

Paving the way for Urban Planning

SUMMARY INFORMATION

Keywords

Physical motion, road safety, congestion, traffic

Topics Covered

Physics

Target Grade(s):

7, 8

Estimated Time Required

2 hours

LESSON

Goals and Pre Requisites

Goals

- To derive from students better models to facilitate transportation within highly congested metros/cities
- To introduce to students the concept of engineering & civil design.

Instructional Objectives

Students would develop:

- Engineering design and modelling skills
- Reasoning skills
- Critical reasoning

Instructional Resources

Problem Statement

In India, if you want to travel to any place inside city limits, it is important that you start an hour early – because of traffic! Why do you think there is a routine occurrence of traffic? One of the main reasons is congestion of roads, which restricts vehicles to move along. How can we come up with solutions to better the construction of roads to facilitate free movement of vehicles?

Background

Indian Road Network

India has a road network of over 4,689,842 kilometres (2,914,133 mi) in 2013, the second largest road network in the world. At 0.66 km of roads per square kilometre of land, the quantitative density of India's road network is similar to that of the United States (0.65) and far higher than that of China (0.16) or Brazil (0.20). However, qualitatively India's roads are a mix of modern highways and narrow, unpaved roads, and are being improved. As of 2011, 54 percent – about 2.53 million kilometres – of Indian roads were paved.



Adjusted for its large population, India has less than 3.8 kilometres of roads per 1000 people, including all its paved and unpaved roads. In terms of quality, all season, 4 or more lane highways, India has less than 0.07 kilometres of highways per 1000 people, as of 2010. These are some of the lowest road and highway densities in the world. For context, United States has 21 kilometres of roads per 1000 people, while France about 15 kilometres per 1000 people – predominantly paved and high quality in both cases. In terms of all season, 4 or more lane highways, developed countries such as United States and France have a highway density per 1000 people that is over 15 times as India.

Major problems faced by Road systems in India

1. Most of the Indian roads are unsurfaced (42.65%) and are not suitable for use of vehicular traffic. The poor maintenance of the roads aggravates the problem especially in the rainy season.
2. One major problem on the Indian roads is the mixing of traffic. Same road is used by high speed cars, trucks, two wheelers, tractors, animal driven carts, cyclists and even by animals. Even highways are not free from this malady. This increases traffic time, congestion and pollution and road accidents.
3. Way side amenities like repair shops, first aid centres, telephones, clean toilets, restaurants, rest places are lacking along the Indian roads. There is very little attention on road safety and traffic laws are wilfully violated.
4. There is very little participation of private sector in road development in India because of long gestation period and low-returns. The legislative framework for private investment in roads is also not satisfactory. The road engineering and construction are yet to gear themselves up to meet the challenges of the future.

Procedure

1. Introduce the **Problem Statement** to students.
2. Form students into groups of four.
3. Allow them to brainstorm with their groups, on the given **Problem Statement**.
4. Each group must come up with their unique solution(s) to the given problem.
5. Each group can compare their solutions with fellow groups and with their teacher to check on the feasibility of their solution.
 - In order to check on feasibility, instruct students to discuss with their team mates and have a rough sketch of their plan before constructing it. Students must be able to provide justification for their choice of materials.
6. Ask students to build a timeline (within the estimated amount of time provided under summary information) and ensure that all members of each group are involved in planning the project in terms of availability and cost of materials.
7. Students must make sure that the design incorporated in their process would address the existing problem.
8. Each group can present their solution and evaluate feasibility with peer groups and the teacher.

Sample Methodology

Note: The following is an example of how the given **Problem Statement** might be addressed. **For Teacher Reference only.**

Materials Required

Chart sheets (White/ Coloured), colour marker pens, pencils and thermocol

Procedure

1. Student groups may visit places that are prone to heavy congestion and observe the topography of roads, junctions and lanes. A table can be created to observe the number of vehicles, types of vehicles and the time taken for signal to change. Students should observe the reasons for traffic congestion.
2. They may pictorially represent the current situation of roads in that area. They may again pictorially represent an improved situation of roads and lanes; such that it would reduce traffic and public congestion.
3. Using their pictorial representation, they should re-create the congestion area with approximate scaling to size. A revised model should be created with suggested changes to the road structure keeping in mind the reasons for traffic congestion – wider road spaces,

a separate lane for cyclists or buses, reduced or increased time in traffic signal changes.

Conclusion

Importance to be given to design and construction of roadways by applying concepts of physical motion and urban planning.

Extension

- Students may propose their solutions to the Municipal Corporations and Councils of the area they visited.

Assessment and Rubric

Define the need or problem – Did students identify the need to resolve this problem? Were they able to relate the problem to their own environment?

Come up with ideas - Did students weigh various possibilities brainstorm on various ideas before arriving at a solution? Did each group collaborate effectively to (1) work within the time given (2) give equal opportunity for participation (3) consolidate relevant information (4) provide rationale for their decisions and choices.

Select the most promising idea or design - Were students able to evaluate the feasibility of their solution to the given problem statement? On what basis was the feasibility of the solution determined?

Communicate and plan the project – Were groups able to provide justification for their choice of materials? Were students able to see completion of the activity within the estimated time?

Create/Build and test a design –Were all members of the team participative during the course of the activity?

Evaluate and revise the design – Were student groups able to present their solutions in a clear and distinct manner with other groups? Were they keen on improving their model further?

Credits

- <https://www.cia.gov/library/publications/the-world-factbook/rankorder/2085rank.html>
- <http://164.100.47.134/intranet/NHDP.pdf>
- <http://www.nhai.org/WHATITIS.asp>

- http://www.business-standard.com/article/economy-policy/highway-developers-face-policy-speed-breakers-114020301323_1.html
- <http://timesofindia.indiatimes.com/city/noida/Yamuna-Expressway-to-open-in-April-trial-runs-on/articleshow/12310774.cms?referral=PM>
- <http://www.thehindu.com/news/cities/Delhi/the-seemingly-unending-road/article5012133.ece>
- <http://business.in.com/article/briefing/crossing-the-chasm/4202/1>
- www.preservearticles.com
- <http://www.bicycling.com/sites/bicycling.com/files/articles/2014/09/honk-honk-traffic.jpg>