TABLE 2 ★ Cumulative Infrastructure Needs by System Based on Current Trends Extended to 2020 and 2040 *(Dollars in $2010 billions)*

	2020			2040		
INFRASTRUCTURE SYSTEMS	TOTAL NEEDS	EXPECTED FUNDING	FUNDING GAP	TOTAL NEEDS	EXPECTED FUNDING	FUNDING GAP
Surface Transportation	$1,723	$877	$846	$6,751	$3,087	$3,664
Water/Wastewater	$126	$42	$84	$195	$52	$144
Electricity	$736	$629	$107	$2,619	$1,887	$732
Airports*	$134	$95	$39	$404	$309	$95
Inland Waterways & Marine Ports	$30	$14	$16	$92	$46	$46
TOTALS	**$2,749**	**$1,657**	**$1,092**	**$10,061**	**$5,381**	**$4,681**

*Airport needs and gaps include anticipated cost of NextGen: $20 billion by 2020 and $40 billion by 2040.

jobs, lower incomes, and higher prices for both domestically produced and imported goods.

The reduction in business sales due to the drop in exports, personal income and consumer spending will eventually reduce national GDP, which a primary indicator of national economic productivity.

Aggregate Economic Impacts

Businesses and households face higher costs due to several factors, including unreliable transportation services, less reliable water and electricity services, and unmet maintenance needs and outdated facilities for airports, marine ports, and inland waterways. These costs absorb funds from businesses that would otherwise be directed to investment or research and development, and funds from households that would go toward discretionary consumer purchases. The costs are expected to total over $1.8 trillion by 2020, as shown in table 3. Thus, not only will business and personal income be lower but more of that income will need to be diverted to infrastructure-related costs. This dynamic creates lower demand in key economic sectors associated with business investments for expansion and research and development, and in consumer sectors.

Compared with baseline forecasts for the years 2012–20, the cumulative impact of deficient infrastructure due to continued underinvestment in the transportation, water, energy, and port sectors is predicted to result in an aggregated loss of $3.1 trillion in GDP from the U.S. economy. Losses are expected to include $484 billion in exports and almost $1.1 trillion in total trade. As a result of this underperformance, job losses will mount annually, and by 2020 it is predicted that there will be 3.5 million fewer jobs throughout the country.

The expected impact for every household in the U.S. will be an average loss of more than $3,000 per year through 2020 in disposable personal income, amounting to $28,000 per household over nine years, as shown in table 4. These losses will be due to job cutbacks and declining business productivity (which includes less sales and lower GDP), which will result in lower household incomes. By 2040, these effects will be more pronounced. Based on extending identified needs and finding trends, by the year 2040, the impacts of a cumulative $4.7 trillion gap in transportation, water, energy, and ports (including the investments through 2020)

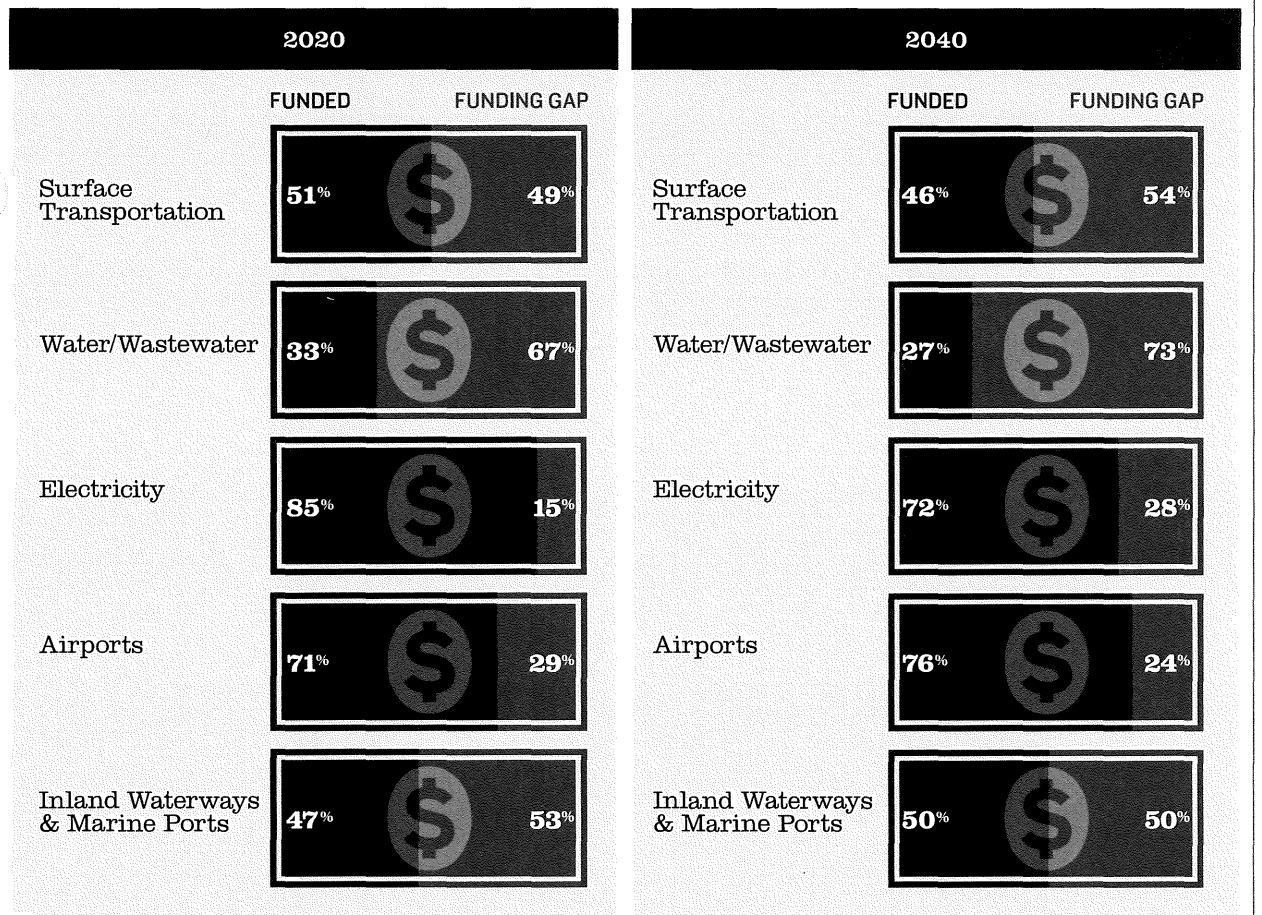
includes losses of almost 7 million jobs from the national economy. In terms of dollar losses from expected levels in 2040 are $2.5 trillion in business sales, including $473 billion in exports ($712 billion in total trade), $1.3 trillion in national GDP, and $1.2 trillion in disposable personal income that would be lost to U.S. households.

Per household, the expected loss of disposable personal income is estimated to exceed $6,000 annually from 2021 to 2040, which adds to $126,000 over the 20-year time frame. On average, the cost of deficient infrastructure is expected to reach $5,400 per year for each household in the nation from 2012 to 2040, as shown in table 4.

From 2012 until 2020, consumer spending will drop by almost $2.4 trillion as a consequence of the declines in disposable income. Although consumer spending is calculated to decline in each of the preceding *Failure to Act* studies, the effect is particularly pronounced when examining impacts on all the infrastructure systems together.

Nationally, the cumulative loss in national business sales[3] will be almost $6 trillion over the years 2012-2020. Nearly $34 trillion more

FIGURE 1 ★ **Investment Gap by Infrastructure Category as a Percentage of Total Needs in the Years 2020 and 2040**



SOURCE Data taken from previous *Failure to Act* studies.

TABLE 3 ★ Costs to Businesses and Households of Degrading Infrastructure

CUMULATIVE TO 2020

INFRASTRUCTURE SYSTEMS	HOUSEHOLDS	BUSINESSES	TOTAL
Surface Transportation	$481	$430	$911
Water/Wastewater	$59	$147	$206
Electricity	$71	$126	$197
Airports	N/A	$258	$258
Inland Waterways & Marine Ports	N/A	$258	$258
TOTALS	**$611**	**$1,219**	**$1,830**

NOTE Dollars in $2010 Billions. Costs do not include personal income or value of time other than business travel.

CUMULATIVE TO 2040

INFRASTRUCTURE SYSTEMS	HOUSEHOLDS	BUSINESSES	TOTAL
Surface Transportation	$1,880	$1,092	$2,972
Water/Wastewater	$616	$1,634	$2,250
Electricity	$354	$640	$994
Airports	N/A	$1,212	$1,212
Inland Waterways & Marine Ports	N/A	$1,233	$1,233
TOTALS	**$2,850**	**$5,811**	**$8,661**

NOTE Dollars in $2010 Billions. Costs do not include personal income or value of time other than business travel.

TABLE 4 ★ Impacts of Infrastructure Investment Gap Per Household

	2012-2020	2021-2040	2012-2040
Average Annual Disposal Income Per Household	−$3,100	−$6,300	−$5,400
Total Disposal Income Per Household	**−$28,300**	**−$126,300**	**−$157,200**

NOTE Dollars rounded to nearest $100. Totals may not multiply due to rounding.

SOURCES LIFT/Inforum Model of the University of Maryland, and EDR Group.

TABLE 5 ★ The Sectors Most Negatively Affected by Degrading Infrastructure in Terms of Business Sales in the Years 2020 and 2040

(Dollars in $2010 billions)

2020		2040	
SECTOR	BUSINESS SALES/OUTPUT	SECTOR	BUSINESS SALES/OUTPUT
Retail trade	–$95	Finance & insurance	–$204
Water and sanitary services	–$76	Retail trade	–$172
Restaurants and bars	–$55	Real estate and royalties	–$159
Finance & insurance	–$51	Wholesale trade	–$132
Electric utilities	–$46	Owner-occupied housing	–$115
Hotels	–$36	Professional services	–$100
Medical Services	–$35	Other business services	–$94
Advertising	–$34	Medical Services	–$94
Personal & repair services*	–$25	Computer & data processing	–$82
Gas utilities	–$23	Air transport	–$62
Computer & data processing	–$21	Restaurants and bars	–$59
Wholesale trade	–$21	Maintenance & repair	–$59
Other instruments	–$19	Aerospace	–$58
Other business services	–$18	Agriculture, forestry, fisheries	–$54
Agriculture, forestry, fisheries	–$17	Movies and amusements	–$50
Other Sectors	–$386	Other Sectors	–$1,037
Total	**–$958**	**Total**	**–$2,529**

SOURCES: LIFT/Inforum Model of the University of Maryland, and EDR Group.

*Excludes auto repair services.

TABLE 6 ★ The Sectors Most Negatively Affected by Degrading Infrastructure in Terms of Jobs in the Years 2020 and 2040

(Dollars in $2010 billions)

2020		2040	
SECTOR	JOBS	SECTOR	JOBS
Retail trade	−786,000	Retail trade	−1,198,000
New construction	−394,000	New construction	−753,000
Medical Services	−298,000	Medical Services	−638,000
Other business services	−294,000	Wholesale trade	−601,000
Restaurants and bars	−272,000	Restaurants and bars	−558,000
Finance & insurance	−245,000	Other business services	−549,000
Wholesale trade	−228,000	Education, social services, NPO	−437,000
Education, social services, NPO	−213,000	Finance & insurance	−358,000
Professional services	−154,000	Professional services	−298,000
Movies and amusements	−102,000	Movies and amusements	−249,000
Printing & publishing	−67,000	Air transport	−191,000
Air transport	−63,000	Printing & publishing	−126,000
Automobile services	−58,000	Computer & data processing	−109,000
Real estate and royalties	−57,000	Real estate and royalties	−107,000
Computer & data processing	−54,000	Personal & repair services, ex. auto	−89,000
Other Sectors	−178,000	Other Sectors	−598,000
Total	**−3,463,000**	**Total**	**−6,859,000**

SOURCES LIFT/Inforum Model of the University of Maryland, and EDR Group.

in sales are predicted to be lost from 2021-2040. The aggregate loss of GDP from the U.S. economy is expected to be $3.1 trillion cumulatively over the years 2012-2020, and an additional $18 trillion from 2021 through 2040.

By 2020, the economy is expected to lose almost 3.5 million jobs, and mounting impacts from underinvestment in infrastructure will result in nearly 7 million jobs lost by 2040.[4] Tables 5 and 6 show that the economic benefits of infrastructure investment reverberate through every sector of the economy and are exacerbated over time as needed investments are deferred.[5]

Tables 5 and 6 show that the impacts by sector will shift by 2040, as the gaps between infrastructure needs and investment widens and the economy has time to adjust to lower levels of services. Large, labor-intensive industries such as retail, medical services, and restaurants will be particularly hard hit by 2040. This is the long-term result of households earning less disposable income and reducing purchases (restaurant meals, home improvements, consumer electronics, new furniture for examples), deferring services (medical care), and the long-term reduction in business sales that will particularly affect construction spending.

By 2040, the key sectors related to America's innovation and knowledge base—including aerospace, air transportation, business services, professional services, and finance—will all be among the hardest-hit in terms of sales and industry sales.

Primarily, these impacts are due to: (1) fewer purchases for higher priced goods and services by both households and businesses in adjusting to declining business sales and lower disposable personal income; (2) higher production costs, transportation costs and a less efficient supply chain reduces the competitiveness of U.S. produced exports; (3) supply-chain impediments, including the costs of transportation, inefficiencies at ports that increase the costs of products; and (4) a redistribution of business revenues from R&D, major purchases and higher priced business services in order to pay for higher costs of transportation, water and energy.

Even though net job impacts are counted in millions of jobs lost from the U.S. due to insufficient infrastructure investment, overall economic impacts in dollars lost in the economy, measured by business sales and GDP will be more dramatic than impacts on overall number of jobs. Job losses in part will be mitigated by more people working for less money. Many of these jobs will replace technology-based and education industry jobs that are the basis of long-term economic development.

In 2020, the United States population is predicted to exceed 340 million people and the national population is expected to grow to more than 400 million by 2040. Workers will still be needed to provide basic and a reduced level of luxury products and services to this population.

The impact of declining business productivity due to inefficient infrastructure may add some jobs to the economy even as income is declining. As an example, in 2020 and 2040, deficient infrastructure is expected to negatively affect the value of agriculture sales and exports as shipping costs rise. However, even though this sector's sales and exports will fall, more workers will be needed in 2020 to produce and supply its products, as shown in table 7. Other sectors that will increase job shares by 2020 are automobile repair services, truck driving, and highway passenger services. These findings are consistent with those of the previous *Failure to Act* study on surface transportation, because poor pavement conditions and deficient roads will cause more damage to vehicles, slower travel times will require more drivers and crews, and a degrading inland waterway system and congested air space will lead more people to travel by car and more goods to be shipped by truck.

Table 7 presents data on those industries that will be most affected by a decline in exports in 2020 and 2040. These industries include a cross-section of critical sectors of the national economy, including finance, aerospace, instruments, and communications. These industries also represent basic manufacturing and services, including wholesale trading, equipment, and agricultural products.

TABLE 7 ★ The Sectors Most Negatively Affected by Degrading Infrastructure in Terms of Value of Exports in 2020 and 2040

(Dollars in $2010 billions)

2020		2040	
SECTOR	VALUE	SECTOR	VALUE
Finance & insurance	–$9	Finance & insurance	–$50
Wholesale trade	–$7	Aerospace	–$47
Aerospace	–$6	Wholesale trade	–$35
Agriculture, forestry & fisheries	–$5	Air transport	–$31
Air transport	–$4	Agriculture, forestry & fisheries	–$18
Other chemicals	–$3	Communications equipment	–$15
Professional services	–$2	Professional services	–$13
Other instruments	–$2	Other instruments	–$13
Petroleum refining	–$2	Other chemicals	–$13
Ag., const. & material handling equipment	–$2	Meat products	–$10
Drugs	–$2	Electronic components	–$9
Meat products	–$2	Ag., const. & material handling equipment	–$8
General & misc. industrial equipment	–$2	Computer & data processing	–$7
Communications equipment	–$2	Plastics & synthetics	–$7
Motor vehicle parts	–$2	Medical instruments & supplies	–$7
Other Sectors	–$41	Other Sectors	–$188
Total	**–$106**	**Total**	**–$517**

SOURCES LIFT/Inforum Model of the University of Maryland, and EDR Group.

3 REVIEW OF INFRASTRUCTURE SECTORS

Each of the specific infrastructure studies that were conducted in the *Failure to Act* series was based on assuming extending current needs through 2040, recent funding trends, and trends in how infrastructure is being used.

The projected needs for investments in infrastructure systems, and the consequent costs to industries and households of not making these investments, are documented by models used by federal infrastructure agencies; databases; reports published by federal agencies and by industry groups that represent local, regional, and private sector infrastructure providers; academic and professional literature; and interviews with industry experts. Economic impacts were calculated using the LIFT model (Long-Term Interindustry Forecasting Tool) of the Inforum Interindustry Forecasting Project at the University of Maryland.