

Instructions for Practical Session: Creating a Spatial Data Infrastructure (SDI) for Cities

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1. Group Formation

- Students can either work in their **existing groups** or form **new groups** of up to **5 students**.
 - Each group selects a **town or city** that is familiar to most of the group members.
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2. Dataset Creation

Each group will create datasets for the following categories: - **Transport** - **Electricity** - **Telecommunication** - **Landcover** - **Institutions** - **Hydrology**

2.1 Define Feature Classes and Attributes

- Identify **feature classes** for each dataset (e.g., roads for transport, rivers for hydrology).
- Specify the **attributes** to capture for each feature class (e.g., for rivers: river type, length, flow volume).

2.2 Define Lookup Tables

- Create and use **lookup tables** to maintain consistency when editing and managing attribute data. For example:

- Lookup table for **landcover types**:

lt_landcovertype			
Code	Landcover Type	Description	
F	Forest	Areas covered by trees (crown ≥ 20%)	
G	Grassland	Grass-dominated areas	
C	Cropland	Areas cultivated for crops	

- Lookup tables should be defined for all datasets to enhance data accuracy and consistency.

2.3 Specify Coordinate Reference System (CRS)

- Define and document the **coordinate reference system (CRS)** to be used for the spatial data (e.g., WGS 84, UTM Zone 37N).
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3. Task Division and Standards Definition

- **Divide the Area:** Each group divides the selected town or city into sections and assigns each section to individual group members.
 - **Define Standards:**
 - **Data Structure:** List datasets, feature classes, attributes, and lookup tables for the project.
 - **Data Description Language (DDL):** Define how spatial data should be structured and organized.
 - **Quality Standards:** Establish rules to ensure the accuracy, consistency, and completeness of the data.
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4. Individual Tasks

Each student: 1. **Creates Data:** - Digitize features or import existing data for their assigned section. - Use the group-defined lookup tables for consistent attribute editing. 2. **Uses Group Data:** - Each student incorporates the datasets created by other group members to build a spatial data structure for the entire town. 3. **Demonstrates Work:** - Each student demonstrates their work to the group and collects feedback for improvement.

5. Group Collaboration

1. **Integrating Data:**
 - Refine and integrate individual contributions to create a cohesive spatial dataset for the selected town.
 2. **Select the Best Dataset:**
 - The group identifies the **most complete and consistent dataset** to represent their town.
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6. Inter-Group Collaboration

1. Each group shares its final dataset with other groups in the class.
 2. Ensure that all shared datasets meet the defined quality and classification standards.
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7. Class-Level Integration

1. Each student uses the shared datasets from all groups to create a unified **spatial data infrastructure (SDI)** for towns and cities.

2. Ensure the SDI reflects:
 - Seamless integration of datasets across all towns.
 - Alignment with established data standards and classifications.
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8. Deliverables

1. **Individual Submission:**
 - Each student submits their individual dataset for their assigned section.
2. **Group Submission:**
 - An integrated dataset for the selected town or city.
3. **Class Submission:**
 - A comprehensive SDI incorporating datasets from all groups.
4. **Deliverables Individual Submission:**
 - Each student submits their individual dataset for their assigned section.

9. Group Submission:

An integrated dataset for the selected town or city.

Class Submission:

- A comprehensive SDI incorporating datasets from all groups.
- Project Finalization Date: April 11 - 17, 2025

10. Evaluation and Monitoring

The instructor will evaluate the progress of each group weekly during practical sessions, using the checklist discussed in class to ensure compliance with standards and timely progress.

More on Attributes for Feature Classes

The feature classes with footnotes added for attribute explanations to make the tables more self-explanatory:

Transport

Feature Class	Attributes	Refers to Lookup Table
Roads	<i>road_id, road_type, length_km, cond</i>	<i>lt_roadtype, lt_cond</i>
Ditches	<i>ditch_id, width_m, depth_m, cond</i>	<i>lt_cond</i>
Bridges	<i>brg_id, brg_type, length_m, cond</i>	<i>lt_brtype, lt_cond</i>

Footnotes: - *road_id*: Unique identifier for each road. - *road_type*: Type of road (e.g., highway, primary road, secondary road). - *length_km*: Length of the road in kilometers. - *cond*: Condition of the road (e.g., good, fair, poor). - *ditch_id*: Unique identifier for each ditch. - *width_m*: Width of the ditch in meters. - *depth_m*: Depth of the ditch in meters. - *brg_id*: Unique identifier for each bridge. - *brg_type*: Type of bridge (e.g., vehicular, pedestrian). - *length_m*: Length of the bridge in meters.

Electricity

Feature Class	Attributes	Refers to Lookup Table
Powerlines	<i>line_id, capacity, length_km, cond</i>	<i>lt_cond</i>
Streetlights	<i>light_id, status, location</i>	<i>lt_lightstat</i>
Substations	<i>sub_id, capacity, status, location</i>	<i>lt_cond</i>

Footnotes: - *line_id*: Unique identifier for each powerline. - *capacity*: Transmission capacity in megawatts (MW). - *light_id*: Unique identifier for each streetlight. - *status*: Operational status (e.g., functional, non-functional). - *sub_id*: Unique identifier for each substation. - *location*: Geographic location or description of the feature.

Telecommunication

Feature Class	Attributes	Refers to Lookup Table
Cell Towers	<i>tower_id, height_m, status</i>	<i>lt_towerstat</i>
Fiber Optic Cables	<i>foc_id, length_km, status</i>	<i>lt_cond</i>

Footnotes: - *tower_id*: Unique identifier for each cell tower. - *height_m*: Height of the tower in meters. - *foc_id*: Unique identifier for each fiber optic cable. - *length_km*: Length of the fiber optic cable in kilometers.

Landcover

Feature Class	Attributes	Refers to Lookup Table
Landcover_2000	<i>lc_id, lu_code, area_ha</i>	<i>lt_landcovertype</i>
Landcover_2025	<i>lc_id, lu_code, area_ha</i>	<i>lt_landcovertype</i>

Footnotes: - *lc_id*: Unique identifier for each landcover polygon. - *lu_code*: Land use type (e.g., forest, grassland, cropland). - *area_ha*: Area in hectares.

Institutions

Feature Class	Attributes	Refers to Lookup Table
Institutions	<i>inst_id, instype, inst_name, cap</i>	<i>lt_insttype</i>

Footnotes: - *inst_id*: Unique identifier for each institution. - *instype*: Institution type (e.g., education, health, bank). - *inst_name*: Name of the institution (e.g., High School, Clinic, Nib Bank). - *cap*: Capacity or size of the institution (e.g., number of students or patients).

Hydrology

Feature Class	Attributes	Refers to Lookup Table
Rivers	<i>riv_id, flow_code, width_m, length_km</i>	<i>lt_riverflowtype</i>
Lakes	<i>lake_id, lu_code, area_ha, depth_m</i>	<i>lt_landcovertype</i>
Domestic Water	<i>domw_id, source_code, cap_liters, status</i>	<i>lt_domwsouce</i>
Water Tankers	<i>tank_id, cap_liters, status</i>	<i>lt_tankstat</i>
Valve Points	<i>valve_id, valve_code, status</i>	<i>lt_valvetype</i>
Pipelines	<i>pipe_id, length_km, status</i>	<i>lt_cond</i>

Footnotes: - *riv_id*: Unique identifier for each river. - *flow_code*: Flow type of the river (e.g., perennial, seasonal). - *lake_id*: Unique identifier for each lake. - *domw_id*: Unique identifier for each domestic water source. - *source_code*: Type of domestic water source (e.g., well, spring). - *tank_id*: Unique identifier for each water tanker. - *valve_id*: Unique identifier for each valve. - *valve_code*: Valve type (e.g., open, closed). - *pipe_id*: Unique identifier for each pipeline.

Collection of lookup tables

1. Landcover Types (lt_landcovertype)

Code	Landcover Type	Description
F	Forest	Areas covered by trees (crown \geq 20%)
G	Grass	Grass-dominated areas
GA	Green Area	Parks, gardens, or recreational spaces
BL	Bareland	Areas with minimal to no vegetation
R	River	Watercourses
S	Shrubland	Land covered with shrubs
P	Pond	Small bodies of still water

2. Institution Types (lt_insttype)

Code	Institution Type	Description
EDU	Education	Schools, colleges
HLTH	Health	Clinics, hospitals
BNK	Bank	Financial institutions
POL	Police	Police stations
GOV	Government Office	Administrative offices
INS	Insurance	Insurance agencies
REL	Religious	
CUL	Cultural	Museums, libraries, theaters
SPR	Sports/Recreation	Stadiums, gyms, recreational centers
EMG	Emergency Services	Fire stations, ambulance services
TRH	Transportation Hub	Airports, bus terminals, train stations
RET	Retail	Shopping malls, markets
IND	Industrial	Factories, warehouses
HOS	Hotels/Hospitality	Hotels, lodges, tourist centers
COM	Communication	Radio, TV, telecom offices
NGO	Non-Governmental	NGO or charity offices

3. Valve Types (lt_valvetype)

Code	Valve Type	Description
M	Main	Main valves for primary control
S	Subsite	Valves at sublocations
L	Local	Valves for localized control

4. Road Types (lt_roadtype)

Code	Road Type	Description
HW	Highway	Major roads for high-speed travel
PR	Primary Road	Main roads within cities/towns
SR	Secondary Road	Roads connecting neighborhoods

5. Condition (lt_cond)

Code	Condition	Description
G	Good	Well-maintained and functional
F	Fair	Usable but needs maintenance
P	Poor	Requires immediate repair

6. Bridge Types (lt_brtype)

Code	Bridge Type	Description
VH	Vehicular Bridge	For vehicles
PD	Pedestrian Bridge	For pedestrians

7. Streetlight Status (lt_lightstat)

Code	Status	Description
F	Functional	Operational
NF	Non-Functional	Needs repair

8. River Flow Types (lt_riverflowtype)

Code	Flow Type	Description
PER	Perennial	Flows year-round
SEA	Seasonal	Flows during specific seasons

9. Domestic Water Sources (lt_domwsources)

Code	Source Type	Description
WL	Well	Water sourced from wells
SPR	Spring	Natural springs