

Traffic Flow Improvements: Taking Induced Travel Into Account

Roger Gorham, US EPA

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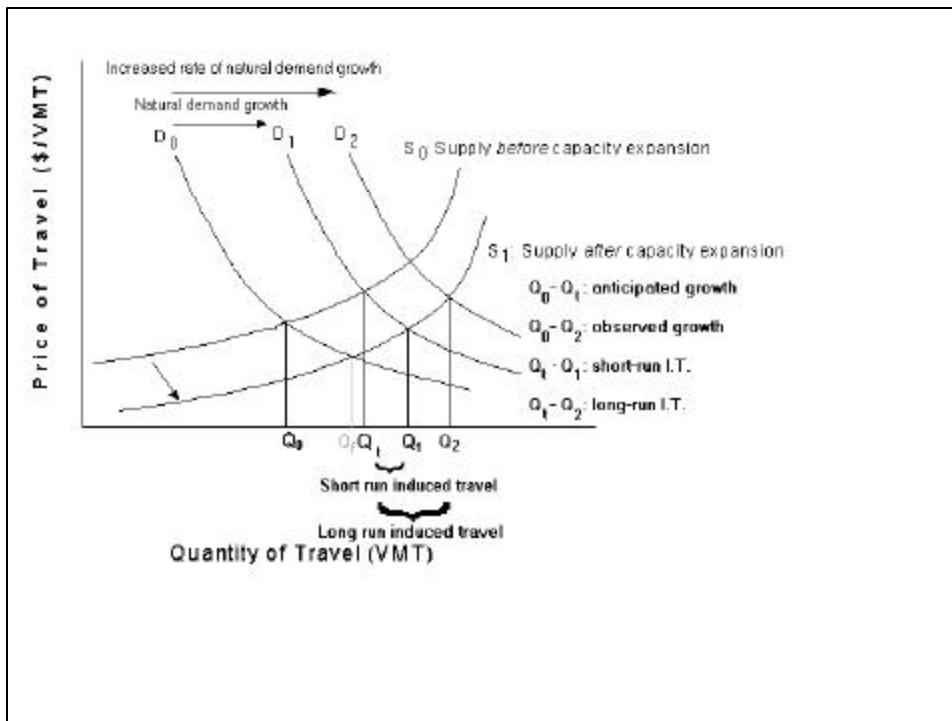
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Program

- † What is induced travel and how is it measured?
- † Air quality implications of induced travel
- † Role of induced travel in economic valuation of projects
- † Is induced travel a net benefit or net burden?
- † Conclusions: lessons for air quality analysis

What is Induced Travel?

- † Additional travel (VKT) that occurs as a result of an improvement in travel conditions, such as an increase in system capacity
- † Additional VKT from induced travel occurs over and above that resulting from
 - † Population growth
 - † Income growth
 - † Lifecycle and other factors



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Induced travel can occur because of ...

- † Short run effects
 - † changes in number of trips (net VKT increase)
 - † changes in destinations (net additional VKT)
 - † changes in route (may be net VKT increase)
 - † changes in travel mode
 - † changes in departure times (no VKT increase)
- † Long run effects:
 - † changes in household vehicle ownership
 - † changes in residential location
 - † employee changes in work location
 - † employer changes in business location
 - † changes in land development location and patterns
 - † general equilibrium effects

DOT Report on Contributions to VKT Growth

- † Factors Contributing to the Growth in Driving:

† Increase in Trips Taken	18%
† Increase in Trip Lengths	35%
† Decrease in Vehicle Occupancy	17%
† Switch to Driving	17%
† Increase in Population	13%
- † Source: Travel Behavior Issues in the 90's, USDOT

Measurement of Induced Travel

- † Lane-km elasticity
 - † Easily measurable
 - † Not theoretically rigorous
 - † -.2 to -.5 short run in literature
 - † -.5 to -1 long run in literature
- † Travel time elasticity
 - † Theoretically rigorous
 - † Not easily measurable
 - † -.3 to -.5 short run in literature
 - † -.5 to -1 long run in literature

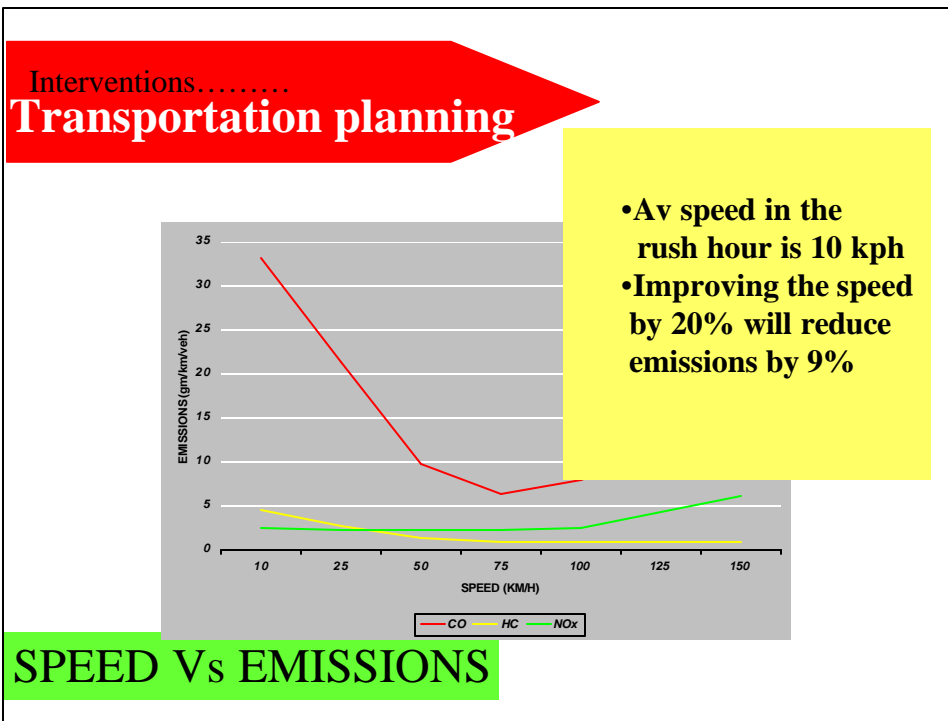
Measurement of Induced Travel

- † General Travel Cost elasticity
 - † Theoretically most rigorous
 - † Difficult to measure
 - † -1.0 short-run (DOT)
 - † -1.6 long-run (DOT)
- † Proportion of overall VKT increase
 - † Easily comprehended by policy makers and general public
 - † Descriptive, not predictive
 - † 15 to 45% in US cities (EPA study)


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Interventions.....
Transportation planning

SO2				HC					
Mode	Delay (Veh-hr/hr)	Delay (Veh-hr/day)	SO2 gms/day	SO2 gms/year	Mode	Veh-hr/hr	Veh-hr/day	HC gms/day	HC gms/year
Cars	7.0699	42.4194	67.45	24618.10	Cars	7.0699	42.4194	712.65	260115.76
TWs	6.3257	37.9542	26.19	9588.77	TWs	6.3257	37.9542	2732.70	997436.38
3ws	20.0934	120.5604	104.89	38283.96	3ws	20.0934	120.5604	8880.35	3168327.31
Buses	1.4884	8.9304	99.13	36181.52	Buses	1.4884	8.9304	176.82	64540.00
		Total	297.65	108642.33	Nox		Total	12302.52	4490419.45

🚗 A typical Fly-Over can reduce the emissions by .04t/day

NOx		
Mode	Veh-hr/hr	Veh-hr/day
Cars	7.0699	42.4194
TWs	6.3257	37.9542
3ws	20.0934	120.5604
Buses	1.4884	8.9304
	Nox	Total

🚗 An optimally designed intersection can reduce the emissions by .02t/day

🚗 There are at least 90 such intersections in our city

tones/day	0.004269178	tones/day	0.03
tones/year	1.558249868	tones/year	9.325052237

Total Emissions (tones/day) 0.04
 Total Emissions (tones/year) 15.48

POLLUTION REDUCTION DUE TO FLY OVER @ ONE LOCATION

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Induced Travel in Economic Analysis of Transport Projects

- † Not accounting for induced demand may artificially inflate expected Internal Rate of Return of evaluated project
- † Could lead to skewed investment priorities and strategies

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Is Induced Travel a Benefit or Burden?

- † Additional travel induced by capacity expansion may lead to
 - † net *gain* in social welfare
 - † net *loss* of social welfare
- † Benefit or burden depends on sum of individual marginal benefits of new travel relative to social costs imposed

Benefit or Burden? Illustrative Example

† Corner store	† Supermarket
† \$1.00 for milk	† 80¢ for milk
† 5¢ travel cost (walk)	† 20¢ travel cost (car)
† 1¢ external cost	† 10¢ external cost
✎ Marginal benefit to individual of enhancement: 5¢	
✎ Marginal cost to society of enhancement : 9¢	
✎ Net social cost of induced travel: 4¢	

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Induced Travel: Benefit or Burden?

- † Even where net social benefit from induced travel, opportunity cost of investment
- † Travel is a *derived demand*
 - † Travel *per se* does not create economic value
 - † Human interaction & exchange from enhanced access creates economic value
- † Opportunity cost of enhancing access by inducing travel vs. other methods

Conclusions: Lessons from Induced Travel

- † Induced travel is a real phenomenon that needs to be taken into account
- † Limits to economic effectiveness of physical & traffic management measures – all flow improvement measures not created equal

Conclusions: Lessons from Induced Travel

- † Travel induced by capacity expansions may be a benefit or a burden – no formulaic answers
- † Pricing for flow improvements much more efficient & effective than physical improvements

CODA

EPA-supported Work on Induced Travel in Asia

Integrated Environmental Strategies – India Project

- † Examining proposed traffic flow improvements for the city of Hyderabad, India
- † Looking at the effects of induced travel on previous estimates of air quality improvement from traffic flow changes
- † Also looking at the implications of bus pricing and service provision on air quality

Wuhan: Analytic Assistance to World Bank

- † Determining critical induced demand elasticity levels for urban transport project
- † Conducting assessment of induced travel sensitivities for viability of different interventions