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Is the provision of park-and-ride facilities at light rail stations an effective approach to reducing vehicle kilometers traveled in a US context?

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ABSTRACT

Park-and-Ride (PNR) facilities are a commonly used means of making a transit system more widely available. However, given that a PNR passenger must drive for part of the trip, this approach to transit provision has an ambiguous influence on vehicle kilometers traveled (VKT). The impact of PNR on VKT is highly dependent of how PNR users would choose to travel if the PNR facilities were not available. Given that this issue has received little attention in a US context, we use the light rail system in Charlotte, North Carolina as a case study to examine the potential impact of PNR removal on VKT. Using a travel survey of PNR passengers, we estimate the VKT currently generated while driving to and from the rail stations and then estimate how VKT would change under various PNR removal scenarios that assume different behavioral responses. We find that, under the most realistic scenarios, PNR removal would lead the average PNR passenger to increase her driving by 8–15 VKT per round trip.

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1. Introduction

In an effort to broaden the customer base for public transportation, transit operators frequently provide parking (often free to transit patrons) at their stations (Pratt and Turnbull, 2004). These Park-and-Ride (PNR) facilities are most frequently associated with rail systems but can also be found near express bus services. This approach to transit provision serves as an adaptation to decentralized regions where relatively few people live close to a transit stop/station. The ability to drive to the transit access point mitigates the lack of proximity. It is intuitive that PNR facilities would significantly increase transit ridership, particularly in auto-oriented US metropolitan areas, and this has generally been demonstrated to be true (as subsequently cited in the literature review). Less apparent is how the provision of PNR influences vehicle kilometers traveled (VKT). This research represents an effort to evaluate PNR-based transit systems in terms of sustainability goals (i.e., VKT reduction) that are frequently associated with the public provision of transit systems. In particular, it speaks to station area planning in terms of whether PNR facilities should be provided at new stations and even whether the removal of existing PNR facilities should be considered.²

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² In making the suggestion that removal of existing PNR facilities should be a consideration, we must acknowledge that there would likely be significant political barriers to such action.

Increased transit use intuitively equates to fewer VKT. However, the driving component of a PNR trip complicates this assessment. In order to determine whether a PNR trip reduces VKT, the VKT generated by driving to and from a station must be compared to the VKT that would be generated if the PNR option was not available. A PNR trip will, in fact, reduce VKT for those that would otherwise drive for the entirety of the trip or for those that would otherwise make a kiss-and-ride³ (KNR) trip. On the other hand, a PNR trip will increase VKT for those that would otherwise use public transit and/or non-motorized means for the entirety of their trip or for those that would forgo the trip altogether. The net aggregate impact on VKT will depend on percentage of PNR users that would respond to PNR removal in the various ways described above.

This research seeks to examine the relationship between PNR and VKT in a US context. More specifically we employ a scenario testing approach to examine the change in VKT that could occur if the PNR facilities were removed from the light rail transit (LRT) system in Charlotte, NC. Under what we consider the most realistic scenarios, we find that average PNR passenger does reduce her VKT relative to how she would travel if the PNR option was not available.

2. Study relevance

Modern auto-oriented regions (particularly those in the US) have a limited demand for mass transit. As such, most transit service only exists because it is publically provided or subsidized. Using public funds to financially support transit provision has a few primary justifications (Black, 1995):

- (1) Transit provides mobility to disadvantaged populations. This includes those that cannot drive because of physical disabilities and those that cannot afford the costs associated with owning and operating a private vehicle (Altshuler, 1969; Giuliano, 2005).
- (2) Driving has public costs such as emissions, dependence on foreign petroleum, and congestion. Transit investment provides an alternative to auto travel that can reduce VKT and the associated negative impacts (Shapiro et al., 2002).
- (3) Rail transit investment might be further justified because of its potential to generate or at least facilitate compact and walkable development around stations (i.e., TOD), which ostensibly provides a smaller ecological footprint, more opportunities for active (i.e., non-motorized) travel, and lower public infrastructure costs than auto-oriented sprawl (Cervero et al., 2004; Litman, 2007).

PNR-based transit does little to help disadvantaged populations because it requires the transit user to have the ability to drive and to have access to a private vehicle. In fact, the users of PNR facilities often have much higher incomes than other transit patrons (Foote, 2000; Shirgaokar and Deakin, 2005). In terms of facilitating TOD, the presence of a PNR facility may actually act as a deterrent by taking up land adjacent to a station and making the neighborhood less attractive and less amenable to pedestrian activity (Duncan and Christensen, 2013).

This leaves the reduction of VKT as the primary justification for PNR-based public transit. Surveys of government agencies in Europe have demonstrated that the rationale for PNR provision frequently hinges on its ability to decrease car use (Dijk and Montalvo, 2011; Meek et al., 2010). However, as previously described, one cannot take for granted that the use of PNR facilities translates to less driving. If PNR passengers do not produce a net reduction in VKT, one can argue that there is little justification for the public funding of PNR facilities.⁴ This holds true even if a PNR lot is heavily utilized and generates high number of transit users. High usage rates would signal that PNR transit provides a relatively attractive travel option (at least when much of the cost is subsidized) but, without an accompanying VKT reduction, the benefits from public PNR facilities would only accrue to the limited segment of the population that uses the facility. Given that PNR patrons are vehicle owners that generally have high incomes, using scarce public resource to subsidize PNR facilities seems a questionable practice *unless* doing so also creates the positive externalities associated with VKT reduction. We hope that this research can provide a framework for understanding the relationship between PNR and VKT and shed some empirical light on this relationship.

3. Park-and-ride literature

The exiting body of literature about PNR transit is somewhat sparse. At the simplest level, authors have described the need that PNR fills and enumerated its increasing presence (Dickins, 1991; Noel, 1988; Pratt and Turnbull, 2004). Other work has examined the optimal location for PNR facilities from the perspective of ridership or service area coverage (Farhan and Murray, 2008, 2005; Horner and Groves, 2007; Wang et al., 2004). Several studies model the aggregate usage of rail transit and generally find that the presence of PNR facilities correlates with increased ridership (Duncan, 2010; Guerra and Cervero, 2011; Kuby et al., 2004; Lane et al., 2006; Quade et al., 1996).

³ Being driven to a station and dropped off has long been referred to as “kiss-and-ride” in the transit industry (Vuchic and Kikuchi, 1974). This kind of transit trip can generate more VKT than a PNR trip because the driver may go to and from the station twice – once to drop the transit user off and then again later to pick her up.

⁴ One could make the argument that, even if PNR does not reduce VKT, it may transfer this VKT to areas with more available road and parking capacity. However, it is also possible that PNR creates just as much congestion and parking scarcity in the neighborhoods surrounding the PNR facilities as it relieves elsewhere in a region. We are not aware of any empirical work that directly addresses this issue.

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