New material studies are investigated through a comparative and woven threads of intersecting regional challenges informing materials compositions in the architectural design process. The materials emerge through the identification of prevalent regional opportunities impacting multiple facets of local society including economies for waste upcycling, interventions for environmental restoration, and industrial ecologies that promote cultural building techniques.

The general regions of study include Mumbai, India; Tehran, Iran; Fuzhou, China; and the Salton Sea in California as well as various biomes in Arizona. The domains influencing material flows selected for each architecture study are categorized into three: situational, bioclimatic-dependent, and responses. The first theme is one that attends to building materials’ value to a waste byproduct in order to assist an environmental or socio-economic challenge in each. The second domain involves capturing of plastics waste in and around sites of Mumbai housing slums to improve socio-economic and environmental health, utilizing permaculture waste in Arizona agriculture to support organic farming practices, integrating dead date palm leaves from the Salton Sea region for shelter construction, and agro-byproduct in Arizona’s Apache-Butte research centers to support clean energy production. The third domain centers upon environmental challenges impacting regional biomes that require the removal of a material system to alleviate perpetual ecological damage. The domain includes removal of increasing quantities of dead pinyon pine from Arizona’s national forests resulting from climate change drought, removing invasive buffelgrass from Arizona’s Sonoran desert resulting from irrigated practices, and removal of high salt contents from the Salton Sea resulting from climate change enhanced evaporation. The third domain addresses a cultural territory for protection and integration of regional building technologies and traditions. This domain includes integration of traditional Chinese construction techniques with tall wood structures, reducing building industry environmental impacts, using hemp textile fabrics and innovations integrated for urban wind-catcher adaptations for socio-environmental performance, and making use of Salton Sea date palm wood for desalination constructions to irrigate a new market for socio-economic and environmental health.

The material compositions are grouped in three categories, including biopolymers and cellulose composites, plastics, and minerals. Each material can also be grouped into its primary fabrication process, which is influenced by the material composition and chemistry, sourcing method, and available local industry. The material fabrication modes are identified as deconstruction (biopolymers, agro, and plastic), harvesting (wood, craft, dead pinyon-pine, and date palms) and aggregation (biopolymers, salts, and cement-shells). It is the processing and fabrication mode of material compositions that most closely informs the architectural designs and potential in these research-based design studies.

The impact of synthesizing these nine independent material studies together for evaluation of commonalities and differences through a methodical and rigorous comparison of the flows, compositions, and processes reveals that our material concepts in architecture design hold non-linear relationships to regional contexts. Similar material compositions in varying regional contexts cannot be assumed to materialize in architectural design in the same way due to other contextual forces at hand. In the same regard, particular concepts for material craft, technique, and application may be recognized as transportable to other places but not without translation into specific regional situations. Overall, these nine studies convey emerging and innovative responses to complex but perhaps synergistic challenges informing a necessity for situational approaches to our material choices and design process.