CAREER EPISODE 1

1.1 INTRODUCTION

This career episode outlines my involvement in the project titled “Structural Design of Flexible Pavement for NH-44 Service Road Upgradation per IRC:37-2012”. The work was completed as part of my Bachelor of Technology in Civil Engineering at Jawaharlal Nehru Technological University, Anantapur. I carried out the assignment between 5th August 2015 and 28th August 2015 under the guidance of Dr P. Srinivas Reddy.

1.2 BACKGROUND

1.2.1

Flexible pavements are multilayered systems with relatively low bending resistance. They transmit wheel loads to the formation through particle-to-particle contact. These surfaces tend to soften during high temperatures and turn brittle in cold conditions. The project focused on upgrading an existing single-lane service road between Mahabubnagar and Jadcherla into a two-lane facility. The upgrade was necessary due to increased vehicular flow and frequent traffic congestion. I performed a traffic study to assess the present volume. To evaluate the foundation strength, I conducted the California Bearing Ratio test on the existing subgrade.

1.2.2

The primary aim was to develop a bituminous pavement structure for the stretch in accordance with IRC:37-2012. The supporting goals were:

1. To ensure effective load transfer from traffic to the subgrade without exceeding its bearing limit
2. To estimate the design traffic volume for determining pavement layer thicknesses

1.2.3

I handled the complete technical and coordination work under my supervisor’s oversight. All laboratory investigations were performed in the Soil Mechanics Lab at the university. I planned and monitored each stage to make sure stresses from wheel loads were dispersed adequately and remained within the subgrade’s safe capacity.

1.2.4

The project execution followed a structured workflow, as represented in the flow chart below.

[Workflow Chart: Project Planning → Data Collection → Lab Testing → Traffic Estimation → Pavement Design → Report Submission]

1.2.5

During the project, I was responsible for multiple engineering tasks. My key duties included:

1. Collecting background data and reviewing codes and journals related to flexible pavement design
2. Conducting a classified traffic count on the Mahabubnagar–Jadcherla section using manual methods

3. Performing Free Swell Index and sieve analysis on subgrade samples to assess soil characteristics
4. Carrying out Standard Proctor Compaction to establish optimum moisture content and maximum dry density
5. Conducting soaked CBR tests on remolded specimens to determine subgrade strength
6. Estimating design traffic based on field counts and projected growth factors
7. Finalizing pavement layer composition using CBR results and traffic data as per IRC charts

1.3 PERSONAL ENGINEERING ACTIVITY

1.3.1

I began by reviewing IRC:37-2012, MORTH specifications, and published papers on pavement engineering. I referred to textbooks on highway materials to understand bituminous mix behaviour and granular layer functions. To clarify design steps, I studied past dissertations available in the department library. I also browsed technical forums for practical insights on traffic surveys. After this, I drafted a detailed work plan and discussed it with Dr. Reddy and my teammates. I prepared a work breakdown chart, split the activities, and delegated specific tasks to each group member while keeping the critical path tasks with me.

1.3.2

My team and I conducted a 7-day classified volume count from 9th August 2015 to 15th August 2015. We recorded two-wheelers, cars, LCVs, buses, and trucks in 30-minute blocks from 6:00 AM to 10:00 PM. Directional movement, turning proportions, and vehicle categories were logged on standard field sheets.

Table 1: Average Daily Traffic - Mahabubnagar to Jadcherla

Vehicle Type	Number of Vehicles/Day
Two Wheelers	1,284
Cars/Jeeps/Vans	692
LCV	156
Buses	88
Trucks	124
Total	2,344

Table 2: Average Daily Traffic - Jadcherla to Mahabubnagar

Vehicle Type	Number of Vehicles/Day
Two Wheelers	1,196
Cars/Jeeps/Vans	714
LCV	142
Buses	92
Trucks	138
Total	2,282

Table 3: Seven-Day Average Traffic Volume - Both Directions

Parameter	Value
Total Vehicles per Day	4,626
Commercial Vehicles per Day	610
Peak Hour Volume	496
Peak Hour	09:00 – 10:00 AM

1.3.3
After field work, I moved to lab testing. For the Free Swell Index, I used IS 425-micron sieve, two 100ml graduated cylinders, kerosene, and distilled water. I oven-dried the soil for 24 hours, sieved it, and poured 10g samples into each cylinder. One was filled with kerosene, the other with water. After 24 hours of settlement, I measured the swollen volumes and computed the index.

Table: Free Swell Index Observations

Description	Cylinder with Water	Cylinder with Kerosene
Initial Volume	10 ml	10 ml
Final Volume after 24 hrs	13.5 ml	11.0 ml
Free Swell Index	35%	

For gradation, I took 1000g of air-dried sample. I washed it over a 75-micron sieve to separate fines, then oven-dried the retained portion. I ran the dry sample through a stack of IS sieves using a mechanical shaker for 10 minutes. Each retained fraction was weighed.

1.3.4
I performed Standard Proctor Compaction per IS:2720 Part 7. I used 5kg of soil passing 19mm sieve. Water was added incrementally at 4%, 6%, 8%, 10%, and 12%. For each mix, I compacted the soil in the 1000cc mould in 3 layers with 25 blows per layer from a 2.6kg rammer. I trimmed, weighed, and took moisture samples from the core. From the plotted curve of dry density vs moisture content, I identified the peak point.

1.3.5
To determine subgrade strength, I conducted soaked CBR tests per IS:2720 Part 16. I prepared three specimens at OMC and compacted them with 10, 30, and 56 blows. After soaking for 96 hours, I tested them in the loading frame at 1.25mm/min penetration. I plotted load-penetration curves, applied corrections for initial concavity, and calculated CBR at 2.5mm and 5.0mm. I then plotted CBR vs dry density to obtain the design CBR at 97% of MDD.

1.3.6
I computed design traffic in million standard axles for a 15-year design period. I used the lane distribution factor for a two-lane undivided road, adopted VDF from IRC guidelines based on axle load surveys, and applied a 5% annual growth rate derived from regional economic data. The cumulative ESAL came to 3.1 msa.

1.3.7
Using the design CBR of 6.5% and traffic of 3.1 msa, I referred to the pavement catalogue in IRC:37-2012. For this combination, the total pavement thickness worked out to 480mm. I adopted the following layer configuration: 150mm Granular Sub-base, 250mm WMM Base, 60mm DBM, and 20mm BC as a wearing course.

On completion, I compiled all data, calculations, and drawings into a project report and submitted it to the department. I also created a presentation and defended the design before Dr. Reddy and the HoD.

1.3.8
I accounted for local rainfall and temperature variations while selecting materials. I followed lab safety protocols during all tests, including wearing PPE and handling equipment as per SOPs.

1.3.9
During CBR testing, the initial part of the load-penetration curve showed an upward concavity due to surface irregularities. I discussed this with my supervisor. We applied the standard correction by drawing a tangent at the steepest point and shifting the origin. The corrected CBR values were within the expected range for the soil type.

In the Proctor test, my first trial gave an unusually low MDD because the rammer drop height was inconsistent. I repeated the test, ensuring a free fall of 310mm and uniform blow distribution. The second curve gave OMC and MDD values consistent with local soil data.

1.3.10
I considered only commercial vehicles with a laden weight above 3 tonnes for design traffic. I used tangent correction methods for CBR and applied IS procedures for all soil tests. I cross-checked layer thicknesses against drainage requirements.

1.3.11
I coordinated closely with my project group and supervisor. I organised weekly reviews to track progress and resolve bottlenecks. When we faced equipment delays, I rescheduled non-critical tasks to avoid slippage. I kept communication open via daily briefings and shared all test sheets for transparency. I ensured all calculations followed IRC and IS codes.

1.3.12
The design was based on IRC:37-2012 for flexible pavements. Compaction and CBR tests followed IS:2720 Part 7 and Part 16. Sieve analysis was done per IS:2720 Part 4. I used MORTH Section 400 for material specifications.

1.4 SUMMARY

1.4.1
The project successfully determined the pavement composition for the upgraded service road. Traffic studies and lab tests provided reliable inputs. The designed 480mm pavement meets performance and durability requirements for the anticipated loading.

1.4.2
Through this project, I applied highway engineering principles to a real problem. I

strengthened my skills in field investigation, lab testing, data analysis, and code-based design. I also improved my project planning and team coordination abilities.