An integrated study on improvement of VIP/concrete-assemblies for prefabricated buildings

Considering the over loading carbon dioxide emission and the heavy pollution by Fine Particulate Matters (PM2.5) in China, we would like to explore the applications of VIPs in constructions of 'zero-energy precast concrete buildings'.

In order to improve the production efficiency and to ensure the high thermal resistance of the external walls, the windows and the doors of the prefabricated buildings, it is necessary to produce integrated assemblies with decorative surface layer. The overall heat transfer coefficient of the assemblies shall be lower than 0.15 $W/m^2 \cdot K$ ($R = 6.67$ $(m^2 \cdot K)/W$). To ensure the low transfer coefficient of the integrated assemblies, the following problems shall be considered and studied:

1. In order to protect the surface of the VIPs at the pouring step of the concrete assemblies, a low-cost protection mortar shall be formulated, which shall lower the impact from the construction aggregates on VIPs as well as the damage caused by the concrete vibrator spear.
2. A detailed study on the formulation of the low-cost mortar and a testing method of its performance.
3. To develop an automated production line for the coating of the low-cost mortar onto the surface of the vacuum panels.
4. The treatment of the thermal bridge problem caused by 'patchwork' of VIPs on the prefabricated assemblies. Looking for a practical method to measure the thermal bridge effect (eg. through embedded sensors) and to determine a correction factor for compensating the heat loss.
5. To develop a simple program which shall simulate and predict the impact of the thermal bridge effect for future production, regarding to different ways of 'patch work', seam-closing and block arrangement.

Cost estimation: 15,000 EUR