Sobolev Theory for Riemannian Manifolds

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When studying geometric stability questions it is common to obtain L^p estimates for a sequence of Riemannian manifolds as a first step. As a next step one often would like to bootstrap from L^p estimates to metric geometry notions of convergence such as Sormani-Wenger Intrinsic Flat (SWIF) and/or Gromov-Hausdorff (GH) convergence. This leads to the question, if one assumes L^p bounds on a Riemannian metric then what kind of regularity does that imply for the corresponding distance function? We will give several theorems which answer this question and explore many examples which provide intuition for all of the theorems discussed.