

PREVENTIVE RESPONSE STRATEGIES IN WINTER MAINTENANCE IN THE SPANISH ROAD NETWORK

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ABSTRACT

Spain features one of the highest average altitudes in Europe, with nearly 50% of its surface covered by mountain ranges making steep road gradients a common feature. The majority of the country features cold, continental winter weather with over 100 days per year of below freezing temperatures.

The Spanish Ministry of Public Works (Ministerio de Fomento) services a 26,037 km network (44.3% motorways and toll motorways and 55.7% conventional roads), on much of which maximum acceptable snow removal times are as short as 1 hour from an event.

This results in significant resource consumption in winter service, particularly of salt and de-icers. The Ministry has therefore made a sustained effort to optimize resource usage, concentrating mainly on promoting liquid treatment systems, encouraging to switch to brines for anti-icing instead of solid salt, improving treatment effectiveness while reducing resource waste and salt-related environmental impacts.