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## **Operational Planning and Design Issues for Retractable Membrane Roofs**

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### **ABSTRACT**

Operable or retractable membrane roof structures have unique operating limitations dependent upon the type of retractable system employed as well as the design of the system. This paper presents some of the operational constraints inherent to various retractable membrane roof systems and illustrates these with existing operating examples. Adoption of a specific retractable membrane roof system should be suited to the particulars of the application; however, service and use of retractable roofs has frequently been different than originally envisioned by the Owner and designers. This paper reviews the service history of several examples in relation to what was initially envisioned during design.

The operational implications of key design considerations are examined such as whether membrane tension is maintained during operation, how the membrane is stowed when retracted, as well as the membrane materials employed. Generally, these issues are scale dependent, e.g. what is operationally feasible for a retractable membrane roof of a cabriolet vehicle with spans on the order of 1 meter is generally not feasible at spans two orders of magnitude larger for say a sports stadium. This paper is limited to large scale applications in long span structures, the majority of which have been for public assembly and sports facilities. As with all retractable roofs, planning and design of retractable membrane systems requires integration of the supporting structure(s), the mechanisms, the controls, as well as seals and drainage to create a serviceable operable system. Consequently, this paper is not limited to the tension membrane components but examines overall integrated retractable roof systems.