UNIVERSITY of GUELPH
R2B2 Regional & Rural Broadband

Policy Brief
ISSUE 03
Nov. 2020

Broadband Infrastructure Quality Gaps in Ontario

Needs-Based Broadband Funding as Economic Stimulus

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SUMMARY: Based on more than 18 million crowdsourced Internet connection tests conducted by Ontarians in 2019, this report provides an empirical assessment of gaps in broadband infrastructure quality within Ontario. We identify Ontario communities where average effective speeds people experience remain below the speed target of 5 Mbps (download) established by the Canadian Radio-television and Telecommunications Commission (CRTC) back in 2011. The current download speed target is 50 Mbps. Given the extent to which the COVID-19 pandemic has made reliable Internet connectivity vital to families and businesses, we call on telecommunications service providers and all levels of government to prioritize improving broadband service quality in these high-need communities in Ontario sooner than later.

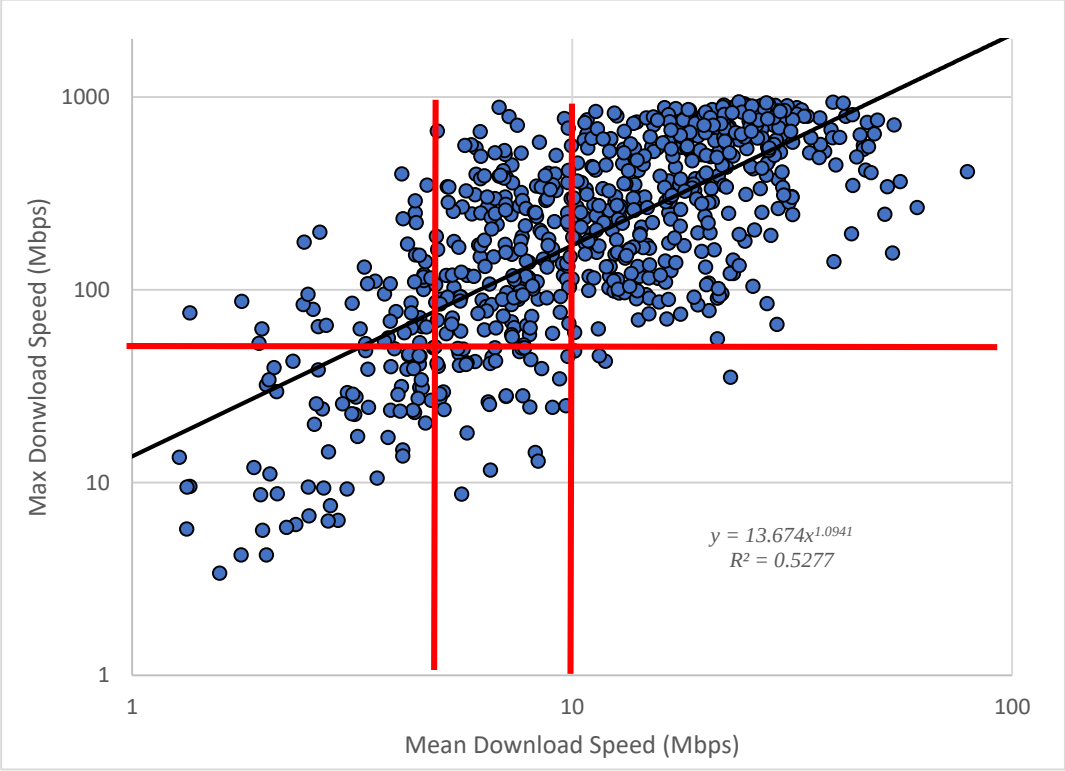
Broadband funding must target high-need communities in Ontario.

Motivation: Growing demand for reliable Internet connectivity has stimulated significant private investment in upgrading cable broadband networks and deploying ultra-high capacity fibre-optic broadband access networks in Ontario's urban centres and larger towns. Despite some improvements in rural connectivity over the past few years, private sector incentives to expand access to relatively high-speed cable and fibre-based broadband access technologies have proven to be limited in small towns, hamlets, rural and remote communities in all regions of Ontario. The consequence has been a growing rural-urban digital divide in broadband service quality and affordability, and potential widening of intra-rural and intra-urban service gaps. With the COVID-19 pandemic, the vital nature of reliable and affordable broadband Internet connectivity has become even more apparent. Rapid growth in demand for network resources caused by the pandemic has pierced the myth that broadband infrastructure quality in rural Ontario is, more or less, good enough. The objective of this Policy Brief is to document substantial gaps in the quality of broadband Internet access speeds within Ontario communities, identify areas that are significantly lagging behind, and encourage public and private sectors to come up with innovative solutions to meet the needs of people that live and work in these severely underserved communities. Unless broadband needs in these communities can be addressed sooner than later, it will be hard to imagine how people in these communities are going to sustain their jobs, go to school, access telehealth services and ultimately recover from the COVID shock.

Market forces and rural broadband gaps: Internet service providers typically advertise connection speeds in terms of maximum theoretical speeds their customer may expect (i.e. "up to" x Mbps). Federal and Ontario governments have historically relied on self-reported advertised speeds from broadband service suppliers to differentiate between adequately serviced and underserved areas.

Actual service quality levels service providers deliver/users experience tends to vary from "best effort" advertised rates, often substantially. This is particularly the case with providers that rely on older, slower technologies (i.e. copper/DSL, wireless) and in rural communities where the scope for facilities-based competition is limited and providers have limited incentives to increase effective network capacity as consumer demand for network resources grows over time.[1] Not surprisingly, broadband coverage maps created based on maximum speeds suppliers advertised in particular areas used by the Federal and provincial governments have proven to substantially under-estimate broadband service quality problems people experience in areas where private providers have little incentives to invest in network capacity and new technologies.[2]

Data: In order to develop an empirical picture of differences in Internet service quality people experience within Ontario, we utilize data from the large scale database of broadband connection tests conduced using Measurement Lab's (M-Lab) Network Diagnostic Tool (NDT).[1] The M-Lab NDT represents a standard-based testing platform that is used by various other broadband testing systems, including Canadian Internet Registration Authority (CIRA) Internet Performance Test (IPT).[1] R2B2 researchers have been working with various Ontario communities concerned about the state of connectivity to encourage testing by residents and businesses as well. For this analysis, we focus only on average and maximum measured download speeds for a sample of approximately 18 million individual connection tests conducted by Ontarians in 2019. We deliberately do not look at 2020 data given that the COVID shock may make the data so far this year more volatile and less reliable for benchmarking service quality levels across communities. We aggregate individual tests into approximately 750 municipalities and localities (i.e. places/population clusters that have a name but governed by upper-tier entities). The subsequent figure provides a visual depiction of the data by mapping the association between maximum measured speeds in particular areas and the mean download speed measured for all tests during 2019.



Measured maximum and mean download speeds in Ontario communities (2019) (log scale; in Mbps; n = 740 communities; ~18 million individual tests (Source: M-Lab/Google/R2B2))

Results: On top of the figure, it is evident that maximum measured speeds that are feasible in many Ontario municipalities are beginning to converge to 1000 Mbps/1 Gigabit per second. This reflects the diffusion of high capacity fibre transport for the "middle mile", and increasing fibre access networks into homes and businesses. There is, however, a large number of lagging communities where maximum speeds that were detected fell short of 50 Mbps (110 communities out of 740). Low maximum speeds suggest potential market failures in the diffusion of high-capacity fibre transport facilities in these areas. While the composition of communities differs depending on the indicator, in terms of effective download speeds people experience, there is a comparable number of communities with average speeds that remained below the 5 Mbps download speed target the CRTC established back in 2011 (127 out of 740, or 17% of all communities). These can be defined as high-need communities because such speeds may have been good enough before COVID (e.g. for basic Internet applications such as email and simple web browsing), but are not sufficient to enable reliable access to more network intensive applications (particularly if there is more than one person and device using the Internet in the household). Notably, in 325 out of 740 municipalities/localities (44% of all communities), effective average download speeds remained below 10 Mbps. This suggests that most users in these communities rely on old copper/DSL, legacy cable, and wireless-based broadband services that are increasingly inadequate for handling advanced multimedia and cloud-based applications people need for working and going to school from their homes.

High-need communities – an immediate policy impetus in Ontario: The subsequent table identifies Ontario communities where average speeds were below the 5 Mbps benchmark in 2019. Our objectives in identifying these communities here are twofold: (a) we hope that the data provided here helps validate concerns by residents and businesses in these communities about the quality of service that are available to them; (b) we substantiate the need to incentivise upper-tier governments and private sector service providers to find innovative solutions for meeting demand from residents and businesses in these critically underserved areas. We believe improving connectivity in these areas will be critical for ensuring their resilience to the COVID shock, quality of life, and future prosperity of Ontario.

Recommendation for policy application in Ontario: Even prior to the COVID outbreak, all levels of government in Canada were beginning to recognize the limited business case to deploy high-quality broadband technologies outside of Canada's large urban centres. With COVID, developing effective policy responses to broadband infrastructure quality gaps has found a new urgency. Rural municipalities and regional governments across Ontario have prioritized broadband service improvements and the provincial government has launched the Improving Connectivity for Ontario (ICON) program.[3] ICON is a discretionary funding model, where a budgetary allocation (initially $150 million and doubled to a total of $300 million as of November 4, 2020) is used to attract a large number applications from service providers and underserved communities. While there is no public data available on the quantum of funds requested from the ICON program, based on previous experience we suspect applicants will be asking for at least 10 times that amount (i.e. for the initial $150 million ICON budget for, we estimate, + $2 to $5 billion in investment demand from areas with sub-standard speeds for wireless vs. wired technologies respectively). Ontario will be able to easily allocate its $1 billion over six years, and should accelerate investment as soon as possible.

To ensure a complement to the usual discretionary broadband spending model that would help existing regional and discretionary upper-tier broadband programs such as the Ontario ICON and the federal Universal Broadband Fund we recommend that the Ontario government develop a need-based funding mechanism that prioritizes improving broadband in the neediest communities in a non-discretionary/evidence-based manner. The data provided above already offers a list of these communities. A needs-based funding mechanism would help mitigate equity concerns associated with previous discretionary approaches, complement local and regional initiatives, and enable people that live and work in these communities to sustain their jobs, allow their kids to continue learning, and remain connected to their socioeconomic networks in the time of COVID. In the long term, the future prosperity of rural Ontario depends on finding innovative solutions to the rural-urban digital divide that complement each other.

Needs-based broadband infrastructure spending as COVID stimulus: In addition to the value of better broadband for people that live and work in rural Ontario, investing in them has spillover benefits for those in urban areas and the rest of Canada. These benefits include regional food systems that feed urban populations. Others include reducing the costs of delivering essential services such as healthcare and education in high-cost rural areas, and thereby fiscal pressures on the Ontario government and taxation on labour in urban areas. Given the economic recession caused by COVID and the fact that interest rates available to the public sector are converging to zero, it might be the right time for the Ontario government to significantly accelerate rural broadband subsidies via both existing regional programs and a new needs-based funding mechanism. Importantly, fiscal spending multiplier effects on jobs, GDP and upper-tier tax revenue tend to be larger in times of recession where there is significant slack on the supply side.[4] As various international organizations recommended during the last recession in the late 2000s, and again more recently in response to COVID, public infrastructure spending on essential infrastructure such as broadband represents a relatively effective method for counteracting negative economic shocks and recovery.[5] This offers an opportunity for the Ontario government to simultaneously meet the needs of rural high-need communities for better broadband while sustaining construction and telecommunications jobs threatened by the depression the COVID pandemic has caused.

[1] Rajabiun, R., & Middleton, C. (2018). Strategic choice and broadband divergence in the transition to next generation networks: Evidence from Canada and the US. *Telecommunications Policy*, 42(1), 37-50. Available at: https://www.sciencedirect.com/science/article/abs/pii/S0308596117301143

[2] See e.g. SouthWestern Integrated Fibre Technology Inc. (SWIFT). Petition to the Governor in Council concerning Telecom Regulatory Policy CRTC 2018-377. Available at: https://www.ic.gc.ca/eic/site/smt-gst.nsf/eng/sf11472.html

[3] https://www.measurementlab.net/

[4] https://performance.cira.ca/

[5] https://news.ontario.ca/en/release/57104/ontario-improving-broadband-and-cell-service-for-rural-communities

[6] Owyang, M. T., Ramey, V. A., & Zubairy, S. (2013). Are government spending multipliers greater during periods of slack? Evidence from twentieth-century historical data. *American Economic Review*, *103*(3), 129-34. Available at: https://econweb.ucsd.edu/~vramey/research/ORZ_Published.pdf ;

[7] OECD (2009). Policy Responses to Economic Crisis: Investing in Innovation for Long Term Growth. Organization for Economic Co-operation and Development (OECD). Available at: https://www.oecd.org/sti/42983414.pdf ; IMF (2020). Fiscal Monitor: Policies for Recovery. International Monetary Fund (IMF). Available at: https://www.imf.org/en/Publications/FM/Issues/2020/09/30/october-2020-fiscal-monitor

Ontario Communities with Average Download Speeds Below 5 Mbps

Source: M-Lab (2019)

Municipality/locality	*Mean*	*Max*	*Municipality/locality*	*Mean*	*Max*	*Municipality/locality*	*Mean*	*Max*
Fort Severn	0.3	2.6	**Starkville**	2.8	7.6	**Eden**	4.3	85.4
Reaboro	0.8	4.8	**Hawk Junction**	2.9	6.4	**Iona Station**	4.3	63.4
Poplar Hill	1.3	13.5	**Kearney**	3.0	25.7	**Oakwood**	4.3	75.9
Box Alder	1.3	5.7	**Dalhousie Lake**	3.1	9.3	**Kenabeek**	4.3	23.8
Nipissing	1.3	9.5	**Iron Bridge**	3.1	29.3	**Port Sydney**	4.4	39.0
Lac Seul	1.4	9.6	**North Spirit Lake**	3.2	22.8	**Ramore**	4.4	110.1
Pikangikum	1.4	75.9	**Sharbot Lake**	3.2	85.0	**Dwight**	4.4	23.1
Lavigne	1.6	3.4	**Little Britain**	3.2	28.7	**Elk Lake**	4.4	249.8
Southgate	1.8	4.2	**Christian Island**	3.2	22.6	**Quinte West**	4.4	289.8
Attawapiskat	1.8	87.2	**Dorset**	3.2	27.7	**Mallorytown Landing**	4.4	151.5
Rockton	1.9	12.0	**South Bruce Peninsula**	3.3	17.3	**Marmora**	4.4	223.2
Eagle River	1.9	52.8	**Nestleton Station**	3.3	62.8	**Dover Centre**	4.5	27.3
Tilden Lake	2.0	8.6	**Charlton**	3.4	131.0	**Wilberforce**	4.5	45.4
Torrance	2.0	62.6	**Freeland**	3.4	48.4	**Bala**	4.5	41.2
Armstrong	2.0	5.7	**Iroquois Falls**	3.4	52.6	**Star Corners**	4.5	151.3
Marston	2.0	4.2	**Kinmount**	3.4	107.6	**Burk's Falls**	4.5	53.1
New Osnaburgh	2.0	32.2	**Goulais River**	3.4	38.7	**Bruce Mines**	4.5	71.6
Sebright	2.0	34.1	**Palmer Rapids**	3.4	24.6	**Beardmore**	4.5	31.1
Maple Leaf	2.1	11.1	**Hurkett**	3.6	110.7	**Thessalon**	4.5	45.4
Kashechewan	2.1	39.4	**Bewdley**	3.6	10.6	**Stoney Point/Pointe-aux-Roches**	4.5	34.2
Gilmour	2.1	29.6	**Tehkummah**	3.7	53.7	**Hudson**	4.6	64.4
Temagami	2.1	8.7	**Englehart**	3.7	95.3	**Chartrand Corner**	4.6	31.0
Upsala	2.2	5.9	**Crystal Falls**	3.8	17.2	**Desbarats**	4.6	100.5
Corbeil	2.3	42.6	**Orton**	3.8	56.4	**Enterprise**	4.6	116.4
Eden Mills	2.4	6.1	**Matheson**	3.9	107.5	**Campbellcroft**	4.6	120.2
Sachigo Lake	2.4	83.7	**Warsaw**	3.9	68.8	**Earlton**	4.6	111.7
Casimir	2.5	176.9	**Coe Hill**	3.9	23.8	**Lansdowne**	4.6	139.9
Sandy Lake	2.5	94.7	**Trent Hills**	3.9	39.9	**Erinsville**	4.6	20.4
Longbow Lake	2.5	9.5	**Cobalt**	3.9	49.5	**Schumacher**	4.7	64.0
Garden River	2.5	6.7	**Ignace**	4.0	77.1	**Roseneath**	4.7	349.0
Cat Lake	2.6	79.1	**Macdiarmid**	4.0	28.6	**Alfred**	4.7	108.4
North Lunenburg	2.6	20.1	**Windham Centre**	4.1	23.4	**Maxville**	4.8	115.3
Ompah	2.6	25.6	**Kilworthy**	4.1	31.5	**Comber**	4.8	26.8
Kasabonika	2.6	64.3	**Manitouwadge**	4.1	399.0	**Caledon Village**	4.8	50.1
Weagamow Lake	2.6	38.5	**South Baymouth**	4.1	13.7	**Emsdale**	4.9	50.6
Longwood	2.7	198.8	**Anten Mills**	4.1	14.8	**Longlac**	4.9	106.1
Bearskin Lake	2.7	24.1	**Hearst**	4.1	233.3	**Moose Creek**	4.9	86.0
Kettle Point	2.7	9.4	**Nestleton**	4.2	59.8	**Bloomfield**	4.9	189.4
Moose Factory	2.8	65.4	**Newburgh**	4.2	38.7	**Fraserville**	4.9	41.5
Sheffield	2.8	6.3	**Moosonee**	4.2	172.4	**Mount Pleasant**	4.9	666.0
Tichborne	2.8	14.4	**Maberly**	4.2	45.8	**Hartington**	4.9	69.4
			Wikwemikong	4.2	46.4	**Calabogie**	4.9	161.7

Note on limitations: The list of high-need communities identified in the table is not exhaustive. There are likely other communities with very poor Internet service quality that our summary of the data may not capture and/or have been grouped under higher-level municipal entities. Furthermore, the data used may generate some errors in aggregating individual tests around local network Points of Presence (PoPs) and associated with names of municipalities/communities. The list of communities will vary if using other indicators, such as maximum speeds, upload, or other Quality of Service (QoS) indicators such as latency and jitter.