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Construction of Jakarta Mass Rapid Transit Project (Phase 2) Contract Package 203 Underground Section-Civil 03 PT Hutama Karya

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Abstract: In every building construction, all structural components must have the strength to withstand the load they carry. Beams and columns are very important structural components in building construction; both structural components must be calculated and analyzed based on the appropriate combination of loads and factored forces. In compiling this research report, the author reviews the use of concrete columns in the Tangerang city sports field construction project. This review aims to determine how many pieces of reinforcement are used and how much concrete volume is needed for each column. From the results of the author's review, the column used in this project is the K1 column type with dimensions of 60x60 cm with 12D25 reinforcement, with a column height of 13 m, the volume per column is 4.68 m^3, with a concrete volume per column of 4.6286 m^3. So that the results obtained on 70 column pillars require a concrete volume of 324,002 m^3, with a large mixer truck capacity of 7.5 m^3, it requires 44 trucks to transport the ready mix concrete.

Keywords: Column usage, Column volume, and Column reinforcement

INTRODUCTION

The Mass Rapid Transit (MRT) project is one of the transportation infrastructures that is very crucial in supporting the mobility of residents in urban areas. This project not only has a strategic role in supporting economic development but is also an important step towards the development of sustainable transportation in Indonesia (PT MRT Jakarta, 2023).

One of the main challenges in the MRT project is the risk of accidents and safety issues in the construction area. The congested work environment, the use of heavy equipment, and work at altitude are factors that increase the potential for accidents in the field. In addition, MRT projects are often carried out in densely populated urban areas, so the risk

to the safety of road users and the surrounding community is also a major concern. Without proper management, this risk can result in material losses, worker injuries, and disruption to community mobility (Sasongko et al., 2025).

Overall, the report serves to raise awareness of the importance of safety in MRT projects and provide insights into how risks can be effectively managed. Thus, this report is expected to support the implementation of safer, more efficient, and sustainable MRT projects, as well as provide long-term benefits to communities and urban environments in Indonesia (PT MRT Jakarta, 2024).

The Phase 2 Mass Rapid Transit (MRT) construction project in Jakarta, particularly in Contract Package 203 (CP 203), integrates various basic theories of civil engineering and project management to ensure safe, efficient, and sustainable implementation. Risk management theory is the main foundation in the management of this project, especially in identifying, analyzing, and mitigating risks related to occupational safety in construction areas (PT MRT Jakarta, 2023). In this context, the safety of workers, road users, and the surrounding community is a top priority in every stage of project implementation, from excavation work, diaphragm wall installation, to concrete casting for underground structures (Sasongko et al., 2025).

This research also adopts the theory of environmental mitigation, which is relevant in managing the environmental impact due to construction activities. The application of modern technologies, such as dust control systems and construction waste management, aims to minimize disturbances to the surrounding environment (Worldsensing, n.d.). In addition, a sustainability-based approach is implemented to ensure that the project not only meets today's transportation needs but also supports future sustainable development (PT MRT Jakarta, 2023).

By integrating these theories, the MRT Jakarta Phase 2 CP 203 project is an example of a holistic application of civil engineering science. The project not only prioritizes technical efficiency and safety but also makes a significant contribution to the development of modern transportation infrastructure that supports the sustainable mobility of urban communities. This approach is expected to be a reference for similar projects in the future (Sasongko et al., 2025).

RESEARCH METHODOLOGY

This research approach uses a case study method to analyze and develop solutions to occupational safety problems in the Mass Rapid Transit (MRT) Phase 2 project, especially in Contract Package 203 (CP 203), which includes the construction of Glodok Station and City Station. Figure 1 shows the research roadmap.

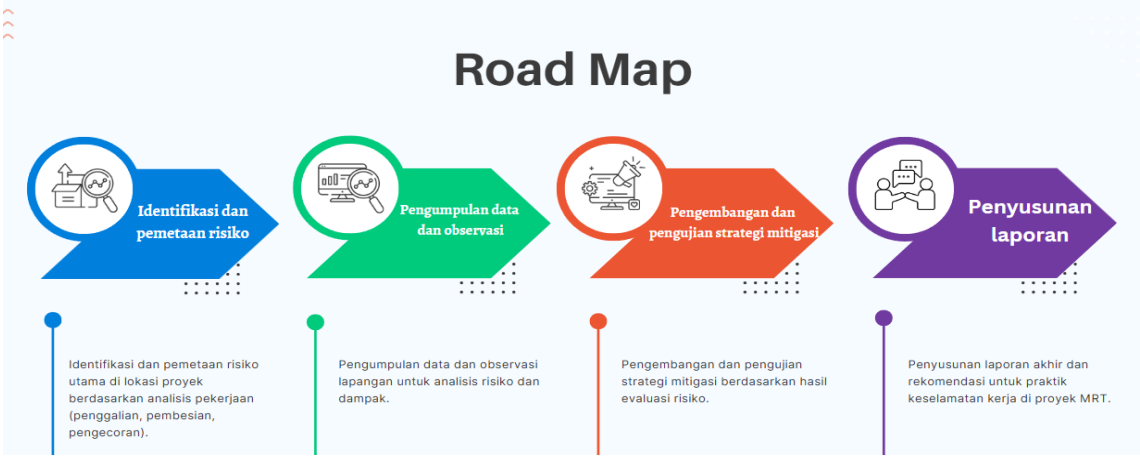

Figure 1. Research roadmap

As a support, the literature review is an important part of this research. The literature study covers occupational safety theory, risk management, and international construction standards such as OSHA and SNI 2847-2019. This study provides a theoretical framework to analyze the field findings and serves as a basis for formulating recommendations that are relevant to the needs of the project.

1. Research Stage

a. Identify Risks

The HIRARC (Hazard Identification, Risk Assessment, and Risk Control) method is used as the main framework to recognize and assess the level of risk at the MRT project site. The stages in this method begin with hazard identification, which is identifying potential hazards that can occur in various project activities, such as excavation work, diaphragm wall installation, or concrete casting. After that, a risk assessment is carried out, where each hazard that has been identified is assessed based on the impact and likelihood of occurring. The HIRARC method ensures that the identified risks can be minimized or eliminated completely to improve occupational safety.

b. Data Analysis

Data analysis is carried out to provide a clearer and more objective picture of the level of risk in the project. The data used includes statistics on work accidents that occurred during the project, including the type of incident, cause, and impact on workers and project operations. This analysis helps to estimate the impact and likelihood of similar risks occurring in the future. By combining historical data and observations, this analysis becomes a solid basis for developing more effective mitigation strategies

1. Development of Mitigation Strategies

The risk mitigation strategy was prepared by considering the results of the HIRARC method and the data analysis that has been carried out. The development of these strategies involves predictive models to project future risk scenarios and simulations to test the effectiveness of planned mitigation measures. In the process, international safety standards such as OSHA, ISO 45001, and local safety regulations are used as references. This strategy includes specific measures, such as increased safety training for workers, rearrangement of job site layouts to minimize the risk of accidents, and increased supervision of machine use. This approach aims to create a safer working environment while ensuring that project execution runs on schedule without significant disruption due to safety incidents.

RESULTS AND DISCUSSION

The implementation of construction work is a process that includes a number of stages, ranging from planning, procurement of materials and equipment, workmanship, to project completion.

1. Survey Preparation and Implementation

This process is the initial stage of a project planning concept, at this stage it includes basic ideas, and then followed up with preparation and planning. The following is the preparation process for the *Mass Rapid Transit (MRT) Phase 2A* project:

2. Traffic Engineering

The traffic engineering and work carried out are as follows:

1) The work location is on Jalan Gajah Mada, Jalan Hayam Wuruk and Jalan Pintu Besar Selatan, starting from Simpang Mangga Besar to Simpang Kota Tua. Job Location on Jalan Gajah Mada

2) There are four work points, namely in front of PT Sumber Mesin Raya, Jonisteak, the entrance of the Holiday Inn, and the entrance of Glodok Market
3) There was a reduction/narrowing of the road on the regular lane by approximately three meters during the work, precisely in front of PT Sumber Mesin Raya, Jonisteak, and the north side of the entrance of the Holiday Inn.
4) Meanwhile, in front of the entrance of Glodok Market, there will be a reduction in the width of the work lane on Jalan Gajah Mada regular by about one meter.

3. The location of the work in the middle median of Jalan Hayam Wuruk

1) There are 14 fourteen employment points;
2) There was no reduction in vehicle lanes during the work.

4. Work location on sidewalks and regular vehicle lanes of Jalan Pintu Besar Selatan

1) There are 16 work points on the pavement and body of Jalan Pintu Besar Selatan
2) During the work, on Jalan Pintu Besar Selatan in the direction of City and Glodok, there will be a reduction in the regular lane width of about one meter.
   a) Site plan planning
   b) Location Fencing
   c) Soil measurement and survey
   d) Soil Test
   e) Railroad Lift
   f) Socialization to local residents about the widening of the road.
   g) Road Widening
   h) Pavement of Work Area
   i) Improving Soil Quality

5. Preparation and Fencing of this Job includes:

a) Relocation of Facilities and Infrastructure,
b) Project fencing (Scope JO)
c) Cleaning and dismantling work

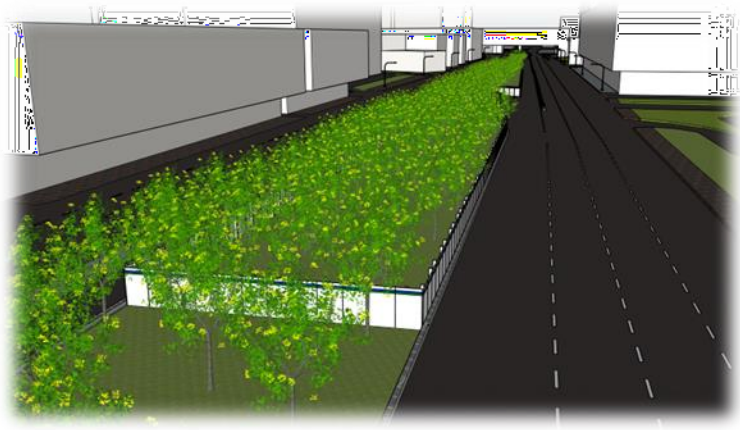

Figure 2. Fencing in the location area

6. Relocation of Facilities and Infrastructure

The relocation of facilities and infrastructure contained in the MRT Jakarta Phase II - CP 203 Construction Project consists of 2 (two) People Crossing Bridges (JPO) and 1 (one) transjakarta bus stop in Glodok, which will be carried out within **180 days**.

Project implementation is described as follow:

1) Before starting work, the Contractor will apply for a permit to the Directorate of Works and related agencies by submitting a plan of the work method, equipment used, and work drawings.
2) The construction of temporary facilities and infrastructure is carried out first in accordance with the location that has been approved by the Board of Directors of Works.
3) Demolition of existing facilities and infrastructure

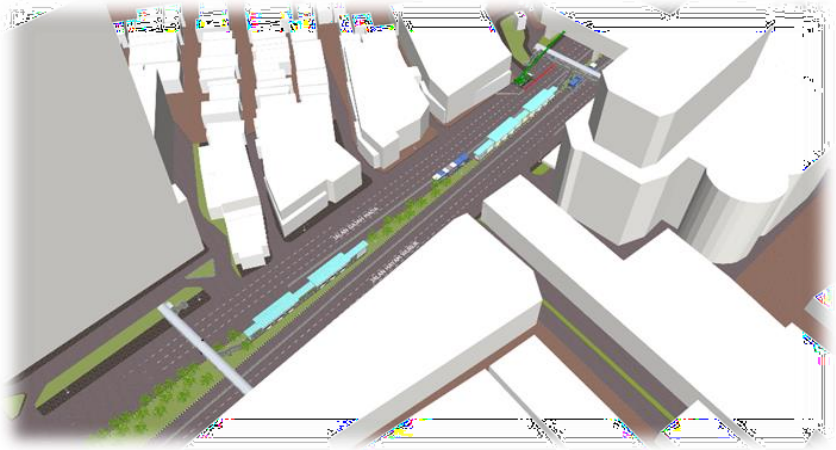

Figure 3. Contruction of JPO

7. Relocation of Facilities and Infrastructure

The demolition work includes stripping the pavement layer, cutting median and pedestrian areas, dismantling canteens, signs, markings, and other objects within the ROW boundary, which will be done within **90 days** in the Glodok Station area and **25 days** in the City Station area. The demolition work includes stripping the pavement layer, cutting median and pedestrian areas, dismantling canteens, signs, markings, and other objects within the ROW boundary, which will be done within **90 days** in the Glodok Station area and **25 days** in the City Station area.

Figure 4. Location Area Cleaning

Data Analysis

1. Quality Control

Quality control on the MRT CP 203 Jakarta project is essential to ensure that the project runs well and achieves its goals. Here are some steps that can be taken for quality control on this project:

a) Identification of Quality Standards;
b) Establishment of a Quality Control Team;
c) Monitoring of Contractor Performance;
d) Monitoring the quality of materials;
e) Examination and Trial;
f) Reporting and Evaluation;

2. Time Control

Project time control is one of the key aspects of project management. Here are some

steps that can be taken for project time control:

a) Realistic project scheduling;

b) Regular monitoring of project progress;

c) Delay analysis;

d) Revision of schedules;

e) Risk management;

f) Use of project management tools;

g) By implementing the above steps, project time control can be done well, thus allowing the project to be completed on time and according to plan.

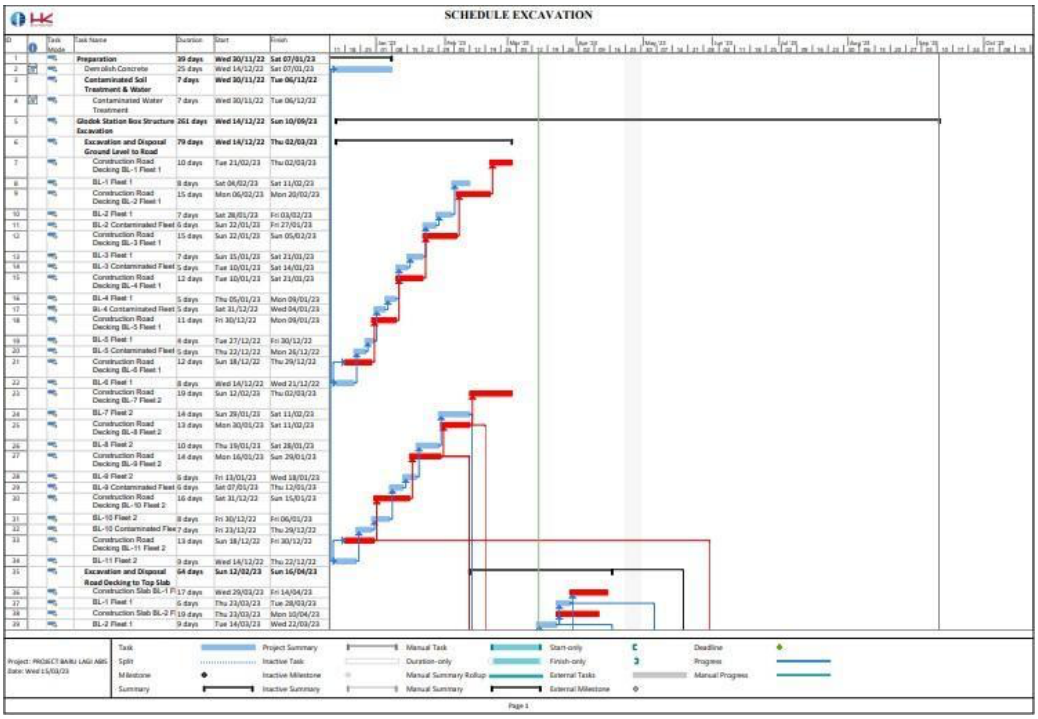

Figure 5. Work breakdown Structure of excavation work

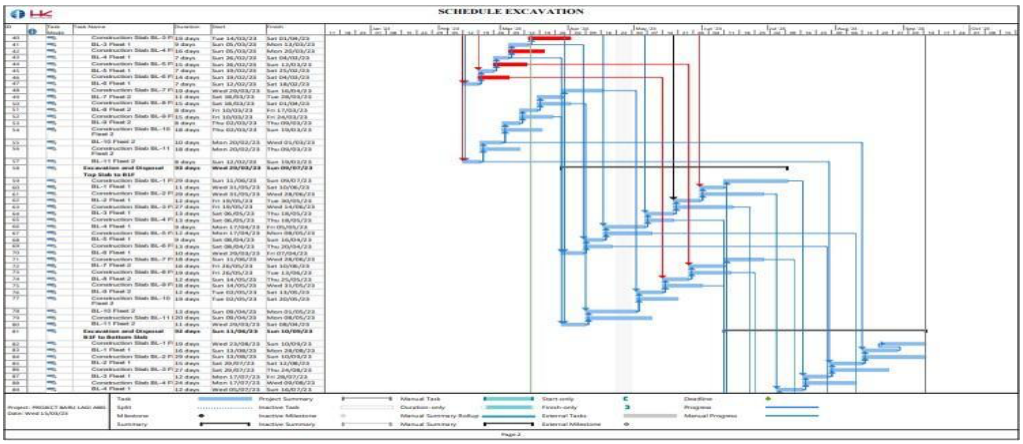

Figure 6. Work breakdown Structure of excavation work

Development of Mitigation Strategies

Mitigation Strategy Development is an action plan designed to mitigate the impact of risks that may occur in a project or situation. This strategy can be used to overcome various risks in work safety in the field of the CP 203 MRT project.

Figure 7. HSE Performance Board

Figure 8. Baggage Check Signs

Preparation Work

a) Initial Preparation

Toolbox Meeting

From the problems and risks that have been analyzed in the preparation of the work section of the toolbox meeting, there are several mitigation strategies that have been prepared and implemented, including:

a) Conduct briefings before starting work

b) Work supervisors are obliged to ensure the health of personnel
c) Supervisor conveys work plans and methods, as well as workplace hazards
d) Fill out a work permit form before starting work
e) Prepare a method/SOP/JSA statement before work starts

b) Workers are not in good health

So the solution and action taken is for the Supervisor to ensure that all teams are in good condition and ready to work; if there are workers who are not in a fit condition, they should be rested first.

Tool Inspection Process

In this process, it can also be risky, and the mitigation controls carried out are:

a) Clean shoes from mud
b) Ensure clean access
c) Use PPE
d) Use gloves
e) Arrange lifting equipment neatly

c) Moving Tools and Materials

Vehicle Falls Due to Slippery

Vehicles fall due to slippery roads and road damage In this problem, the mitigation strategies carried out are:

a) Installing flags in place of damaged road areas
b) Installing the road shoulder
c) installing barrier signs for damaged areas

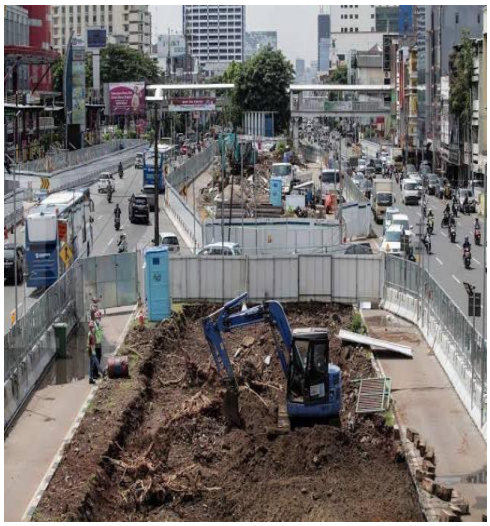

Figure 9. Installation of the shoulder of the workmanship

d) Speed in carrying vehicles

In this situation, the things that can be done to prevent the risk that occurs are:

a) Creating safety signs on the project's main access road
b) Conducting speed limit inspections by imposing sanctions
a) Installing flags in place of damaged road areas
b) Installing the road shoulder
c) Installing barrier signs for damaged areas

a) Exposure to dust and pollution

In this case, there are 2 mitigation strategies that have been carried out such as measuring and monitoring the quality of the air in the project area and installing speed limit signs

b) Consequences of Facility damage

In this activity, the strategies used to control this risk are by inspecting vehicles regularly, cleaning roads regularly, and providing counseling to drivers

c) Road damage

In this problem, prevention has been carried out by making a special detour for residents to access to avoid access to interfaces with vehicle projects, making regular road repairs, using road repair materials that are in accordance with quality

Execution Work

1) Excavating Soil with Tools

In this activity, the mitigation strategy carried out is the use of PPE such as respirators,

lights, safety glasses, ensuring that the roof decking structure has met the test requirements so that it can be used., heavy equipment used in good condition and there is no damage, ensuring that the operator has a SIO and the heavy equipment has a SILO that is still valid.

2) Soil Stack

In this matter, before the operator works, it is first ensured that the SIO letter and SILO heavy equipment letter are still active and valid.

3) **Material Mobilization in the Direction of Excavation**

a) Heavy equipment falls into a pit

To prevent this from happening is by; Installing speed limit signs and light reflecting lights, Hazard communication through signs, Engineering Control Lighting Lighting Installation, Hazard communication through signs, Lighting Installation

b) Faults in braking

This can be prevented by communicating hazards through signs with workers in the area or to workers in that area.

Beam Connection Installation

1. Lifting to install H-beam joints

In this problem, there are several mitigation strategies carried out, which are as follows:

a) Check the lifting equipment before use
b) Make sure the lifting equipment is in good condition and suitable for use
c) Perform the binding correctly

2. Working at height

In this activity, the risks obtained are very dangerous, therefore the control must also be maximized. SMCC HK-JO has made a very extraordinary mitigation strategy in dealing with this is to install a lifeline and use a full-body seat belt, Make sure the body seat belt hooks are properly attached, provide access to wash the feet (make sure there is no mud on the surface)

3. Lack of lighting at night

The thing that is done in dealing with this problem is to provide lighting in the form of lights to work at night, Put all lights on all sides of the work site

Figure 10. Lighting Installation Description

4) King Post Installation

a) King post table installation

In this activity, the risk of danger and the way to deal with this problem is to do this: Inspect the equipment before use, make sure the unit is in good condition and tie it correctly.

Figure 11. Installation of the king post table

b) Raising the king post

From this problem, the mitigation strategies carried out are: Make sure the base of the unit is flat and hard, use steel plates as the base of the unit, Make sure the operator is experienced and

competent to operate the unit Only operators who are competent and have a competent and certified to operate the equipment

c) King Post Setup

In this activity, the risk of danger and the way to deal with this problem is to do the following: Make sure all objects are silent when arranging moving the kingpost to the table, avoid body parts / hands from potential pinching, always use PPE, especially gloves.

d) Concrete casting

So what is done in this concrete casting activity so that there are no unwanted risks is by: Only a competent operator/driver can operate the unit, make sure the handbrake is installed when refilling / casting pouring concrete, install wheel studs so that the truck does not move backwards during the casting process.

e) Heavy Equipment Operation (Excavator)

Being exposed to heavy equipment, This risk is quite fatal if the incident occurs but take it easy, there are even mitigation controls that have been prepared to be implemented in the field by SMCC HK-JO.

Architectural Work

Loading and unloading materials, carried out using PPE such as respirators and gloves, warming up before transporting, is carried out by more than 1 person and the operator who works is required to have a SIO and the heavy equipment has a valid SILO.

a. Painting, Workers are required to use PPE such as respirators, gloves and glasses.

Recovery work, including:

1. replanting trees;
2. MCB Installation
3. Installation of JPU

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that: Project implementation is an important stage in the realization of planning, where all construction activities must run in accordance with the technical and operational standards that have been designed. In the context of the MRT CP 203 project, the application of Occupational Health and Safety (K3) principles is a top priority to ensure that every construction activity runs safely and efficiently. The risk control and mitigation strategies implemented in this project have been well designed to minimize the potential for work accidents and significantly reduce the level of risk. The implementation of K3 in the MRT CP 203 project

includes the implementation of safety induction for new workers, the distribution of adequate personal protective equipment (PPE), and the provision of health facilities in the project area, such as P3K, doctors, and nurses to handle emergency situations. With these measures, the MRT CP 203 project not only demonstrates its commitment to work safety, but also ensures the continuity of construction activities on schedule without major disruptions due to incidents in the field. This reflects the importance of a structured K3 implementation as an integral part of the success of large infrastructure projects.

The suggestions in the following study are as follows:

1. Supervisors are even stricter to workers who often remove PPE while working.
2. It is more thorough to check the readiness of the facilities provided in the project area such as, checking the condition of the availability of drugs in the p3k box and also checking the availability of drinking water so that workers do not become dehydrated.

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