

# Mid Hinged CCTV Pole for Easy Maintenance

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**Abstract:-** A counterweight hinged pole which allows easy access to the CCTV camera attached at the top of the pole to be accessed. Hinged pole consists of a support base, and middle support pole which is attached to the base, and which has a hinge located at the end opposite the base. A top pole to which the CCTV Camera are attached is affixed to the hinge. A second bottom member is also attached to the hinge and is an extension of the top pole in the opposite direction. A rope attached to the top of the CCTV Camera pole enables a worker to lower the pole fixtures by applying tension to the rope. The top of the pole rotates in a downward arc around the hinge. The mid-hinged CCTV camera pole consists of a sturdy cylindrical pole structure made from high-quality materials such as aluminium or galvanized steel. It typically ranges in height from 6 to 12 meters, although custom heights can be accommodated based on specific requirements. The pole is designed to be mounted securely onto a foundation, ensuring stability and resistance to strong winds or adverse weather conditions. The key feature of the mid-hinged CCTV camera pole is its hinged mechanism located at the midpoint of the pole. This mechanism allows the pole to be easily lowered to ground level for maintenance and camera servicing purposes. When maintenance is required, a simple unlocking mechanism enables the pole to be lowered safely and efficiently, eliminating the need for ladders, scaffolding, or specialized equipment. This feature greatly simplifies the installation, maintenance, and repair processes, resulting in cost savings and reduced downtime. The mid-hinged design also provides enhanced safety and security features. By allowing the pole to be lowered, the risk of accidents or injuries during maintenance tasks is significantly reduced. Additionally, the hinged mechanism can be equipped with locking mechanisms to prevent unauthorized access and tampering with the camera equipment, further enhancing the security of the system.

**Keywords:-** Hinge, Base Plate, Foundation Bolt, Pole.

## I. INTRODUCTION

Mid hinged CCTV camera pole is a technologically advanced and innovative solution designed to address the challenges of installing and maintaining closed-circuit television (CCTV) camera systems in outdoor environments. This pole system offers numerous advantages over traditional fixed or telescopic camera poles, providing

enhanced flexibility, convenience, and efficiency.

CCTV cameras play a crucial role in surveillance and security applications, monitoring public spaces, commercial premises, parking lots, and other areas. However, the installation and maintenance of these cameras can be a complex and time-consuming process, often requiring specialized equipment and technical expertise. The mid-hinged CCTV camera pole aims to simplify these tasks while ensuring the optimal positioning and functionality of the cameras.

The mid-hinged camera pole consists of a robust cylindrical structure typically made from durable materials such as aluminum or galvanized steel. This construction ensures the pole's strength and longevity, allowing it to withstand harsh weather conditions and resist corrosion. The pole is engineered to be securely mounted on a foundation, providing stability and support for the camera system.

The key feature of the mid-hinged CCTV camera pole is its unique mid-hinged design. Located at the midpoint of the pole, a specially designed hinge mechanism enables the pole to be easily lowered to ground level for maintenance, servicing, or camera adjustments. This mechanism simplifies the task of accessing and working on the cameras, eliminating the need for additional equipment like ladders, scaffolding, or cranes. When maintenance or adjustments are required, the operator can unlock the hinged mechanism, allowing the pole to be lowered smoothly and safely. This convenient feature significantly reduces the time and effort needed for camera servicing, resulting in cost savings and minimized downtime. It also improves the overall safety of maintenance personnel by eliminating potential hazards associated with working at heights.

The mid-hinged CCTV camera pole offers additional benefits beyond ease of maintenance. The hinged mechanism can be equipped with locking mechanisms to prevent unauthorized access or tampering with the camera equipment. This enhances the security of the surveillance system, protecting against potential sabotage or vandalism. Moreover, the pole system is designed to

## II. LITERATURE REVIEW

Accommodate various types of CCTV cameras and their associated equipment. It features a secure mounting bracket specifically designed to hold the cameras firmly in

place, ensuring stability and optimal camera positioning. The pole may also have provisions for cable management, allowing for neat and organized installation of power and data cables.

Furthermore, the mid-hinged camera pole can be customized to meet specific requirements. Optional accessories such as lighting fixtures can be incorporated

onto the pole, providing illumination for the surveillance area during nighttime.

Additional brackets may also be added to support signage or other auxiliary equipment. In certain cases, the pole can be fitted with solar panels to generate renewable energy, making it a sustainable and eco-friendly solution.

Sr. No	Title of Paper	Year of Publication	Author	Abstract
1.	Design and Analysis of Mid-Hinged Camera Pole	2015	T.S. Reddy et al	This study focuses on the design and analysis of mid- hinged CCTV camera poles. The authors developed a prototype mid-hinged camera pole and tested its performance under different wind loads. The study found that the mid-hinged pole was more stable and had less deflection than a conventional CCTV camera pole
2.	An Efficient Method of Camera Monitoring in Large Surveillance Systems using Mid Hinged Poles	2017	C. Palanisamy and R. Ravi	Proposes an efficient method of camera monitoring in large surveillance systems using mid-hinged poles. The authors developed a system that uses mid-hinged poles to support cameras and monitor large areas, such as airports and stadiums. The study found that the mid-hinged poles were effective in reducing the number of cameras needed and improving monitoring capabilities.
3.	Energy Efficient Solar Powered Mid-Hinged CCTV Camera Pole	2018	R. Choudhary et al	The development of an energy-efficient solar-powered mid-hinged CCTV camera pole. The authors developed a prototype pole that uses solar power to operate the cameras and lighting system. The study found that the solar-powered mid-hinged pole was effective in reducing energy consumption and lowering operating costs.
4.	Privacy in Public Space Surveillance "	2019	J. Zhi et al	This study focuses on the privacy implications of mid-hinged CCTV camera poles in public spaces. The authors conducted a survey of public attitudes towards CCTV cameras and found that the use of mid-hinged poles could raise concerns about privacy and civil liberties. The study suggests that policy makers should consider the potential privacy implications of mid-hinged CCTV camera poles when deploying these systems in public spaces.
5	Finite element analysis and experimental validation of a mid-hinged CCTV camera pole	2019	Jean Little	This study presents a finite element analysis and experimental validation of a mid-hinged CCTV camera pole. The authors developed a numerical model and conducted experiments to validate the model's accuracy. The study found that the mid-hinged pole had better performance than a conventional CCTV camera pole in terms of stability and deflection
6	Design and Development of Mid-hinged CCTV Camera Pole for Smart City Applications" by A. Shrivastava et al. (2020)	2020	A. Shrivastava.	This study focuses on the design and development of a mid-hinged CCTV camera pole for smart city applications. The authors developed a prototype pole with features such as solar power, wireless communication, and an automated cleaning system.
7.	Optimization of Mid-Hinged CCTV Camera Pole Design for Wind	2020	K. Mohanraj	This study focuses on the optimization of mid-hinged CCTV camera pole design for wind load resistance. The authors developed a numerical

	Load Resistance		model and used optimization techniques to determine the optimal design parameters for the pole. The study found that the optimized mid-hinged pole had better wind load resistance than a conventional CCTV camera pole
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**III. PROBLEM STATEMENT**

The installation and maintenance of CCTV camera systems in outdoor environments present various challenges that need to be addressed. Existing fixed telescopic camera poles pose limitations in terms of maintenance, flexibility, security, installation complexity, and customization. Maintenance tasks, such as accessing and servicing cameras mounted at significant heights, can be time-consuming, hazardous, and costly. Fixed poles lack the flexibility to easily adjust camera positions, hindering optimal surveillance coverage. Security vulnerabilities exist due to unauthorized access, tampering, and vandalism. Complex installation processes, inefficient cable management, and the inability to accommodate customization requirements further complicate the deployment of CCTV cameras. These challenges underscore the need for a solution that simplifies maintenance, enables adjustable camera positions, ensures security, streamlines installation, and allows for customization. The mid-hinged CCTV camera pole aims to address these problems by providing an accessible, flexible, and secure platform for the installation and maintenance of outdoor surveillance systems.

**IV. PROJECT PLAN FLOW CHART (METHODOLOGY)**

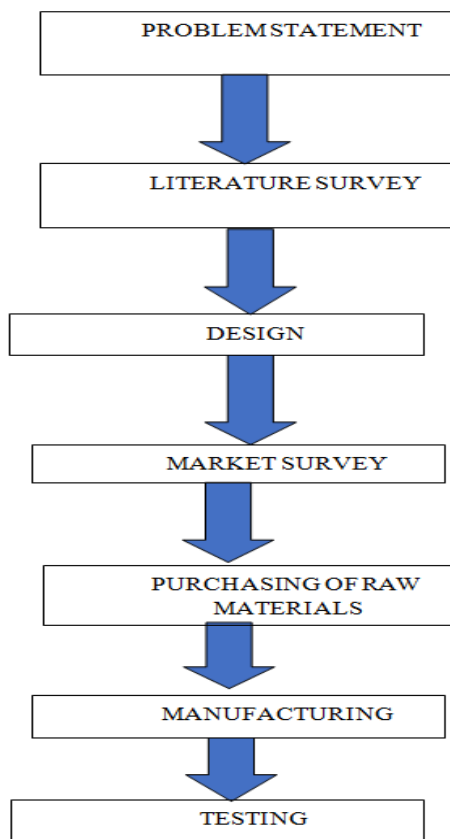


Fig 1 Project Plan Flow Chart

➤ *Objective:*

The objective of the mid-hinged CCTV camera pole is to provide a versatile and efficient solution for the installation, maintenance, and security of outdoor surveillance systems. By incorporating a mid-hinged design, the pole aims to simplify maintenance tasks by allowing easy lowering of the pole to ground level, reducing the need for specialized equipment, and minimizing downtime. The objective is also to enhance flexibility by enabling adjustable camera positions, ensuring optimal coverage and adaptability to changing surveillance requirements. Additionally, the mid-hinged pole seeks to improve security by offering locking mechanisms to prevent unauthorized access and tampering. The objective is to streamline the installation process, providing provisions for efficient cable management and accommodating customization needs, such as additional lighting or signage. Overall, the objective is to enhance the effectiveness, convenience, and security of CCTV camera installations in outdoor environments.

**V. CALCULATIONS**

A. *Design of Hinge*

$P=2KN$

Assuming material C-45

$\sigma_t=700N/mm^2 \quad \sigma_{yt}=360N/mm^2 \quad (\text{From PSG 1.9}) \quad \sigma_c=\sigma_t$

$\sigma_t = \frac{700}{3} = 234N/mm^2$

$\tau=117N/mm^2$

➤ *Design of Pin or Bolt*

$\sigma_t = \sigma_c$

$\sigma_c = \frac{P}{\frac{\pi}{4} dp^2}$

$234 = \frac{20}{\frac{\pi}{4} dp^2}$

$dp=3mm$

$dp^2=14mm \text{ (STD)}$

$\tau = \frac{P}{A}$

$117 = \frac{P}{2 \times (\frac{\pi}{4} \times dp^2)}$

$dp=3mm$

$dp=14mm \text{ (STD)}$

➤ *Design of Single Eye Hinge*  $\sigma_c = \frac{P}{A}$

$$A = \frac{P}{\sigma_c \times t}$$

$$t = 0.61$$

$$t = 20\text{mm}$$

➤ *Design of Double Eye Hinge*  $t_1 = 0.75 \times dp$

$$t_1 = 0.75 \times dp$$

$$t_1 = 0.75 \times 14$$

$$t_1 = 9.8\text{mm}$$

$$t_1 = 10\text{mm}$$

$$\sigma_c = \frac{P}{(dp \times t) \times 2}$$

$$234 = \frac{2000}{(14 \times t_1) \times 2}$$

$$t_1 = 0.3\text{mm}$$

$$t_1 = 10\text{mm}$$

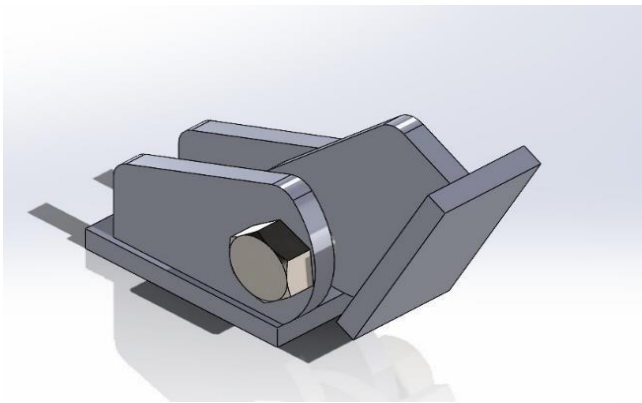


Fig 2 Hinge

B. *Design of Hand Winch*

For Tilting pole down, we use a hand winch, The standard hand winch available in market is 600LBS,1200LBS,2000LBS

As our design load is 2KN, so we have selected 600LBS Maximum capacity for 600LBS is 3000N

2KN is less than 3000N Hence it is Safe.



Fig 3 Handwinch

C. *Design of Rope*

Capacity: 1KN

Design Load: 2KN

Number of Falls: 4

Number of Bend: 3

$$\text{Maximum Load} = \frac{\text{Design Load}}{\text{Number of fall} \times \text{Efficiency}}$$

$$= \frac{2}{4 \times 0.97}$$

$$F = 515.47\text{N}$$

$$23 = \frac{D_{\min}}{d}$$

$$17 = \frac{D_{\min}}{d}$$

$$P = \frac{F \cdot \sigma_u}{n \cdot \frac{\sigma_u}{D_{\min}} \times 36000}$$

$$\sigma_u = 180 \times 10^3$$

$$n = n' \times \text{duty factor} = 5$$

$$P = \frac{515.47 \times 180 \times 10000}{5 \cdot \frac{180 \times 10000}{23} \times 36000}$$

$$P = 2694 \times 10^3$$

$$N P = 269.4 \text{ kgf}$$

$$P = 2.69 \text{ Ton}$$



Fig 4. Rope

## VI. ANSYS SIMULATIONS

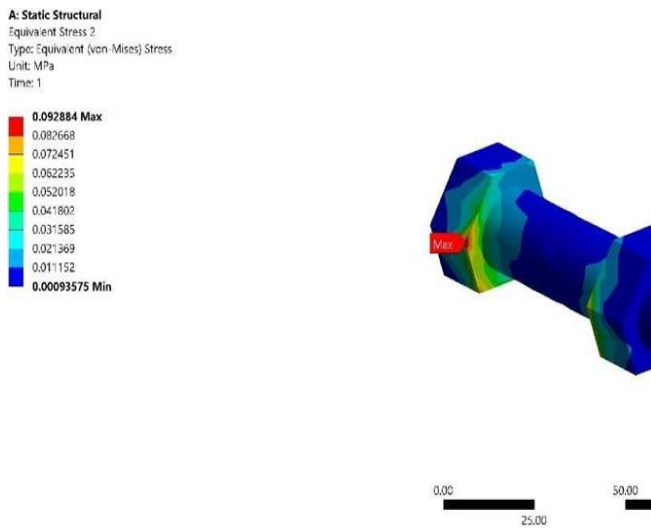


Fig 5 Pin Analysis

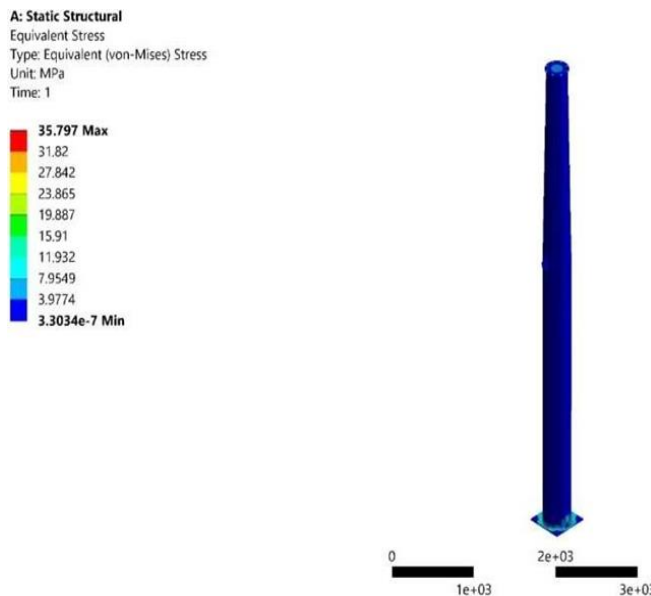


Fig 6 Static Structural



Fig 7 Distributed Mass

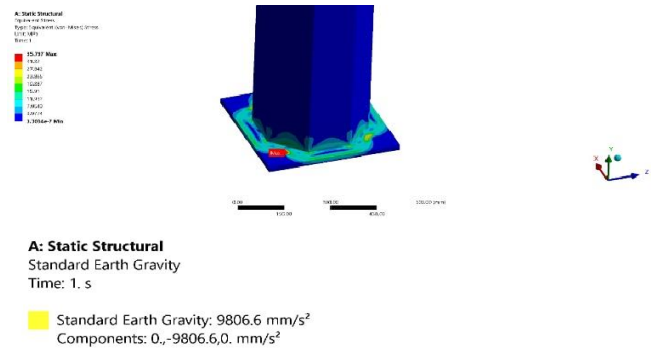


Fig 7 Static Structural on EarthGravity

## VII. RESULTS

The mid-hinged CCTV camera pole is a type of camera pole used for surveillance purposes. It is called mid-hinged because it has a hinge mechanism in the middle, which allows the pole to be lowered or raised for maintenance purposes. The camera is mounted on top of the pole, providing a high vantage point to monitor the area under surveillance.

The mid-hinged CCTV camera pole has several advantages over other types of camera poles. One of the primary advantages is its ability to be easily lowered for maintenance or repairs without the need for specialized equipment or personnel. This can save time and money, as well as reduce the risk of accidents during maintenance.

Another advantage of the mid-hinged CCTV camera pole is its flexibility. It can be installed in a wide range of locations and can be adjusted to provide the best possible view of the area under surveillance. Additionally, the pole can be designed to accommodate multiple cameras, which can be used to monitor different areas simultaneously.

The mid-hinged CCTV camera pole is commonly used for security and surveillance purposes, such as monitoring public places, parking lots, and industrial facilities. It can also be used for traffic monitoring, crowd management, and monitoring critical infrastructure. The camera can be equipped with features such as night vision, motion detection, and facial recognition, which can enhance its surveillance capabilities.

In conclusion, the mid-hinged CCTV camera pole is a versatile and flexible tool for surveillance and security purposes. Its ability to be easily lowered for maintenance, its flexibility in installation, and its ability to accommodate multiple cameras make it a popular choice for a wide range of applications. With the integration of new technologies, such as AI and high-resolution cameras, the mid-hinged CCTV camera pole can become an even more potent tool for surveillance, safety, and security purposes.

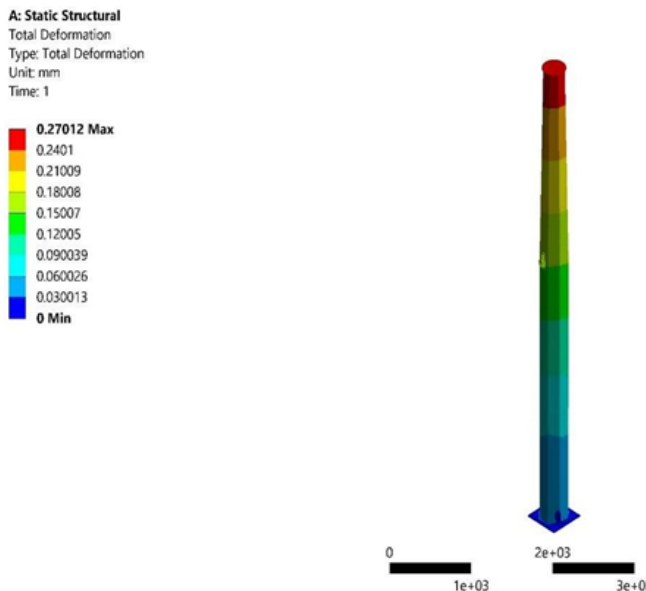


Fig 8 Total Deformation of Pole

### VIII. CONCLUSION

Mid-hinged CCTV Pole can vary in shape and sizes depending on their application in small scale application and large-scale application. For this type of pole is suitable for highways surveillance system and also a streetlight and surveillance system.

This project studied design, 3D Model and manufacturing. The 3D model of Mid-hinged CCTV Pole was modelled on SOLIDWORKS. This project was demonstrated the importance of careful design and manufacturing in producing high-quality industrial components. The successful completion of this project serves as a testament to the expertise and dedication of the team involved and highlights the potential for continued innovation and advancement in the field of industrial design and manufacturing.

With this we demonstrated to overcome the problem of adhesiveness in Mid-hinged CCTV Pole and design have been successfully completed with Design calculations, 3D Model of the Mid-hinged CCTV Pole and graphical conclusion.

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