Transportation Research Part D 50 (2017) 316–326

Contents lists available at ScienceDirect

Transportation Research Part D

journal homepage: www.elsevier.com/locate/trd

Mitigating environmental impacts in advance: Evidence of cost and time savings for transportation projects

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ARTICLE INFO

Article history:

Keywords:
Environmental impact
Environmental delay
Environmental mitigation
Compensatory mitigation
Advance mitigation
Conservation
Transportation
Project development

ABSTRACT

The traditional model for mitigating a transportation project's environmental impacts typically operates project-by-project and delivers the mitigation just-in-time. In contrast, the newer practice of advance mitigation comprehensively assesses and mitigates impacts from one or multiple transportation projects before or during project planning, sometimes long before project construction begins. The practice has gained adherents for its potential to improve ecological outcomes, by better aligning mitigation and conservation goals. Advance mitigation also stands to reduce mitigation costs, an important secondary benefit for transportation agencies with constrained resources. Evidence of cost savings, however, has been piecemeal and anecdotal. This paper advances knowledge of advance mitigation's financial impacts in two ways. First, it critically assesses the evidence about cost savings realized through advance mitigation, both through avoided up-front costs and reduced project delay. Second, it directly estimates the project time savings that might accrue with advance mitigation of state highway projects in California. Overall, the balance of evidence is encouraging for transportation agencies that would introduce the practice, and general agreement exists on its financial benefits. Considering project delays related only to the environmental process, we estimate advance mitigation could reduce delivery times by 1.3–5.0 months per project. Still, we also identify factors limiting comprehensive analysis. Transportation agencies adopting advance mitigation practices into their operations could use a pilot approach that includes rigorous environmental and mitigation cost accounting; such pilots would build needed empirical evidence of advance mitigation's financial and ecological outcomes.

1. Introduction

Maintenance and construction of new roads is widely known to impact ecosystems, habitats, and species (Forman et al., 2003; Trombulak and Frissell, 2000). Many transportation agencies have the responsibility under federal and state environmental laws to offset these impacts with the conservation and restoration of natural resources. Environmental mitigation is

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http://dx.doi.org/10.1016/j.trd.2016.10.017
1361-9209/

the practice of offsetting project impacts through a sequential process of avoiding, minimizing, rectifying, reducing or finally compensating for impacts (Federal Highway Administration [FHWA], 2016). It is the framework under which such impacts are typically addressed in US transportation projects.

Traditionally, transportation agencies have assessed, planned, and implemented environmental mitigation on a project-by-project basis and relatively late in the project development cycle. This approach has frequently resulted in undertaking mitigation activities or land acquisitions that are disconnected from larger land and habitat preservation objectives; for instance, so called "postage stamp" mitigation may add little to habitat connectivity.

In contrast, advance mitigation uses a geospatial approach to estimate and potentially address impacts from one or more transportation projects, before or during project planning (Thorne et al., 2006). The practice has received attention for its potential to improve mitigation's ecological outcomes and is an emerging practice for transportation agencies from federal to regional levels in the United States (Brown, 2006; Greer and Som, 2010; Marcucci and Jordan, 2013). Applied regionally or programmatically across multiple projects, and at the landscape-level, advance mitigation can align transportation agencies' mitigation actions with statewide, regional or landscape-level conservation goals and priorities; consequently, it can result in more holistic consideration of species preservation and biodiversity needs, conservation priorities, and ecosystem function (Brown, 2006).

Advance mitigation can also deliver important secondary benefits by lowering transportation agencies' costs in project delivery in various ways. For one, advance mitigation can consolidate projects' environmental reviews and the time they require. Regulatory agencies must review and approve a project sponsor's assessment of anticipated impacts and its mitigation plans, and advance mitigation can enable regulators to examine those plans across multiple projects instead of project-by-project (Thorne et al., 2014). Next, in cases where compensatory mitigation is necessary, advance mitigation can position agencies to purchase mitigation parcels that are larger and that offset impacts for multiple transportation projects. Conventionally, compensatory mitigation purchases offset impacts of only a single project and are thus likely to be smaller. In advance compensatory mitigation, the larger parcels required could yield a lower price per acre (Thorne et al., 2009). Advance mitigation can further reduce mitigation acquisition costs by necessitating fewer land purchase transactions, realizing economies of scale in associated costs, and by allowing agencies to avoid land price inflation and project delays when suitable mitigation takes time to identify and acquire.

Evidence that advance mitigation provides costs savings has been piecemeal and anecdotal, and yet the potential to realize such savings and mitigate projects more economically deserves serious attention. The costs of compliance with federal and state compensatory mitigation provisions are significant and can absorb significant financial resources. One survey of selected state transportation departments suggests per project mitigation costs (excluding right-of-way or land acquisition) range between 2 and 12% and average 7.5% of total project cost (Macek, 2006).

Given the scale of mitigation expenditures, practices that offer even small project-level savings can provide orders of magnitude larger savings when carried across whole programs of investment. Consider the implications in California, as the state aims to invest $53.4 billion in transportation and high speed rail from 2014 to 2019 (California Department of Finance, 2014); roughly $4 billion (7.5%) would be needed for mitigation. Expressed as a range, costs could run between $1.07 billion (2%) and $6.4 billion (12%).

Finding the financial means to plan and implement advance mitigation is challenging. Better evidence of the approach's beneficial financial impacts could pursuade more decisionmakers to support it. For instance, such advance initiatives as regional habitat conservation plans typically must be pieced together from different sources (Lederman et al., 2015). This has lead to proposals for consolidated funding via "conservation clearinghouses" and for enhanced public lending programs (Lederman and Wachs, 2016). Compelling evidence that advance mitigation yields cost savings could give state transportation departments and their federal, state, and local partners the financial motivation to adopt this new approach and to improve mitigation outcomes along the way.

Here we use reviews of transportation programs in various states, focusing in particular on California, to assess the evidence that advance mitigation provides important cost savings. This paper's contribution to the literature is two-fold. First, it comprehensively and critically reviews the available evidence surrounding the costs of advance mitigation versus project-by-project mitigation. In doing so, it identifies a conceptual framework for considering the different dimensions or categories of cost savings that advance mitigation might produce. Second, it provides a state-level assessment for California of the potential savings that could accrue from advance mitigation, specifically where the practice reduces mitigation-related project delays for the state transportation agency. We focus on California because the state is piloting an advance mitigation program to address impacts associated with state highway maintenance (California Transportation Commission, 2015) and made valuable project data available for this study. Our assessment provides a state-level model of some of the potential financial advantages for advance mitigation.

After analyzing the existing evidence and developing our own California scenarios, we are optimistic that advance mitigation could provide financial savings to transportation agencies. Yet we also note reasons for caution when estimating its ability to do so. We recommend that interested agencies introduce advance mitigation through a pilot initiative designed carefully to measure the initiative's impact on agency operations.