

ABSTRACT

The development of quality road infrastructure is a key factor in supporting economic growth and community mobility in West Java Province. The need for Asphalt Mixing Plants (AMP) is crucial for producing hotmix, a hot asphalt mixture used in road construction and maintenance. However, the main challenge lies in determining the optimal AMP locations that can minimize distribution costs while meeting hotmix demand across various regions. This study aims to optimize AMP locations in West Java, specifically in the Regional Technical Implementation Unit (UPTD) III area, using the Fixed Charge Facility Location Problem (FCFLP) method.

The FCFLP method was chosen for its ability to solve optimization problems involving continuous variables (such as cost and distance) and discrete variables (such as facility opening decisions). The research began by collecting data on road length, population, road conditions, quarry locations, existing AMP locations, and demand points (sites) in UPTD III. This data was then processed to calculate hauling costs (transporting materials from quarries to AMPs) and hotmix distribution costs (from AMPs to sites). Additionally, factors such as maximum travel time (90 minutes), AMP production capacity, and fixed facility construction costs were considered in the optimization model.

The results show that out of 7 existing AMPs, only 5 locations are optimal to operate: Margaasih, Padamulya, Cipageran, Padaasih, and Wanakerta. These locations were selected because they can meet all hotmix demand in UPTD III with the lowest distribution costs and travel times not exceeding the 90-minute limit. Furthermore, these locations balance hauling costs and hotmix distribution costs, preventing excessive dominance of either cost component. Total distribution costs decreased significantly from IDR 7.37 billion (existing) to IDR 3.90 billion (proposed), saving up to 47% or IDR 3.47 billion.

A sensitivity analysis was conducted to test the model's resilience to parameter changes, such as increases in fuel prices and fixed AMP construction costs. The results show that even with a 20% increase in fuel prices, the number and locations of AMPs remained stable. However, changes in the maximum distribution travel time (from 90 minutes to 60 or 120 minutes) affected the number of AMPs required, indicating that travel time coverage is a critical factor in location determination.

The implications of this research cover two main aspects: practical and policy-related. Practically, reducing the number of AMPs from 7 to 5 can save resources, reduce land use, and ensure hotmix quality is maintained during distribution. From a policy perspective, these findings can serve as a basis for local governments to plan more efficient and effective AMP development, balancing public service and budget efficiency.

This study has several limitations, such as the assumption of constant truck speed (30 km/h) without considering traffic conditions, static hotmix demand data, and the assumption of optimal AMP capacity. Future research should incorporate dynamic factors such as demand fluctuations, production downtime, and more comprehensive operational costs. Additionally, using more empirical cost ratios could improve model accuracy.

Keywords: Asphalt Mixing Plant, Location Optimization, Fixed Charge Facility Location Problem, Hotmix, Hauling Cost, Distribution Cost