Application of non-destructive testing with non-contact laser technique to detect damage in Concrete

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It is strongly required to apply an efficient non-destructive testing (NDT) method to evaluate damage in aged and deteriorated infrastructures. In terms of NDT, such as impact echo and elastic wave propagation analysis, implemented with non-destructive damage evaluation for concrete structures, those NDTs are successfully and widely performed for identification of cracks and voids in concrete. Those NDTs need elastic wave excitation source by conventionally accessing and hammering the targeted concrete surface, where it is generally known that contact time of a mechanical impact due to a steel-ball drop depends on diameter of the ball and the frequency band generated by the steel-ball impact is derived by the contact time. In this study, the applicability of the laser-induced elastic waves is consequently discussed to enable remote inspection work which must be significantly improving the future labor cost and the inspection cost time as well. In order to introduce the elastic wave into concrete, laser impact system is employed for high-power and high-frequency laser pulses with YAG laser and fiber laser, which are irradiated at the concrete surface to generate vibrations that potentially can be acoustic emission with the excitation of elastic waves on the surface of targeted structure. Followed by investigating the influence of laser energy and irradiation condition, the waveform amplitude and frequency dependence detected from intact and damaged concrete are analyzed.