

## 1.4 HIGHWAY ALIGNMENT

The position or the layout of the central line of the highway on the ground is called the alignment. Highway Alignment includes both

- a) Horizontal alignment includes straight and curved paths, the deviations and horizontal curves.
- b) Vertical alignment includes changes in level, gradients and vertical curves.

A new road should be aligned very carefully as improper alignment will lead to increase in construction, maintenance and vehicle operation cost. Once the road is aligned and constructed, it is not easy to change it due to increase in cost of adjoining land and construction of costly structures by the roadside



### Requirements

The requirements of an ideal alignment are

- a) **Short:** The alignment between two terminal stations should be short and as far as possible be straight, but due to some practical considerations deviations may be needed.
- b) **Easy:** The alignment should be easy to construct and maintain. It should be easy for the operation of vehicles. So, to the maximum extent easy gradients and curves should be provided.
- c) **Safe:** It should be safe both from the construction and operating point of view especially at slopes, embankments, and cutting. It should be safe for traffic operation with safe geometric features.
- d) **Economical:** The alignment should be economical and it can be considered so only if the total life cycle cost considering the initial cost, maintenance cost, and vehicle operating cost is lowest.

### Factors Controlling Alignment

For an alignment to be shortest, it should be straight between the two terminal stations, but this is not always possible due to various practical difficulties such as intermediate obstructions or topography. A road which is economical with low initial investment may not be the most economical in terms of maintenance or vehicle operation cost(VOC). Thus, it may be seen that an alignment can fulfil all the requirements simultaneously, hence a judicious choice is made considering all the factors.

The various factors that control the alignment are as follows:

- a) Obligatory Points
- b) Traffic
- c) Geometric Design
- d) Economics
- e) Other Considerations

### **Obligatory Points**

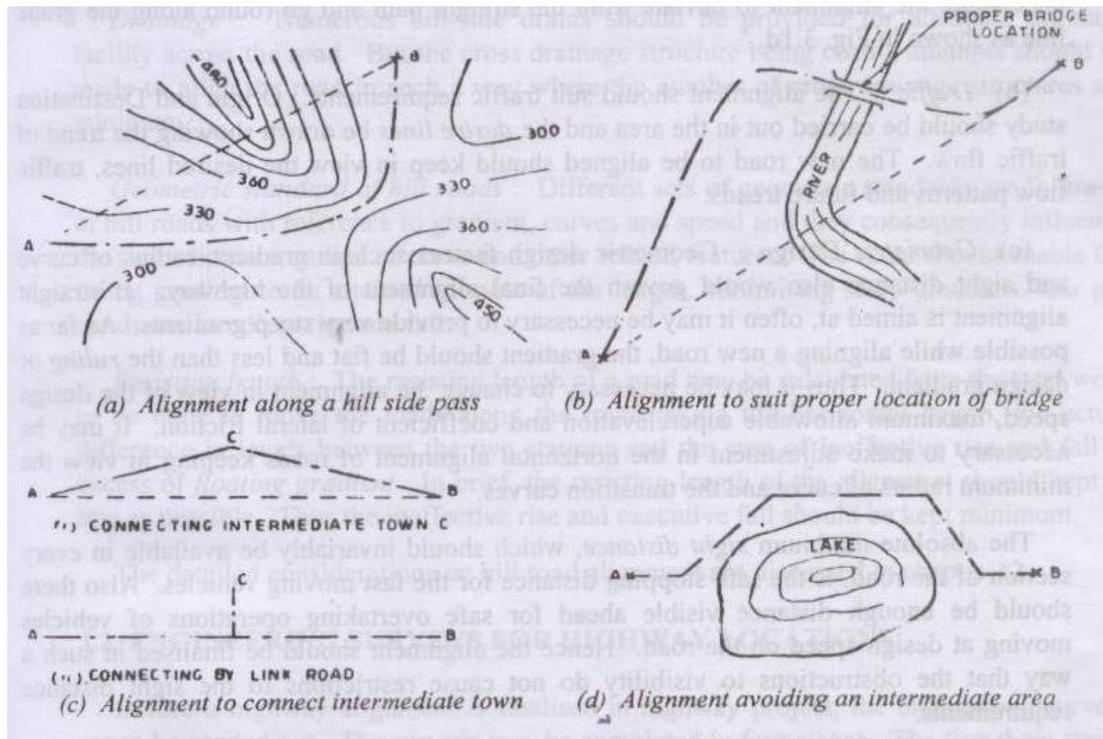
These are the control points governing the highway alignment. These points are classified into two categories.

- 1) Points Through Which the Alignment Should Pass
- 2) Points Through Which the Alignment Should Not Pass.

### **Points Through Which the Alignment Should Pass**

- a) Bridge site: The bridge can be located only where the river has straight and permanent path and also where the abutment and pier can be strongly founded. The road approach to the bridge should not be curved and skew crossing should be avoided as possible. Thus, to locate a bridge the highway alignment may be changed.
- b) Mountain: While the alignment passes through a mountain, the various alternatives are to either
- c) Construct a tunnel or to go around the hills. The suitability of the alternative depends on factors like topography, site conditions and construction and operation cost.

- d) Intermediate town: The alignment may be slightly deviated to connect an intermediate town or village nearby. These were some of the obligatory points through which the alignment should pass.



**Figure 1.4.1 Points Through Which the Alignment Should Pass**

[Source: "Highway Engineering" by S.K. Khanna, C.E.G. Justo, Page: 53]

### Points Through Which the Alignment Should Not Pass.

- Religious places: These have been protected by the law from being acquired for any purpose. Therefore, these points should be avoided while aligning.
- Very costly structures: Acquiring such structures means heavy compensation which would result in an increase in initial cost. So, the alignment may be deviated not to pass through that point.
- Lakes/ponds etc.: The presence of a lake or pond on the alignment path would also necessitate deviation of the alignment.

### Traffic

The alignment should suit the traffic requirements. Based on the origin- destination data of the area, the desire lines should be drawn. The new alignment should be drawn keeping in view the desire lines, traffic flow pattern etc.

## **Geometric design**

Geometric design factors such as gradient, radius of curve, sight distance etc. also governs the alignment of the highway. To keep the radius of curve minimum, it may be required to change the alignment of the highway. The alignments should be finalized such that the obstructions to visibility do not restrict the minimum requirements of sight distance. The design standards vary with the class of road and the terrain and accordingly the highway should be aligned.

## **Economics**

The alignment finalized should be economical. All the three costs i.e. construction, maintenance, and operating cost should be minimum. The construction cost can be decreased much if it is possible to maintain a balance between cutting and filling. Also try to avoid very high embankments and very deep cuttings as the construction cost will be very higher in these cases.

## **Other Considerations**

The various other factors that govern the alignment are drainage considerations, political considerations and monotony. The vertical alignment is often guided by drainage considerations such as sub surface drainage, water level, seepage flow, and high flood levels. A foreign territory coming across the alignment will necessitate the deviation of the horizontal alignment. In flat terrain, even though it is possible to have a very long stretch of road which is absolutely straight may be monotonous for driving. Hence it is recommended to have a slight bend or road side amenities to break monotony.