

## Runoff Estimates of Rapidly Urbanizing Indian Cities: An Integrated Modeling Approach

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**Abstract :** Runoff contribution from urban areas is generally from manmade structures and few natural contributors. The manmade structures are buildings; roads and other paved areas whereas natural contributors are groundwater and overland flows etc. Runoff alleviation is done by manmade as well as natural storages. Manmade storages are storage tanks or other storage structures such as soakways or soak pits which are more common in western and European countries. Natural storages are catchment slope, infiltration, catchment length, channel rerouting, drainage density, depression storage etc. A literature survey on the manmade and natural storages/inflow has presented percentage contribution of each individually. Sanders et.al. in their research have reported that a vegetation canopy reduces runoff by 7% to 12%. Nassif et el in their research have reported that catchment slope has an impact of 16% on bare standard soil and 24% on grassed soil on rainfall runoff. Infiltration being a pervious/impervious ratio dependent parameter is catchment specific. But a literature survey has presented a range of 15% to 30% loss of rainfall runoff in various catchment study areas. Catchment length and channel rerouting too play a considerable role in reduction of rainfall runoff. Ground infiltration inflow adds to the runoff where the groundwater table is very shallow and soil saturates even in a lower intensity storm. An approximate percent contribution through this inflow and surface inflow contributes to about 2% of total runoff volume. Considering the various contributing factors in runoff it has been observed during a literature survey that integrated modelling approach needs to be considered. The traditional storm water network models are able to predict to a fair/acceptable degree of accuracy provided no interaction with receiving water (river, sea, canal etc), ground infiltration, treatment works etc. are assumed. When such interactions are significant then it becomes difficult to reproduce the actual flood extent using the traditional discrete modelling approach. As a result the correct flooding situation is very rarely addressed accurately. Since the development of spatially distributed hydrologic model the predictions have become more accurate at the cost of requiring more accurate spatial information. The integrated approach provides a greater understanding of performance of the entire catchment. It enables to identify the source of flow in the system, understand how it is conveyed and also its impact on the receiving body. It also confirms important pain points, hydraulic controls and the source of flooding which could not be easily understood with discrete modelling approach. This also enables the decision makers to identify solutions which can be spread throughout the catchment rather than being concentrated at single point where the problem exists. Thus it can be concluded from the literature survey that the representation of urban details can be a key differentiator to the successful understanding of flooding issue. The intent of this study is to accurately predict the runoff from impermeable areas from urban area in India. A representative area has been selected for which data was available and predictions have been made which are corroborated with the actual measured data.

**Keywords :** runoff, urbanization, impermeable response, flooding

**Conference Title :** ICSRD 2020 : International Conference on Scientific Research and Development

**Conference Location :** Chicago, United States

**Conference Dates :** December 12-13, 2020