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1. Introduction

The Freight Rail Futures study for the City of Chicago[1] aimed to estimate the economic impacts of the rail freight industry on Chicago[2]. It provided a framework that could help city and state officials assess the ways that changes in a region's freight transportation system would affect employment, Gross Regional Product (GRP), and other economic indicators in the future. The core of the study was a multi-sector, regional economic analysis that showed how economic activity in the city, the inner suburbs, and the region would be affected by various possible scenarios concerning rail activity.

Transportation-sensitive regional economic analysis is becoming an increasingly important part of the statewide freight planning toolkit – and an increasingly critical item for informed policy decisions. This case study is devoted to illustrating the state-of-art

[1] The full report on this project, entitled *Freight Rail Futures for the City of Chicago*, may be obtained by interested parties from Reebie Associates' website at http://web.reebie.com/. There are many details present in the report, which are not presented in this summary, particularly with respect to the scenarios chosen. The report dealt with many of these nuances, but obviously was specific to Chicago and does not represent a general framework.

[2] Reebie Associates, in conjunction with Economic Development Research Group, Inc. conducted the study for the City of Chicago Department of Transportation. Inputs on traffic patterns were provided by the Reebie Transearch database, while Chicago area real estate consultant Margaret Collins provided land value appraisal and site-specific inputs.

methodologies for creating transportation scenarios and using them to make economic forecasts.

1.1 Project & Study Background

For well over a century, the railroad industry has been an inescapable part of Chicago's landscape. For many of the 150 years since the "Iron Horse" first came to Chicago, the railroad industry and the city shared a collective destiny: the triumph of one became the success of the other. However, as the rail industry struggled through the latter half of the 20th century, the once-common pathways began to diverge. The rail industry struggled for survival, consolidating from twenty major carriers to six, and fused the region's 19th century aggregation of railroad lines and terminals into a more compact and denser network. The city was likewise locked in its own battle, digging out from the collapse of the manufacturing-based economy that had been its foundation for many years. Regional growth spread westward away from the city, creating a massive suburban sprawl of residential and light industrial development. Highways became Chicago's arteries. Just as it had served for a century as the crossroads of the Nation's rail commerce, so Chicago emerged as the midwestern "hub" of the interstate network. The divergence of pathways was now complete. Nevertheless, at the dawn of the 21st century, the city retains its position as the center of North American railroading more strongly than ever, and railroads – and the shippers that rely on them – remain a significant physical and economic presence.

Certainly, there were problems with the freight transportation system in Chicago at the time of the study. The rail network was complex, prone to congestion, and forced to serve burgeoning freight traffic that it was not designed to handle. Chicago was a major hub for intermodal traffic, yet the structure of the network demanded "rubber tire interchange" for many trailers and containers. The challenge was compounded by the steadily growing demand for rail capacity by regional and intercity rail passenger services. In many cases, these services utilized the same main line infrastructure that was most heavily used by the region's freight trains.

While Chicago continued it pre-eminent role in rail freight commerce, the goal of the study was to examine in detail the future of that role. The existing infrastructure, which resulted from accident of history, may or may not be optimal for the freight industry's future, or for the region and its environment for its businesses and residents. The City of Chicago faced a decision in its future – should it encourage freight activity, or distance itself from it? The study concentrated on the way that the rail system affected local jobs and local industrial activity. The base case was driven by standard economic forecasts and continued trends for regional freight activity. Interviews and surveys of carriers, shippers, and public officials provided insights into both the trends that might affect the freight system and the response of railroads and their customers to these changes. The results showed how changes in the location of rail terminals would eventually lead to changes in the distribution of transportation and industrial employment throughout the region.

The regional rail system could potentially evolve without any dramatic changes to operations within the city; it could also evolve so as to require far more or far less rail activity within the city. To some extent, the City could influence how the system evolves, and this study examines how different evolutionary paths are likely to affect both the city and the region. The study also aimed to understand the linkages and interactions among the rail system, the distribution of economic activity, and patterns of regional development. By understanding those linkages, Chicago could make informed policy decisions with respect to its position towards the freight industry.

1.2 Methodologies Demonstrated

The key lesson in this case study for transportation planners and analysts conducting statewide freight analysis is that economic development and the freight transportation system are inseparably linked through the complex system of industrial development, population changes, and employment[3]. Transportation operations and investments generate jobs, consume land, affect both demand and supply markets in many commodities, which in turn affect the regional economic potential. When making large-scale transportation improvements (or indeed disinvestments), zoning decisions, or policies to encourage the development of certain industrial sectors (e.g. warehousing, transloading, manufacturing, intermediate processing), the collateral impacts must be studied carefully to understand implication of investments on the local economy.

The background of this study was mainly a comparison of development potential of the City of Chicago core, versus suburban Cook County and the rest of the six-county exurban area – and how development in freight rail service and infrastructure might affect the relative competitiveness of each of the areas. However, the methodology could be widely applied to statewide freight analyses. The construction or upgrading of an intercity corridor could have an impact on the competitiveness of one state versus another, or the region abutting the new highway versus the rest of the state. Application of this methodology would allow the impacts to be understood before the investment is made.

Economic impacts cross metropolitan and state boundaries, and the individual pieces – like operations of the transportation sector within a specific locality – are interdependent parts of a larger statewide and national economic system. Economic development changes driven by land-use and transport infrastructure changes in a locality can be created by investments and actions in other regions and other states, and conversely investments made locally will produce statewide and nationwide benefits[4].

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[3] For example, see W.L.Garrison & Elizabeth Deakin, Chapter 19 – Land Use, in Gray & Hoel's *Public Transportation, 2nd Ed.* (1992). The principle and results are clearly discussed in J. Gomez-Ibanez's *Puget Sound Case Study* (1997), Harvard Kennedy School of Government. See also Cervero, Robert. (1989). *America's Suburban Centers: The Land Use-Transportation Link.*

[4] See for instance Kaliski, JG; Smith, SC; Weisbrod, GE, *Major Corridor Investment-Benefit Analysis*

Understanding the relationship between transportation investment scenarios and economic development potential is of paramount importance to statewide freight planning.

2. Methodology: Using an Input-Output Regional Economic Model to Inform Transportation & Investment Policies

An input-output model is a way of characterizing trade relationships in an economy. It can be used to determine the impact of investment and infrastructure changes on the region: if a policy change or investment affects demand and supply in a certain commodity, to what extent would other markets be affected?

Typically modelling the impact of transportation or investment policy with a regional economic model involves three steps: (1) create a number of alternative scenarios in transportation or investment policy; (2) translating the proposed transportation or investment policy into changes in demand-supply, or cost, in all relevant markets; (3) using the supply-demand changes, combined with an economic forecast, to predict differentially the economic impact on the various industrial sectors and the regional economy as a whole[5]. Figure 1 is a simplified diagram representing the main steps in a transportation-economic analysis.

System, for a discussion on how local corridor investment in Indiana has resulted in economic benefits to the Indianapolis-South Bend area.

[5] For a development of the passenger version of this transportation and land-use model, see E. Cascetta & F. Pagliara, *Modelling Long Term Impacts on Travel Demand*, presented at European Transport Forum, September 9-11, 2001. Other transportation demand methodologies are treated in the publication *Handbook of Transport Modelling*, edited by D. Hensher and K. Button (2000), in particular Chapters 25, 32-34 deal with more complex models that are in principle similar to the methodology presented here.

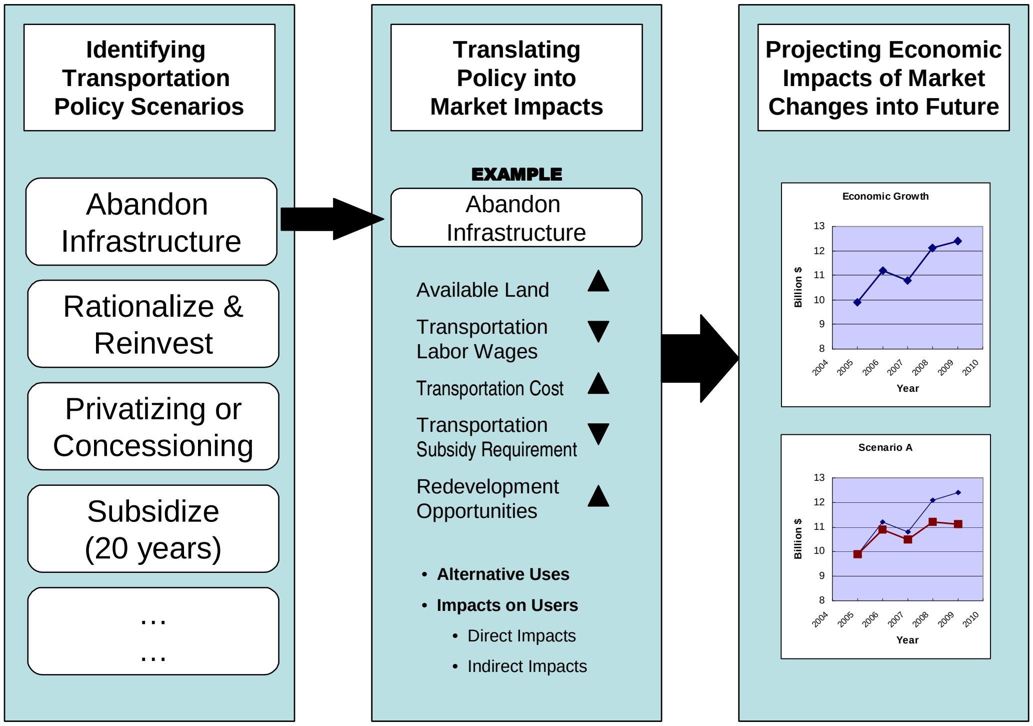

Figure 1: The three main constituent parts of a transportation-economic model

The first step requires a fairly detailed analysis and understanding of the regional transportation strategy. In terms of highways, it is often possible to gather some information from the state highway plan. Other important information to consider include the systems maintenance strategy, designated major routes, and related development and zoning plans. Corridor plans available in some areas may also be helpful. In some states or municipalities, the detailed plan may not exist; in those cases, stakeholder outreach and some degree of long-range planning would be required from the analysts before the economic model can be used to predict its effects. This is essentially a qualitiative policy analysis task, and would require analysts with good local knowledge but also creativity to imagine a number of different visions for uses of existing infrastructure and future funds. At a minimum, the scenarios should acknowledge major developments that are already being planned.

The second step is the work of translating the qualitative visions into quantitative market impacts. This is a difficult and sometimes subjective step, requiring different analytical techniques depending on the local circumstances and the scenarios chosen. For example, if certain infrastructure will be abandoned and redeveloped in a particular scenario, care is required in assessing the direct and indirect (carriers and shippers/abutters) impacts of such abandonment, and making reasonable assumptions with respect to potential and timing for redevelopment. Professionals with transportation operations and/or real estate project evaluation experience would be needed for this task. Generally, data sources would include extensive freight flow market data, survey data, stakeholder outreach (focus group data), historical commodity, labor, and real estate price data.

The third step is primarily concerned with running the regional economic model, using a driving economic forecast such as those provided by the Bureau of Economic Analysis, national input-output account tables, and perhaps commercially or freely available software such as Regional Economic Model Inc.'s REMI model, or Yale University's Fairmodel. More details on how to construct and/or calibrate such models can be found in the documentation that comes with such software, or standard regional economic forecasting textbooks[6]. The focus of this case study will be on the transportation aspects of this methodology, namely steps 1 and 2.

2.1 Creating Scenarios

Economic analysis is essentially a comparative exercise. Thus, all scenarios must be compared to a 'base case', which is often referred to as the 'do nothing' scenario. Once this base case is defined, all scenarios can then be defined relative to it. The base case should be defined in sufficient detail as to capture the distinguishing features of policy options – but only just enough detail, to minimize the risk of creating analytical artifacts. A detailed how-to, based on the Chicago Freight Rail Futures example, will be presented in the following sections.

A good starting point for a base case scenario is a regional growth plan, which is often produced by metropolitan planning organizations. On a statewide level, the state highway strategy, state rail plan, and regional economic development plans can be useful sources. These should be supplemented by planners' knowledge of the local area and impending development activities. In certain areas, where substantial public infrastructure is held by private consortiums or pseudo-private authorities (such as a port authority), the strategic plan for the relevant bodies should be consulted. If such plans do not exist or do not cover sufficient detail, the relevant bodies should be contacted and inputs solicited.

If these basic sources are inadequate, other sources should be considered and may provide additional insight. In the absence of a plausible regional growth plan, it may possible to purchase a private economic forecast, or develop one through a partnership with a local university or a federal research institute. The econometric forecast will capture the most likely scenario of development – and in many cases will be more accurate than focus group data for long-range projections.

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[6] For example, see Avrom Bendavid-Val. 1991. *Regional and Local Economic Analysis for Practitioners*. New York, NY: Praeger Publishers; Ronald E. Miller. 1998. "Regional and Interregional Input-Output Analysis." In *Methods of Interregional and Regional Analysis*, by Walter Isard, Iwan J. Azis, Matthew P. Drennan, Ronald E. Miller, Sidney Salzman, Erik Thorbecke. Aldershot, England: Ashgate, pp. 41-124. MIT's OpenCourseWare also hosts a course on this subject: Regional Socioeconomic Impact Analyses and Modeling at http://ocw.mit.edu/OcwWeb/Urban-Studies-and-Planning/11-482JFall2003/CourseHome/

2.1.1 How to define good scenarios

In this type of studies, the desire when designing scenarios is to examine the effects of specific trends and directions if taken to their logical conclusion. For instance, in the Chicago study, railroads were adding intermodal capacity in the periphery of the urban area where land was cheap and plentiful, and retiring capacity in the downtown where congestion was adversely affecting drayage efficiency. In the future, Chicago's railroads might have moved all of its intermodal capacity out of the urban core. The "intermodal-to-rim" scenario (see 2.1.3) addressed this trend.

Figure 2 demonstrates the thinking behind this type of scenario analysis. The base case is a representation of the present conditions, and exists somewhere within the solution space. Trend A is moving the present condition towards one edge in the two dimensional plane, and scenario "+A" represents the position when trend A is taken to extremities. Scenario "-A" is the antithesis of A. On another dimension, scenario "B" represents the result of a different trend when allowed to proceed on its own course.

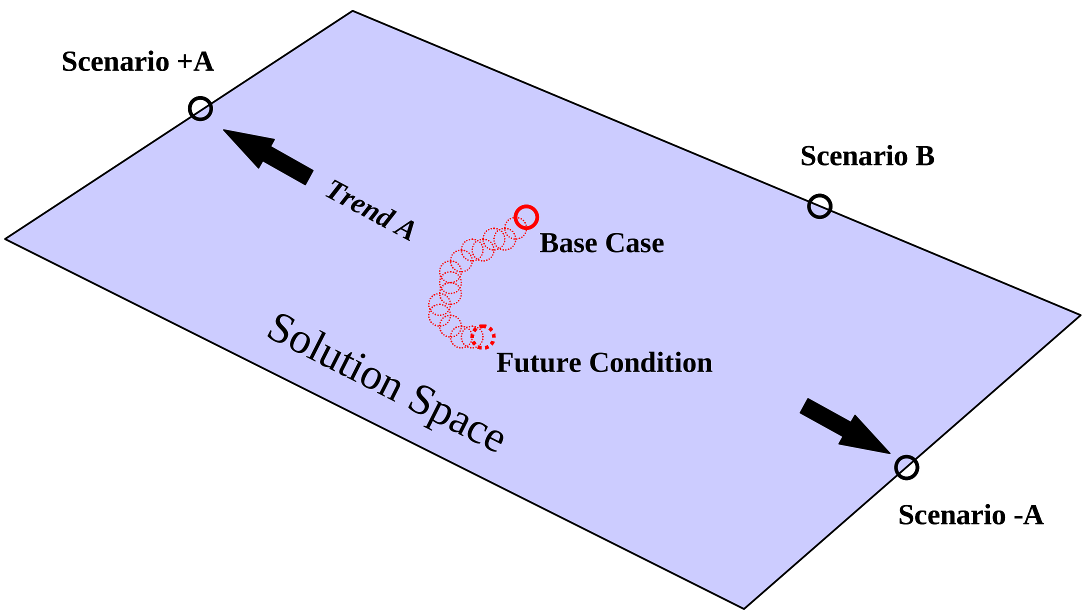

Figure 2: How scenarios relate to trends, future condition, and the solution space

None of the scenarios actually represent the future condition as analysts believe will exist. In fact, the future condition (shown) may differ drastically from all scenarios. In the case shown in Figure 2, intervention occurred to counteract trend A (perhaps after analysis demonstrated that scenario "+A" in fact leads to undesirable economic results). By choosing scenarios that sit at extreme edges of the solution space, it helps analysts to understand what would happen if the trends continued unchecked; it is not intended to as an accurate representation of the future. Understanding the relationship between trends and economic consequences are key to sound public policy decision making.

2.1.2 Defining a Base Case

In the Chicago Study, the base case described a scenario in which no major changes in the nature of the freight network in the region occurred. The system continued to adapt to support local and regional industry, and Chicago continued to be a major hub for the North American rail system. Existing yards within the city continued to be utilized, productivity trends allowed some improvements in cost and capacity, and additional terminal capacity is constructed largely outside of the city. This is a scenario of organic growth, where existing institutions adapt as they see fit.

Some care is required when defining the base case to specifically determine whether existing plans are carried out, and when those plans are put in place. For instance, although the current base case suggests "no major changes in freight network", it assumes that track renewals would continue to take place, and operations expenditure will continue to grow in proportion with traffic. Grade-crossing elimination program that have been taking place will continue to move along at a slow pace (a few crossings per year) using available funds. The state of these renewal-enhancements – where the design of life-expired equipment is improved as it is replaced, resulting in a partial upgrade – and their contribution to the regional economy, would require careful calculation in Step 2. In that step, the qualitative descriptions of the scenarios are translated into quantitative impacts.

The base case is also sometimes referred to as the 'steady-state renewal' scenario, to distinguish it from one where maintenance spending is cut with dramatic decline in infrastructure condition, which will ultimately result in abandonment.

Some engineers prefer to think of the base case as the 'traffic management scenario' in terms of highway planning. Even without major investment such as large-scale capital expansion that may require land-taking and can provide an economic boom to the construction industry, it is generally accepted that some minor upgrades will still take place as a matter of continuous improvement. Minor improvements that may become part of a base case scenario include:

1. Highway signal upgrades or revised timing to increase capacity;
2. Removal of roadside parking facilities to improve flow;
3. Diversion of through traffic onto existing parallel artieries;
4. Reallocation of existing pavement space to create more lanes, left-turn lanes, and other dedicated facilities such as commercial vehicle lanes and high-occupancy vehicle lanes to improve traffic flow;
5. Very limited capital upgrades conducted with committed funding – for instance, construction of pull-offs on two-lane highways or small sections of heavy vehicle climbing lanes in hilly terrain.

2.1.2 Defining Alternative Scenarios

When conducting comparative analysis, as alluded to earlier, it is important to choose scenarios that are drastically different from the base case in a variety of dimensions. The advantage in choosing the extreme case is that the analysis will find the upper and lower bounds of impacts from changing a particular variable or allowing a trend to continue unimpeded. However, this analysis would not pick up the nuanced effects that a more thorough sensitivity analysis may shake out. There is a trade-off between the amount of work required and the resolution of the analyses. Scenarios chosen should not be so similar that the effect is swamped by noise introduced in the simulation process. On the other hand, there are many cases when extreme scenarios would be inappropriate (e.g. construction of a dedicated truck-only highway network).

In the Chicago study, the analysis focused on how the changes to the railfreight system (which might occur without any active public intervention) would impact the economic competitiveness of the Chicago metrpolitan area. The base case represented a lassiez-faire policy, where the private sector optimized for its own operational and economic efficiency without either public regulation (e.g. prevention of property sales or abandonment) or assistance (such as the creation of new corridors).

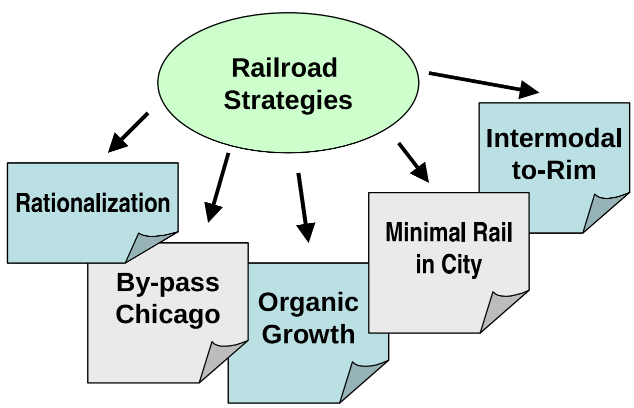

Figure 2: The five scenarios in the Chicago Freight Rail Futures Study

The definition of alternative scenarios was a critical part of the study, not so much because it would impact the study results and outcomes, but because it was part of the planning process. A study that outlined a series of alternative visions for freight rail development in a certain locality (metrpolitan area, region, or state) would have the potential to become a reference document which state planners and other analysts would refer to time and time again. The decisionmakers might simply pick the 'best' scenario arising out of the study and choose to have it implemented with revisions. Thus, the alternative scenarios must include the full gamut of possible options. The team defining the scenarios must include experienced and creative planners who are able to envision how the powers available could be used in different ways to create infrastructure that might result in better freight movement and economic benefits.

2.1.3 The Chicago 'Rationalization' Scenario

The word rationalization had generally been associated with abandonment of surplus infrastructure. Instead, here it described a smart growth strategy in Chicago. Selected older rail corridors would be replaced by modern, grade-separated alternatives. Some free parcels of former railway land would be redeveloped for both industrial and commercial uses. The precise routing of traffic after rationalization was not important; new investments would aim to preserve and upgrade the freight railroad presence in downtown Chicago, while minimizing its impact on the city's other activities. Maximum public planning powers would be used to build public-private partnerships and coalitions to enable extensive reconfiguration to take place while realizing economic benefits to the city as a whole. Thus, this is a scenario of directed change, where a radical vision would become reality.

Of course, it was important to create a win-win-win situation for the railroads, the City, and the private landowners in the detailed planning stage – and the devil would be in the details. However, the scenario assumed that such obstacle would be overcome and the reconfiguration of urban trackage would be possible.

In terms of statewide highway freight planning, the rationalization scenario might include a package of improvements aimed at reducing the impact of freight movements on the state's residents and the region at large. For example, a typical regional freight rationalization scheme might include:

1. Relocation or development of new intermodal terminals to divert existing long- and medium- haul freight demand, or reduce drayage mileage;
2. Geometry improvement (including widening) of highways serving industrial estates;
3. Designing traffic patterns (including the use of suitable restrictions) such that heavy freight traffic is routed away from residential areas and major urban areas;
4. Construction of suitable by-passes and/or new ramps where appropriate, and applying appropriate tolls to shape the demand pattern in a sustainable and socially desirable way;
5. Creation of dedicated HOV, HOT, or freight-only lanes on key highway segments;
6. Zoning changes to enable development of new industrial estates in areas where existing highway service is good, while encouraging new commercial or residential uses to replace formerly industrial areas where the transportation infrastructure is no longer adequate;

7. Other freight and traffic policies aimed at reducing social externalities or increasing the efficiency of freight operations; may include provision of truck stops, fueling points and other infrastructure, as well as 'softer' policies.

All of these developments would have corresponding land-use impacts, which would in turn affect the real estate market and the economic system as a whole. Once the scenario is defined, they can be translated into dollar impacts in Step 2, and their economic implications will be modelled in Step 3.

2.1.4 Other Scenarios in the Chicago Study

Unlike a typical environment impact statement (EIS), the other scenarios were not intermediate values between the two extremes of 'no build' and 'full build' – or, 'organic growth' versus 'directed change'. They were qualitatively and substantially different visions to solve the same perceived problem of increasing rail and freight congestion in the city centre.

The Intermodal-to-Rim scenario called for the continuation of the trend of moving existing intermodal terminals to the periphery of the region. Land was much cheaper outside of the city, where it was also easier to assemble large sites. There was a clear logic for railroads to consolidate intermodal operations on the periphery. This scenario would reduce the importance of Chicago as a terminus and eliminate much of the urban rubber tire interchange.

These other scenarios reflected other possible solutions for freight movements that were driven by forces outside the control of the city. The decision by national freight railroads to route their traffic using this particular strategy would have had important impacts on the transportation sector in the City of Chicago, and therefore the existing infrastructure and availability of transportation-related land for re-use. It would clearly change the real estate market, land use, and have substantial impact on the city's economy.

All scenarios, including the three outlined above, are discussed in substantial detail in the full report[7]. The remainder of this case study shall focus on the techniques needed to translate qualitative scenarios to quantitative dollar figures, which could then be fed into regional economic models.

2.2 Determining Market Impact

There are many methods of determining market impacts, some very simple and direct and others elaborate and detailed. In general, the direct methods rely more on empirical

[7] See Footnote 1.

observations and survey data, while the indirect methods rely more on economic modelling, forecasting, and other calculations. The direct methods are often more specific to one situation while the indirect methods could usually be applied more generally. Essentially, the methodologies used in determining market impact have much in common with demand forecasting (see Virginia Toll Case Study), and provide answers to the question: what will happen to transportation and other markets if all the conditions defined in a scenario occur. Specifically, how much extra cost, cost savings, or changes to externalities will each relevant industrial sector or stakeholder realize?

2.2.1 <u>The Marginal Impact Analysis Method</u>

The marginal impact analysis method, is sometimes called incremental cost analysis or the delta cost method. While economic definitions of marginal and incremental costs differ, the basic idea behind the delta cost method is to calculate on an aggregate basis how costs will change given a change in production inputs. This type of methodology is generally suitable for evaluating short- to medium-term changes, but not for predicting longer-term macro-economic evolution where substantial changes in the underlying cost function could occur as a result of re-investment, re-location, process re-engineering, or land-use changes. Essentially, the method assumes that the technologies and unit costs thereof would not change given the new demand pattern.

In the Chicago study, the Intermodal-to-Rim scenario called for capacity to be slowly moved over the next 20 years, from the downtown to the suburban collar counties or even further out, up to a distance of 80 miles from the 'Loop' district of downtown Chicago. This process is termed 'capacity attrition'; an immediate move away form the downtown yards to the outlying yards would be unthinkingable both in terms of costs and operational disruption – plus the fact that there isn't sufficient capacity in the outlying yards to handle all current lifts in Chicago area yards.

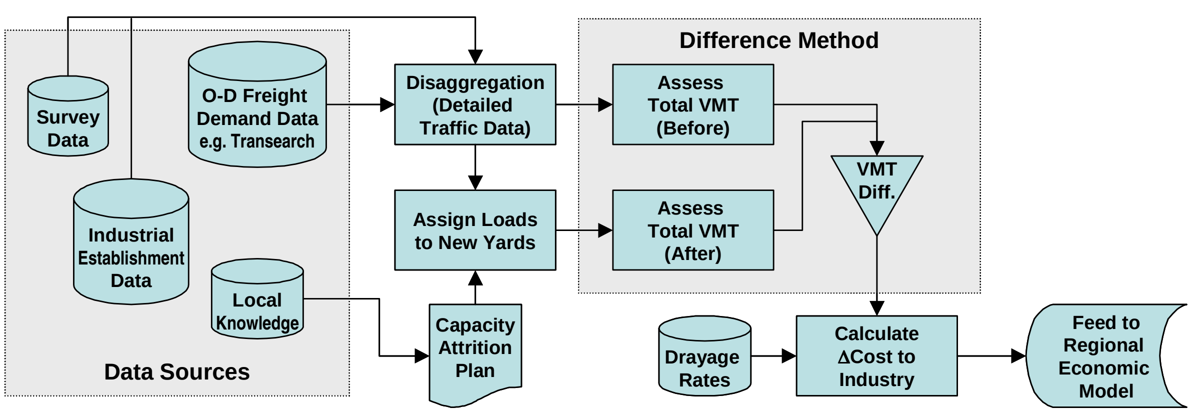

Figure 3: Outline of the Marginal Impact Analysis Method

To determine the cost impacts of capacity attrition to the transportation sector (and therefore shippers), the study team could have consulted origin-destination freight demand data at the county level, and could have made use of an industrial establishment database from the state and survey data designed to further disaggregate intermodal destinations into zipcode5 level. This would have enabled an assessment of the total vehicle miles traveled (VMT) driven by intermodal drayage contractors serving all railroads. Based on the proposed capacity attrition plan, the existing loads could then have been assigned to new yards in the outlying areas over the next 20 years, starting with loads that were thought to be driven to yards slated for abandonment in the Intermodal-to-Rim scenario. Other loads that might benefit from the excess capacity offered by new outlying yards during their initial years of operation, could also have been reassigned. Based on this new drayage assignment, the VMT impacts could then be calculated, and translated into a cost to the industry based on prevailing drayage rates, which could be suitably modified to reflect the different tractor utilization patterns that might have emerged as a result of the new operating patterns.

Carrying out this methodology successfully would have required some local knowledge, and intelligence on existing intermodal operating patterns. It could have been difficult for an aggregate VMT model based on statistical calibration of historical data to capture these subtle effects. The local knowledge would have served to inform the capacity attrition plan, which would have given rise to a VMT-change prediction more 'intelligent' than statistics alone. Note that it is not always necessary to identify the new yards or a capacity attrition plan; the study was actually carried out at a higher level simply by estimating the VMT increase based on summary trip and mileage statistics.

The economic effects resulting from the loss of convenient intermodal service in the core of Chicago would not be captured with the simple incremental VMT analysis – there will likely be land-use changes, leading to some business relocating further afield to the suburban areas in order to receive better intermodal service. These effects would have to be separately accounted for in the next step, where regional economic models were used to predict land-use and economic impacts.

2.2.2 Application to Highway Planning Studies

The direct application to statewide freight planning is the use of regional economic methodologies to analyze different growth strategies, specifically the state's policies towards the warehousing and transportation industrial sectors. Recently, many states and other governmental entities have been considering issues such as: reducing or eliminating inventory taxes; providing dedicated or toll infrastructure for freight users; charging user-fees on existing or improved infrastructure; providing state assistance to railroads; zoning or re-zoning currently vacant land to encourage industrial development including manufacturing, warehousing, and retail. These are issues for which the current methodology can be applied.

Applying the incremental impact analysis method to the toll highway issue would consider the increase in cost of tolls against the reduced costs in congestion – and consider diversions from the toll highway resulting in VMT changes and therefore cost changes to the operator (see Virginia I-81 Case Study); these cost changes could then be fed into the regional economic model to produce an estimate of the policy impact on the local economy. Applying the method to the inventory tax issue would count the reduction in taxes as a cost reduction – but the resulting indirect cost base changes due to land-use and real estate market variations must also be considered. In the next section, we will examine another methodology, which will capture these important policy-sensitive parts of the local economic system as it relates to transportation and warehousing land uses.

2.2.3 Methods for Assessing Land-Use Changes

Fieldwork is a critical part of assessing land-use patterns and trends. To translate scenarios into cost changes due to real estate market changes and zoning, it is helpful to start with the local municipal planners – who would often have information on specific parcels of land that are either currently being used for transportation and warehousing, or are part of a planned industrial development. If this analysis is being conducted at the state level, it is critical that a dialogue is opened between the state and municipal officials. One such dialogue could serve to avoid expensive duplication of work, build a relationship of trust between the state and the municipality, and unearth much useful information prior to actual field work and stakeholder interviews.

In the Chicago study, the re-use potential of land currently used for transportation purposes were assessed by a three step process: (1) identify currently operational railroad sites that may be abandoned under various scenarios; (2) consult municipal planners to discuss any recent developments, major ownership changes – and any published sources on land value; (3) conduct site visits, focusing on any land value changes that real estate professionals may have knowledge of (e.g. recent marketings), as well as physical changes that have taken place in the landscape. Stakeholders who are likely to privy to helpful information include: (a) neighborhood groups, (b) economic development organizations, (c) real estate brokers and developers.

The findings ranged from some quite concrete dollar figures for sites that were considered strong re-use candidates to sites with dubious value that were still owned by railroads for historical reasons. In some cases, sites were already owned by property developers, with railroad operating at the site with a short- to medium-term lease. Around the fringes of these sites, recent development could often be found as the rail yard shrunk over the years past – resulting in changes in land value that was easily measured by consulting historical records. Generally, it could be assumed that abutting sites will gain a similar amount in value when redeveloped, provided that similar infrastructure and accessibility could be provided. Features such as distance to highway interchange and pubic transportation are important for residential uses, while direct links to interstates are important for industrial uses.

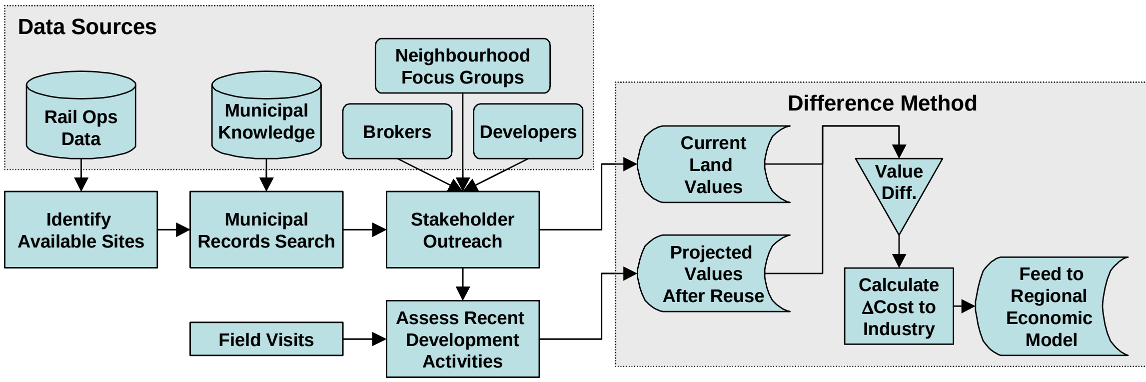

Figure 4: Outline of the Method to Assess Land Value Changes

As figure 4 demonstrates, the best way to assess possible land re-use, land-use and land value changes, is to develop trends based on recent activity and consider to what extent it is feasible to continue the present trends under different scenarios. In a way this is an extension of the difference method discussed earlier, although the measures are not as concrete as vehicle-miles travelled. In part, the analyst must understand that some of the present trends will change under different development scenarios; on the other hand, if a site currently has extremely poor access, it is unlikely to become highly developed even if transportation policy allows more land to be freed up in the same proximity. However, in some scenarios, if a major project would materially change access to the area, the brownfield sites could be opened up for development. Nevertheless, such urban redevelopment projects are unlikely to fall within the jurisdiction of statewide freight planning.

2.3Using a Regional Economic Model

The central element of the Chicago study was to assess the economic impacts of alternative future directions in the railroad industry on the city and the surrounding metropolitan region. Four potential trends or scenarios plus a "status quo" baseline were selected for analysis. The assessment of economic impact in the future requires the use of an economic simulation model, which will be discussed in this section.

The regional economic models[8] could be specifically designed for project and policy impact analysis. This approach is generally accepted for forecasting the economic

[8] In the Chicago Freight Futures project, Regional Economic Models Inc.'s REMI model was used. Other models are available either commercially or freely, from such purveyors as: Global Insight, DRI*WEFA, and Yale University (Fairmodel).

development impacts of major transportation projects by state and regional agencies around the United States. The software system allowed the user to fine-tune any aspects of the calibration using local expertise and available data – and it was this feature that allowed the team to develop a base case economic outlook based on current practitioner inputs. The model then predicted, for each year in the future, the impact of the proposed project or policy change on employment and business output for each of 53 industry categories and 94 detailed occupational categories. The model also predicted other variables such as changes in regional personal income, population, business competitiveness, industry wage rates, and industry value added.

The development of a regional economic model requires a detailed input-output database and calibration based on the current year's economic indicators. This is a time-consuming process, and is generally not worth developing for a single study. This case study will mainly focus on the application of the model – and not its development.

2.3.1 Additional Data Sources

In addition to work carried out in Step 2, the regional economic models generally require many more inputs. The four parts of the model – General economic forecast, Policy impact, Population trend, Input-output analysis – require separate inputs. The sources of data available for these will be discussed in this section.

Metrics of business activity. The regional economic model required inputs in terms of business activity in dollars. The projected cost changes in Step 2 could be translated into both railroad and shipper/receiver activity changes through the use of a conversion metric. For this, an input-output metric for Illinois from the Federal Bureau of Economic Analysis might have been used.

Railroad activity measures. If major changes to railroad activity are anticipated in a given scenario, a productivity metric (in terms of railroad revenue per job; warehousing jobs per acre) are used to translate changes in activity to jobs and dollar values – for the regional economic model.

Cost of doing business/Business relocations and reductions. These are softer factors which can be difficult to simulate computationally. For these type of factors, an empirical approach was taken. Surveys revealed that certain businesses would relocate if the rail service were degraded or discontinued. Using an employment by industry SIC, it was possible to estimate a measure of job impact factor from the survey results.

Construction spending. To determine the amount of capital investment required constructing new rail facilities, costs of yards recently constructed were used to develop a model and a cost per-acre metric was calculated. The redevelopment or new development costs were similarly calculated.

2.3.2 ***Execution of the Model***

A multi-area macroeconomic model was first calibrated with data to describe the affected region(s) under study, and then was applied to forecast the changes in employment and income by year for every year out to the year 2035. For each scenario, the model was executed multiple times. The first was to capture the base case of the economy, and then a second time to represent the economy under the influence of a specific alternative.

For the Chicago study, the base case assumed no changes to the current rail system, and each alternative represented a specific reconfiguration of the rail system. Each time, results were provided in terms of employment, personal income, economic value added, business output and population. Results of the "control" forecast and an "alternative" forecast (describing a rail freight system reconfiguration) were then compared to estimate project impacts.

In operation, economic simulation models are usually broken down into five key economic arenas: (1) output, (2) labor and capital demand, (3) population and labor supply, (4) wages, prices and profits, and (5) market shares. Changes in freight movement can affect the model in the following ways[9]:

- For labor and capital demand, transport and warehousing jobs will shift within the region. The regional sales, capital requirements, investment, wages and working age population migration aspects of the economic model will be affected by these shifts.
- In terms of output, construction spending for demolition and eventual site redevelopment affects demand for construction jobs, supplier jobs, wages, regional income level, and consumer spending.
- Logistics and freight cost changes for area businesses will affects their market share competitiveness and jobs, which come under wage, price, profit.
- New jobs coming on-line as a result of land re-use from transportation to new light industrial and/or retail uses affects the region's economic output, wages, and city income levels.
- The degree to which area industries can export their products and satisfy local demands is determined as regional market shares. This is based on the region's price competitiveness, which is a function of the cost of doing business in that area relative to other potential suppliers.

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[9] Adapted from the Chicago Freight Futures Final Report.

2.3.3 The Model Output

Regional economic models generally present output in terms of gross regional product (GRP), income, jobs, and revenues. These are general economic indicators that measure the region's financial health. Such economic indicators can also be presented as a trend of year-over-year growth.

The model outputs must be regarded as comparative. First, the output could be compared against national economic forecasts and growth; if the growth rates lag behind national averages, it could be a reason for concern. However, in some cases freight policy could do nothing to abate the trends that are primarily driven by other parts of the macroeconomic system. Secondly and more critically, the base case forecasts should be compared against the scenario forecasts. The results would inform the policymaker what the effects of a particular freight policy scenario are. If a certain industrial development/freight transportation policy could provide more jobs and higher income, this was considered positive.

In some cases, materially quite different policies could give rise to similar economic impacts. In those cases, the environmental impacts, economic risks, and investment costs associated policies would be important variables in determining the region's freight strategic direction. It is quite possible for similar economic prosperity to be achieved with two or more drastically different policies – and one may be more environmentally friendly than the other; perhaps one depends on natural resources to a greater degree while another is a riskier technologically-driven policy. There may be no right answer – and only the stakeholders and local representatives can make a decision that is politically feasible and sensitive to the local culture.

In the case of the Chicago study, redeveloping and restructuring the city's economic engine by moving all rail facilities to the rim produced paybacks that were roughly the same as rationalization. However, that was considered a riskier strategy than rationalizing the existing railroad infrastructure; it was thought that the redevelopment and "reinvention" of Chicago as a non-transportation-based city might not be an easy redevelopment project to accomplish, compared to the rationalization scenario.

Another issue is the timing of impacts. Some policies would appear attractive for the first 10-15 years but demonstrate decline in the longer term, while other policies would require the region's economy to 'take a hit' before it improves. Again, the alternatives might have mutually exclusive advantages and disadvantages. If a scenario resulted in indeterminate projections, it is better to change the scenario to produce a more stable result. Successful economic development in the first 15 years that began to decline thereafter might suggest that a policy change was required in year 10 that would reduce the problem. Or there might be a less aggressive growth policy, which could prevent the anticipated decline. Ultimately, whether policymakers choose a strategy to produce an immediate boom or one positioned for longer-term growth, is a matter of policymaking and not a question that analysts can answer.

3. Lessons Learned

- Using a regional economic model to inform transportation policy is typically a three step process: (1) create a number of alternative scenarios in transportation or investment policy; (2) translate the proposed transportation or investment policy into changes in demand-supply, or cost, in all relevant markets; (3) using the supply-demand changes, combined with an economic forecast, predict differentially the economic impact on the various industrial sectors and the regional economy as a whole.

- When creating scenarios for this type of studies, each scenario should represent the logical conclusion of a materially different trend; each is a distinct vision of the statewide freight policy over the planning horizon. The base case often represents one of organic growth and lack of a specific direction; the other scenarios should represent specific focused strategies by stakeholders. If no such strategic plans exist, they should be sketched out as part of the statewide freight planning study.

- Translation of policies into impacts can make use of simple methodologies and approximations with readily available data. Regional economic models typically require inputs in terms of cost, population, or job changes. Cost changes are easily translated from productivity, production or demand changes based on a metric or a cost model. The 'incremental cost analysis method' enables anticipated impacts to be translated into inputs suitable for a regional economic model. In some cases, results of fieldwork, focus groups, and structured questionnaires can be directly adapted for processing with a macroeconomic model.

- For each scenario, the regional economic model would be executed twice. First the base case conditions are predicted, using a national or regional driving forecast. The policy inputs are then used to modify the base case forecast, and the model is executed again with the revised assumptions. The difference between the two results represents the economic effects of the policy inputs.

- This methodology is highly applicable to large-scale facility and freight strategic planning at a statewide level. This is a high-level methodology, used to assess the effects of different visions for industrial development and freight transportation. Once a vision is chosen, much planning and simulation work remains to work out the details with the stakeholders and to establish optimality for each variable.

ENDS