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Comparative Study on Hot Bituminous Mixes by Drum Mix and Batch Mix Plant

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Abstract: The primary objective of asphalt plants is the quick, efficient manufacturing of high-quality asphalt concrete in huge quantities. Two varieties of plants are grown and used globally to achieve these goals. These are batch and continuous (drum-mix) plants. They are distinguished from one another by their production processes, as implied by their names. Asphalt concrete is manufactured continuously in continuous types as aggregate flow. Asphalt concrete is made in batch forms, one batch at a time. The primary manufacturing processes have not altered, but new processes and components have been introduced to plants as a result of technological advancements. This study's primary goal is to assess asphalt plant performance and compare it to actual applications. The first section of this paper introduces the essential tasks of plants independent of production mode and explains the production procedures of asphalt plants in order to achieve this goal. The primary functions of asphalt plants for continuous and batch type plants are contrasted in the second half of this essay.

The benefits and drawbacks of each type of asphalt factory are described. Investigated are each type of asphalt plant's innovative production methods and parts. Finally, the production capabilities, product quality, quality control procedures, efficiency, and environmental tasks of the various plant types were compared. Additionally, production capacities—both theoretical and actual—costs, production losses, and quality losses resulting from various application-related issues are explored.

Keywords: Batch Mix Plant (HMP), Drum Mix Plant (HMP).

I. INTRODUCTION

Hot mix asphalt (HMA) is used to pave roads and highways. They are making asphalt in stationary or mobile mixing units. The asphalt mixing plant (HMP) is the name of this technical apparatus. Batch plants, drum mix plants, and continuous mixing plants are the three different types. Construction is used for a certain HMP manufacturing process. The HMP technology entails two main operations: preparation (initial proportioning of cold aggregates, drying and heating, hot mix aggregate screening to three or four hot fractions, hot fractions, imported filler, necessary dust, and asphalt cement proportioning by weight), and hot mixing of all materials that have been prepared. The difference between the HMP quality and the HMP manufacturing quality must be made. The job mix formula or standards for the quality of normative documentation (component composition, temperature, etc.) are what define the quality of HMP manufacturing.

The quality of the applied materials and the production processes both influence the quality of the generated HMP. High-quality HMP production may be achieved by automating processes and effectively managing them using computers. But the operator performs the primary function. He has to make good use of the opportunities offered by contemporary technology. Numerous publications examine and illustrate the development of HMP structures and their history of modernization. The effort of continuously modernizing the HMP generating technology and suitable HMP construction is underway. In order to achieve modernization, the finest HMP quality, productivity, and technology for environmental protection, universality, etc. Numerous issues with HMP quality were developed in AMPs of various build and the analysis and investigation of automatization procedures took many different factors into account. The contemporary approaches being used nowadays are the Asphalt Institute's presentation. Sivileviius and Vislaviius presented research on the assessment of random errors' effect on the on the homogeneity of the hot-mix asphalt, a stochastic technical process taking place in a batch type facility. They offer the method for predicting the mineral component composition of the HMP that takes into account variations in the mineral material total percentage of material passing through control sieves and weight-dose errors for mineral materials during finite dosing.

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One of the most crucial steps in the production of HMP is material dosing. The accuracy of HMP creation is improving as random and systematic proportioning mistakes are declining. When hot aggregate fraction segregation decreases, the manufacturing quality increases. As in the majority of European nations, HMP is produced in Lithuania in batches using traditional technologies. The suggested statistical control and operational approach is used to evaluate the quality of HMP generated in batches.

1. BATCH MIX PLANT

The asphalt concrete batch mix facility is made up of several parts. The cold aggregate feeder bins, where the aggregates are stored/fed in distinct components according to their sizes, are the initial component. Each bin has an additional feeder belt underneath it, and a gathering conveyor runs beneath every bin. All of the aggregates will be transferred via this conveyor to another inclined conveyor belt, which will then transport all of the materials to the drying drum. Aggregates must pass through a vibrating screen to remove any large elements before being delivered to an inclined conveyor belt. The drying drum is the following element. It has a burner unit installed so that the drying and heating of the aggregates may be done. A temperature suitable for mixing is reached. An elevator then lifts these aggregates to the top of the tower unit. The vibrating screen is at the top of the tower unit, followed by the hot bins, and the mixing unit is below the hot bins. As when the aggregates reach the tower unit's top, a multi-deck vibrating screen (often four decks) is used to separate them. Screens are present to segregate aggregates based on their sizes.

Following separation, they are momentarily kept in various compartments known as hot bins. The heated bin area is just underneath the screening unit. The aggregates will be kept in separate bins by hot bins, which will then release them into the mixing unit below in accordance with the weight specified on the control panel. Bitumen and any additional optional mineral filler are weighed and delivered into the mixing device at the same time as the aggregates. The mixture is discharged into awaiting trucks or the storage silo after being properly mixed.

There are air pollution control devices installed for environmental protection. The majority of the time, these devices are bag filter units. The bags of the bag filter are designed to allow the particles to flow through while trapping the dust. It is also possible to reinsert the gathered dust into the aggregate elevator. Hot mix asphalt is produced at asphalt batch facilities in a number of batches.

2. DRUM MIX PLANT

The cold bins in batching plants and asphalt drum mixers are identical. The procedure continues to be the same until the aggregates pass past the vibrating screen and into the drum unit. Here, the drum is used for both mixing and drying. The aggregates are heated in the drum's first half, while bitumen and filler material are mixed in the second half. Since this is a continuous mixing facility, a modest sized hopper is offered for momentary storage of the HMA. Bitumen is added to the second half of the drum after being kept in separate tanks. Wet scrubbers or bag filters are included with the plant for pollution control.

II. LITERATURE REVIEW

Thomas W. Kennedy, James A. Scherocman, and Maghsoud Tahmoressi [1] This study summarizes the theory underlying drum mix plant operations and outlines the best practices for common drum mix plant components. Although the usage of drum mix machines in the asphalt paving business has acquired widespread recognition, there are still issues related to their use. The majority of these issues are thought to be caused by drum mix plants being used improperly. When correctly run, drum mix facilities can provide homogeneous asphalt mixes. This study offers guidance for the correct operation and inspection of drum mix facilities as well as a summary of the fundamental ideas behind their functioning.

A. Miguel Baptista and L.G. Picado-Santos [2] This article outlines a mix design process and a case study for HMR that are applicable to everyday life in Portugal and are based on the mechanical performance of various mixes. According to the study, a typical 0/25 bituminous mixture for the base layer was created, containing up to 40% recovered bituminous material that was added to the plant mixer without being heated first. Based on the findings, it can be said that, with the adoption of an appropriate mixture design and some construction directions, the degree of trust is equivalent to that obtained from traditional mixes.

Gayle E. Albritton,William F. Barstis And Glynn R. Gatlin [3] This study was designed to satisfy the section of ISTEA that instructs the different states to do research on the technical performance of CRMHMA pavement and the recyclability of crumb rubber modified hot mix asphalt (HMA). These goals were achieved by keeping an eye on the construction of

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highway test sections where CRM HMA was used as part of the pavement structure, assessing how well these sections performed, and then cold milling and recycling this pavement material into new HMA using a hot mix asphalt plant. The CRM HMA pavement was developed in the first phase of this project, and about two years later, it was milled and used as RAP in the surface course during the second phase. This article addresses both.

MO and Cary [4] This report evaluation addresses harmful substances including CO2 and sulphur dioxide that are released into the environment. Additionally, it considers the potential for gas enclosures and distinguishes between different plant types depending on the aforementioned perimeters. The associated tables and transcripts provide a greater understanding of the practical use of batch mix and drum mix asphalt manufacturing.

Henrikas Sivilevicius[5] This research project includes a mechanism for evaluating AMP quality. Additionally, the model and a set of chosen evaluation criteria are described. This approach enables comparison and evaluation of AMP status and condition. The real-world application of the paradigm is demonstrated by the example.

Vinay Purandare [6] Examining in this study is a government-owned plant that was founded in 1991 and has been ISO 9001:2008 certified. It had 40 employees at first. The plant is open 24 hours a day to accommodate the construction activities with different government agencies from Maharashtra, such as MIDC, CIDCO, PWD, and others, as well as different municipal councils and municipal corporations, engaged in various construction activities, including the building of roads and other civil works at various locations in and around Pune, which are successfully completed by these areas.

III. CONCLUSION

Cold aggregate feeders, a vibrating screen, and a charging conveyor are the fundamental parts. A counter-flow drying unit and a separate mixing unit are both part of the main unit, commonly referred to as the plant's heart. As the aggregates go toward the burner, the counter flow dryer treats them to ensure equal heating. A separate mixing zone enables improved mixing quality. The use of a separate mixing device also keeps the priceless liquids away from the heat. Here, the drying and mixing times are extended to ensure a high-quality final product.

At the moment when the aggregate enters the drum, there is a dust suction. Dry dust collectors are used to treat collected dust as a primary pollution control measure before being treated by secondary pollution control measures. A moist dust collection or a bag filter are also possible options for this supplementary pollution solution. While bag filters clean the dry air by allowing it to flow through the numerous bag filters installed within the bag house, wet dust collectors (wet scrubbers) employ water to clean the dust.

According on the customer's needs, bitumen tanks can have varying capacity and direct or indirect heating methods. Along with bitumen, it is possible to add minerals right into the mixing machine. For plants marketed in India, the control panel is microprocessor-based; for plants intended for export, it is PLC-based.

In comparison to parallel flow asphalt plants, this design provides the greatest results in terms of pollution control, mixing, fuel savings, and most significantly, superior quality of hot mix. Dust is suctioned before mixing, and aggregates are moved toward the flame. By enabling recycled asphalt to be added directly into the mixing machine, recycled asphalt may also be produced. There are also available storage silos with various capacity. Then there are asphalt drum mix machines that operate in parallel flow, which are the least complicated and most suited for simple tasks. With capacities of 30-45 tph, 40-60 tph, 60-90 tph, and 90-120 tph, and available in 4 versions.

This machine has the most straightforward design, and the cold feeding bins may be altered to meet specific needs. Aggregates are weighed in the charging conveyor before being sent to the drum. Here, aggregates are heated and mixed in a single drum. The aggregates flow toward the burner flame, which is at the other end where hot aggregates are combined with bitumen and mineral. Heating and mixing are the two basic operations carried out in a single drum.

The plant is more compact than the other two variants and is perfect for creating hot mix asphalt rapidly. Hot mix silo addition provisions are also possible, and PLC- or microprocessor-based control panels are also acceptable. Customers that desire a hassle-free experience and speedy production can benefit from simple designs.

Look no farther than this mobile asphalt mixing plant if you're seeking for a single drum design (parallel flow type) mobile plant. There are capacities of 30-45 tph, 40-60 tph, 60-90 tph, and 90-120 tph available.

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REFERENCES

[1]. Zenonas Turskis., "MULTI-ATTRIBUTE ASSESSMENT OF THE ASPHALT MIXING PLANTS" Vilnius Gediminas Technical University Sauletekio av. 11, LT-10223., 2008
[2]. Koenders, B. G & Stoker, D. A & Bowen, C & de Groot, P & Larsen, O & Hardy, D and Wilms, K. P., "Innovative Process in Asphalt Production and Application to Obtain Lower Operating Temperatures", 2nd Eurasphalt & Eurobitume Congress Barcelona, 2000
[3]. HiMALCOLM D. GRAHAM &WILLIAM C. BURNETT & JEROME J. THOMAS and WILLIAM H. CLARK,. "Reduced Mixing Time for Asphalt Concrete Mixes" Bureau of Physical Research, New York State Department of Transportation.,1963- 1964
[4]. Sivilevičius, H., "Substantiation of complex evaluation criteria of asphalt paving plant quality". Journal of Civil Engineering and Management, Vol. 8 Supplement 2, 112-125. (In Lithuanian).,2002
[5]. Petkevičius, Kazys., "Necessary Measures for Ensuring the Required Quality of Hot Mix Asphalt and Their Practical Implementation". The Baltic Journal of Road and Bridge Engineering. , Vol. l3, No. 1, 29-37.,2008
[6]. Krishnareddygari Prathima., "Emission and Environmental Management Plan for Hot Mix Asphalt Plant" Sri Venkateswara College of Engineering and Technology, Chittoor, Andhra Pradesh, India.,2017
[7]. H. E. Friedrich., "Air Pollution Control Association" Air Pollution Control Association, Dustex Division, American Precision Industries Tunnicliff., "D. G. Laboratory Studies of the Mixing Process". AAPT Proc., Vol. 28, p. 74, 1959.
[8]. F. Yonar, S. Iyinam, A. F. Iyinam & M. Ergun,. "Evaluation of Asphalt Plants in Terms of Performance" Department of Civil Engineering, Technical University of Istanbul, Turkey, 2010.