The success of recent experiments to transport data using combined wavelength division multiplexed (WDM) and mode-division multiplexed (MDM) transmission has generated optimism for the attainment of optical networks with unprecedented bandwidth capacity, exceeding the fundamental Shannon capacity limit attained by WDM alone. Optical mode converters and wavelength converters are devices that can be placed in future optical nodes (routers) to prevent or reduce the connection blocking rate and consequently increase network throughput. In this thesis, the specific problem of the placement of mode converters (MC) and mode-wavelength converters (MWC) in combined mode and wavelength division multiplexing (MWDM) networks is investigated. Four previously proposed wavelength converter placement heuristics are extended to handle the placement of MC and MWC in MWDM networks. A simple but effective method for the placement of mode and wavelength converters in MWDM networks is proposed based on ranking the nodes with respect to the volume of received connection requests. The results of extensive simulation tests to evaluate the new method and compare its performance with the performance of the other four heuristics are presented. The thesis provides extensive comparison results among the five converter placement methods using different network topologies and under different network loads. The results demonstrate the effectiveness of the new proposed method in achieving lower blocking rates compared to the other more-complex converter placement heuristics.