

This topic is “practice ready.” Yes No

Iowa Pavement Analysis Technique (IPAT)

Stephen W. De Vries, P.E.¹ and Danny R. Waid, P.E.²

Abstract

Iowa secondary road departments maintain nearly 18,000 centerline miles of paved roadway. The pavement assets of this network were constructed at different times and deteriorate at different rates due to variations in subgrade, structure, weathering, decomposition and traffic. This non-uniformity makes it a challenge to establish a pavement preservation and rehabilitation program that will, over time, keep the overall system in acceptable condition within the limits of available funding.

All road agencies employ some means of tracking conditions, assessing needs, selecting treatments and scheduling projects. This can be as simple as maintaining a spreadsheet list of key pavement sections based on visual observations of surface conditions, to sophisticated simulation engines with complex decision trees using highly detailed, automatically collected condition data. These tools seek to answer the following questions: What is the road condition today? When will the road condition decline to an action level? What will rehabilitation then cost? Could something less costly be done sooner? What are the consequences of delay? How will the rehabilitated pavement perform?

The Iowa County Engineers Association Service Bureau has synthesized a Pavement Analysis Technique, (IPAT) to help answer those key questions, either on a standalone basis or in coordination with other pavement management tools. IPAT uses a mathematically defined pavement deterioration curve, based on a logistics equation, to perform computational analysis of pavement situations. It

¹ Steve De Vries, P.E., Executive Director, Iowa County Engineers Association Service Bureau, West Des Moines, IA, 50266, Ph: 515-244-0779, Fax: 515-244-6397 steve@iceasb.org

² Danny R. Waid, P.E., Secondary Roads Research Engineer, Iowa County Engineers Association Service Bureau, c/o Iowa DOT, Bldg 5, 800 Lincoln way, Ames, Iowa 50010, Ph:515-835-7960, Fax 515-239-1120, danny.waid@iceasb.org

allows an engineer to account for the interrelationships between pavement/subgrade structural capacity, weathering/materials decomposition, traffic, and condition levels over time. Because of its interactive nature, the IPAT model can be tuned, on the basis of successive observations, to fit actual field performance. The tuned model, in turn, can be used predict the timing and magnitude of future needs, evaluate repair options, explore feasibility of pavement preservation, and predict performance of pavements after treatment. It additionally enables analysis of change in circumstance situations, such as, “How will a pavement’s lifecycle be changed if a major new traffic source opens or if the road is used as a detour route for a year?”

Along with the deterioration curve, IPAT also includes a concept for evaluating current or future pavement structure capacity based upon the composition of layers within it. This method estimates lifetime structural capacity as the sum of contributions from each individual layer, taking into account the material type, prior years of service, thickness, and depth in the slab. The resulting structural index value can be used to predict ESAL capacity over a design lifetime.

Field evaluation has demonstrated that IPAT can model all types of pavements, conditions and point-in-lifecycle situations. The field work also revealed that IPAT’s technology will best be delivered in the form of an app usable on a portable device for onsite use, linked with a desktop workstation version for use when comparing pavements and selecting program options. This approach would make it possible for the tool to accept and use data from many sources: field condition assessment, automated distress data, vehicle ‘ride quality’ assessments, etc.

Keywords: Pavement—Distress—Lifecycle—Traffic—Weathering