

Measuring Infrastructure in BEA's National Economic Accounts

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Snapshot: What We'll Cover



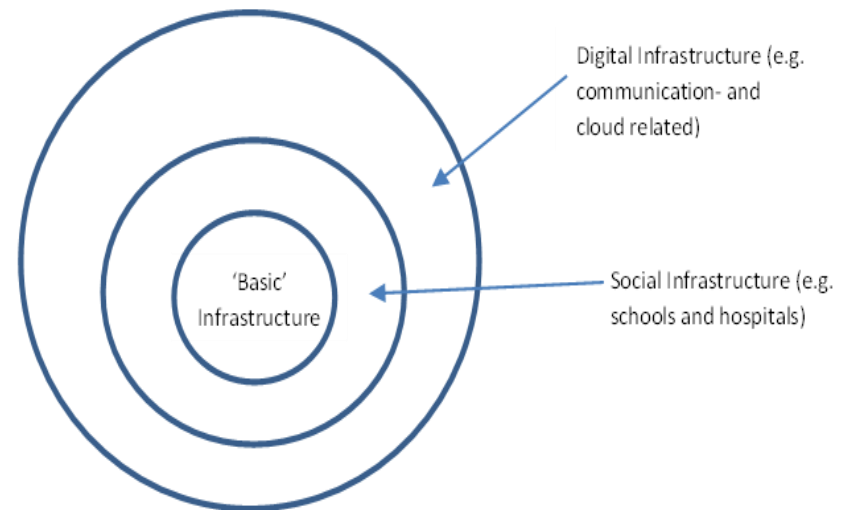
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1. Defining infrastructure
2. Data trends and metrics for adequacy
 - Including experimental regional estimates
3. New analysis
 - Using direct and total requirements
4. Future directions

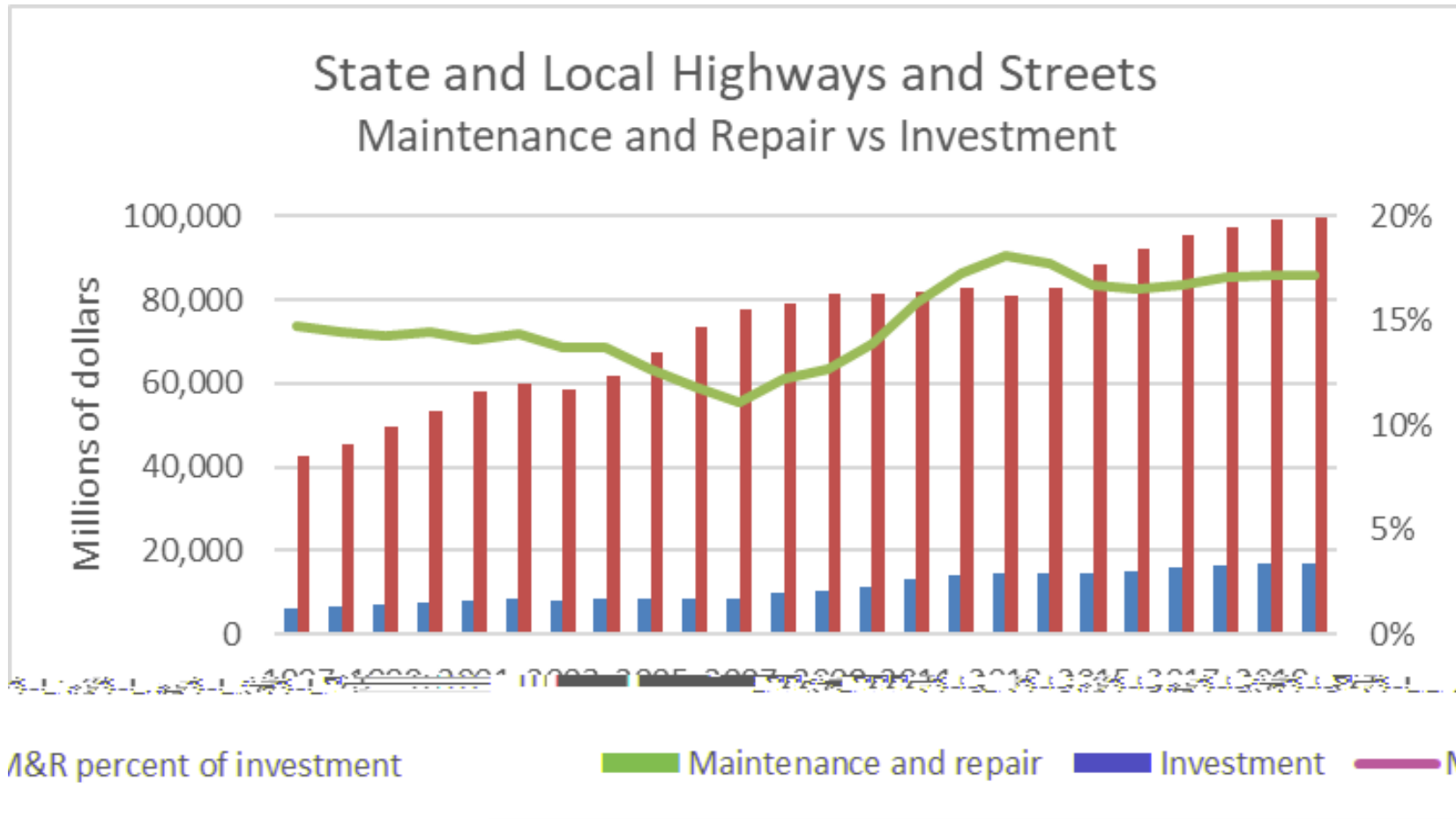
Defining Infrastructure

Table A.--Components (and net stock shares) of Infrastructure

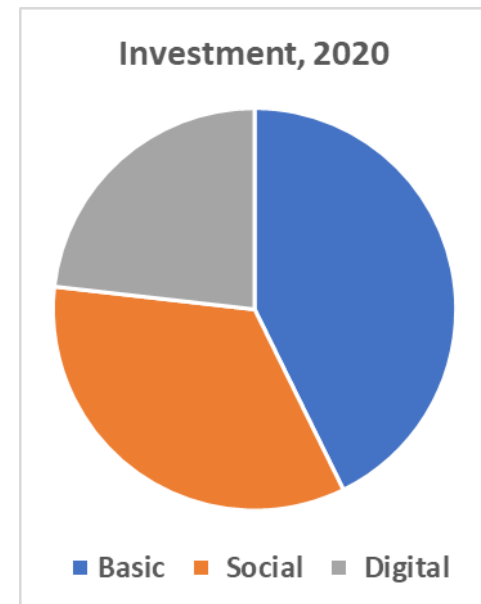
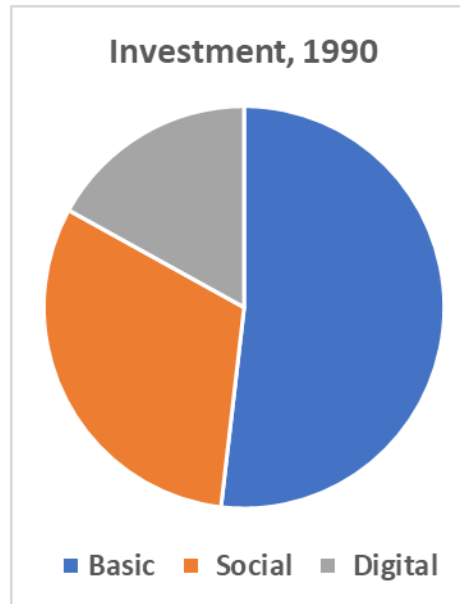
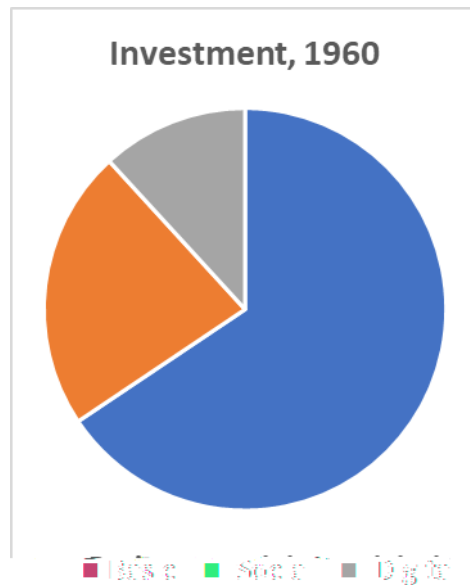
	2020
Basic	60%
Water	4%
Sewer	5%
Conservation and development	3%
Power	20%
Electric	16%
Structures	4%
Equipment	12%
Gas /petroleum	4%
Transportation	29%
Highways and streets	21%
Air transportation	2%
Water transportation	1%
Rail transportation	2%
Transit	2%
Social	33%
Public safety	2%
Education	19%
Health care	11%
Structures	8%
Equipment	3%
Digital	7%
Structures	4%
Equipment	3%



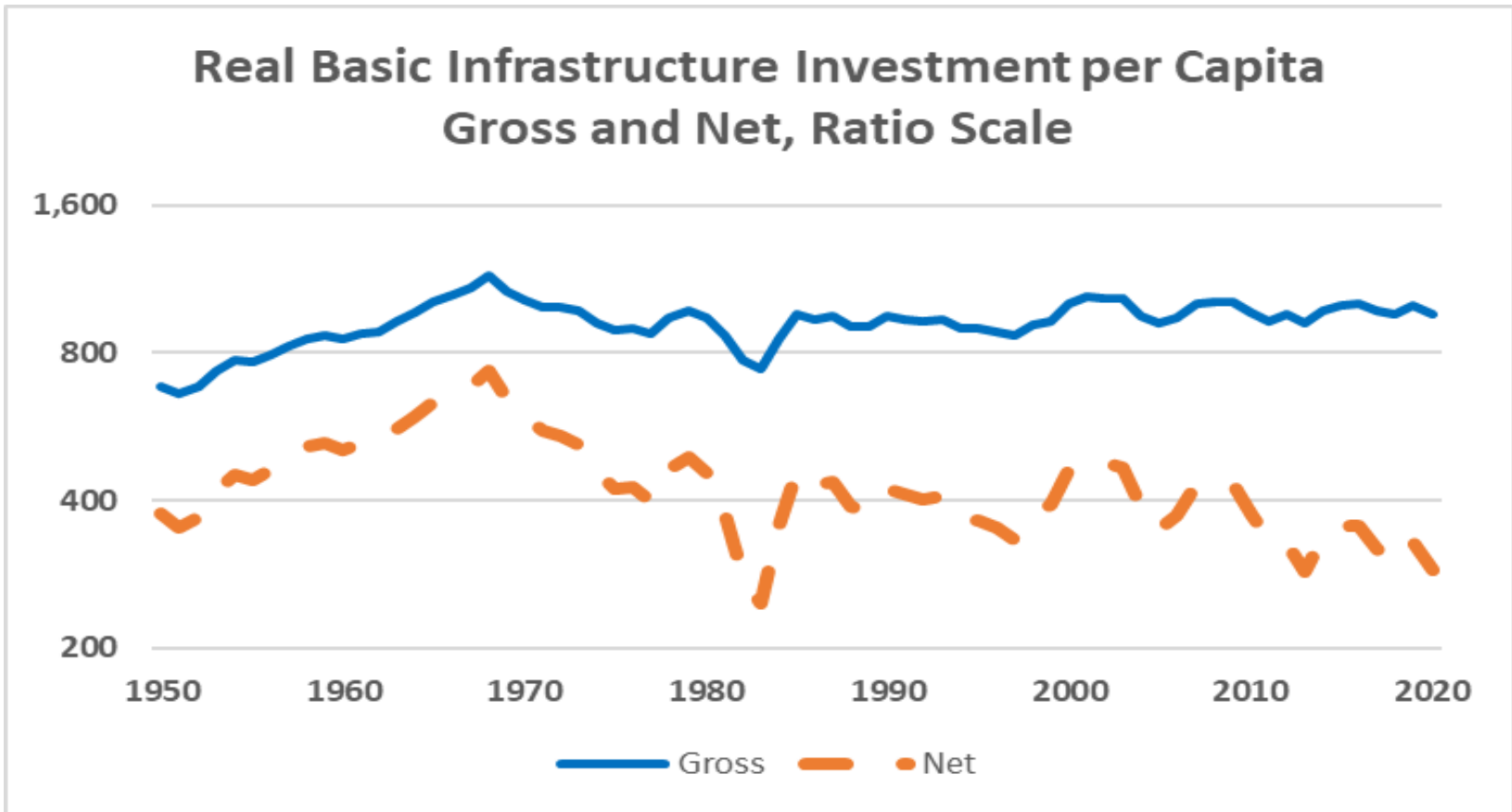
Maintenance and Repair -vs.- Improvements



Infrastructure Shares by Type, Investment



Metrics for Analyzing Adequacy



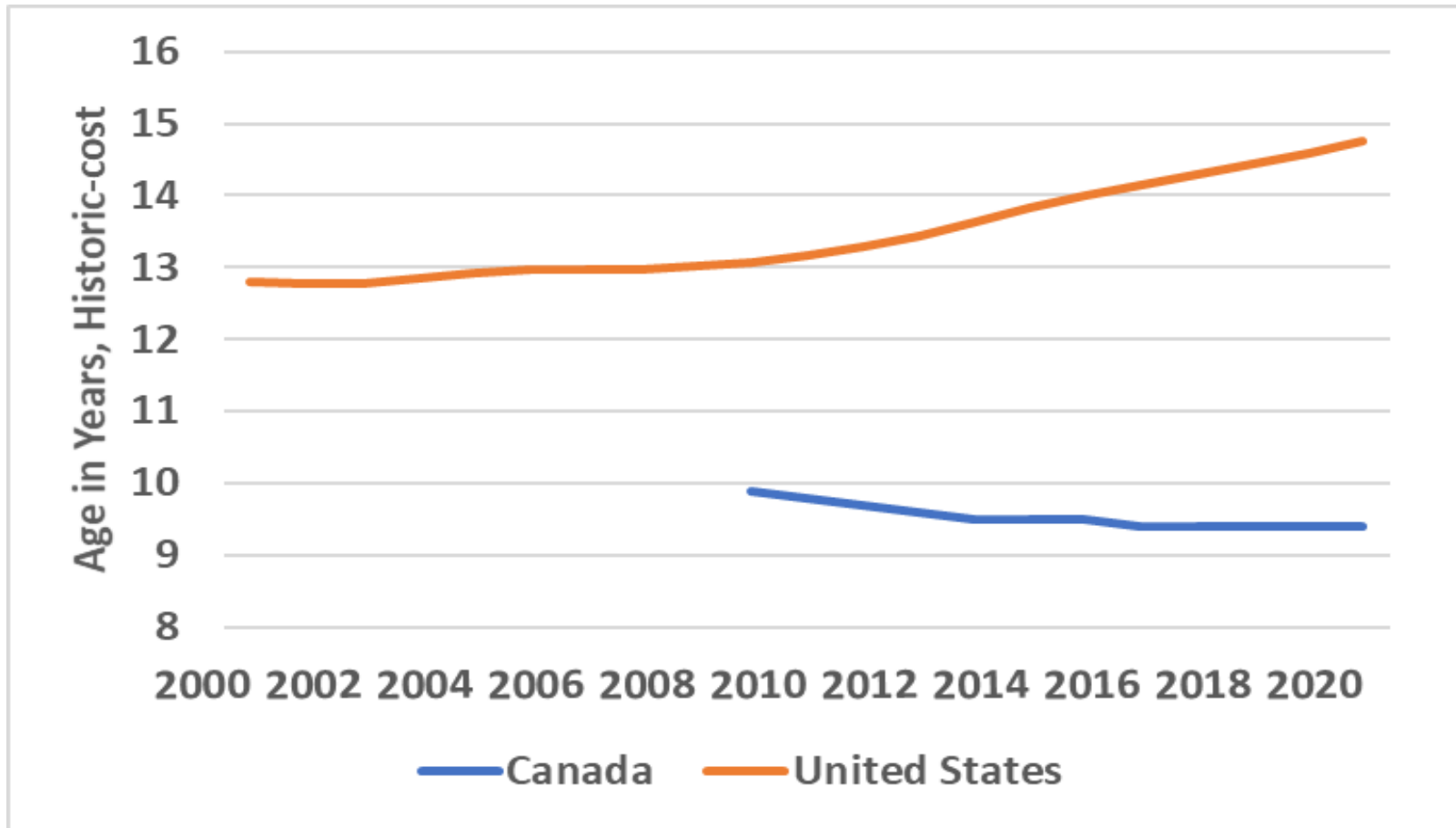
Metrics for Analyzing Adequacy: Real Capital Stock Growth

Real Net Capital Stock per Capita, by type of Infrastructure (Average Annual Growth Rates)		
	1997-2007	2007-2019
Total	1.2	1.1
Basic	.6	.6
Social	2.2	1.2
Digital	3.7	4.7
Memo:		
TFP Growth, Private Business	1.5	0.5
Real GDP per capita	2.1	1.0

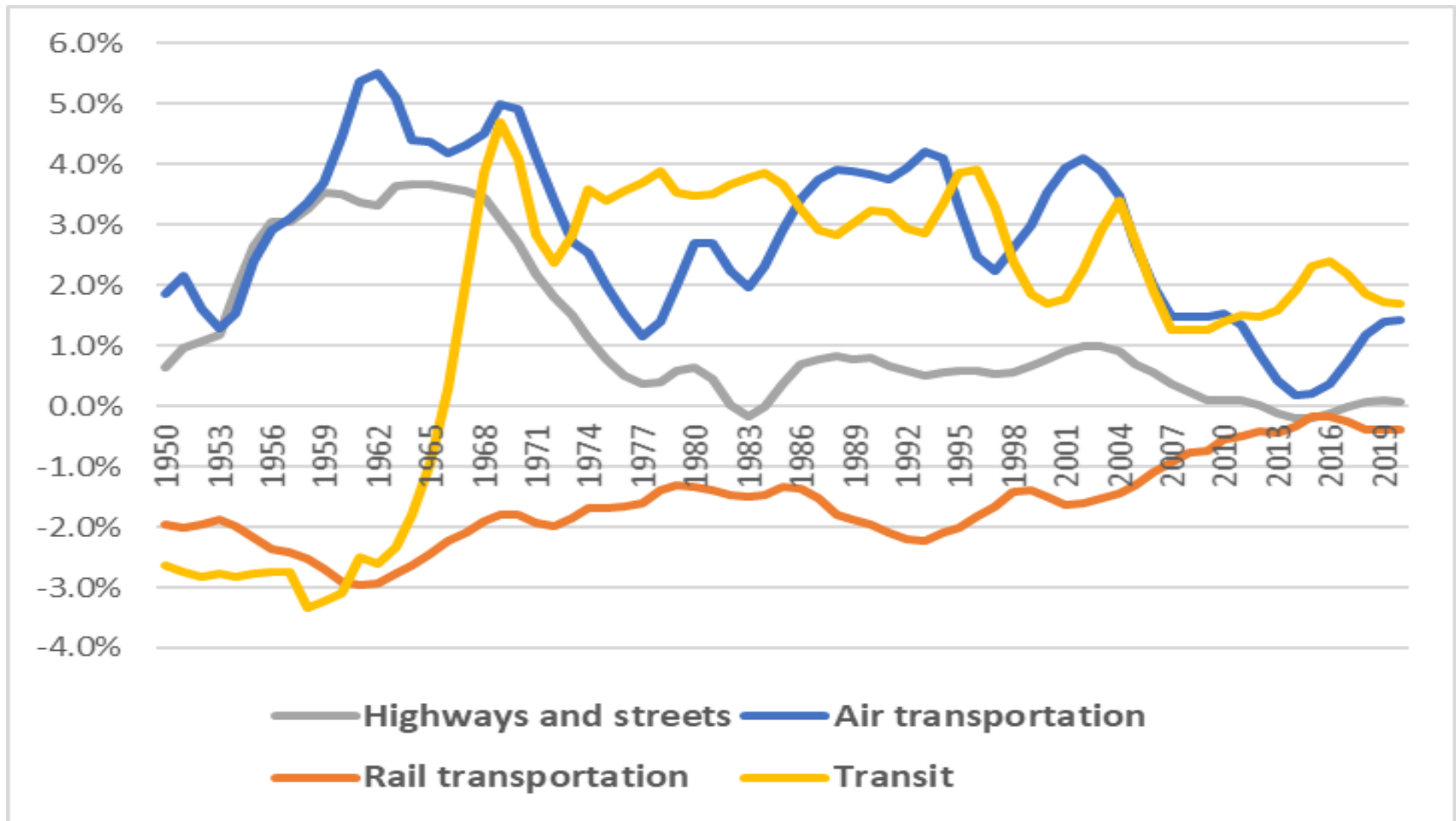
Metrics for Analyzing Adequacy: Age of Infrastructure

- Average ages are derived as weighted average of the ages of all depreciated investment remaining in the stock as of yearend.
- Current-cost (i.e. replacement cost) vs historic-cost (i.e. acquisition cost).
- Historic-cost age tends to be lower than current-cost age

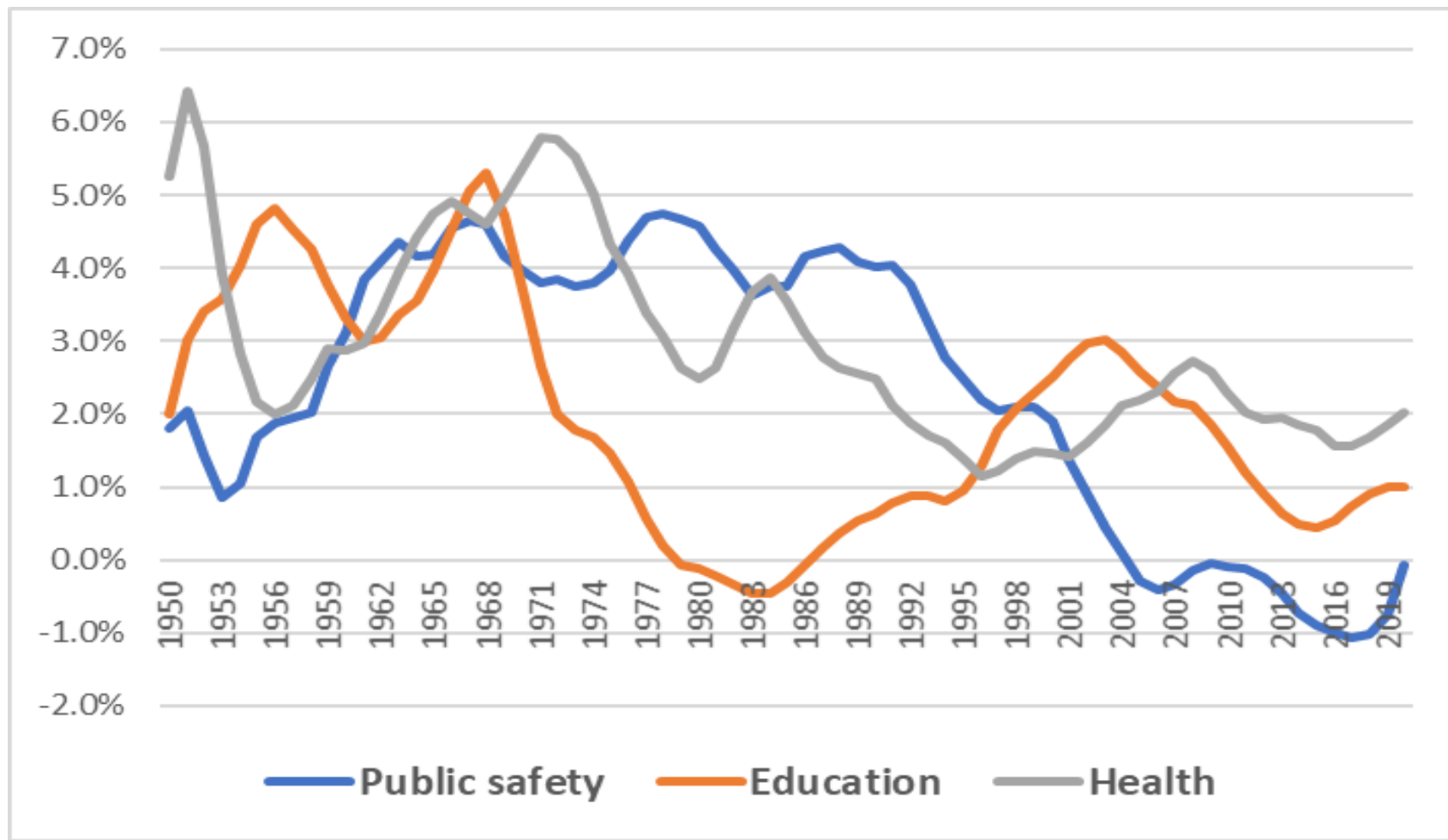
Average Age: Highways & Streets



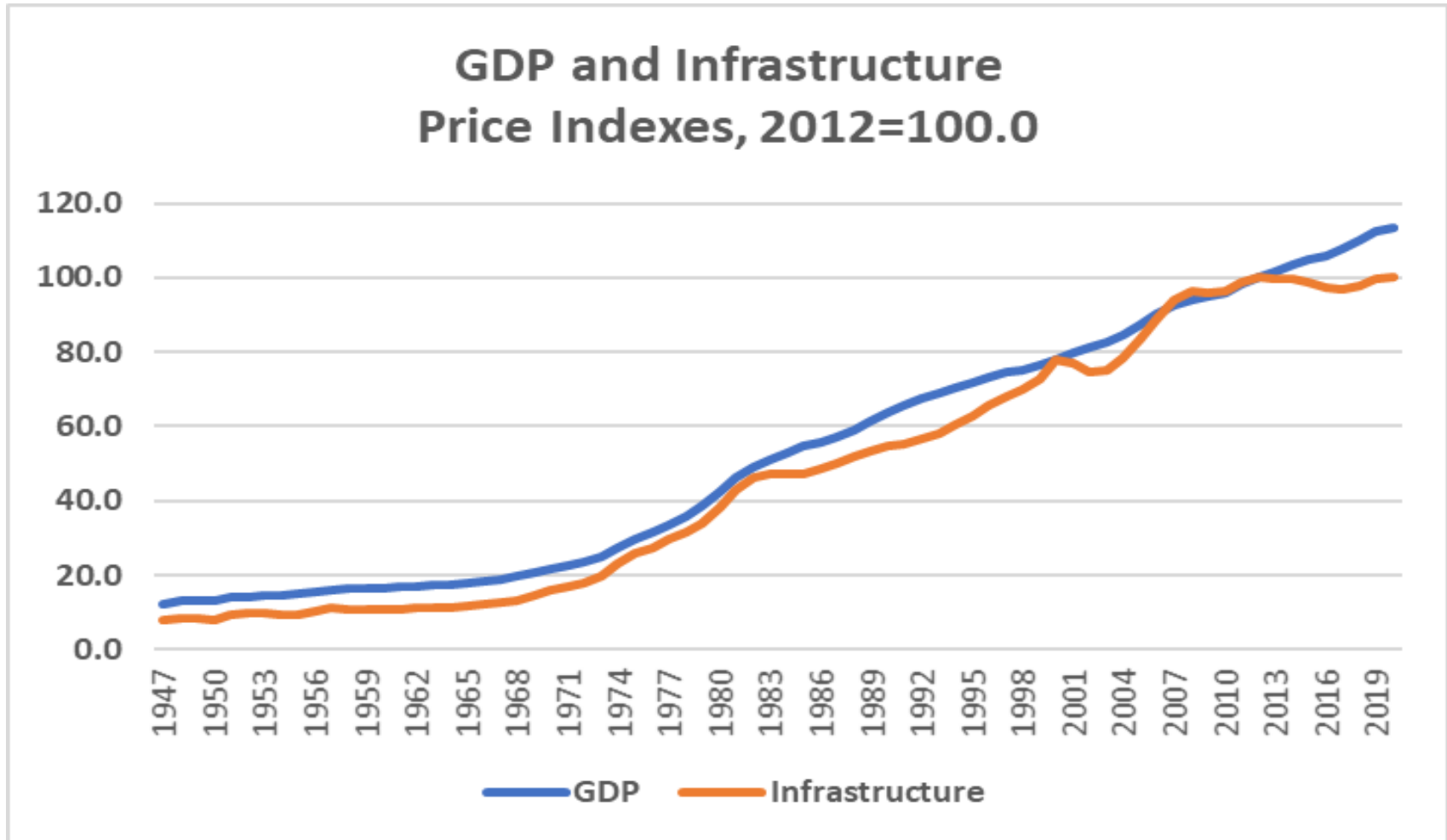
Transportation, Real Net Stock per Capita, 1950-2020 (3-Yr Avg %)



Social, Real Net Stock per Capita, 1950-2020 (3-Yr Avg %)



Trends and Analysis: Prices



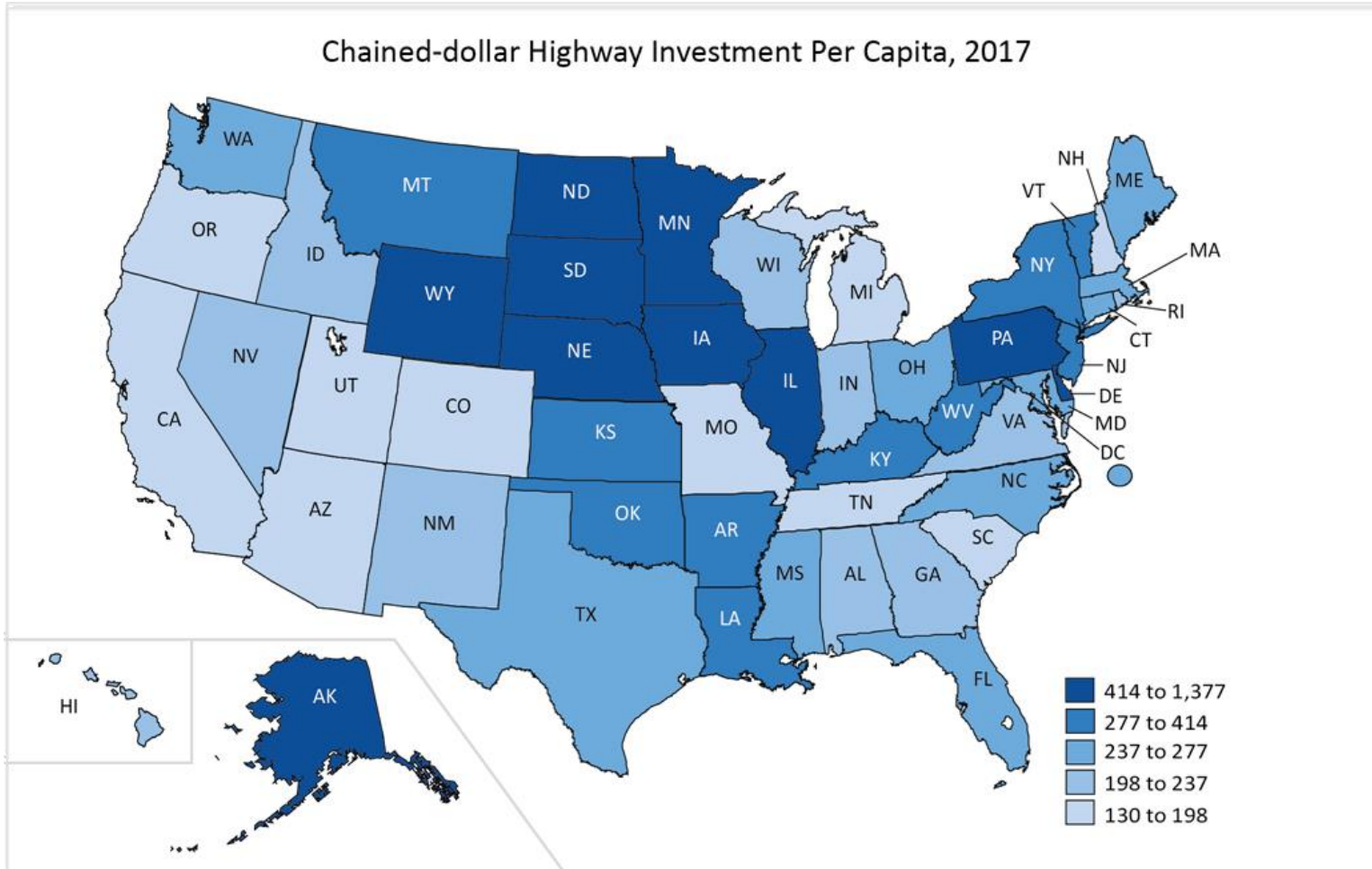
Experimental Regional Estimates



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- Developed experimental state-level investment in highways and streets.
 - Using results from Census Bureau’s Annual Survey of State and Local Government Finances
 - “Heat maps” for highway investment per capita developed for 1992, 2002, 2012, and 2017

Experimental Regional Estimates



Additional Analysis

- Direct requirements
 - Amount of value added and intermediate inputs that are required by an industry to produce a dollar of that industry's output.
- Total requirements
 - Inputs that are required directly and indirectly to deliver a dollar of output to final uses
- Employment requirements
 - Employment supported directly and indirectly per one million dollars of final demand

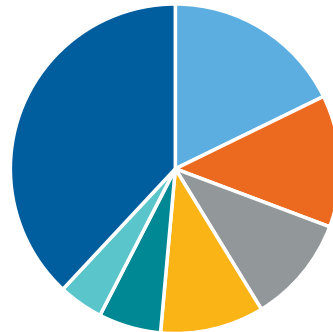
Direct Requirements

Top 10 Direct Requirements for Producing Infrastructure Assets (Inputs Required to Produce \$1 Billion of Industry Output, 2012)

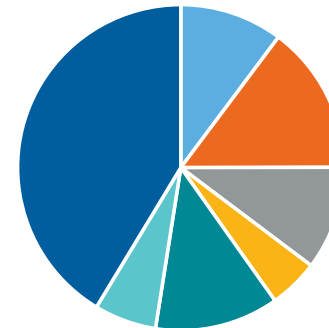
Transportation structures, including highways and streets [Millions of dollars]		Power and communication structures [Millions of dollars]	
Compensation of employees	\$ 363	Compensation of employees	\$ 399
Gross operating surplus	\$ 177	Gross operating surplus	\$ 286
Plate work and fabricated structural product manufacturing	\$ 43	Architectural, engineering, and related services	\$ 33
Petroleum refineries	\$ 38	Petroleum refineries	\$ 24
Asphalt shingle and coating materials manufacturing	\$ 31	Plate work and fabricated structural product manufacturing	\$ 21
Ready-mix concrete manufacturing	\$ 26	Commercial and industrial machinery and equipment rental and leasing	\$ 17
Architectural, engineering, and related services	\$ 22	Building material and garden equipment and supplies dealers	\$ 14
Other durable goods merchant wholesalers	\$ 20	Other durable goods merchant wholesalers	\$ 14
Commercial and industrial machinery and equipment rental and leasing	\$ 19	Turned product and screw, nut, and bolt manufacturing	\$ 12
Stone mining and quarrying	\$ 16	Ready-mix concrete manufacturing	\$ 7

Shares of Intermediate Inputs Required for Producing Infrastructure

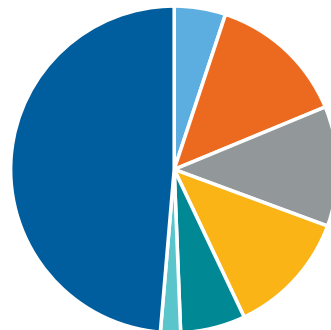
Transportation Infrastructure



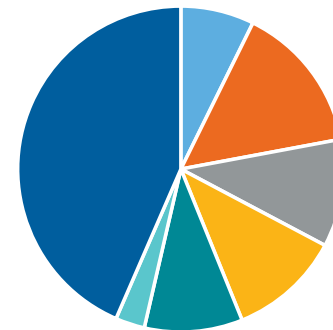
Power and Communication Infrastructure



Education Infrastructure



Other Infrastructure



Petroleum and coal products
Nonmetallic mineral products

Fabricated metal products
Professional services
All other intermediate inputs

Wholesale trade
Rental and leasing

Total Requirements

Top 10 Total Requirements To Deliver \$1 Billion of Infrastructure Assets, 2012

Transportation structures and highways and streets		Power and communication structures	
Total Commodity Output Requirements	\$ 1,991	Total Commodity Output Requirements	\$ 1,648
Transportation structures and highways and streets	\$ 1,000	Power and communication structures	\$ 1,000
Petroleum refineries	\$ 68	Architectural, engineering, and related services	\$ 38
Oil and gas extraction	\$ 57	Petroleum refineries	\$ 34
Plate work and fabricated structural product manufacturing	\$ 46	Oil and gas extraction	\$ 31
Other durable goods merchant wholesalers	\$ 34	Other durable goods merchant wholesalers	\$ 23
Asphalt shingle and coating materials manufacturing	\$ 31	Plate work and fabricated structural product manufacturing	\$ 22
Architectural, engineering, and related services	\$ 30	Commercial and industrial machinery and equipment rental and leasing	\$ 19
Ready-mix concrete manufacturing	\$ 26	Iron and steel mills and ferroalloy manufacturing	\$ 18
Iron and steel mills and ferroalloy manufacturing	\$ 26	Other real estate	\$ 17
Truck transportation	\$ 23	Management of companies and enterprises	\$ 15

Employment Requirements

Employment Supported Directly and Indirectly Per \$1 Billion Construction Investment, 2012

<u>All Industries</u>	<u>10,293</u>
Agriculture, mining, and utilities	185
Construction	6,193
Manufacturing	1,216
Wholesale and retail trade	936
Transportation and warehousing	236
Information, finance, real estate and rental and leasing	277
Professional, scientific, and technical services	502
Administrative and support and waste management	409
Other services, including government	338

Future Research Directions

- More fully assess data gaps and the need for improved prices and depreciation profiles
- Explore industry/functional dimensions
- More international comparisons
- More regional experimentation
- Explore alternative volume indicators

Future Research Directions: Depreciation Profiles

- Many of BEA's depreciation profiles were developed 40+ years ago
- Recent BEA / BLS working paper, "[Alternative Capital Asset Depreciation Rates for U.S. Capital and Multifactor Productivity Measures](#)"
 - Statistics Canada's depreciation rates and other US studies are based on recent surveys and are higher than BEA's for many types of structures
- Eurostat-OECD Compilation guide on land estimations (2015)
 - Several OECD countries have higher depreciation rates

Discussion Questions

- 1) What additional future directions should we consider?
- 2) Are there other metrics or dimensions that we should consider?
- 3) Ideas on alternative volume measures to explore?
- 4) What uses of this data do you envision?