

Planning, Redesign and Structural Analysis of Samarlakota Railway station Building by using Staad.pro

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Abstract: A railway station is a place where trains routinely stop to pick up and drop off passengers or freight. Because the station is the first place most passengers see the railway, it should be thought of as the "shop window" for the services it offers. It should be well-designed, attractive, comfortable, easy to use, and efficient in layout and operation. They need to be properly managed and cared for, and they need to be used securely.

The penultimate stop for local trains on the Southern Railway is Samarlakota, which is quite busy. The lone Foot over Bridge (FOB) right now makes things quite messy at busy times, which is undesirable for travelers. Also, the bridge is old and weak, so it shakes as more weight is added. Many people are unhappy that the new skywalk doesn't link to the FOB. Thousands of peasants from Surampalem, Rameshampet, Peddapuram, and Rangampeta travel to Samarlakota to go to the city. This means that the number of passengers is growing every day. This situation forces many people to cross the train tracks, resulting in numerous fatalities and injuries. Because of things like food booths and ceiling supports, the station's existing layout doesn't let passengers move about the platforms easily. Our effort aims to examine the station's present goals and pinpoint the main problems. It suggests reworking the main structural aspects and gives practical advice for how to make the current facilities better. Finally, it wants to make the station more efficient and welcoming for commuters, bringing it up to the level of contemporary train stations, according to Staad.pro

Keywords: Southern Railway is Samarlakota, lone Foot over Bridge (FOB), train stations. Staad.pro.

I. INTRODUCTIONS

Railway stations play a vital role for passengers, non-travelling users and the communities in which they are located. They serve the growing needs of an increasingly mobile population and are used by a wide range of users. Stations are primarily a means of access to the national rail. The importance of good station design network, in turn acting as a gateway to or from other destinations. They have become increasingly important as destinations in their own right – as places to shop, work, or simply to meet family and friends. Most stations also function as interchange hubs, providing connections between different transport modes. A station is made up of several constituent parts and, from the perspective of its users, fulfils a range of roles and functions. Typically, its customers will include commuters, those interchanging between services and long-distance passengers or tourists, as well as the non-travelling public. Station designs need to cater for a broad range of activities and should be resilient to the changing conditions experienced within a station, both during the operational day and throughout the year. Depending on context, station design may also need to accommodate a range of operational scenarios, such as major events, changes to service, or adverse weather

conditions. The design of a station must recognise the differing needs and aspirations of the station's varied stakeholders and user groups. As a minimum requirement all users should expect clean, efficient, accessible, reliable, safe and legible facilities. Railway stations and railway lines often form a barrier that results in severance of local communities. As a result, station facilities should be designed to integrate seamlessly with the public realm, including adjacent office buildings and shopping facilities, and to facilitate cross-, as well as through-movement. Creating a strong relationship between the station and its surrounding context delivers a richer and more fulfilling environment, enhancing local character and providing a sense of place for its users. Samarlakota is a prominent town in the Kakinada district of Andhra Pradesh and serves as a crucial railway junction in the South Central Railway zone of Indian Railways. Strategically located on the Chennai–Howrah trunk line, Samarlakota acts as an important rail node connecting coastal Andhra Pradesh with major cities such as Visakhapatnam, Vijayawada, Chennai, and interior regions through branch lines.

Due to its strategic location and proximity to major industrial hubs, ports, and educational institutions in Kakinada and surrounding regions, Samarlakota has witnessed steady population growth and increased commuter movement. The town also serves as a transit point for passengers traveling between urban centers and nearby rural and semi-urban areas, thereby increasing daily footfall at the railway station.

As a key junction station, Samarlakota experiences significant passenger traffic from long-distance express trains, passenger trains, and suburban services. With the growth of nearby industrial areas, port-related activities, and regional development, the pressure on station infrastructure has increased substantially. During peak hours, platforms often become overcrowded, making passenger movement difficult and unsafe.

The existing station infrastructure struggles to accommodate the rising number of commuters. Narrow platforms, limited circulation space, and insufficient entry and exit points lead to congestion, particularly during train arrivals and departures. Passengers are frequently forced to cross tracks to access platforms, posing serious safety risks and increasing the likelihood of accidents.

Passenger amenities at the station are also inadequate. The limited number of ticket counters serving both short- and long-distance travelers results in long queues that obstruct circulation areas and access routes to platforms. The existing foot over bridge is insufficient in width and capacity to handle peak-hour passenger volumes, leading to bottlenecks, delays, and commuter discomfort.



Fig 1: Samarlakota railway station

Given Samarlakota's growing importance as a regional railway junction and urban node, a comprehensive redesign and modernization of the railway station is essential. A well-planned station redevelopment should aim to improve passenger safety, circulation efficiency, accessibility, and service quality, while integrating the station seamlessly with its surrounding urban fabric. Such an intervention would transform the station into a well-connected, inclusive, safe, and environmentally responsive public transport hub capable of meeting present and future demands.

- The extension of the platforms will ensure that more circulating space will be available at the main entrance of the station which will be indispensable for commuter movement during peak hours.
- The redesigned station building will house a larger number of ticket booths which will be able to handle the influx of people buying tickets daily. Along with the above, provisions for facilities like separate long distance booking counters, drinking water fountains and more will be provided.
- The food court inside the station will be the primary fast food outlet which will provide the commuters with all sorts of beverages. A separate toilet block, with adequate ventilation will be provided which will follow the

'pay and use' system.

- The newly designed parking lot will reduce the number of vehicles being parked haphazardly near the platform and around the station thereby increasing the effective circulating area.
- The new lanes will ensure that auto rickshaws will be parked according to the destination to which the commuter wishes to go. This will improve the organisation of auto rickshaws and refine traffic flow to and from the station.

II. PLANNING AND METHODS

Accessible station design is about making places easy to use for all passengers and station users. Users include people with visual or cognitive impairments, those in wheelchairs, older people, people with heavy or bulky baggage, young children and their careers, and those with bicycles. Accessible design relates to stations, their amenities, surrounding context and information systems that support movement, use and understanding. The philosophy underlying signing and passenger information at stations should be that of clarity, consistency and coherence in order to guide people through the stations in a steady, convenient and safe manner helping to ensure station users have a positive, stress-free experience. This philosophy supports a well-planned and well laid out station, and is integral to its design. Comfortable, clean, well maintained stations provide an attractive environment that protects users from uncomfortable climatic conditions and unpleasant sensory experiences such as polluted air, dirt or noise and provides users with a sense of security and safety. Amenities should be included, where appropriate, to fulfil basic needs and add value to the passenger experience. Amenities are features that enhance passenger comfort, convenience and pleasure and that help to instil passenger confidence. Provision of amenities within and around stations will offer practical advantages for passengers and surrounding communities. The design of station facilities and their immediate surroundings should promote efficient operations and maintenance in an environment that is functional, comfortable and safe. An efficient station design helps deliver a positive passenger experience, minimises delays and disruption, supports modal integration and results in cost savings for asset managers and station operators over the full course of a station's life. The movement of passengers, public transport vehicles and non-users through a station can be complex. Therefore, it is important to plan and design safe, legible and accessible spaces that make the use of our stations intuitive, attractive and accessible for all users.

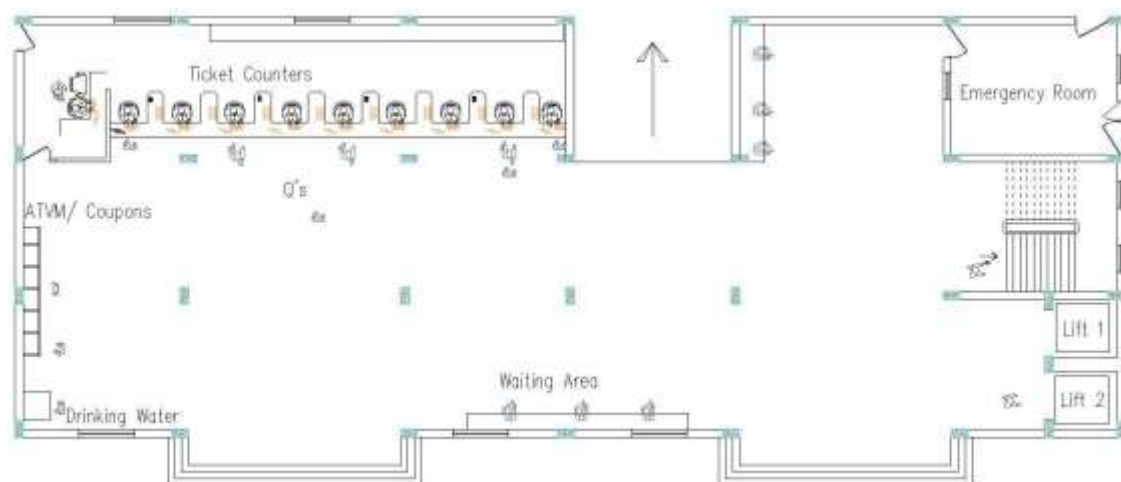


Fig. 2: Ground Floor Plan

Fig 3: First Floor Plan

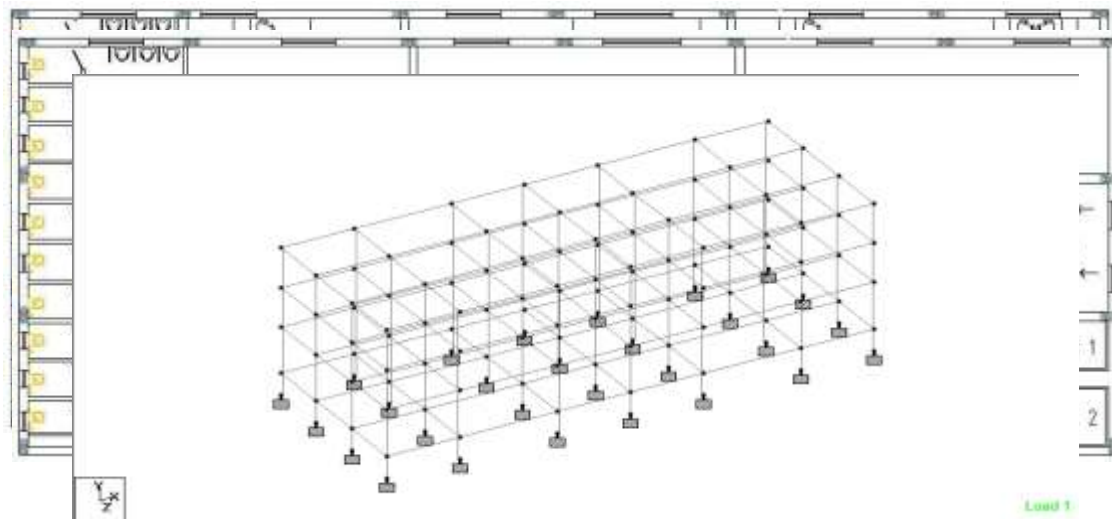
Fig. 4: Second Floor Plan

III. DESIGN AND ANALYSIS

A. Creation of staad model

The technical design for the station building was done using STAAD.Pro v8i. A grid of size 15X40m was created with spacing of 1m. The process began with importing the AutoCAD plan into the STAAD workspace by converting it into a 3D DXF file. After successfully importing the file, a check was done in order to ensure the integrity of the positions of beams and columns were not compromised.

STAAD considers the joint between beams and columns as 'nodes'. Thus after checking for beam and column integrity, a check was performed to find 'orphan nodes' and delete them if required.

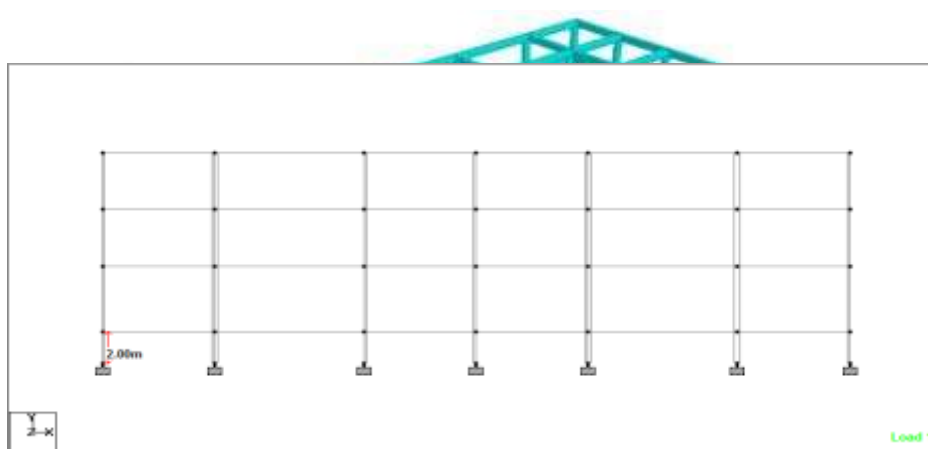


This basic grid forms the base of the station building model. This grid was then repeated 3 times with different height values considering the floor to floor height.

Fig 5: STAAD Model

Fig 6: 3D model frame

Fig 7: Depth of footing below ground level



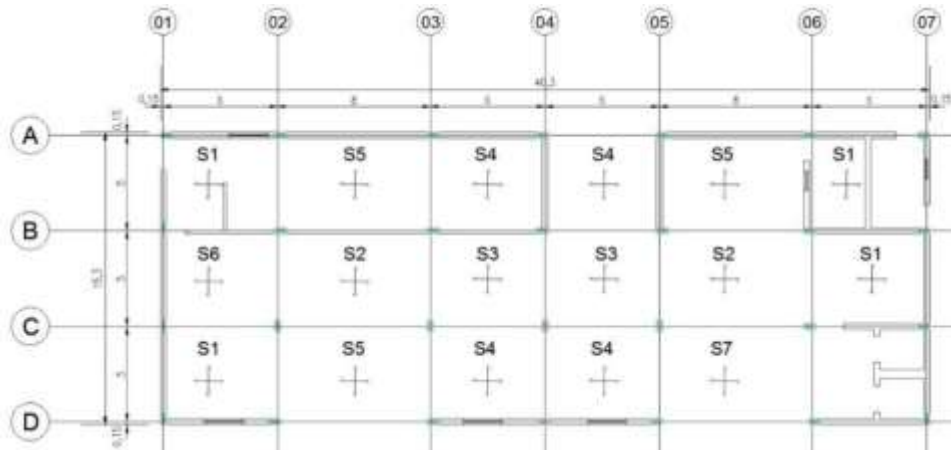


Fig 8: Slab layout for Station Building

B. Assigning loads to the model

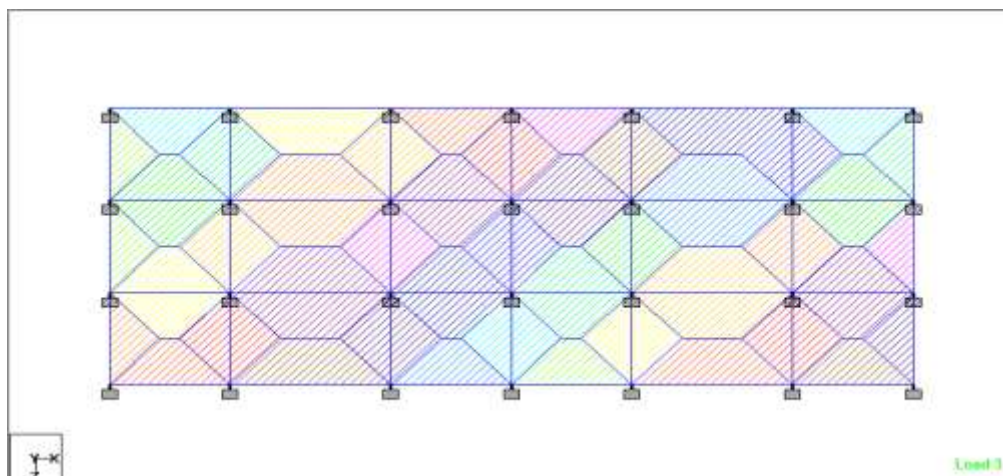
Dead and Live Loads

The dead load includes loads that are relatively constant over time, including the weight of the structure itself, and immovable fixtures such as walls, plasterboard or carpet. Dead loads are also known as Permanent loads.

Live loads, or imposed loads, are temporary, of short duration, or moving. These dynamic loads may involve considerations such as impact, momentum, vibration, slosh dynamics of fluids, fatigue, etc.

Live loads, sometimes also referred to as probabilistic loads include all the forces that are variable within the object's normal operation cycle not including construction or environmental loads.

The dead and live loads were assigned as 'Floor Loads' on the model. 'Floor loads' command ensures that the loads from the slabs are properly distributed to the beams with trapezoidal distribution pattern for two way slabs and



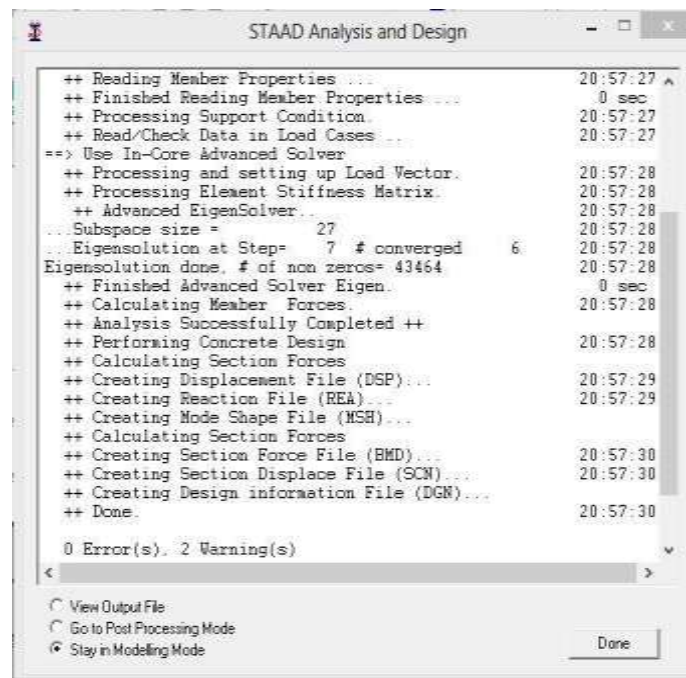
rectangular distribution for one way slabs.

Fig. 9: Load distribution for slabs

Density of brickwork (Common burnt clay brick) was taken as 18.85 KN/m from IS 875 Part 1 and was added as a

uniformly distributed load with magnitude 5.655 KN/m over the beams.

All loading parameters were checked once again before analysis. The analysis was completed successfully with two warnings and zero errors.



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STAAD Analysis and Design
++ Reading Member Properties ... 20:57:27
++ Finished Reading Member Properties ... 0 sec
++ Processing Support Condition ... 20:57:27
++ Read/Check Data in Load Cases ... 20:57:27
==> Use In-Core Advanced Solver
++ Processing and setting up Load Vector ... 20:57:28
++ Processing Element Stiffness Matrix ... 20:57:28
++ Advanced EigenSolver ... 20:57:28
... Subspace size = 27 20:57:28
... Eigensolution at Step= 7 # converged 6 20:57:28
Eigensolution done, # of non zeros= 43464 20:57:28
++ Finished Advanced Solver Eigen ... 0 sec
++ Calculating Member Forces ... 20:57:28
++ Analysis Successfully Completed ++ 20:57:28
++ Performing Concrete Design ... 20:57:28
++ Calculating Section Forces ... 20:57:29
++ Creating Displacement File (DSP) ... 20:57:29
++ Creating Reaction File (REA) ... 20:57:29
++ Creating Mode Shape File (MSH) ... 20:57:30
++ Calculating Section Forces ... 20:57:30
++ Creating Section Force File (BMD) ... 20:57:30
++ Creating Section Displace File (SCN) ... 20:57:30
++ Creating Design information File (DGN) ... 20:57:30
++ Done ... 20:57:30

0 Error(s). 2 Warning(s)

View Output File
Go to Post Processing Mode
Stay in Modelling Mode
Done
  
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Fig 10: Analyze

A careful analysis of the result yielded that **none** of the members to be designed failed under **all** the possible combination of loadings. The results of the STAAD analysis are enclosed within.

IV. CONCLUSIONS

- Robust and resilient station operations require integrated and optimised operation of fleet, infrastructure and facilities to provide easy access for transport services, seamless movement across modes and effective maintenance. Efficient stations ensure cost savings for operators and owners.
- Eliminating the choke points allow the commuters by providing ample amount of room to circulate around the area. Provisions for extra parking makes the present scenario more competent. The provisions for 4 wheeler parking serve as a boost for this station.
- The new station building provides lots of facilities which are mandatory for a station viz. waiting room, separate reservation counters, cloak room, locker rooms etc. which were missing earlier.
- The various operations of the building have been analysed perfectly and the local codes have been followed correctly. The manual design of other components is also given high importance and calculations of desired reinforcement are found with high factors of safety. We propose that this building has adequate strength to resist all the loads and meet its purpose. STAAD analysis results show that the structure can resist various loads coming on to it.
- The obstructions like columns, food stalls etc. which cause a lag in the flow of the commuters are eliminated, saving the time of commuters. Considered design of infrastructure can minimise risk of accidents and conflicts. Clean, well maintained infrastructure and places create a sense that the environment is safe, controlled, managed and cared for – this reduces the fear of crime or accidents for all users.
- We have ensured that the recommendations made can be carried out without disturbing the existing working of the

station.

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