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# Development of Site Logistics Plan of Pune Metro Budhwar Peth Station

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**ABSTRACT:** Construction logistics is one of the important governing factor of project progress. Site logistics is considered as critical operation as it is carried throughout the project cycle. Especially in Metro construction projects factors like city crowded areas, overhead high voltage electric lines, Surrounding Buildings, trees, city traffic, Human flow etc. are considered to develop smooth operations flow of construction logistics to complete the project in given time frame. This paper is a research case study of development of site logistics plan of Budhwar peth Metro Station.

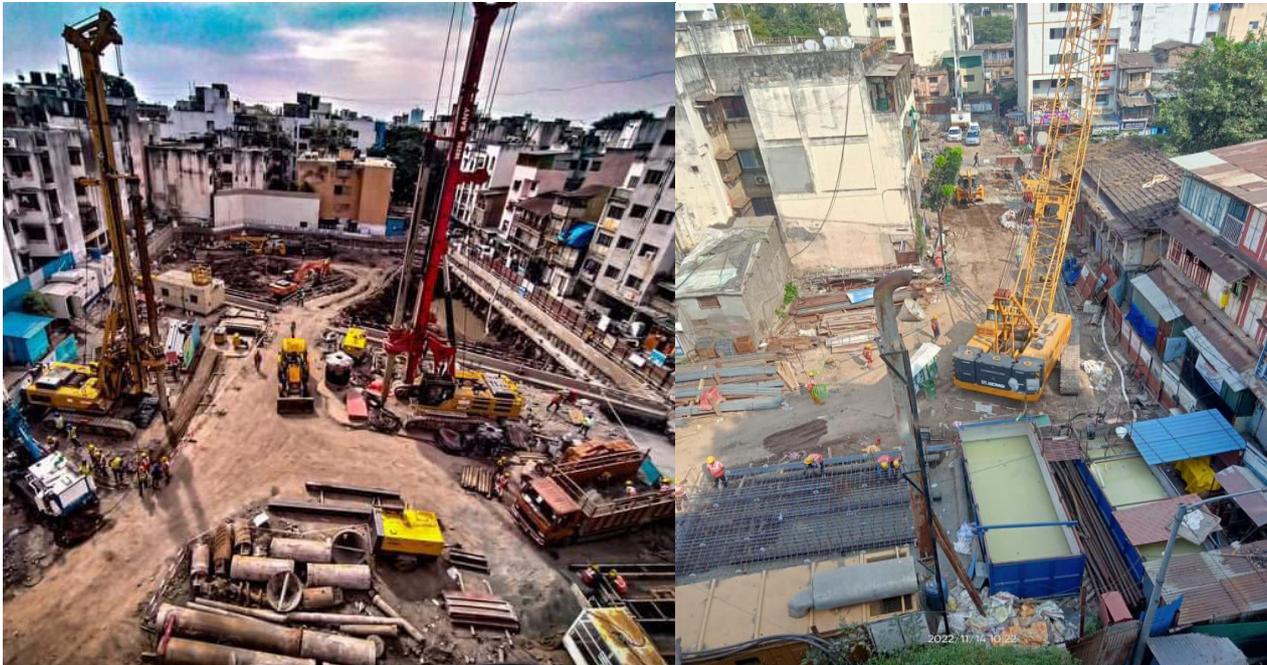
**KEYWORDS:** Construction logistics, critical operation, Metro construction, Smooth operations, Budhwar Peth Station.

## I. INTRODUCTION

To replicate the Western Transportation System, India is making significant investments in the nation's transportation infrastructure. In India, the metro rail's future is rather promising. Cities are seeing rapid economic expansion, which is clearly visible in the rise in personal automobile ownership. The other side of the coin is that it has led to a country's level of pollution rising and significant traffic congestion. The public transit system has to be fixed, and the deployment of the MRTS is the most crucial fix. Metro rail has grown significantly in India in recent years, and the rate of expansion is expected to double or triple in the future years. Cities are confronting the necessity for metro rail to satisfy their everyday mobility needs. The metro train promotes walkable growth, which is also advantageous to society. Another advantage of Metro rail is that it cuts costs and travel time, which lowers the cost of producing products and services and so increases the city's competitiveness. The use of public transit has also lowered pollution, lowering chronic illnesses and resulting in public health advantages. India being second largest populated country in the world transportation becomes a key factor in country's development. In today's present day scenario Indian cities are categorized based on population of the city as Tier 1, Tier 2 & Tier 3. Tier 1 being the most populated city clearly states the unbalanced distribution of population in country due to various factors requires good transportation flow in cities for smooth day to day operations of cities residents. Therefore, Metro construction is one of the most popular & economical mode of transport considered by city residents. Metro projects are constructed through elevated and underground metro lines. While construction phase of metro projects parameters like Traffic management, crowded areas, overhead high voltage electric lines, Surrounding Buildings & trees etc. are considered as one of the critical factors for project successful completion. This paper is a research case study of development of site logistics plan of Budhwar peth Metro Station.

## II. ABOUT BUDHWAR PETH STATION

Budhwarpeth metro station is an underground metro station. This station is intended in a highly populated residential neighbourhood near Kasaba Peth. It connects to Shaniwarwada, Kamala Nehru Hospital, Somwarpeth, and Raviwar Peth, among others. Budhwar peth station is surrounded by buildings from all sides which is considered as a critical condition for site logistics including the set of machineries like Tunnel Boring Machine, Flow of Transit mixers at site etc. This station has an unusual design in that central passenger circulation is planned within the cut-and-cover shaft, and the platform will be built using the NATM Concept - New Austrian Tunnelling Method. According to the RFP, the area was adjacent to several historic monuments such as Shanivarwada and Lal Mahal. Because of this, the NATM-New Austrian Tunnelling Method (for the first time in India for stations) is used, which results in low land utilisation and hence little disruption for existing traffic on the route.



Aerial view of Budhwar Peth Metro Station

### III. LITERATURE REVIEW

- **Changjiang Zheng<sup>1</sup>, Xiaojin Zhao, and Jinxing Shen, published a paper titled “Research on location optimization of metro-based underground logistics system with Voronoi diagram” in IEEE Access**

This paper proposes a strategy for optimising the placement of a metro-based underground logistics system (MULS) to transfer goods by metro during off-peak hours. First, using questionnaires and field surveys in metro stations, we conduct a qualitative and quantitative feasibility analysis of the MULS. The analysis results suggest that more than 85.22% of interviewees favour metro logistics delivery. An improved p-median model is created that takes four influencing factors into account. The shortest path algorithm is utilised to reduce transportation expenses, while the remaining costs are estimated using the acquired data. The Voronoi diagram is then used to optimise the position of potential metro stations and redraw the logistical service scope by using weighted terms. Finally, the Nanjing metro is used as an example.

- **Ezzeddine Fatnassi, Jouhaina Chaouachi, Walid Klibi published a paper titled “Planning and operating a shared goods and passengers on-demand rapid transit system for sustainable city-logistics” in “Science Direct”.**

The possibilities of integrating a shared products and people on-demand rapid transit system in metropolitan areas is investigated in this article. Although people and goods movements have different goals and constraints, mixing them on the same network is consistent with current trends. So, in this paper, we look at how they can share a rapid transit network and use available transport capacity within a city more efficiently in an interconnected manner. Based on the similarities between personal rapid transit (PRT) and freight rapid transit (FRT), this research suggests an emerging and efficient transportation solution to improve municipal logistics sustainability. The operational level then focuses on characterising the dynamic transportation challenge and proposing two solutions. This challenge seeks to provide acceptable service to a large number of transport requests that arrive on a regular basis while minimising empty movements of a fleet of electric cars with limited battery capacity. We propose and test an efficient solution technique based on forward optimisation of periodic transportation sub-problems. The usefulness of the PRT-FRT mode is illustrated, and computational results are provided and analysed in contrast to other modes of transportation.

- **Zhao, Laijun ; Li, Huiyong search by orcid ; Li, Meichen ; Sun, Yan ; Hu, Qingmi ; Mao, Shirong ; Li, Jianguang ; Xue, Jian published a paper titled “Location selection of intra-city distribution hubs in the metro-integrated logistics system” in “Tunnelling and Underground Space Technology incorporating Trenchless Technology Research, Volume 80”.**

Ground transport is heavily used in urban logistics, which produces issues such as traffic congestion, environmental impact, and delivery delays. Using an underutilised metro system's capability to convey same-day delivery products inside a city during off-peak hours is not only creative, but it may help to alleviate the aforementioned urban transportation issues. We locate distribution centres and build a metro-integrated logistics system in this research. First, we propose a method for segmenting the urban metro network. Second, complex network theory is used to pick indices for assessing the relevance of each metro station based on the resulting sub-networks, and the weight of each evaluation index is determined using the AHP approach. Furthermore, the TOPSIS model and the candidate are used to assess the importance of each metro station. The metro distribution centres for the location model are identified. Then, with logistics demand in mind, a location model is developed to select the final metro distribution hubs from the candidate metro distribution hubs. Finally, we use the Shanghai metro system as a case study to give strategic planning for metro distribution hub location selection.

- **Zhen Di, Lixing Yang, Jungang Shi, Housheng Zhou, Kai Yang, Ziyou Gao published a paper titled “Joint optimization of carriage arrangement and flow control in a metro-based underground logistics system” in Science Direct.**

This study investigates a joint optimisation problem of carriage arrangement and flow control in a metro-based underground logistics system, in which passengers and freights are permitted to share each service train, against the backdrop of developing sustainable urban freight transportation on the operational level. The issue of interest is defined as an integer linear programming model by introducing the carriage arrangement variable and flow assignment variables relating to passengers and freights, with the goal of minimising the weighted sum of the operating cost and the overall delay penalty. It is demonstrated that the suggested model may be turned into an analogous mixed-integer linear programming model to address the solution issues given by a high number of integer choice variables. Then, based on the model characteristics, an improved Benders decomposition algorithm is designed to solve the proposed model. Finally, a set of numerical examples are run on the Beijing metro Batong line to validate the performance and effectiveness of the proposed approaches.

#### IV. METHODOLOGY



#### V. EMPIRICAL RESULTS

Several steps were followed to develop a site logistics plan for Budhwar peth metro station as stated below.

##### Step 1 – Site Survey (Analysing Environmental Factors)

Familiarity with the local environment is essential for site logistics planning, particularly the desired time of year for building. Building in rainy weather, hot weather, delicate wetlands, or other areas can have an impact. These



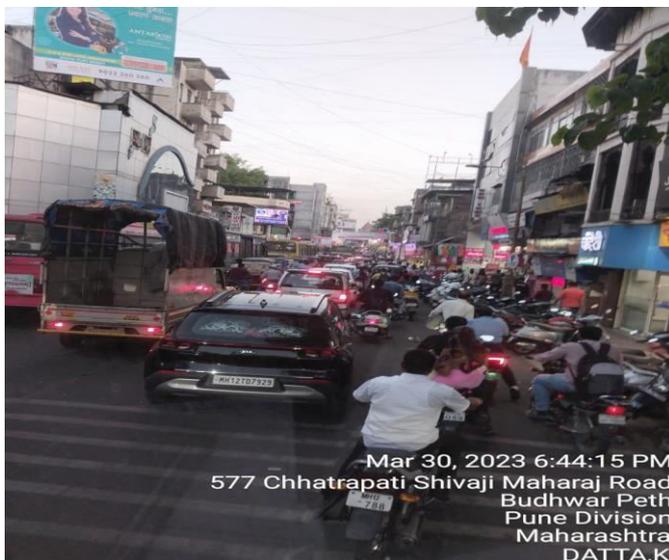
circumstances will have an impact on a number of aspects, including Erosion control measures, ground water levels, Materials used for haul roads Utilization of cement, Dust pollution etc. Weather worries will also have an impact on the staging of workers' break spaces. In the summer, this involves shade or air-conditioned places, but in the winter, it may entail warming break areas or creating wind breaks. Furthermore, specific environmental protections for local wildlife or environments must be considered. Protection measures and knowledge of these areas are all critical to maintain throughout building activity.

### Step 2 – Site Survey of Physical factors

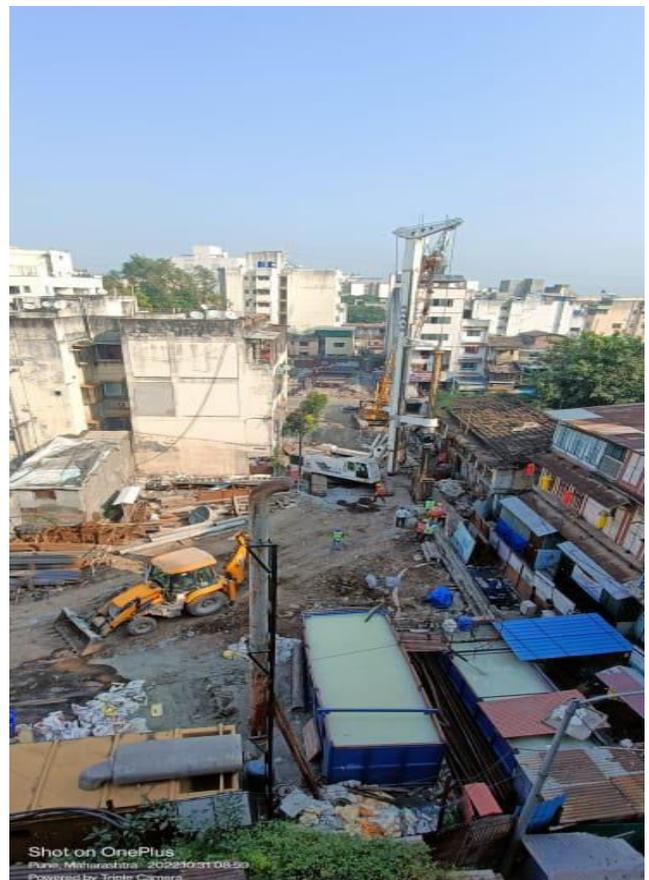
Looking at the real site is one of the first things to consider while planning site logistics. There are several aspects to consider: Are there any existing land features that must be adjusted before construction can commence, such as: Significant trimming and filling, Blasting of rocks, Retaining structures, Permanent driveway access or temporary haul roads?, How will the site be accessed? Will it be done through temporary or permanent access, Is there a single building or several, and when will each one begin or end? & where will the hardscaping and soft scaping be placed at the end of the project?

### Step 3 – Traffic Flow

The next step in efficiently designing site logistics is to consider traffic flow. A good team must be aware of the number of cars, equipment, and personnel that must be moved across the site. Considerations for traffic flow include: Exits and entrances One-way traffic flows or two-way traffic flows Areas for pedestrian crossing Location(s) of entrance gates, and if they alter for public vs construction traffic Wheel wash station locations Parking spots for crew members Clear traffic paths serve to maintain safety and keep vehicles out of construction zones.



Traffic Flow near site



Ariel View of Site to showcase moment of Site Machineries

#### Step 4 – Site Store Area for Material Storage

Materials storage places will be required, but their position will be determined by the size of the site, traffic flow, and the materials needed. At cases when space is limited, this may imply keeping items elsewhere, either nearby or at an offsite warehouse. It may also include establishing specialised places for materials to be held on the site, usually with increased security. Important considerations include: Physical dimensions are necessary to accommodate materials. Weather protection is necessary. People and/or heavy equipment distribution to the location must be accessible. Theft prevention security ideally, the objective for materials storage is to identify a safe facility that can remain in the same position for the duration of construction and is conveniently located to be as near to the regions where the materials are needed as possible. While just-in-time delivery used to be the ideal goal in coordinating materials for job sites, this strategy has been largely abandoned in recent and increasingly turbulent times in favour of early supply acquisition and storage. Unfortunately, this is sometimes the only method to assure that the supplies required for the job arrive ahead of time. This increases the quantity of materials storage required at any particular construction, necessitating the use of materials lay down or offsite storage facilities.

#### Step 5 - Plan for building access

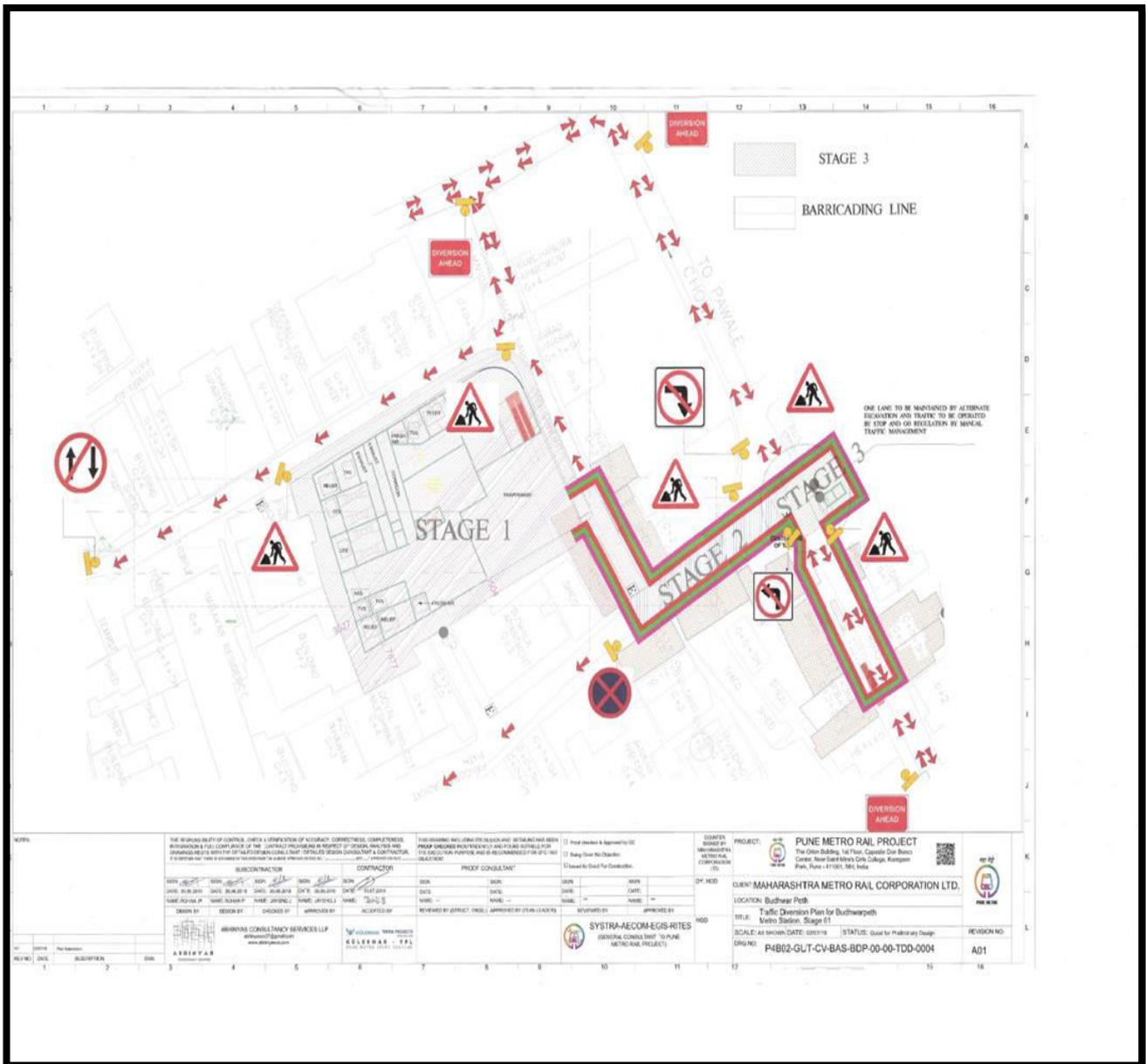
To construct a structure, the personnel and equipment on-site must be able to reach the building area effectively. This implies that traffic movement, material storage, and temporary facilities must not interfere with work zones. This isn't always achievable, which pushes construction teams to develop a phased approach to site logistics and building development in which staged regions migrate to fit the flow of the construction stages. When planning for building access, the following items must be considered: Close proximity to worker parking places to shorten the trip



pathEquipment access roads, such as aerial lifts and cranesTemporary access necessitates ground preparation.The purpose of building access planning is to minimise the time and expense necessary to access each section.

**Step 6 - Plan for crew relief areas and site offices**

Buildings cannot be built without people, hence it is vital that crew workers have access to break rooms. These are some examples:Site office with enough of meeting space Break facilities should include clean water and potentially modest equipment for meal preparation. Stations for hand washingPortable toilets Locations with Shade In the case of a natural catastrophe or an accident, there will be emergency meeting places. It is critical that the sites personnel have adequate lodgings, especially when severe weather is expected. Perlo and the industry as a whole place a high value on worker safety and health.



Budhwar Peth Metro Station - Site Logistics Plan



## VI. CONCLUSION

After conducting site survey several parameters were brought down and consider to prepare the Site logistics plan for Budhwar Peth Metro Station. The Site is surrounded by closed buildings and the traffic flow is high due to congested roads near site therefore for free flow of site machinery like Mobile tower cranes, Transit mixtures has to be taken care at regular intervals. Since the most critical factor to successfully implement the logistics plan it is important to regularly update the logistics plan as per the conditions of site.

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