

**DEVELOPMENT OF OTTV BASED APPROACH FOR THREE
TROPICAL CLIMATES AS AN ALTERNATIVE TO THE
PRESCRIPTIVE APPROACH IN BUILDING ENERGY CODES**

by

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CERTIFICATE

This is to certify that the thesis entitled “**Development of OTTV based approach for three tropical climates as an alternative to the prescriptive approach in building energy codes**”, being submitted by **Ms. Seema Devgan** to the Indian Institute of Technology Delhi, India, for the award of the degree of “**DOCTOR OF PHILOSOPHY** in Civil Engineering”, is a record of original bonafide research work carried out by her under our guidance and supervision. To the best of our knowledge, the thesis has reached the requisite standard. The material contained in this thesis has not been submitted, in part or full to any other University or Institute for the award of any degree or diploma.



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ABSTRACT

This thesis attempts to formulate OTTV coefficients for *Composite, Hot- Dry and Warm- Humid climates*, the three main tropical climates in India. Case studies of four existing air-conditioned office buildings- two mid-rise and two high- rise were modeled using eQuest v.3.6, which is a DOE2.2, based simulation engine. Based on the building envelope, loads, operation and HVAC system characteristics of these representative buildings, a hypothetical high rise office building of octagonal plan and 16 storey was created for parametric studies. 98 types of opaque exterior wall constructions and 93 types of glass constructions were varied sequentially in parametric runs to obtain results for hourly wall conduction, glass conduction and glass radiation heat flow in eight orientations for each of the climate type. The selection of the time period of the year for summing the hourly ‘gains’ was crucial and dependent on the characteristic of the climate type. Regression analysis was used to obtain coefficients TD_{eq} , DT and SF for the three climates. A new OTTV equation is obtained as both the wall conduction heat flow intensity and glass conduction heat flow intensity are found to have non- linear second order polynomial correlation with wall solar transmittance ($U_w * \alpha$) and glass transmittance (U_f) respectively.

The set of coefficients obtained were validated by calculating the OTTV for the four case study buildings, again by varying exterior wall and glass constructions in parametric runs. The computed OTTV for the four case study buildings had linear correlation with the annual space cooling plus heating energy use in all three climates. Thus the obtained coefficients can be used for calculating the OTTV value for similar operation air-conditioned office buildings situated in places with similar tropical climates.

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