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Construction of Broadband in the Eastern Upper Peninsula of Michigan: Estimates of Economic Impacts

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Construction of Broadband in the Eastern Upper Peninsula of Michigan: Estimates of Economic Impacts

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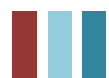
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Thank you to Charlotte Bewersdorff and Bob Stovall from the Merit Network for the detailed data as well as for many conversations on how the data can be applied in REMI to create the best and most reliable estimates for the project.



Executive Summary

The Merit Network, in support of a U.S. Economic Development Administration (EDA) grant application, asked the Regional and Economic Planning Services Team at the W. E. Upjohn Institute for Employment Research (Upjohn) to estimate the economic impact of building and maintaining more than 70 miles of broadband infrastructure in the eastern Upper Peninsula of Michigan.

The region for estimating economic impacts is referred to as the eastern Upper Peninsula (EUP) and the region includes Luce, Chippewa, and Mackinac counties. The estimates for constructing the broadband infrastructure are reported for the period 2021 to 2023 and include labor as well as hard and soft costs.

While the study contains estimated impacts to the study region as well as to the rest of the state of Michigan and the rest of the United States, it focuses only on the construction and maintenance of the broadband and not the benefits of the “last mile” to firms operating such systems, or to businesses or residents using such systems.

The study finds that the combined impact for all regions – the EUP, the rest of Michigan, and the rest of the United States – for the 2021 to 2023 period is slightly more than \$18 million in increased output or sales. The estimated impact in value added (or gross domestic product) for all regions is \$10.4 million, and the estimated impact in personal income for all regions is \$4.9 million.

Introduction

The Merit Network (Merit), in support of a U.S. Economic Development Administration (EDA) grant application, asked the Regional and Economic Planning Services Team at the W. E. Upjohn Institute for Employment Research (Upjohn) to estimate the economic impact of the construction and operations of broadband capacity in the three eastern counties of the Upper Peninsula in the state of Michigan.

To create the needed estimates for the application, Merit staff provided Upjohn with detailed data on the costs of construction and maintaining the infrastructure after construction is complete. The team at Upjohn used an economic impact model from Regional Economic Models, Inc. (REMI: www.remi.com). The model was custom designed to estimate the impacts for the study region. The study region is defined as the eastern Upper Peninsula of Michigan and includes Chippewa, Mackinac, and Luce counties. Impacts are reported for the study region, rest of the state of Michigan, and the rest of the United States.

There are a few caveats to the input data and related impact estimates. First, the estimates were created using a baseline for the study areas that is from a pre-COVID model. Since that baseline was released by REMI in early 2020, there have been five updates to the forecasts and associated baseline. The changes in forecasts mostly relate to expected recovery within the national and regional economies. Given the variation within the forecasts, the Upjohn team chose to use a steadier state model with less volatility.

The second caveat to the data is that, with any pro forma, the Upjohn team uses data provided by the client. The Upjohn team assumes that these data are reliable. In conversations with Merit staff, the Upjohn team validated assumptions and inputs on how best to understand and use the data as inputs into the REMI model.

Inputs into REMI

Staff at the Merit Network supplied the Regional and Economic Planning Services team (Upjohn) with detailed proformas of the build-out and maintenance of more than 70 miles of broadband in the Michigan eastern Upper Peninsula (EUP). Information on timing within the year, number of days and number of workers, and function were included in the proformas. This was particularly important as there are challenges to doing this type of construction and installation work in the EUP.

First, seasonality is an issue in the EUP workplace. Due to the relatively northern location of the work, the ability for horizontal or underground construction is limited because of hard freezes in the subsurface. Due to the location, the length of workdays vary significantly by time of year of activity, as shown in Table 1. In the summer, workdays are estimated to be 14 hours because of the length of the day and available daylight. In the fall and with the loss of daylight, the workday shrinks to a more common 8-hour day. As shown in Table 1, the composition of the work crew varies as the project progresses, as do the number of days and hours worked. While some work will occur in 2021 and 2023, the largest share of work will occur in 2022. As discussed in further detail in the per diem section, an additional 10 hours of travel time was included in the estimates of full-time equivalent (FTE) hours. The travel time is expected to average about 5 hours to and from the permanent home base to work locations in the EUP.

Table 1: Estimates of Time Demand for Construction Workers by Function (2021 to 2023)

Construction	September - November 2021		April - November 2022		April - November 2023	
	Number of Workers	Days	Number of Workers	Days	Number of Workers	Days
UG Crew	6	35	9	120	0	0
HH/Restoration	2	10	2	50	0	0
Inspector	1	15	1	75	2	40
Fiber Install	0	0	3	75	6	35
Splicer	0	0	0	0	2	30
Fiber Testing	0	0	0	0	4	30
Hours in a Typical Day		8		14		10

In most cases, construction activities that occur across multiple years allow for FTEs to be easily entered to the REMI model. For reasons discussed above, the seasonality of this project required Upjohn to use the data on days and hours to estimate the FTEs for use as inputs into the REMI model. Upjohn used the following approach to develop the estimates of FTEs: First, for each year the number of workers in each category of activity is multiplied by the number of days worked. Second, the total number of workdays is then multiplied by the estimated number of hours to create an annual number for total hours worked. Finally, total

annual hours are then divided by 2,080 annual hours¹ to estimate total FTEs by year (shown in Table 2).

Table 2: Conversion of Hours Worked to Full-Time Equivalents

	Year		
	2021	2022	2023
Workdays	245	1480	255
Hours Worked	1960	20720	2550
Travel Hours	612.5	3700	637.5
Total Hours	2572.5	24420	3187.5
Annualized Hours	2080		
Full-Time Equivalents	1.24	11.74	1.53

There are a variety of skill sets needed to complete the installation and inspection of the broadband network. In consultation with the team at Merit, it was determined that the construction workers and others working on the project would likely travel from outside of the EUP study region to work on the project. Since these workers were temporary rather than permanent in the region, per diems for lodging, meals, and incidentals need to be included in the model. Given the commute from outside the region into the EUP, a few assumptions are made about work and travel time. First, it is estimated that the work week would be 4 days and full per diems would be needed for each day in the work week. Second, and according to the rates posted on the General Services Administration (GSA) website² (shown in Table 3), travel is expected the day prior to the beginning of the work week and the day following the end of the work week. These days are reimbursed for meals and incidentals per the GSA website at 75% of the full-day rate.

Table 3: General Services Administration Rates for Nonspecified Areas in Michigan

	Full day	Travel days (at 75%)
Lodging	\$96	\$0
Meals	\$50	\$38
Incidentals	\$5	\$4

In working with the Merit team, it was estimated that the commuting time on travel days to the work site would be at least 5 hours, so another night of lodging per diem was included in the modeling for each work week and for each worker. Total per diem costs are shown in Table 4.

¹ This approach was validated by Upjohn’s President Michael Horrigan, PhD. Doctor Horrigan is a former Associate Commissioner at the Bureau of Labor Statistics (BLS). He independently verified that this was the methodology used by BLS in estimating FTEs.

² <https://www.gsa.gov/travel/plan-book/per-diem-rates/mie-breakdown>

Table 4: Expenditures in the Eastern Upper Peninsula

	Year		
	2021	2022	2023
Incidentals	\$464	\$2,780	\$488
Lodging	\$29,400	\$177,600	\$30,600
Meals	\$16,844	\$101,750	\$17,531
Total Annual Expenditures	\$46,708	\$282,130	\$48,619

Any construction project requires both hard and soft costs that are incurred outside of the labor costs. In working with the Merit team, it was determined that some spending would occur within the EUP while other expenditures would likely occur in other parts of Michigan. Non-labor expenditures that are expected to occur within the EUP include contingencies, land, materials, and other annual operating expenses (see Table 5). Note that materials were added into the model as being supplied by the wholesale industry within the region, as the direct purchases were diverse and relatively small. This may suggest a more local and accessible supplier to help provide inventory to the project.

Table 5: Non-Construction Labor Related Costs Allocated to the Eastern Upper Peninsula

	Year		
	2021	2022	2023
Contingencies	\$33,285	\$133,140	\$55,475
Land, Structure, and Right-of-Ways	\$52,700	\$0	\$0
Other Annual Operating Expenses	\$0	\$21,120	\$54,690
Materials	\$95,692	\$578,055	\$99,597
Totals	\$181,677	\$732,315	\$209,763

Similarly, in working with the Merit team, it was determined that many of the identified soft costs and associated needed services would likely be done outside of the EUP, but somewhere in Michigan. This may likely occur in places such as Ann Arbor or Lansing, but the service providers for the expenditures have not been identified. The expenditures outlined in Table 6 and taken from the pro forma include architecture and engineering costs and project inspection fees.

Table 6: Non-Construction Labor Related Costs Allocated to the Rest of Michigan

	Year		
	2021	2022	2023
Architecture and Engineering	\$171,000	\$0	\$0
Other Architecture and Engineering Fees	\$109,200	\$54,600	\$0
Project Inspection Fees	\$32,600	\$163,000	\$130,400

Economic Impacts: All Regions

Total employment impacts for all regions range from 13.2 to 63.4 workers (see Table 7). Private-sector jobs range from 10.7 to 59.7 workers. These jobs include not only the direct jobs listed as FTEs in Table 2, but they also include direct jobs from service providers and jobs in the supply chain of goods and services (indirect effect) and the impacts to households based on worker earnings (induced effect). This combined impact across all regions and for all years includes just over \$18 million in increased output or sales, just over \$10 million in value added or gross domestic product, and just under \$5 million in personal income (in summed places and summed years).

These regions include the study region of the eastern Upper Peninsula, the rest of Michigan (non-EUP Michigan), and the rest of the United States or the other 49 states. The following section breaks down the impacts to each of the regions. Given the technical content in the materials needed for the project, it is unlikely there is a local producer of these goods in the EUP. This may also be true for some components not being produced within the state of Michigan. Due to unique demands of the project and the ability of the study areas to self-supply, the rest of the United States (RUS) impact estimates are included in the analysis as they are an important part of the total impacts. REMI identifies share of local and non-local purchasing of goods and services using regional purchase coefficients (RPCs). The RPCs help to identify local sourcing of goods and services while also identifying goods and services that need to be imported from outside the study regions.

Table 7: Estimates of Impacts for Combined Output from All Regions

	Year			Total
	2021	2022	2023	
Total Employment	15.6	63.4	13.2	
Private Nonfarm Employment	15.0	59.7	10.7	
Output	\$2,698,000	\$11,472,000	\$3,872,000	\$18,042,000
Value-Added	\$1,555,000	\$6,629,000	\$2,227,000	\$10,411,000
Personal Income	\$837,000	\$3,216,000	\$864,000	\$4,917,000

Economic Impacts: Detailed Regions

The estimates in Table 8 show the impacts to the three-county Michigan EUP region. Total employment ranges from 4.3 jobs in the first year to 31.2 jobs in the highest year (2022), when the most activity will occur in the EUP. Private-sector³ employment is just under four jobs in the first year and peaks at 28 jobs in 2022. Total combined output in the EUP is just over \$6.5 million, just under \$4 million in value added, and just under \$2 million in additional income in the three-county region.

Table 8: Estimates of impacts for the Eastern Upper Peninsula

	Year			Total
	2021	2022	2023	
Total Employment	4.3	31.2	7.6	
Private Nonfarm Employment	3.9	28.0	5.3	
Output	\$598,000	\$4,539,000	\$1,435,000	\$6,572,000
Value-Added	\$361,000	\$2,763,000	\$871,000	\$3,995,000
Personal Income	\$168,000	\$1,289,000	\$465,000	\$1,922,000

Given the limitations of self-supply within the EUP region, it is important to look at not only the investment in the rest of the state of Michigan (as shown in Table 6), but also important to look at the estimates of the impacts on the other 80 Michigan counties. REMI is a dynamic model that accounts for trade flows and demand that can't be met within the region, which may be referred to as "imported." In this case, many of the imports will come from Michigan-based suppliers, including services from industries like architecture and engineering, as well as from demand-driven supply chains and households. Additional jobs in the rest of Michigan are estimated and shown in Table 9. The number of jobs range from 4.1 private-sector jobs in 2023 to 8.4 jobs at the peak in 2022. The project in the EUP adds an estimated additional \$3.3 million in output, just under \$2 million in value added, and just over \$1.6 million in personal income to the rest of Michigan's 80 counties.

³ The difference between Total Employment and Private Non-farm Employment is that the latter does not include farm employment nor jobs classified in the North American Industrial Classification System (NAICS) as part of Public Administration. Within NAICS, Public Administration includes not only local, state, and federal government employment, but also all public education including workers in K-12 and higher education.

Table 9: Estimates of Impacts for the Rest of Michigan

	Year			Total
	2021	2022	2023	
Total Employment	5.8	8.8	4.5	
Private Nonfarm Employment	5.6	8.4	4.1	
Output	\$897,000	\$1,519,000	\$910,000	\$3,326,000
Value-Added	\$524,000	\$855,000	\$516,000	\$1,895,000
Personal Income	\$372,000	\$619,000	\$367,000	\$1,358,000

Finally, the project in the EUP has the potential to support private-sector jobs outside of Michigan. Table 10 contains the estimate of impacts outside of the state. Jobs estimated to be supported in the rest of the United States range from 1.3 in 2023 to more than 23 in 2022. For the rest of the United States, an additional \$8.1 million in output, \$4.5 million in value added, and more than \$1.6 million in personal income is estimated to occur with the investment in the EUP.

Table 10: Estimates of Impacts for the Rest of the United States

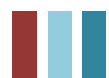
	Year			Total
	2021	2022	2023	
Total Employment	5.4	23.3	1.3	
Private Nonfarm Employment	5.4	23.3	1.3	
Output	\$1,204,000	\$5,415,000	\$1,527,000	\$8,146,000
Value-Added	\$670,000	\$3,011,000	\$839,000	\$4,520,000
Personal Income	\$296,000	\$1,308,000	\$32,000	\$1,636,000

Summary

The investment in broadband in the eastern Upper Peninsula of Michigan has the potential to create jobs and increase incomes. The combined impact for all regions – the EUP, the rest of Michigan, and the rest of the United States – for the 2021 to 2023 period is slightly more than \$18 million in increased output or sales. The estimated impact in gross domestic product (or value add) for all regions is \$10.4 million, and the estimated impact in personal income for all regions is \$4.9 million.

The impacts occur not only in the study region, but also in other parts of the state of Michigan and the rest of the United States. However, these estimates only reflect the estimated impacts of direct construction and operation of the fiber. They do not include other benefits to households and businesses from increased access to broadband.

In Upjohn's work across the country, and in light of the current COVID crisis, there is evidence of a need to have broadband service to businesses so they are able to communicate and compete globally, and, particularly with many working from home, to provide service to households. Pre-COVID, higher Internet speeds to households may have been perceived as an amenity that affected residential location decisions. In some places the availability or lack thereof affected workforce availability for firms—both on the attraction and retention sides of the equation. In the last year, however, with work-from-home and school-from-home taking place, broadband capacity and speed have become essential for residential location decisions. While it is beyond the scope of this study to identify the economic and social impacts of increased access to broadband by businesses and households, the impact to the region would be across the longer term than the build-out from 2021 to 2023, and would be additive to those estimates contained in the report.

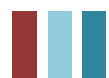


The REMI Model

The Upjohn Institute uses a model to estimate economic impacts developed specifically for the study region by Regional Economic Models, Inc. (REMI, www.REMI.com). The team's project director has over 20 years of experience with REMI to estimate economic impacts across a wide range of economic activity including visitor/tourism activities, industrial development, mixed-use development, and forecasting future economic and labor conditions. The REMI model is the preeminent model of its type and is widely recognized to be at the forefront of modeling, with clients not only in North America but also in the European Union.

REMI is a dynamic model that creates estimates using equations rather than a simple input/output (I/O) table. This allows sensitivity in the analysis for both timing and scale/scope issues that are not found in other models. Features that are unique to REMI include:

- It is calibrated to local conditions using a relatively large amount of local data, which is likely to improve its performance, especially under conditions of structural economic change.
- It has an exceptionally strong theoretical foundation.
- It combines several different kinds of analytical tools (including economic-base, input-output, and econometric models), allowing it to take advantage of each specific method's strengths and compensate for its weaknesses.
- It allows users to manipulate an unusually large number of input variables and gives forecasts for an unusually large number of output variables.
- It allows the user to generate forecasts for any combination of future years, allowing the user special flexibility in analyzing the timing of economic impacts.
- It accounts for business cycles.
- It has been used by many users under diverse conditions and has proven to perform acceptably.



Terms Used in this Study

Jobs Created or Retained

The estimated number of jobs created or retained by project activities are simply “jobs” as counted by the U.S. Bureau of Economic Analysis (BEA) and can be either full- or part-time positions. They are likely distributed across multiple industries. In any given industry, a “job” may represent a summation of positions across several industries in which each industry has less than one complete position. For example, the impact study may report one “job,” but the spending patterns in the study may generate positions in three industries. However, each industry may require only one-third of a person. In this case, the three industries that employ one-third of a person each to meet demand would sum to one “job” in the REMI model.

Employment is composed of three elements:

- Direct – The employment created by actual investment, growth, or change
- Indirect – The employment created by the need of the new firm to purchase goods and services, essentially the local supply chain
- Induced – The household that supplies goods and services to the workers in the prior two elements. Examples include education, dry cleaners, accountants, gas stations, lawyers, and grocers.

Gross Domestic Product

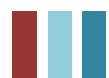
Gross domestic product is an economic measure of the value of goods and services produced within the United States. It is the broadest measure of economic activity within a region or country. It consists of compensation of employees; taxes on production and imports, less subsidies; and gross operating surplus. It does not include intermediate inputs; it is a measure of the value contributed by labor and capital to production.

Personal Income

Income is the goods and services produced by citizens and residents in the study region (i.e., gross national product) minus the consumption of fixed capital (i.e., depreciation).

Output

Gross output includes both GDP and expenditures on intermediate inputs. In that way, it is considered double counting, but it is an essential statistical tool to understand the interrelationships between industries. Gross output is principally a measure of an industry’s sales or receipts.



About the Upjohn Institute

The W.E. Upjohn Unemployment Trustee Corporation was incorporated on October 24, 1932, as a Michigan 501(c)(3) nonprofit corporation, and is doing business as the W.E. Upjohn Institute for Employment Research. The W.E. Upjohn Institute for Employment Research has been conducting economic research and consultation for 75 years, since its founding in 1945.

The Upjohn Institute is governed by a Board of Trustees, which employs a President who is responsible for the overall operation of the Institute. The President of the Upjohn Institute is Dr. Michael Horigan.

The Upjohn Institute currently employs 104 individuals. Upjohn's research and consultation program is conducted by a resident staff of professional social scientists, 12 of whom are Ph.D.-level economists (senior staff). Senior staff is supported by a staff of research analysts and additional support staff. Upjohn also administers the federal and state employment programs for its four-county area through the local Workforce Investment Board. Upjohn also publishes books on economic development, workforce development, and other employment-related topics.

The Ph.D.-level economists have more than 175 years of collective experience, conducting research on a broad variety of economic and employment topics. Their experience includes, but is not limited to, employment program evaluation, labor market dynamics, labor-management relations, employment and training programs, economic and workforce development, income replacement policy, worker adjustment, the role of education in labor markets, employment and compensation, disability, international comparison of labor adjustment policies, site selection experience, and state, regional, and local economic analysis.

The Upjohn Institute also has a Regional Economic and Planning Services team of specialists who provide economic insights and analysis regionally and statewide in Michigan, in other individual states, and nationally. The team has experience in:

- Economic impact analysis
- Fiscal/cost-benefit impact analysis
- Labor market analysis
- Facilitating and conducting effective one-on-one interviews, focus groups, workshops, and charrette sessions in a diverse array of environments
- Economic and workforce development and education strategies
- GIS mapping abilities
- Rural and urban land use and economic development planning services
- Regional data analysis

For questions or information about this report, contact Jim Robey, Director of Regional and Planning Economic Services, 269-365-0450, or jrobey@upjohn.org.