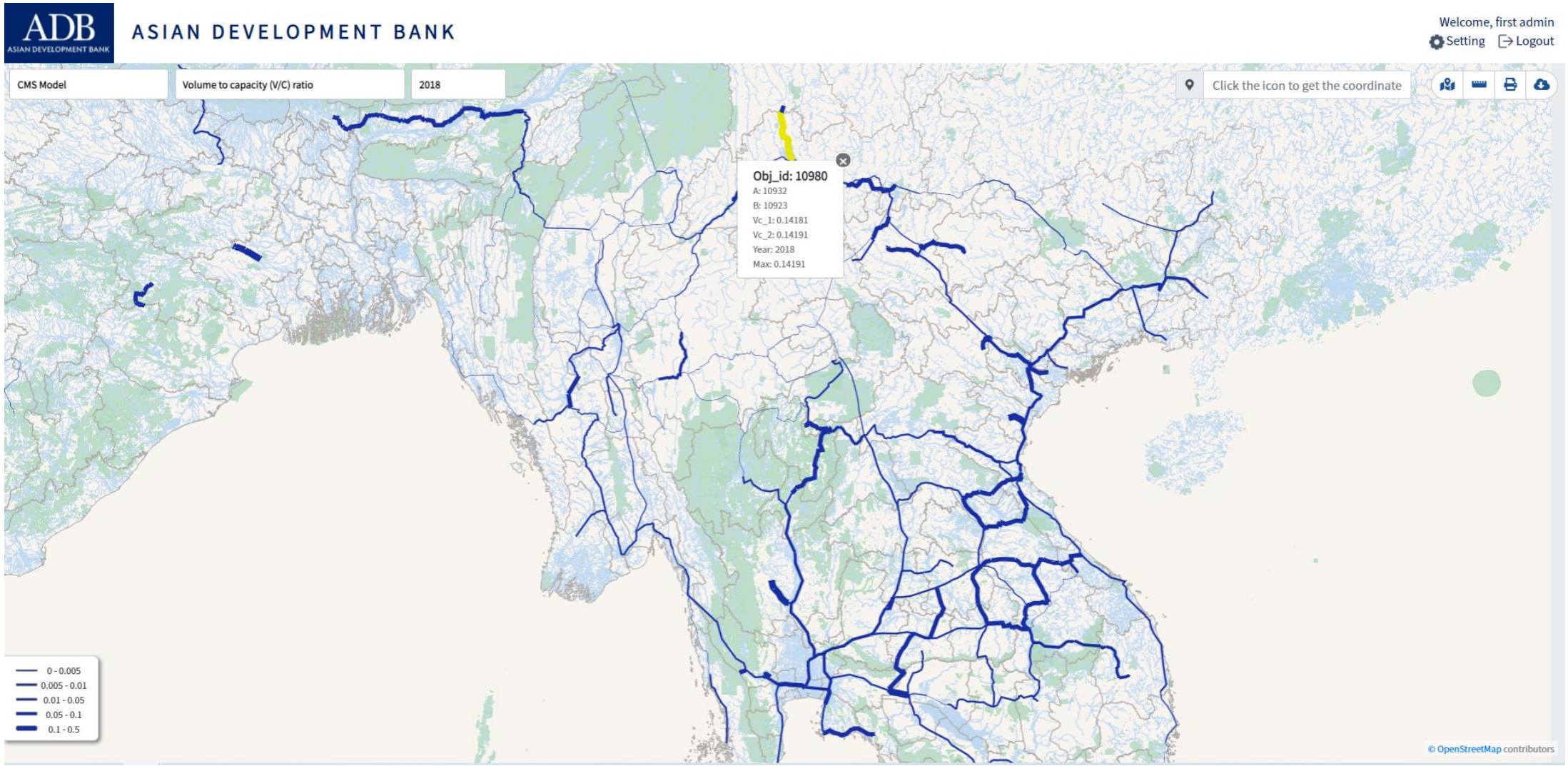
THEMATIC MAP – TRIP DISTRIBUTION (DESIRE LINE) FOR COMMODITY DEMAND



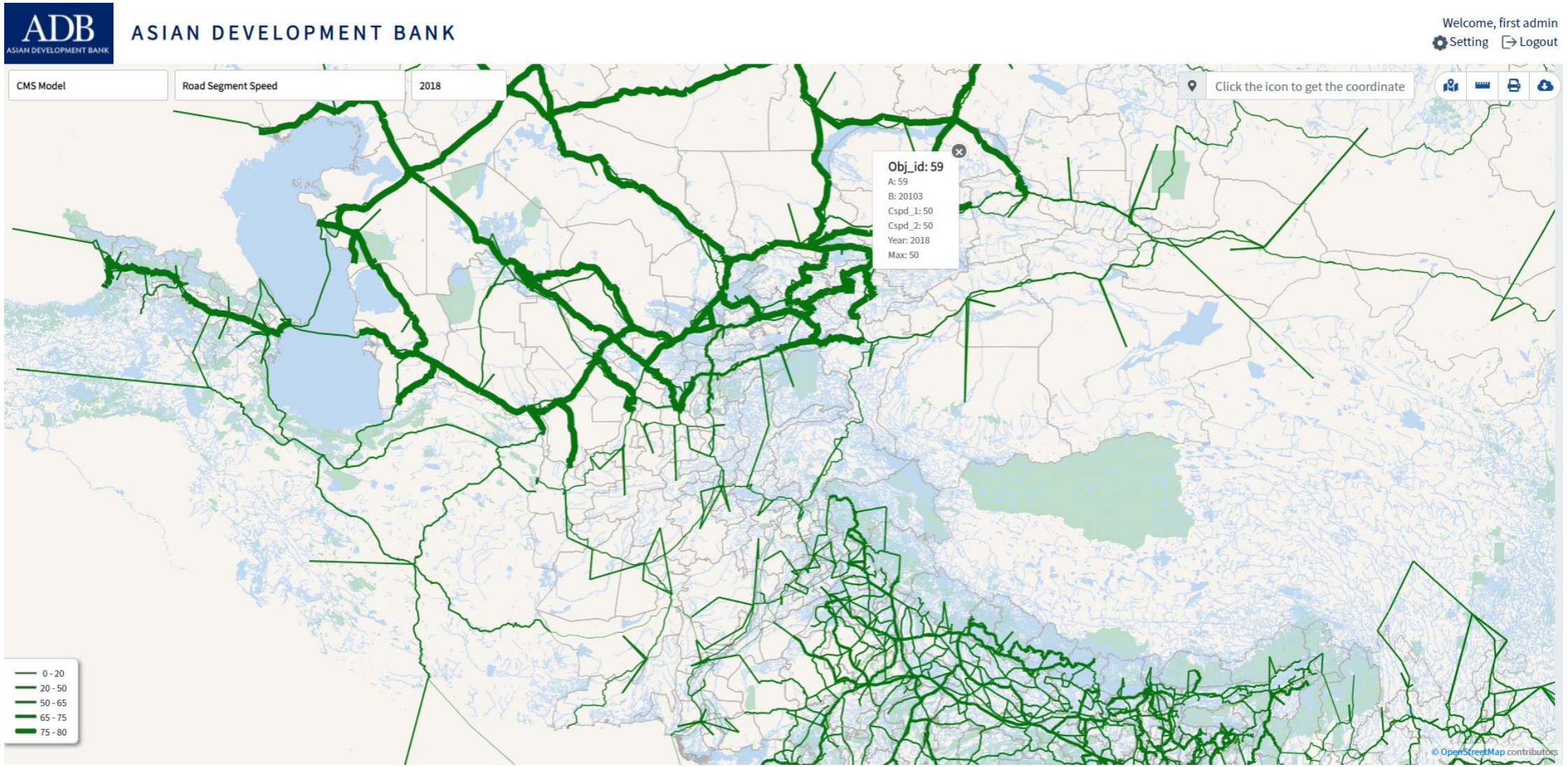
THEMATIC MAP – TRAFFIC VOLUME



THEMATIC MAP – VOLUME TO CAPACITY (V/C) RATIO

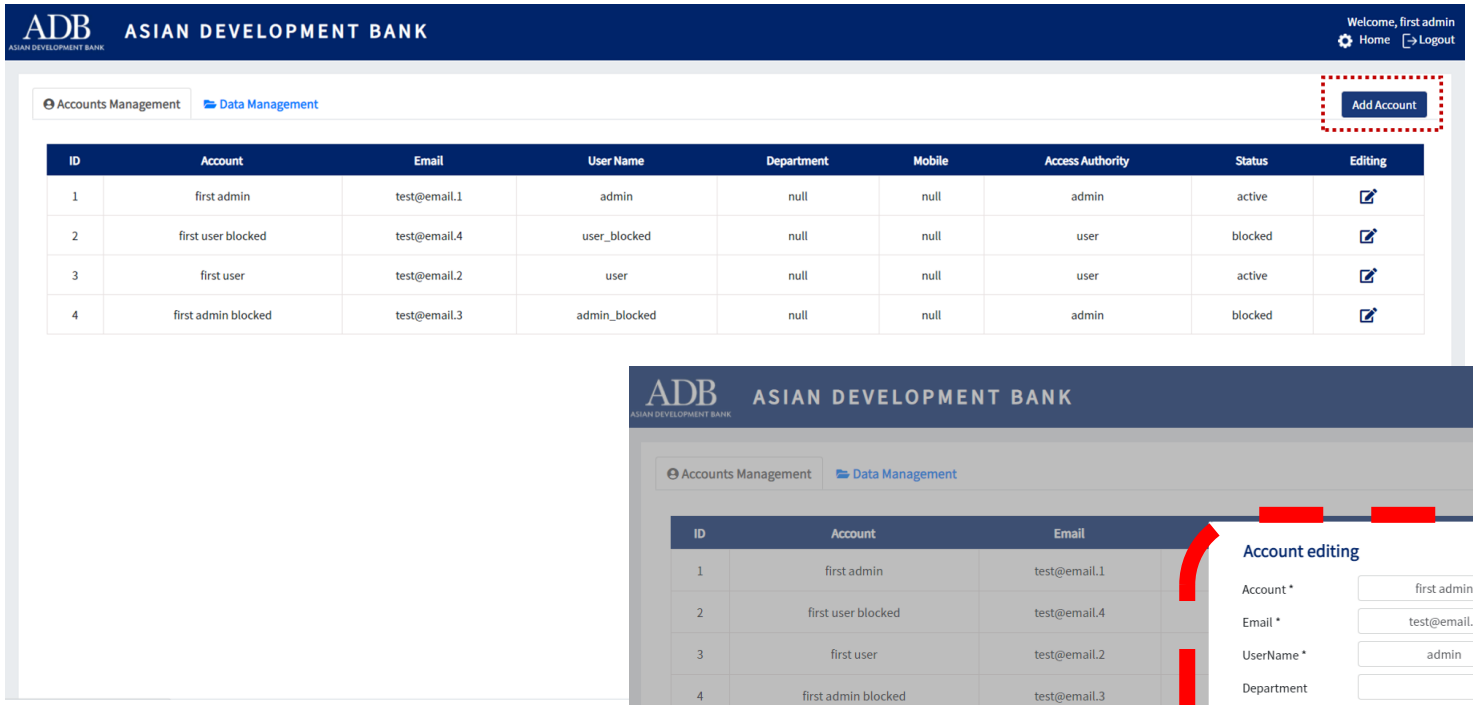


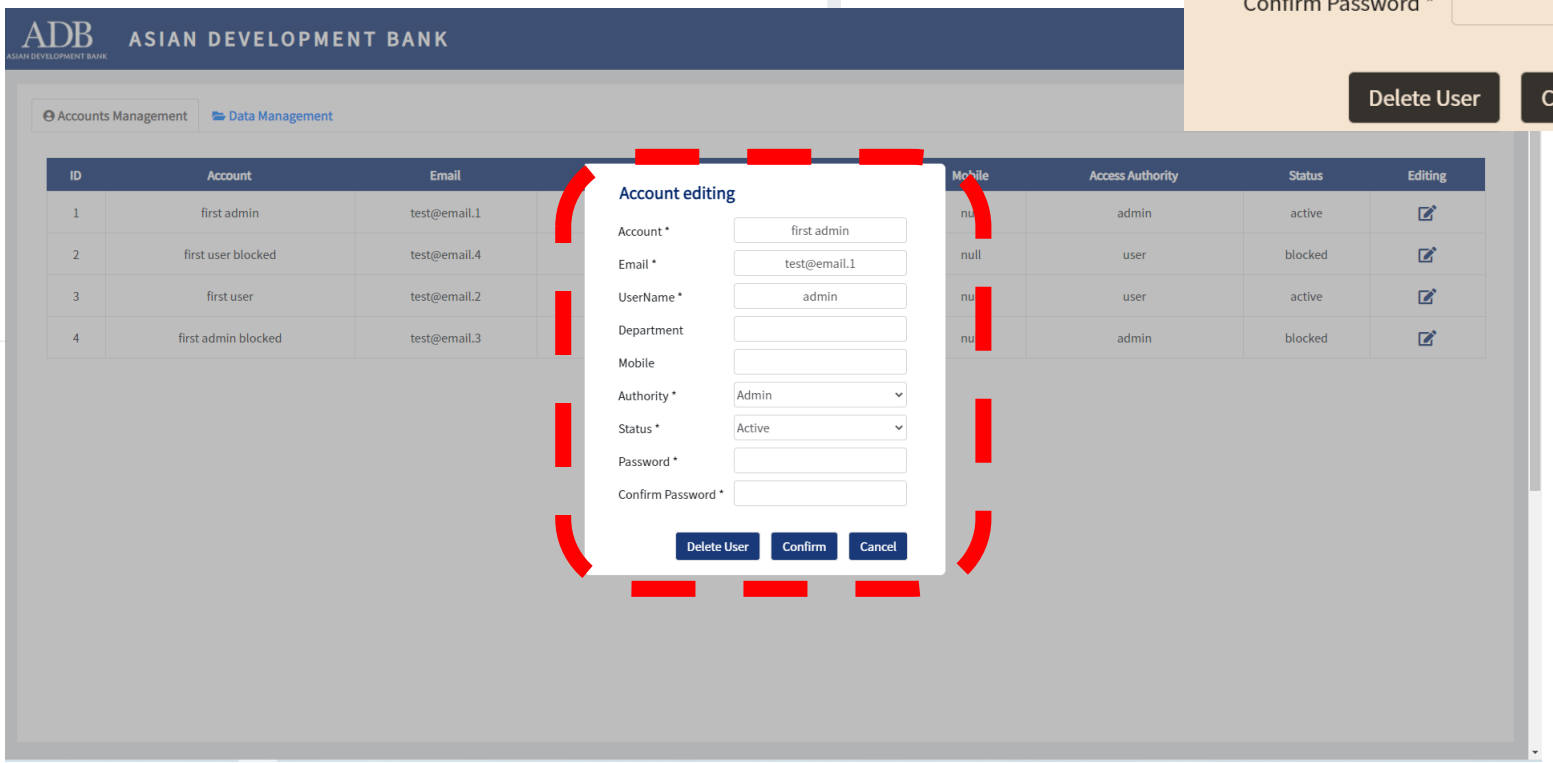
THEMATIC MAP – ROAD SEGMENT SPEED

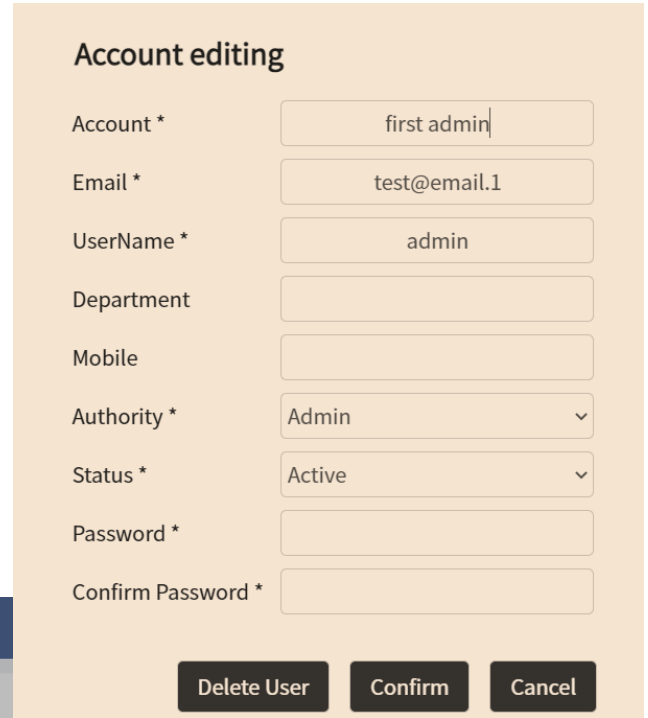


ACCOUNTS MANAGEMENT

- **Add user**
- **Edit account**
- **Delete user**

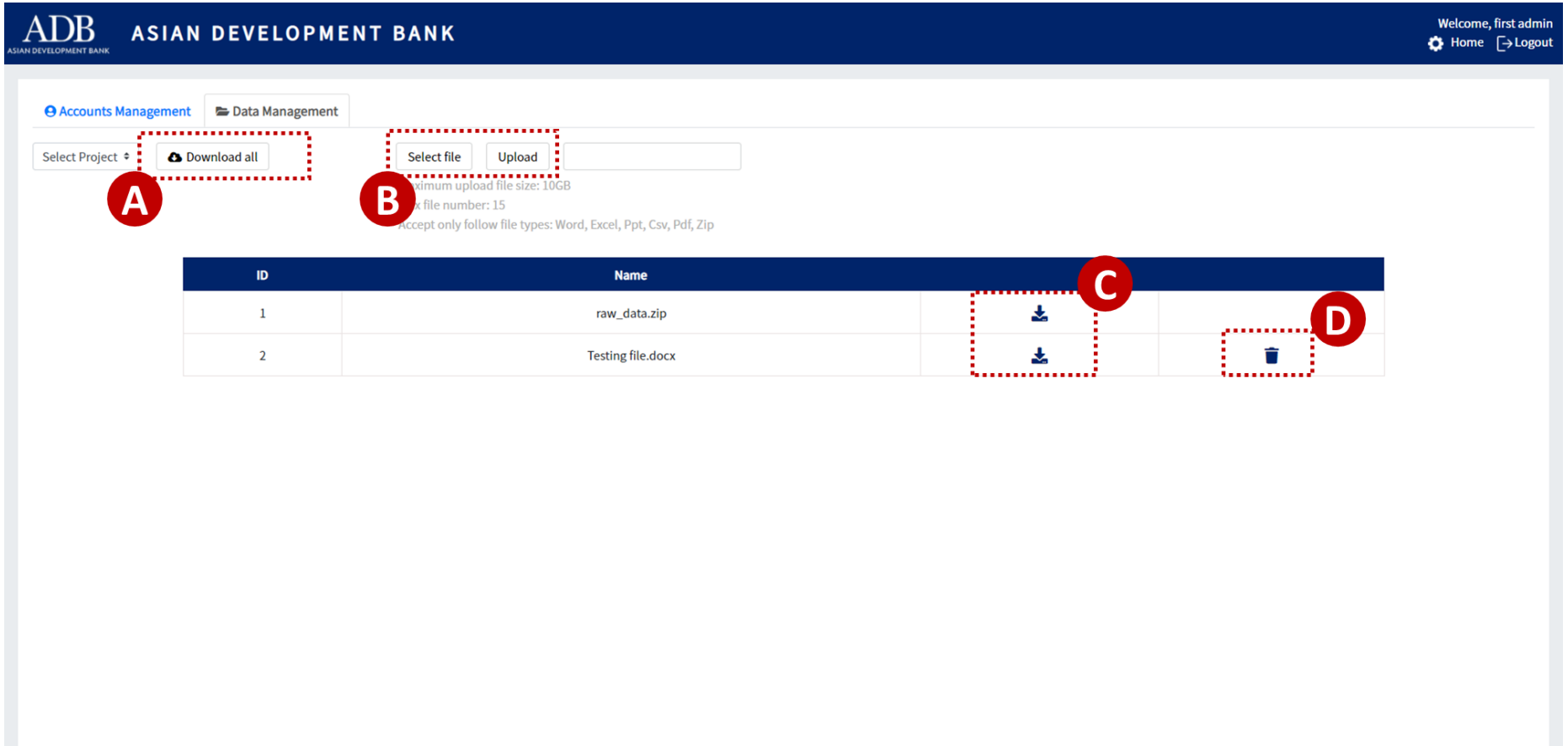




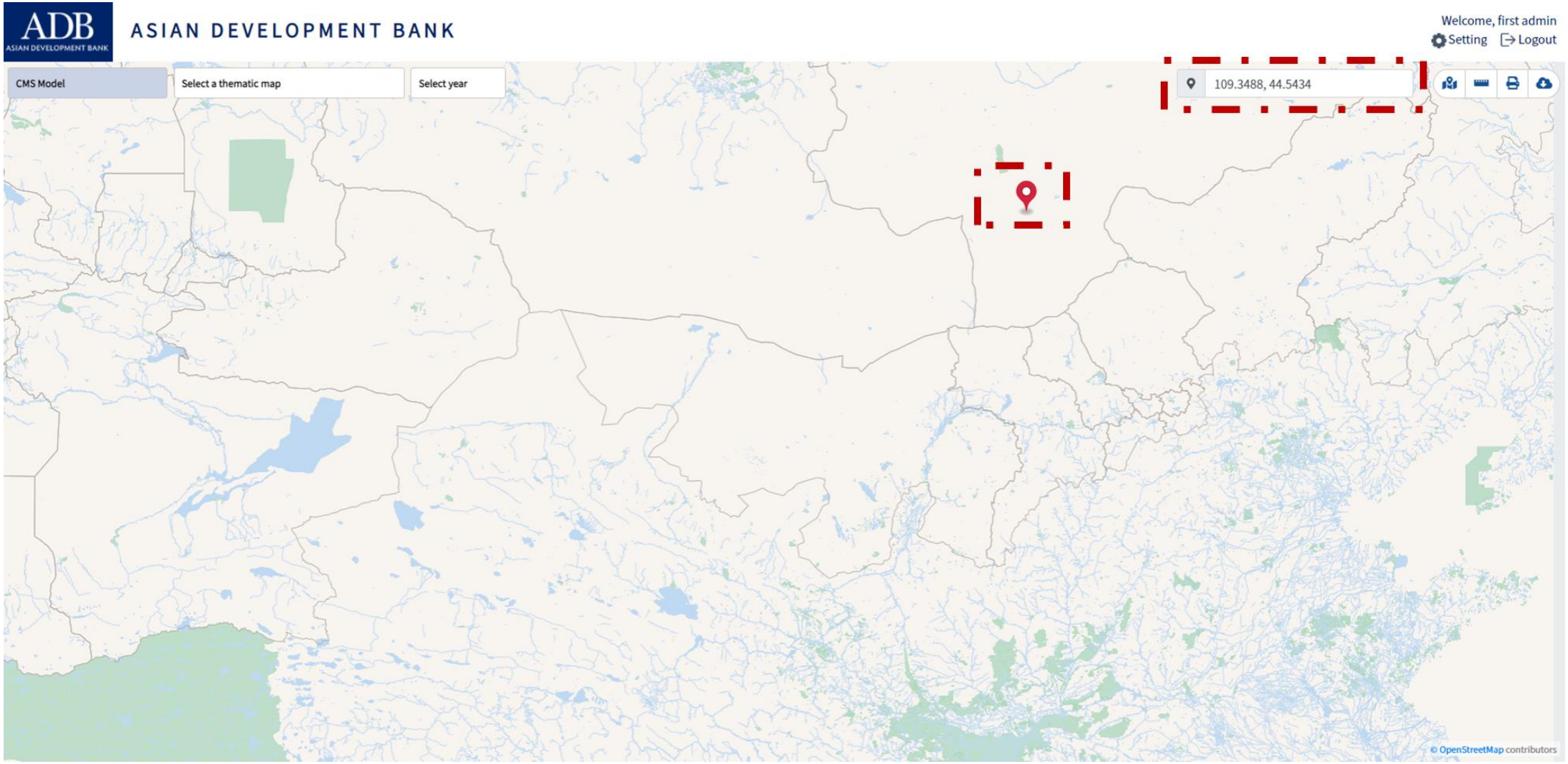


DATA MANAGEMENT

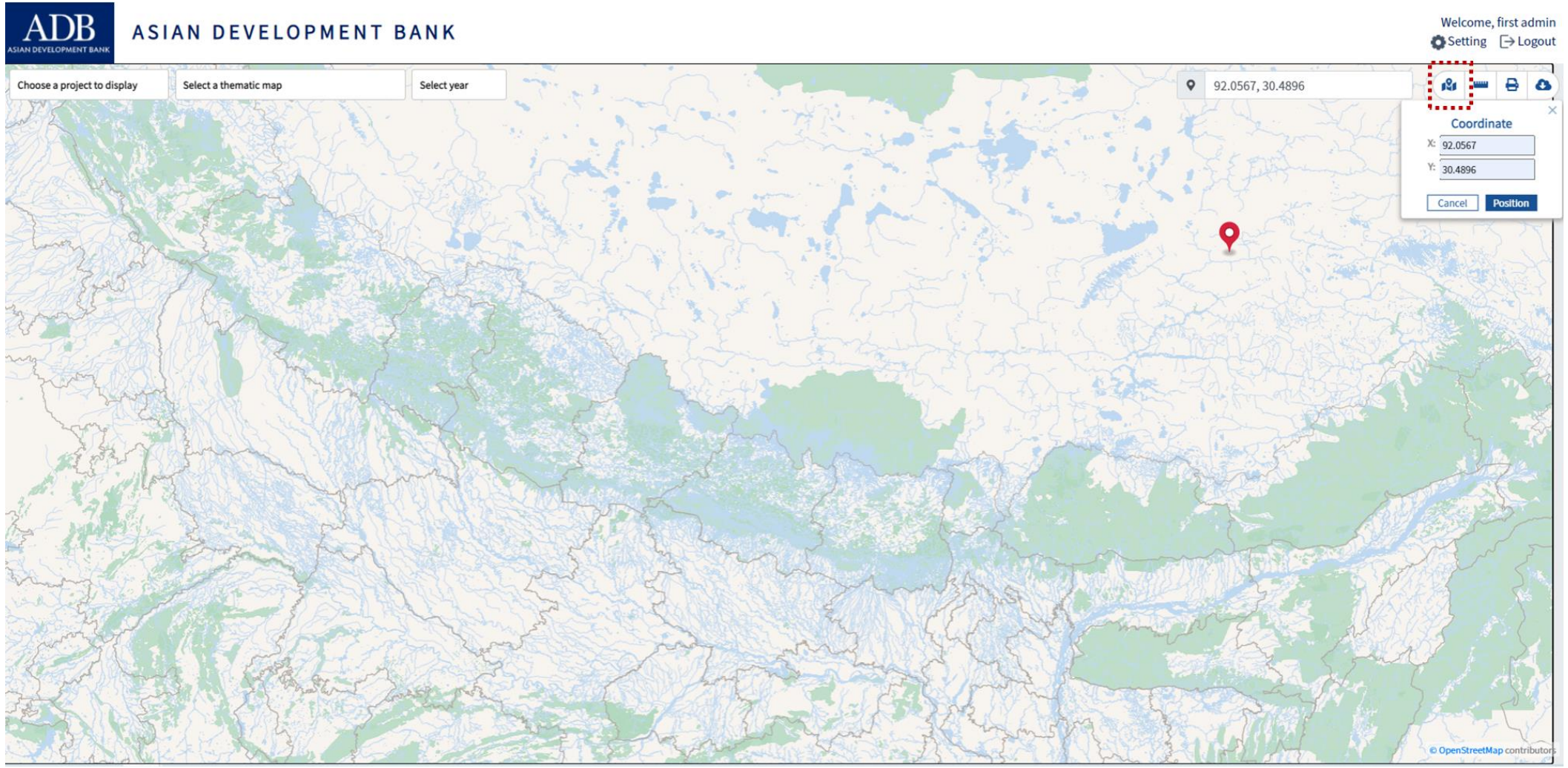
A. Download all: download all relevant information with one click
B. Upload data: The system provides administrators to upload files. File upload restrictions are described below:
    - Maximum upload file size: 10GB
    - Max file number for one project: 15
    - Accept only following file types: Word, Excel, Ppt, Csv, Pdf, Zip
C. Download file
D. Delete data



INTERACTIVE FUNCTIONS – COORDINATE TOOL (1)

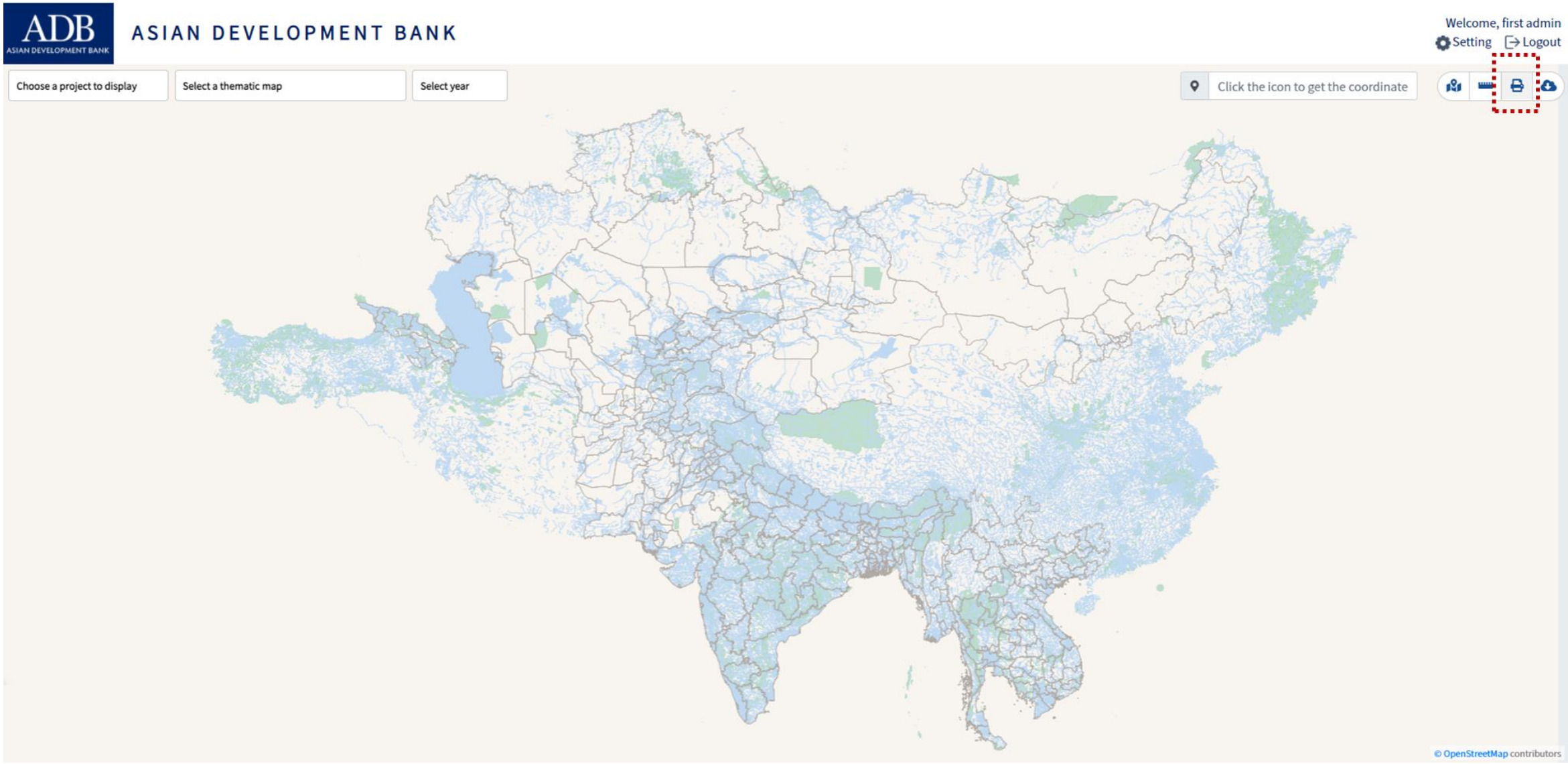


INTERACTIVE FUNCTIONS – COORDINATE TOOL (2)



INTERACTIVE FUNCTIONS – STATIC MAP PRODUCTION TOOL

- **One-click automatic static map production function**



INTERACTIVE FUNCTIONS – DATA DOWNLOAD