- ***Highway Functional Classification***

It is the process by which streets and highways are grouped into classes or systems according to the character of services they are intended to provide, i.e. the type of travel associated with the road.

The classification of highways is important for:

- Design purposes to enable the road designer to relate the structure and design standards to different roads under different classes.
- Planning purposes to provide a basic long-term plan where different properties could be assigned to different classes
- Administration needs

Highways are classified in accordance with functional characteristics. These characteristics are based on the location of the road such as **urban** or **rural**, **width of the road (single lane or multilane)** and **the type of service the road provides such as local access or travel between cities**.

AASHTO defines an urban area as "those places within boundaries set by the responsible State and Local Officials having a population of 5,000 or more". Furthermore, the AASHTO Policy defines an urbanized area as one with a population of 50,000 and over. The small urban area is the area with a population between 5,000 and 50,000. While, the rural areas are defined as areas have population less than 5000.

Arterials are surface facilities that are designed primarily for through traffic movement but permit some access to abutting lands. Arterials can be classified into major arterials and minor arterials.

Highways: They represent the superior type of roads in the country. Highways are of two types- rural highways and urban highways. Rural highways are those passing through rural areas (villages) and urban highways are those passing through large cities and towns, i.e. urban areas.

Freeway is a divided highway with fully controlled access. Access to a freeway is made without use of at-grade intersections.

The freeway (limited-access facility) provides for 100% through movement or mobility. No direct access to abutting land uses is permitted.

Expressways: They are superior type of highways and are designed for high speed (120 Km/hr is common), high traffic volume and safety. They are generally provided with grade separations at intersections. Parking, loading and unloading of goods and pedestrian traffic is not allowed on expressways.

Local streets are designed to provide access to abutting land uses with through movement only a minor function if provided at all.

The collector is an intermediate category between arterials and local streets. It connects major arterials and local streets with direct access to abutting property.

- Properties of principle arterials
  (Freeways, expressways or other types of highways (connecting cities))
  - Long distance (connecting cities)
  - High design speed (≤ 130 Kph)
  - Full control of access
  - High L.O.S. (level of service) (≈ B)

- Properties of minor arterials
  - Moderate design speed (≤ 110 Kph)
  - level of service (B - C)
  - Partial control of access

- Properties of collectors (major or minor)
  - Intermediate design speed (≈ 80 Kph)
  - Level of service (C – D)

- Properties of Local roads and streets: (Road-rural area) while (street-urban area)

  Road ----------Rural Area ---------population ≤ 5000 capita

  Street ---------Urban Area -------population > 5000 capita

  - Design speed (20 – 40 Kph)
  - Low level of service (D – E)
  - Serving abutting area.

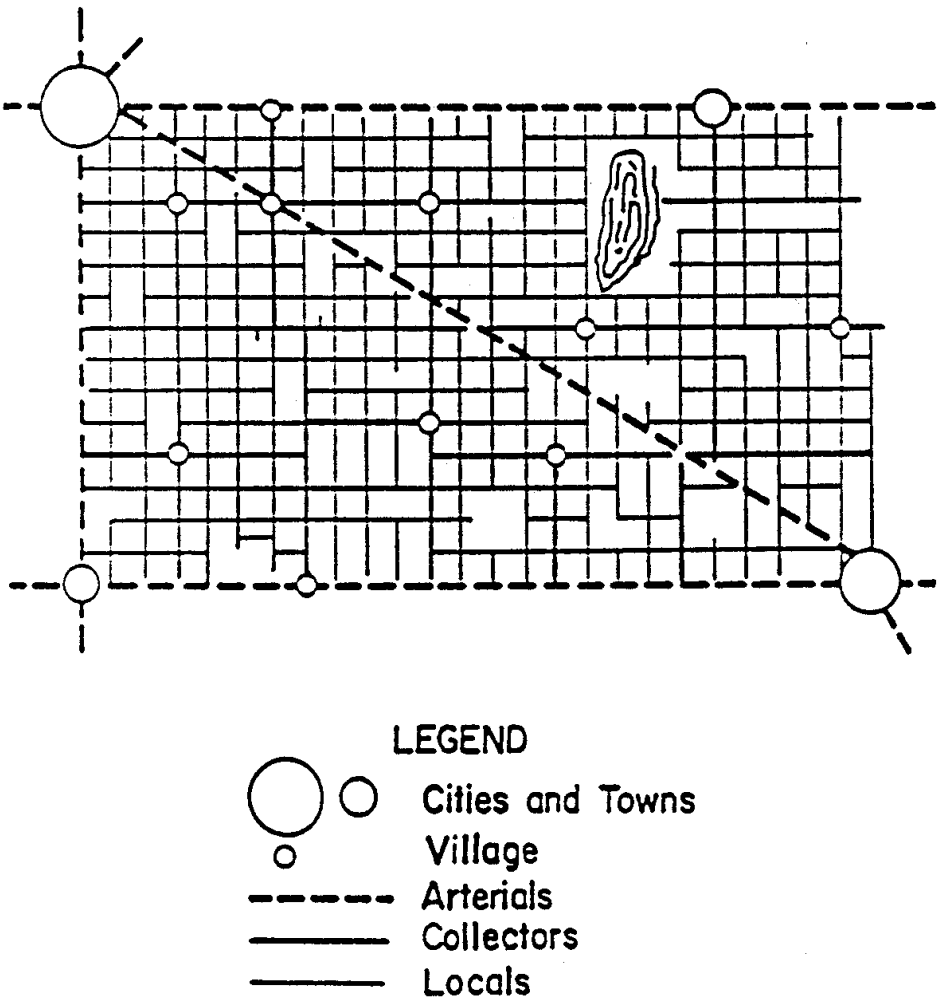


Figure 2.1: Schematic Illustration of a Functionally Classified Rural Highway Network

Traffic Mobility and Land Access

There are two primary categories of service provided by roadways and roadway systems. These are: Accessibility and Mobility.

"**Accessibility**" refers to the direct connection to abutting lands and land uses provided by roadways.

"**Mobility**" refers to the through movement of people, goods and vehicles from point A to point B in the system.

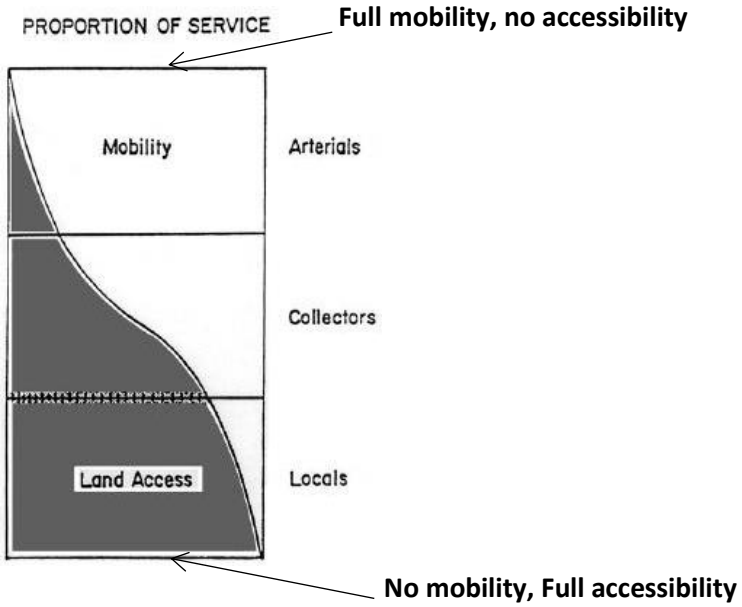


Figure 2.2: Relationship of Functionally Classified Systems in Serving Traffic Mobility and Land Access

Figure 2-2 shows the connection between access, mobility, and the functional classification of highways. Arterials have high level of mobility because they provide high speed traffic movement but they have lower level of accessibility because they do not provide access to adjoining properties. On the other hand, mobility in the local streets is very poor because of the low speed but they provide maximum accessibility.

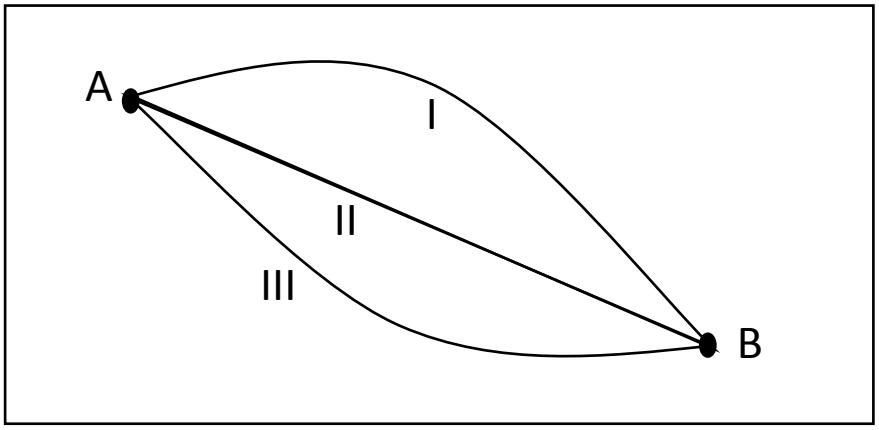
Highway Route location

It is an important essential step in highway design.

The phases of highway location are carried out after deciding the needed data and preparing the existing data. In general, data can be classified into:

1. Engineering data including topography, geology, climate, and traffic volume
2. Social and demographic including land use and zoning patterns

3. Environmental including location of recreational, historic and archeological sites. It also includes effect of air pollution and noise pollution.
4. Economic including unit costs for construction and the trend of agricultural, commercial and industrial activities.



- **Principles of Highway Route Location Process**

The highway location process involves three phases: Reconnaissance survey, Preliminary location survey, and the final location survey.

1. **Reconnaissance survey**. In this phase:

a. Available maps and Arial photography for the area are collected.

b. Several feasible alternatives routes are identified and the control points between the two endpoints are determined also based on:

- Terrain and soil conditions, earthwork and grading cost
- Crossing of other transportation facilities such as rivers, railroads and highways.
- Drainage structure (bridge or culvert)
- Design standard
- Serviceability of route to industrial and population areas
- Traffic services
- Availability of construction materials
- Direction of the route

عند تقاطع الطريق مع نهر (مجرى مائي) اذا كان عرض المجرى المائي اقل من 10م نستخدم قنطرة اما اذا كان اكبر من 10 م نستخدم جسر.

2. **Preliminary location survey**

In this phase,

a. Evaluation of the alternative route and the selection of the best route is based on:

- Economic criteria: to determine the future effect of investing the resources necessary to construct highways. These criteria includes road user cost, construction cost, maintenance cost, and benefits
- Environmental criteria. The environment effected by construction of a road are plant, animal, human communities, social activities, and pollution.
- Others such as connection local streets and coordination with other transportation systems including pedestrians.

b. Locate on paper the centerline of the proposed route (P. line) to determine the preliminary vertical and horizontal alignment.

3. **Final location survey**

The task of this phase is locating the final centerline of the route on ground and preparing design drawing as well as estimation for construction cost.

- Detailed survey
- Soil investigation
- Alignment design: vertical and horizontal
- Cross-section design
- Pavement structural design
- Preparing bill of quantity (Boq)

Example (1)

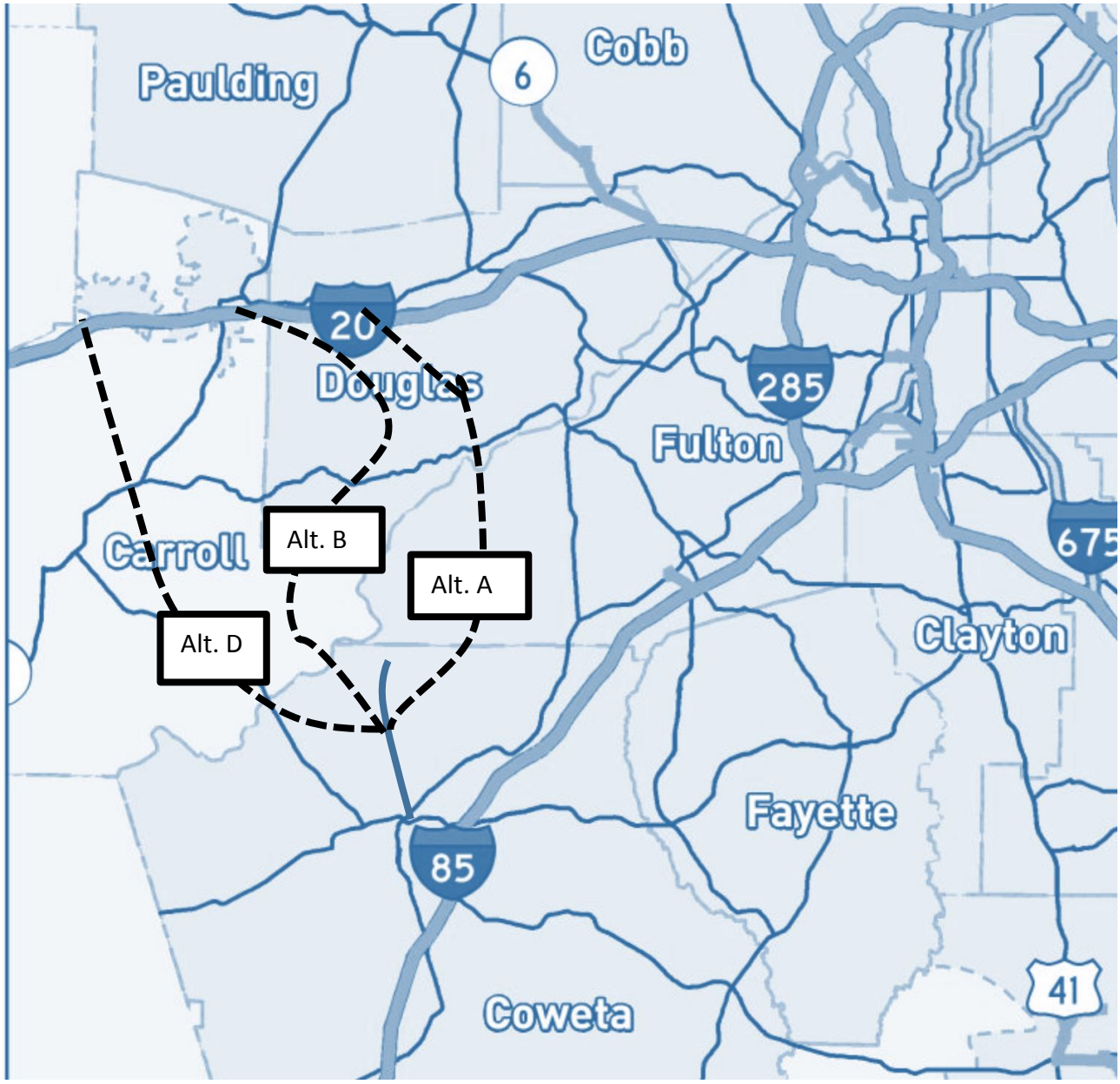
A location study for a 4-lanes controlled access parkway near Atlanta illustrates the wide variety of factors that must be considered in the location selection process. The purposes of

the proposed highway were to improve the accessibility to and from eastern Douglas County and south central Fulton County and to link Interstate Route I-20 west of Atlanta with Rote I-85 near Hartsfield/Atlanta Intersection Airport.

Originally two alternate locations were considered, designated A and B on Figure 1. After a public hearing, Alternate D was developed and evaluated along with the other two alternates. Alternate C is added as no-build alternate.

Table 1 shows the details of the proposed alternates

Criteria of evaluation	**Alternates**			
	A	**B**	**C**	**D**
Length	5.8 miles	5.7 miles	-	5.3 miles
Average daily traffic	26.500-33.800	26.500-33.800	-	26.500-33.800
Expenditure on public funds annual loss in tax revenues	$7498000	8303000	-	$73270000
House unit relocations	5	0	-	1
Historical and archaeological	4 sites	7 sites	-	11 sites
Air quality (Carbon monoxide)	2.7-4.1 ppm	2.7-4.1 ppm	-	2.7-4.1 ppm
Noise	5 residence	0	-	2 residence



Solution

According to the economic impact, alternate D is the cheapest. However, this alternate will results in relocation of one house unit and affect 11 historical sites. In addition this alternate will cause noise for 2 residents.

Alternate A the second cheapest alternate. This alternate will cause relocation of more houses and has impact on 4 historical impacts. It also will cause noise for higher number of residence.

Alternate D the most expensive but it will not cause relocation of houses units and will not cause noise for any residence. Despite it will affect 7 historical sites, the aggregated score of alternate D is the higher and it is selected as the preferred location.

Examples of Multi-choice question (MCQ)

1. AASHTO defined the area as rural area when the population is

a. 5000 or less	b. 50000	c. 10000	d. 50000 or over

Ans.
a. 5000 or less

2. AASHTO defined the area as urban area when the population is

a. 5000 or less	b. 50000	c. 10000	d. 50000 or over

Ans.
d. 50000 or over

3. AASHTO defined the area as small urban area when the population is

a. 5000 or less	b. 50 to 50000	c. 10000	d. 50000 or over

Ans.
b. 50 to 50000

4. AASHTO defined the highway as accessible highway when highway

a. Direct connect land to land	b. movement of people	c. limit access point	d. full control access point

Ans.
a. Direct connect land to land

5. The difference between freeway and expressway is:

a. level of service of highway	b. number of vehicles moving through it	c. base speed of vehicle moving through it	d. type of connect access point

Ans.

d. type of connect access point

6. AASHTO defined the highway as mobile highway (or has a high level of mobility) when highway provides:

a. Direct connect land to land	b. movement of people	c. limit access point	d. full control access point

Ans.
b. movement of people

7. AASHTO classified speed of principle arterial as

a. 120 or large	b. 100 or large	c. 120 or less	d. 100 or less

Ans.
c. 120 or less

8. AASHTO classified speed of minor arterial as

a. 120 or large	b. 100 or large	c. 120 or less	d. 100 or less

Ans.
d. 100 or less

9. AASHTO classified speed of collector arterial as

a. 80 or large	b. 100 or large	c. 80 or less	d. 100 or less

Ans.
c. 80 or less

10. AASHTO classified speed of Local Street as

a. 120 to 100	b. 100 to 80	c. 120 to 60	d. 20 to 40

Ans.
d. 20 to 40

11. AASHTO classified LOS of principle arterial as

a. LOS B	b. LOS B to C	c. LOS C to D	d. LOS D

Ans.
a. LOS B

12. AASHTO classified LOS of Minor arterial as

a. LOS B	b. LOS B to C	c. LOS C to D	d. LOS D

Ans.
b. LOS B to C

13. AASHTO classified LOS of Collector as

a. LOS B	b. LOS B to C	c. LOS C to D	d. LOS D

Ans.
c. LOS C to D

14. AASHTO classified LOS of Local Street as

a. LOS B	b. LOS B to C	c. LOS C to D	d. LOS D

Ans.
d. LOS D

15. AASHTO classified type of Local Street as

a. Local road and local street	b. freeway and expressway	c. Mobility and accessibility	d. Serving and unnerving highway

Ans.
a. Local road and Local Street

16. AASHTO classified type of Principle Arterial as

a. Local road and local street	b. freeway and expressway	c. Mobility and accessibility	d. Serving and unnerving highway

Ans.
b. freeway and expressway

17. Collection of available maps, Arial photograph for the area call as

a. Final location survey	b. Reconnaissance survey	c. Design Control and Criteria	d. Preliminary survey

Ans.
b. Reconnaissance survey

18. Selection of the best route depends on the:

a. Design standards and Earthwork and grading cost	b. Detail survey and Soil investigation	c. Locate on the paper the CL of the proposed route (P-line)	d. All the previous

a. Design standards and Earthwork and grading cost