## **Draft New Network Report**

JULY 2024

BUS CONNECTS WATERFORD SUSTAINABLE TRANSPORT FOR A BETTER CITY.

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## 1 Summary

## What is BusConnects Waterford?

BusConnects is a programme of public transport investment in Ireland's major urban centres. It is developed and managed by the National Transport Authority (NTA), and funded by Project Ireland 2040.

BusConnects includes many elements:

- Redesigning the bus network
- Building new bus corridors and cycle lanes
- Implementing a state of the art ticketing system
- Implementing a cashless payment system
- Simpler fare structure
- New bus livery
- New bus stops and shelters
- Transitioning to a new zero emissions bus fleet

BusConnects Waterford will help realise these local and Government strategies and plans:

- Waterford Metropolitan Area Transport Strategy (WMATS)
- Regional Spatial and Economic Strategy for the Southern Region
- Waterford City and County Development Plan 2022-2028



This redesign of the Waterford bus network is one of the eight strategies that make up the BusConnects programme.

- National Development Plan 2021-2030
- National Sustainable Mobility Policy
- Climate Action Plan 2023

As foreseen in the WMATS, BusConnects Waterford will deliver approximately 63 kms of bus lanes and bus priority measures alongside new cycling routes and greenways. The new bus network will incorporate the relocation of Plunkett Station to a new site in the North Quays, and the availability pedestrian and cycling connections over the new active-travel bridge. Finally, BusConnects will increase the quantity and quality of bus service, as planned in WMATS, and will deploy 75 new zero-emission buses.

## What is the Network Redesign?

The Waterford bus network has evolved with the growth of the city. Recent improvements to bus frequencies, weekend service levels and reliability have improved the usefulness of public transport in the city.

The Waterford Metropolitan Area is expected to grow 50% more populous by the year 2040. In order to accommodate this growth whilst maintaining a high quality of life, a step-change in the level of use of public transport will be needed. There is an urgent need to build on recent success in Waterford by restructuring the Waterford bus network and making greater investments in useful, reliable bus service.

This network redesign is one step in that process of restructuring and reinvestment. It is a collaboration among:

- National Transport Authority
- Waterford City and County Council
- Kilkenny County Council
- Bus Éireann

This network redesign is focused on the Public Service Obligation (PSO) network, for which Bus Éireann is the contracted operator.

## The bus network redesign is a review of where and how often the bus

**should come.** This includes which roads buses run on, times and days of service, frequencies, stop locations, and how people will interchange between routes.

The network is being reinvented from a blank slate, rather than adjusted from the current network. There is no assumption that inherited patterns of bus service must be maintained for the sake of tradition or to avoid change.

#### **Redesign Process**

This report forms the basis for public consultation on the Draft New Network and the gathering of public feedback. Public consultation begins on 10 June 2024 and is expected to continue for six weeks after.

This report includes:

- An assessment of existing demand and need for public transport.
- Key principles and choices in redesigning the bus network.
- The Draft New Network for public consideration.

Since every detail of the existing network is something somebody relies on, NTA expects a broad range of positive and negative comments. Any large change to a bus network will result in inconvenience for some people, even if it benefits most people.

Once the planning team has understood the feedback on the Draft, a Final New Network will be designed. Implementation of route changes consistent with the Final New Network are planned to begin in 2026.

#### **Routes Under Review**

This network redesign focuses on the urban portions of Counties Waterford & Kilkenny (as shown on the next page). It is focused on these PSO routes:

- W1: Clock Tower SETU -Merchants' Quay
- W2: Clock Tower SETU -Meagher's Quay
- W3: Clock Tower St. John's Park -Meagher's Quay
- W4: Peter Street Carrickphierish -Browns Road
- W5: Oakwood Waterford Hospital

## **Focus Area**

The area of focus for this network redesign is the urban portion of the City & County of Waterford, plus the urban areas north of the river in County Kilkenny.

Additional developed areas nearby may also be served by urban services. However, services among smaller towns in the City & County of Waterford and County Kilkenny are addressed by the Connecting Ireland Rural Mobility Plan, a national initiative to improve public transport outside and between major cities and towns.



## How to Read the Network Maps

#### **New Route Numbers**

All of the proposed routes have been given new numbers, without the "W" prefix, to differentiate them from existing routes.

The numbers proposed are not final, and may change before the Final New Network is put in place.

#### Line Width Shows Frequency

In the maps on the next two pages **the thickness of the lines represent the route frequency.** Thicker lines are routes coming every 15 minutes, Monday through Sunday, whilst thinner lines are routes coming every 30 minutes.

#### **Route Branching**

Some routes in the Draft New Network would branch, shown on the maps with this diagram:

What does it mean when two branches split on the map?



Route branches continue at lower frequency

**These are not interchanges.** The buses on the less frequent "branches" run together to form the more frequent "trunk."

This is proposed for:

- Route 3 at Pearse Park
- Route 4 in Ferrybank and at the Outer Ring Road
- Route 5 at Ballybeg

Route 1 is proposed to have a similar structure, but with only one branch. A high frequency of service would go as far as Waterford Hospital (and the Woodlands Hotel during rush hours) whilst a lower frequency of service continues on to Dunmore and Williamstown and circling back to Ardkeen. Essentially, every second bus would continue past the hospital.

No interchange is necessary between the two segments of the route, but the inner segment would offer shorter waits for a bus than the outer segment.

#### **Route Descriptions**

Street-by-street descriptions of each proposed route are provided starting on page 80.

Text descriptions of proposed frequencies are given in the appendix starting on <u>page 103</u>.

#### **Other Services**

There are more publicly-supported regional bus services in the Waterford area than are shown on the maps in this report.

BusConnects is focused on the urban Waterford area, whilst planning for connections among cities, towns and rural areas is happening through the Connecting Ireland Rural Mobility Plan.

## Maps of the Draft New PSO Network



For a closer look at the Draft New Network, please visit <u>busconnects.ie</u> and the online map linked there.

#### **City Centre**



For a closer look at the city centre in the Draft New Network, please visit <u>busconnects.ie</u> and the online map there.

## Maps of the 2023 Existing Network

#### **PSO Services**



l Summary

#### **PSO Services in the City Centre**



This map shows the existing urban PSO routes in Waterford city centre as of autumn 2023.

#### **All Services**



This map shows all routes (PSO, Expressway, commercial, etc.) that offered day-long service in the focus area as of autumn 2023.

## **More Service Investment**

#### **Added Service**

The existing PSO bus network does not adequately address local or national goals for growth, quality of life and sustainability. The NTA is proposing a major increase in service through BusConnects Waterford.

#### This proposal would *more than double* the amount of service in the Waterford Public Service Obligation

(PSO) bus network. This increase includes some service that can be seen on a map – such as new route segments – and some service that appears in timetables:

- New routes covering new areas.
- Better frequencies where the most people are travelling.
- Earlier morning starts on all routes.
- Higher frequencies on Sundays, and for more hours of each day.
- Two-way service in areas that are today served in one direction only.

#### Patronage vs. Coverage

One of public transport's main goals is high patronage. High patronage is necessary to meet climate, growth and liveability goals. High patronage generally results when places with many people are connected by frequent, fast and linear service.

But patronage is not public transport's only goal. Public transport is also expected to provide some service to all urbanised areas, even where few people live or work, and even where patronage is low. The purpose of such service is to prevent isolation and support people's needs for mobility no matter where they live.

These two goals are in tension. The more service is focused into frequent, all-day routes, in the areas where the large numbers of people live and work, the less it can be spread out to cover all areas.

Not all of the routes proposed in the Draft New Network are expected to attract high patronage. Some of them serve the purpose of covering areas where patronage will likely be low, but the service is important nonetheless.

## What is the value of high patronage?

- Make service more useful for more people
- Support dense and walkable development
- Improve access to jobs, education and other opportunities for large numbers of people
- Encourage people to switch from car to public transport
- Combat traffic congestion
- Reduce carbon emissions

## What is the value of coverage?

- Promote social and economic inclusion, regardless of where people live
- Prevent isolation for people who live in less-populated areas
- Include everyone in the benefits of public transport

## **Higher Frequencies**

The Draft New Network would improve the frequencies offered across the city as well as the hours of service.

The graphic below uses colour to describe each route's proposed frequency by time and day. Text tables with the same information, for the Existing and Draft New Networks, are provided in the appendix starting on page 103.

#### **15-Minute Frequency**

In the existing network, three routes offer 20-minute frequency. In the Draft New Network, *four routes* are proposed to offer *15-minute frequency* all-day, and these routes cover much more of the busiest parts of the city. An additional two routes would offer 15-minute frequency during weekday rush hours.

Routes with frequencies of 15 minutes or better not only shorten waiting time, they also make it easier for people to interchange and thereby access more of the city.

#### **Every-day Frequency**

In the existing network, frequency is worse on Sundays than on other days of the week. In the Draft New Network, the daytime weekday frequencies are also proposed to be the Saturday and Sunday frequencies – which means four routes have buses every 15 minutes all weekend.

#### **Earlier Morning Service**

In addition to frequency improvements, some routes would offer a longer span of daily service by starting earlier in the morning, especially on Saturdays and Sundays.





## **Service to More Areas**

The Draft New Network would provide PSO service in certain areas which are not served today. They are marked in yellow on the map below.

The Draft New Network would also remove service on a few streets, which are marked in pink on the map below. In these cases, the total number of people affected would be small, and improved service would be provided within a short walk of all existing bus stops. Removing these few, small segments has a benefit to a large number of people as it allows bus routes to be more linear and direct and the network to be simpler.

Overall the share of residents within 400 metres of a bus stop (about a five minute walk) would increase from 67% to 73% (measuring on weekdays at midday). Across every demographic group measured the proportion near service would increase with the Draft New Network. The percentage of jobs and school enrolments near bus service would also increase.



## **More Access to Opportunity**

It's impossible to predict exactly how many people might use an improved bus network. The future is inherently unpredictable, as our recent experience with the Covid-19 pandemic demonstrated. Predictive models can be used to forecast future public transport patronage, to use them we must make myriad assumptions about the future at least some of which will turn out to be wrong.

At the individual level, it is also hard to predict public transport patronage. It is difficult to know how someone will make their travel decisions in the future if there are changes in where they live, where they work, fuel prices, traffic congestion, the quality of public transport service, improvements to cycling and walking facilities, their own ability to drive a car, etc.

In the face of so much uncertainty, we can rely on simpler measures that focus on the near-term consequences of a change, and that require fewer assumptions about the future. One such measure is "access," also sometimes called "accessibility." Access measures the usefulness of a public transport network for any person who has a limited amount of time to spend traveling. Public transport is useful to the extent that it allows people to go where they want in a reasonable amount of time. **The more destinations you can reach in a reasonable amount of time, the greater your access to opportunity.** 

When we measure access, as illustrated at right, we use Census data representing where people live and work. We then use arithmetic to sum travel times between all residents and jobs. This arithmetic is described on the next page.

Designing cities and their public transport networks so that more people have access to more opportunities, within a reasonable journey time, is a reliable way to increase patronage.



#### What Factors Affect Access to Opportunity?

Access to opportunity via public transport is affected by:

- How many destinations are near public transport
- How long a person has to walk to and from service
- How long they have to wait for the service
- How far they have to travel in the public transport vehicle
- The **speed** of the vehicle
- How long they have to wait to interchange between services

Public transport operators have control over some of these factors: waiting time, interchange, route directness, where service is provided.

They have less or no control over other factors that affect access: public transport speed, travel distances, or where jobs and housing are located. These factors are generally controlled by local authorities as they manage land use, development and roadways.

#### **Estimating Journey Times**

Often when people describe public transport journey time they focus on the time spent on the bus. Public transport journeys also include time spent walking and waiting, which can exceed the time spent on the vehicle itself.



Most public transport journeys begin and end with a walk.



Waiting doesn't only happen at the start of your journey, it can also happen at the end. You may leave home shortly before your bus departs, but if your bus comes infrequently you often have to arrive at your destination early to avoid being late.

If you're interchanging, you'll have to wait a second time.

On average, across all passengers, the minutes spent waiting will sum to approximately one-half of the frequencies of the routes in question.



#### **On-board the vehicle**

Time spent on-board is affected by distance and speed. In summing travel times on the Draft New Network, we used conservative (slow) assumptions, and did not take into account the faster speeds that may result from other BusConnects improvements. Improvements in speeds will result in greater job access for more people.



#### **Increased Access to Jobs and Education**

As described on <u>page 15</u>, the Draft New Network would increase the percentage of residents, jobs and school enrolments near bus service. However, simply being near service isn't enough to make a service *useful*.

To measure the usefulness of the Draft New Network, we measure access to destinations *within a reasonable amount of time*. We have analysed this for:

- Door-to-door journeys of 30- or 45-minutes or less.
- Rush hours and midday.
- Weekdays, Saturdays and Sundays.
- To jobs and to education (primary, secondary, and third-level).
- For all residents, and for residents of areas of social deprivation; unemployed residents, young and senior<sup>1</sup> residents.

The tables at on the following page report the median<sup>2</sup> increase in access that would be provided, for all residents and by demographic group, within 30- and 45-minutes of travel, and to either jobs or education.

#### The Draft New Network would increase residents' access to jobs by +36% on weekdays all day, and +47% on weekdays at rush-hours, within 30 minutes of travel.

#### On Sundays, the increases are particularly large: +67% more jobs would be accessible within 30 minutes.

Access to jobs within 45 minutes of travel would improve for all groups, though generally by a smaller degree than access within 30 minutes would improve. Whilst 45 minutes sounds like a long commute time for a small city like Waterford, it is necessary for some cross-city journeys once one accounts for all walking and waiting time, and when one considers residents of more distant areas such as Tramore (who were included in this measure).

To measure access to education, we measured travel times from residents to primary schools, secondary schools, colleges and universities, with the number of enrolments available at each building accounted for. Access to educational enrolments would improve for all residents and specifically for youths.

Maps showing changes in access within 30 or 45 minute journeys, for any specific location in Waterford, can be made using the interactive webmap linked from <u>busconnects.ie</u>.

Many places people visit (such as shopping, schools, restaurants, medical services) are also places of work, so access to a greater number of jobs goes along with access to important destinations.

<sup>1</sup> Access to jobs for senior residents was measured not because seniors are likely to hold a job, but because job locations often represent areas with shops, services and social opportunities. Access for seniors would improve on all days, and especially on Sundays.

<sup>2 &</sup>quot;Median" is similar to "average" but it represents the point in the middle of the range of all experiences, rather than being a numerical average of all experiences. *Median* is a better representation of the most common experience Waterford residents would have with the Draft New Network than is *average*.

#### Changes in Access to Jobs within 30 Minutes

Waterford-area residents, by demographic	Weekday midday increase in jobs reachable within 30 minutes of travel	Weekday rush-hours increase in jobs reachable within 30 minutes of travel	Saturday increase in jobs reachable within 30 minutes of travel	Sunday increase in jobs reachable within 30 minutes of travel
All	+36%	+47%	+30%	+67%
Residents in Disadvantaged Areas	+12%	+15%	+13%	+37%
Unemployed Residents	+23%	+40%	+15%	+69%
Young Residents	+41%	+46%	+36%	+56%
Senior Residents	+15%	+17%	+17%	+35%

#### Changes in Access to Jobs within 45 Minutes

Waterford-area residents, by demographic	Weekday midday increase in jobs reachable within 45 minutes of travel	Weekday rush-hours increase in jobs reachable within 45 minutes of travel	Saturday increase in jobs reachable within 45 minutes of travel	Sunday increase in jobs reachable within 45 minutes of travel
All	+18%	+19%	+23%	+28%
Residents in Disadvantaged Areas	+19%	+12%	+20%	+4%
Unemployed Residents	+15%	+15%	+22%	+32%
Young Residents	+21%	+16%	+23%	+11%
Senior Residents	+20%	+15%	+24%	+18%

#### **Changes in Access to Education with 30 or 45 Minutes**

Waterford-area residents, by demographic	Weekday midday increase in education reachable within 30 minutes of travel	Weekday rush-hours increase in education reachable within 30 minutes of travel	Waterford-area residents, by demographic	Weekday midday increase in education reachable within 45 minutes of travel	Weekday rush-hours increase in education reachable within 45 minutes of travel
All	+19%	+19%	All	+6%	+19%
Young Residents	+15%	+17%	Young Residents	+18%	+20%

### How to Learn About the Draft New Network

#### In this Report

This Report is one source of information about the Draft New Network. Within this Report you will find:

- The principles used in bus network design, starting on page 21.
- An overview of the existing Public Service Obligation (PSO) bus network, starting on <u>page 33</u>.
- An overview of the demographic and built environment factors in Waterford, which affect public transport, starting on <u>page 45</u>.
- A description of the Draft New Network, starting on page 73.
- Analysis of how residents' access to service and to destinations would change with the Draft New Network, starting on <u>page 85.</u>

#### **Online Map**

To explore what the Draft New Network would mean for your area and for your journeys, you can refer to the online webmap available at the <u>BusConnects Waterford website</u>.

The online map allows you to:

- Zoom in and see detailed routing.
- Look at areas that are difficult to show on these small pages.
- See how average access to jobs or residents would change from your area.
- Create your own access map comparing how far you could travel using the existing network or the Draft New Network.

#### **Give Your Feedback**

The planning team hopes that you will give your feedback on the proposed new routes and network.

The <u>project website</u> offers more resources, such as the online map and videos explaining the new network.

An online feedback form is also linked from the project website, from 10 June through 19 July of 2024. You are invited to submit feedback using that form, and you may also upload letters or other files using the form.

For queries about public consultation, contact the planning team at <u>waterfordnetwork@busconnects.ie</u>.

*Give us your feedback through the project website: <u>busconnects.ie</u>* 

All routes in the Draft New Network have new numbers!



# Route & Network Design2 Principles

## What Leads to High Patronage?

Access to opportunity, described starting on <u>page 16</u>, is the way that public transport network design can affect **patronage**.

Access describes the likelihood that any person's trip, at the time they want to travel, will be possible in a reasonable amount of time.

There are many factors that affect patronage which have nothing to do with access or bus network design, such as:

- Economic activity and overall travel demand
- Public transport fares
- Road tolls
- Fuel prices
- Car ownership rates
- Car park prices

In this report, we focus on factors that the NTA and its local partners in the Waterford area **can** influence:

- Where routes go
- Their frequency and hours of service
- The **connections** among public transport services, and the ease of interchange

- Land use and development patterns
- **Demographics**, and where people with particular needs are located
- Street design and walkability

The first three factors on this list have to do with the design of bus routes and of the integrated public transport network. These are the factors proposed to change in the Draft New Network in ways that would make the network more useful for more people.

The latter three factors on this list land use, demographics and street design - have a heavy influence on the cost and usefulness of public transport. They are primarily controlled by local Councils. They cannot be immediately changed through BusConnects, but they can be improved over the longterm to make public transport more useful and more efficient. Planning for better land use and street design will maximise the benefits of BusConnects.

A high-patronage network is more useful for more people. And most people are in a hurry.

#### **Free Interchange**

In support of BusConnects and this network redesign, a new fare structure will soon be introduced in Waterford which reduces barriers and penalties for interchange.

Interchange between urban bus routes will be free. Simply changing from one public transport vehicle to another will not come with an extra charge, because fares will be based on distance travelled rather than the number of vehicles used.

Reliability is an important consideration in planning for interchange. People must have confidence that when they get off one bus and wait for another, the wait will be reliably short.

There is some discomfort involved in interchange. But most people want to get where they are going, quickly, more than they want to avoid interchange. Free and reliable interchange allows us to design a more frequent network, providing shorter overall journey times for more people.

#### **Productivity**

Almost every time we use the word "patronage" in this report, we mean patronage relative to cost. The word for this is "productivity."

Productivity takes into account the cost of providing a service, in addition to the number of people using the service. The table at right, top, demonstrates how productivity can be calculated per route: the number of boardings on Waterford routes in spring 2023 has been divided by the vehicle hours that were used to operate each route. All else being equal, a route that has a better frequency, a longer length or a slower speed will require more vehicle hours to operate.

Among the urban PSO routes, Route W5 is the most expensive to operate, requiring 48 vehicle hours per weekday – but it attracts so many patrons, making it the most productive! On weekdays it attracts 22 boardings per vehicle per hour.

Route 360 Tramore is not part of this study but is included here for interest. It has a slightly higher productivity than Route W5. In late 2023, more

#### Calculating Productivity by Route on Weekdays

Existing Route	Weekday Boardings (April-May 2023)	Weekday Vehicle Hours Required (April-May 2023)	Weekday Productivity (Boardings ÷ Vehicle Hours)
W1	816	29	17
W2	707	28	15
W3	789	28	18
W4	710	33	18
W5	1,389	48	22
360	1,402	38	23

#### Weekday, Saturday and Sunday Productivity

Existing Route	Weekdays	Saturdays	Sundays
W1	17	17	13
W2	15	18	12
W3	18	14	10
W4	18	12	9
W5	22	19	16
360	23	27	20

service was added to Routes 360 and 360a, as a response to their growing patronage and high productivities.

The second table above compares Weekday, Saturday and Sunday productivities. Frequencies on the urban W routes are consistent Monday-through-Saturday, and productivities decline only modestly if at all on Saturdays. The W2 is actually more productive on Saturdays than on Weekdays. On Sundays, frequencies are worse, yet the productivities of routes W1, W3 and W3 are still moderate despite this. For public transport planners, productivity is a clue about how people have been responding to a given level of public transport investment on a route. High productivity can be an indicator of greater patronage potential.

If a route with poor frequency and low operating cost attracts a modest number of patrons, then it may actually be more productive than other routes. This suggests that there is high underlying demand for public transport in the area, but the poor frequency prevents many people from using the route. This is likely the case for Waterford routes on Sundays, as frequencies drop to every 30 minutes but certain routes have only a modest decline in productivity.

Conversely, a route that attracts many patrons but has high operating cost will not be very productive - the cost of attracting each patron will be higher than on other routes.

Adding service to just any route - whether in the form of better frequency, longer hours or an extension to the route - will tend to increase patronage. However, to make the most efficient use of limited service investments, planners generally try to add service in places where it will result in the greatest possible increase in patronage, and this means keeping an eye on operating costs and on productivity.

## Frequency

One of the most powerful ways to increase access across a network is to shorten waiting times by improving frequency.

More frequent service:

- Reduces waiting time (and thus overall travel time).
- Lets you travel whenever you want.
- Improves reliability, because if you miss your bus or it breaks down, another one is coming soon.
- Makes interchange (between two frequent services) fast and reliable.

When frequency improves in places with large numbers of residents, jobs and other opportunities, that improves access for many people.

Better frequency increases the potential for high patronage, though it isn't enough by itself to cause high patronage.

#### How Frequent is Frequent Enough?

In small cities like Waterford, peoples' trips tend to be short. Public transport must be very frequent for short trips, since waiting time can dwarf journey time on the bus.

#### The shorter the trip, the less people tend to tolerate a long wait.

To think about whether any frequency is "frequent enough," imagine waiting one-half of the frequency (since on average, for most trips, you will). Ask yourself whether you could tolerate waiting that long as part of an *everyday* trip.

For many residents of the study area, the city centre and other major destinations are within a 30-minute walk or a very quick drive in a car. A bus that arrives only once every 30 minutes will therefore struggle to compete with these other options.

One can imagine that with realtime arrival information available on smartphones, frequency doesn't matter, because nobody needs to wait for a bus anymore. If a bus only comes once an hour, that's ok, because you only go to the stop at the right time.

But despite this new technology, frequency still matters enormously:

• Waiting doesn't just happen at the start of a journey, it also happens at

the end. You might not spend time waiting at the stop, but if your bus is infrequent you often have to wait at your destination. For example, if you start work at 8:00 am but the bus happens to pass your workplace at 7:35 and 8:05 am, you have a choice between being 25 minutes early or 5 minutes late.

- You can't always plan the start time of a return journey. You may be able to time your departure from home to the bus timetable, but many of life's errands end at unpredictable times – and many workers can't choose the end time for their shift.
- This reality can be hard for professionals to relate to, since most of us can start work whenever we arrive at our office, and choose when to leave. Other jobs have lessflexible start and end times.
- If you're making an interchange, the precise timing of that interchange also isn't up to you.
- Frequency improves the resilience of a journey, because if something happens to your bus, another one is at least coming fairly soon.

Frequency and productivity are related to one another. More frequent routes are likely to have more patrons relative to their operating cost.<sup>1</sup> Not only do they attract more passengers, they attract *disproportionately* more passengers relative to the higher cost of providing the better frequency.

The scatterplot at right shows routeby-route data from four medium-sized northern European cities. More frequent routes are to the left, and more productive routes are higher.

As the upward-left leaning curve shows, more frequent routes are, on average, more productive. In pursuit of higher patronage, operators and authorities tend to increase frequency on routes that are already very productive, or on routes serving areas with high patronage potential. When they increase frequency in such places, the average growth in patronage exceeds the increased cost of the better frequency.

We cannot increase the frequency of just any route and expect productivity



#### This scatterplot shows the frequencies and productivities of every route in four different cities' bus networks. Routes with better frequency tend to have more patrons relative to their cost.

to increase as well. The geographic and geometric conditions must also be in place: density, walkability, a mix of land uses, continuity and linearity. In places without these conditions, public transport tends to be less productive. But it can serve important coverage goals regardless, if the availability of the service is what matters most. In such areas, authorities typically offer infrequent service because the cost of better frequency is difficult to justify for a small number of passengers.

<sup>1</sup> A common way to represent operating cost is "vehicle hours" or "revenue hours:" the hours a vehicle and its driver are on the road, available to passengers.

#### Distance, Cost and Frequency

Within a limited public transport budget, longer routes trade-off against higher frequencies. This doesn't mean that a high frequency network is all short routes. But it does mean that as a system expands to serve new areas, maintaining high frequency would require investing in more vehicles and paying more drivers.

Alternatively, lengthening routes to serve new areas can be accomplished without new funding, but by cutting frequencies or hours of service to cover the increased cost of the distance, as illustrated below.

#### **Speed and Reliability**

Slower speeds have the same effect on public transport services as do longer distances. If the same route takes twice as long to drive now as it did ten years ago, the transport provider will need twice as many buses and drivers to maintain the same frequency.

This means that, **as public transport slows down, the cost to operate it increases**. A public transport provider can either reduce frequencies or come up with additional funding – funding which could otherwise have been used to *improve* service rather than run slower service at a higher cost.

Over recent years, the speed of

One bus can provide 30-minute frequency over a short distance...

...but double the distance means half the frequency. Now the bus comes every 60 minutes.

As routes get longer, a public transport authority must either **cut frequencies** or **spend more** to add buses and drivers to the route.

Waterford bus routes has been decreasing due to congestion. This has causes buses to arrive late, sometimes so severely late that a bus misses an entire trip, which patrons describe as the bus "never showing up."

Between 2019 and 2023, punctuality became much worse on four of the five city routes, as exemplified by the adjacent table comparing punctuality in the month of June.

Route	2019 bus trips arriving on time	2023 bus trips arriving on time	% points of decline in punctuality
W1	87.2%	72.4%	-14.8
W2	87.2%	79.7%	-7.5
W3	88.2%	81.7%	-6.5
W4	91.0%	89.2%	-1.8
W5	86.2%	79.6%	-6.6

Bus Éireann can address reliability problems by writing bus schedules that assume slower speeds. For example a timetable might be revised to say that a bus takes 20 minutes to reach the city centre instead of the 17 minutes it took in the past.

Bus Éireann has made such changes to timetables in the recent past, to

improve punctuality.

Another way to improve punctuality and reliability is to add buffer time at the ends of routes. A late-running bus can "catch up" by skipping that buffer time and going immediately back into service. This buffer time increases the cost of providing bus service, without increasing the number of bus trips available to patrons.

Bus Éireann has recently added a great deal of buffer time to improve the reliability of routes W1 and W2, so much that an entire additional bus and driver are now required to operate those routes.

W1 and W2 are operated together, by a single team of drivers each day. In the past, routes W1 and W2 required

When congestion slows down public transport, it becomes more costly to operate. This consumes funding that could otherwise be spent making the service better. four drivers and four buses each weekday. To provide additional buffer against delay, in September 2023 Bus Éireann added a fifth bus and driver to the daily operation of those two routes. This addition would not yield any improvement in frequency on the routes, nor in speed. It only improved the certainty of a slower but more reliable operation.

#### **Speed and Frequency**

As public transport vehicles slow down, a responsible operator must do least one of three things:

- Cut frequencies, or
- Shorten routes, or
- Find funding for more drivers and buses.

For example, on routes W1 and W2, as the buses moved more slowly, the gap between arriving buses at a stop could lengthen to every 25 minutes or so, instead of the intended frequency of 20 minutes. If Bus Éireann didn't have additional funding to spend on an additional driver and bus, they would have been forced to concede a worse frequency, writing new timetables for routes W1 and W2 with 25 or 30 minute headways.

In Waterford, slowing speeds and worsening reliability have consumed funding for public transport service. The percentage of Public Service Obligation investment in Waterford which goes towards slower operations and more buffer time has been increasing over the past five years.

Writing slower but more realistic timetables, adding more buffer time, and adding more vehicles to a route, all improve the reliability of the bus. However, they are short-term solutions, a necessary acceptance of the degradation of bus speeds. These actions cannot address the long-term problem.

Strategies to speed bus service including some of the BusConnects measures - will support bus service that is frequent, reliable, fast and an efficient use of public funding in the long term.

## **Radial and Orbital Services**

A public transport network should be greater than the sum of its routes. One route can take people only so many places – but if that route makes connections with many other lines, vastly more places become reachable.

The Waterford public transport network is highly **radial**: all lines connect in the city centre. This reflects the shape of the city: most major surface roads lead to the city centre, which comprises the highest concentration of activity, and these radial roads are also very busy and lined with dense housing, shops and offices.

In a purely-radial network, every route connects with every other route at the centre; only one interchange is needed to reach every point in the system.

But as Waterford has grown, more journeys take place between outlying locations, and travelling through the centre can feel like a hassle.

**Orbital** routes might solve this problem, by allowing for cross-city travel without going through the centre.

Orbital routes succeed under these conditions:



Radial bus routes travel between a City Centre and outlying areas or towns. The existing bus routes in Waterford mostly follow radial patterns, in and out of the centre of the city.

- Continuously high densities along the length of the orbital route.
- A mix of uses (housing, jobs and schools) along the length of the orbital route.
- Good walkability to development near orbital route stops (rather than isolated stops on a dual carriageway, for example).
- Easy interchange with radial routes.

The last point is often overlooked. It must be easy for people to Orbital bus routes travel between outlying residential and job areas, without passing through the centre. As any city grows outwards and as its radial bus network is improved, a trade-off arises between adding a new orbital route or making radial routes more frequent and useful.

interchange to and from orbital routes. As solitary routes, orbital routes in outlying areas rarely serve a sufficiently high density of jobs and residents to attract high patronage. Orbital routes are also typically long and therefore costly to operate, which means they need even more patrons to justify their high cost. When orbital routes are useful *in combination with radial routes,* then they begin to make sense. For an orbital route to succeed it is important that both the orbital route and the radial routes offer high frequencies and good interchanges.

To have such a robust and widespread frequent bus network in Waterford implies a level of transport operating cost that may be out of reach at this time. It is also a solution to a problem that is particular to larger cities: indirect journeys between places distant from the city centre. This is naturally a smaller problem in smaller cities. An orbital route only recently became appropriate in Cork, which is a much larger city than Waterford and has dense mixed-use developments at great distances from the centre.

The small size of Waterford and concentration of demand both along radial roads and in the city centre mean that larger numbers of journeys are served by focusing investment on frequent radial routes. At the same level of funding, adding more orbital routes would mean less frequent service overall, which would lengthen journeys made by great numbers of people.

If the goal is to improve access to opportunity for the greatest number

of people in Waterford, then it will be more effective to offer higher frequencies and faster speeds on radial routes, rather than dilute service levels in order to create a new orbital route. In other words, we can get most people to their destinations sooner by routing them through the centre, on more frequent and fast radials, than by sending them on a seeminglymore-direct orbital route with a poorer frequency.

BusConnects priority measures will allow for faster journeys *through* the city centre, making radial routes more useful even for journeys between outlying areas such as the University Hospital in the east and the SETU Arena in the west.

In the future when Waterford is a much larger city, adding an orbital route may result in a more useful network. But at the size foreseen for the next decade, a bigger effect can be made on journey times and the overall usefulness of public transport if the focus is put on higher frequencies, better connections between routes, and improving bus speeds through the city centre.

## **Connections or Complexity?**

There is a trade-off between interchange and complexity that arises from the maths and geometry of transport. A public transport network designed to avoid interchange will be more complex, with poorer frequencies than are otherwise possible.

Obviously we would all prefer a oneseat-ride, rather than a second wait for a second bus. But making that wish come true for all would spread service thin, and thereby make it less useful.

The illustrations on this page and the next page show why designing a network for some interchange allows for higher frequencies, better reliability and shorter journey times overall.

The network at right is made of direct routes, one from each of three residential areas to each of three major destinations. The routes are operated by 18 buses and drivers.

There are a total of nine routes, but each is only operated by two buses, so the frequencies are poor. You always get a one-seat journey, but you can't depart when you want to. You have to time your trip to the bus schedule. If you miss your bus, it's a long wait until the next one.



A well-connected network is key to high patronage. Routes must connect with one another so that people can reach many different places across the city. In contrast, the network on this page has just three routes, but serves the same six places and has 18 buses and drivers.

Each route offers much better frequency, because the available buses are concentrated onto fewer routes. Because there are only three routes. some journeys require interchange. The high frequencies make those interchanges fast and reliable.

In this more frequent network, you can depart at the right time for your work shift or class, because a bus is always coming soon. Your needn't arrive too early just because that's when the bus timetable dictates. You spend less time waiting for the bus and your door-todoor travel time is shorter - despite the interchange.

An important thing to note about these two networks is that *they cost* the same to operate.

Designing the Waterford bus network to avoid interchange would mean running a "spaghetti-pile" of routes, between every residential area and every destination. With so many unique routes, each route would have a poor frequency, since available service would be divided across all of them.



People would save a little time by avoiding interchange, but they would lose more time every day due to the poor frequencies of the routes. Such a network would also be complex and hard for people to learn and remember, especially for people new to the city.

Whilst everyone would understandably prefer a route that goes directly from where they live to where they work; and another route that does the same to where they shop; and a third to where they socialise...satisfying those

individual desires would result in an infrequent network that few people would find useful.

This is why the Draft New Network is designed with an acceptance that some journeys will involve interchange.



## The Existing Bus Network

This chapter describes the Existing Network, route frequencies and hours of service, and how the network serves coverage and patronage goals:

- To describe coverage provided by the Existing Network, a map and analysis are provided describing how many people are within a short walk of any bus service.
- To describe the patronage potential of the Existing Network, an analysis is provided which shows how many people are within a short walk of *frequent* service, as high frequency correlates with high patronage.

#### **Recent Improvements**

In 2018, new investments in bus service in Waterford were made, improving frequencies and lengthening hours of service, especially on weekends. The timetables were also simplified, with consistent 20- or 30-minute frequencies offered on every route six or seven days per week. These changes resulted in patronage growth. Patronage fell due to the COVID-19 pandemic, but it has recently been coming back.

In the past year, the Waterford network has been improved in a

number of ways:

- As described earlier, one bus and driver were added to the operation of Routes W1 and W2 in 2023 to improve their reliability.
- Very recently, in December 2023, Route 360 was made more frequent due to high patronage.
- Route 360a, which was previously just a few trips varying from the 360 during rush hours, was made a proper all-day all-week route by itself.

The service increases that began in 2018 also required more infrastructure in the city centre, in the form of setdown spaces for buses. With more buses on the network, more space was required where routes could end and drivers could take a break. The City Council provided additional road space on Meagher's Quay to make the additional service possible.

## Maps of the 2023 Existing Network

#### **PSO Services**



This map shows the existing urban PSO services in the focus area as of autumn 2023.

#### **PSO Services in the City Centre**



This map shows the existing urban PSO services in Waterford city centre as of autumn 2023.


This map shows all services (PSO, Expressway, commercial, etc.) in the focus area as of autumn 2023.

# **Existing Frequencies and Hours of Service**

The graphic below uses colour to convey the frequency of each existing urban bus route, during each hour of the day, as of summer 2023. (Text tables with the same information are provided in the appendix starting on page 103.)

The Existing Network of PSO services consists of 6 routes, operated by Bus Éireann.

The Route 360 to Tramore (with special trips called 360A) is also shown in this table, for context, with its summer 2023 frequencies (which have since been improved).

#### **Span of Service**

All five PSO routes operate seven days per week. Daily spans (hours of service) vary on each route. Most routes offer service all day on weekdays starting around 6 or 7 am, with slightly later start times on Saturdays. On Sundays, most routes start at 8 or 9 am.

All week long, routes operate beyond 11 pm at night.

#### **Consistent "Clockface" Frequencies**

As mentioned above, the Waterford PSO network offers consistent 20or 30-minute frequencies all day long. These are called "clockface" frequencies because they repeat in a predictable pattern each hour (as do frequencies of 60 or 15 minutes). This makes the daily timetable easy for someone to remember. This is a laudable feature of the existing service

> Waterford Urban Bus Route Frequencies The bus comes about every:

which should be maintained in the future.

#### Lack of High-Frequency Service

The Waterford network includes three routes with buses coming every 20 minutes, Mondays-through-Saturdays. There are no routes that would be considered "frequent" by public transport industry standards, meaning headways of 15 minutes.

In a small city, where journeys are short, a frequency worse than every 15 minutes does not compete well against driving, hiring a taxi, cycling or just walking all the way. The shorter someone's trip, the less they tend to tolerate a long wait for the bus before finding an alternative.



\*The 360A is one direction hourly service: northbound AM and southbound PM

# **Proximity to Bus Service**

The chart to the right shows how many people and jobs are within a 400m walk of public transport services in the Waterford area, at midday on a weekday. Proximity to service is distinguished by frequency, with some people or jobs near a route coming every 20 minutes and others only near routes coming every 30 minutes.

As of the 2022 Census, there were about 61,000 residents in the study area. As of the 2016 Census (which is still the most recent available for jobs data), there were about 25,000 jobs in the study area.

67% of the area's residents and 75% of jobs are within a 400 m walk (about five minutes) of some type of public transport service. These figures are much higher for households without cars (85%) and residents in deprived areas (80%). The percentage of seniors living near PSO routes (73%) is slightly higher than the percentage of overall residents (67%).

Increasing the percentage of residents and jobs near **any service** addresses **coverage** goals such as social inclusion.

Only 38% of residents and 55% of jobs are today within a 400 m walk

#### Residents and Jobs Near Service at Midday on Weekdays



#### Legend:

Within 400 m walk of buses coming every:

20	30	60	60+ over 400 m minutes from service
minutes	minutes	minutes	

of public transport coming every 20 minutes or better. Encouragingly, the figures are much better for households without cars (66%) and residents in deprived areas (61%).

The Waterford bus network does not include any bus services coming every 15 minutes or better at midday. During rush hours, one set of services (Routes 607, 617 and 627) combine to offer approximately 15-minute frequency, however it is not offered for most of the weekday nor on weekends.

Increasing the number of people near **frequent service**, especially **all-day and all-week** frequent service, addresses **patronage** goals, because higher frequency services tend to be more useful and attract more passengers.

# **Existing Patronage and Productivity**

Data describing patronage on the existing Waterford routes is available for each route in total. This allows for a comparison of each route's patronage relative to its service level and cost to operate. The table below gives frequencies and productivities for Routes W1-W5 from spring 2023.

Route	Frequency (weekdays at midday)	Productivity (boardings per revenue hour of service)
W1	20 mins.	17
W2	20 mins.	15
W3	20 mins.	18
W4	30 mins.	18
W5	30 mins.	22

To the right, these routes have been added to the scatterplot previously shown on <u>page 26</u>. Routes W1-W5 are green dots in the columns for 20 min. and 30 min. frequencies.

The Waterford PSO routes are less productive than routes of similar frequencies in the four northern cities included in this scatterplot. Waterford is a smaller and less-dense city than the other cities, and route productivity would be understandably lower as a result. (Larger and more urban cities typically have higher densities and



This scatterplot shows in grey the frequencies and productivities of every route in four other cities' bus networks. The five Waterford PSO routes are shown as blue dots.

higher costs for car parking, which make public transport more useful for more people.)

#### **Frequency and Journey Length**

In such a small city as Waterford, journey length is quite short. People experience waiting time in proportion to the length of their journey.

Frequencies of 20 or 30 mins. might therefore be reasonable when people are making journeys over a long distance in a large city, but they are poor frequencies relative to the short trips people make within Waterford.

For public transport to really "compete" for passengers in Waterford, or in any place where journeys are short, frequencies will need to be fairly high.

In addition, the existing Waterford network offers many one-way route segments and one-way loops. These cause people's journeys to be circuitous and time-consuming, often more time-consuming that simply walking all the way. In some cases the one-way loops make it very difficult to use a route for anything other than travel to and from the centre, as we describe in the following pages.

# Fit of Frequency to Land Uses and the Built Environment

The Waterford routes with 30-minute frequency (W4 and W5) are actually slightly more productive than the Waterford routes with a better, 20-minute frequency, which does not fit the usual pattern.

BusConnects Waterford is an opportunity to review the fit between route frequencies and land uses, and consider whether changes to route frequencies would result in a higherpatronage and more efficient network.

BusConnects is also an opportunity to replace one-way loops and one-way splits in service with simpler, two-way routes.

# **One-Way Loops and Splits**

The existing Waterford PSO bus network makes use of one-way loops and one-way splits in bus routes to provide wide coverage. Loops and splits are less-costly way to run bus service down many different streets, compared to the cost of providing two-way service.

However, one-way loops and splits are useful to many fewer people than is two directional service. They are a tool for coverage, which trades-off against high access and high patronage.

On a map, a route with a one-way loop may give the impression that people can use it to easily travel among all of the places on the loop. In fact, for every return journey they



make, they will need to travel around the entire length of the loop, all 360 degrees.

In Waterford, one-way loops and splits happen both at the outer ends of routes and in the middle of routes.

For example, as shown in the map to the right, Route W3 serves the city

centre, travels out Ballytruckle Road, and then drives in a large clockwise one-way loop along Airport Road, the Outer Ring Road, Ballytruckle Road, rejoining itself at Pearse Park.

This one-way loop allows the route to cover a large area of residences. It costs half as much to provide this one-way service as it would to provide two-way service on both roads at the same frequency.

Imagine a journey from point A on the map to the city centre. But before someone is taken towards the centre, they must first journey all the way to the Ring Road. Similarly, someone who lives at point B on the map has a direct journey to the centre, but a circuitous journey back home.<sup>1</sup>

Another limitation of one-way loops like the W3 is that they *fail to connect places on the loop to one another*.

If a resident at point A wanted to travel to a shop at point B, their journey to the shop would be

circuitous but relatively short. However their journey home, from **B** to **A**, would go via the city centre, or would require an interchange from one W3 bus to another at Pearse Park. Either would be intolerable for most people looking to make such a short trip.



<sup>1</sup> Some people might prefer to walk the 400-700m between Ballytruckle and Airport Roads, to skip the circuitous part of their bus journey. This is impossible due to a total lack of streets or paths that go through between the parallel roads.

Route W5, shown on the right, also includes a one-way loop or split at its western end. This allows the route to cover a large area across Crescent Drive, Cleaboy Road and Skibbereen Road.

This route design prioritises coverage over short journey times or high access to destinations. Journeys to and from the centre from the west side are circuitous and time consuming, as someone must go around the entire loop for each return journey.

For example, if someone living at point wanted to travel to the city centre, their journey there would first go north and then south on Crescent Drive, then via Lismore Park, Skibbereen Road and Árd Na Greine before finally turning towards the city centre.<sup>2</sup>

If this one-way loop were narrower, many people could walk to its opposite side for one part of their journey. The service would still be complex and harder for people to understand,



The one-way loop that makes up the western part of Route W5 covers many areas. However it is time-consuming to use because a person must travel the entire loop plus the deviation up and down Crescent Drive for every return trip.

but it would offer faster journeys. Unfortunately, the loop is 500m across, and few streets connect across it. This means there are hardly any areas from which a resident is *within a short walk of service in both directions*.

This is a general problem with one-way splits in service. As shown in the diagram to the right, when the two directions of a service are spaced farther apart, fewer places and people are within a reasonable walking distance of stops for both directions. A one-way split or one-way loop therefore *appears* to do more, but offers useful two-way service to fewer people.



<sup>2</sup> They would also need to sit through the buffer time and the driver's break at Crescent Drive. Every route has an "end," where the buffer time is scheduled. On one-way loops the "end" is typically halfway around the loop - making the circuitous return journey even longer.

For potential patrons who aren't going to the city centre, Route W5's western loop appears to connect Crescent Drive, Cleaboy Road, Lismore Park and Skibbereen Road to one another. But it does so in an extremely timeconsuming way.

If someone lives at point **B** and wants to travel to the Training Services office at point **C**, their journey going there would be fairly direct. But their journey back home, from **C** to **B**, would go *via Waterford Hospital.* Alternatively, they could alight from the inbound bus once the two directions of service come together, and wait for another outbound W5 bus to complete their journey.

Of course, few people are likely to spend an hour using the bus to go 2 km, a distance most people can walk in about 25 minutes.

Regardless of someone's particular solution to this problem, Route W5 provides low access to opportunities on the west side due to the large one-way split in the route.





..but the journey home would require staying on Route W5 to and from Waterford Hospital! It's faster to get off the bus at Upper Yellow Road...

..and wait for another W5 bus coming the other direction. (Or just walk all the way.)



# 4 Analysis of Markets and Needs

In this chapter, we present data that informs two different considerations in transport planning:

- Where are the strongest markets for transport, with potential for high patronage and low operating costs?
- Where do people have moderate or severe needs for transport, where services may be justified regardless of patronage or cost?

### Indicators of Strong Public Transport Markets, or High Needs

The maps on the following pages show:

- Residential density
- Job and education density
- Activity density, which combines residents, jobs and education into one measure
- Density of no-car households
- Areas of affluence and deprivation
- Density of unemployed residents
- Density of young residents (ages 17 and under)
- Density of senior residents (ages 65 and over)

Whilst residential and demographic data from the 2022 Census is now available and has been used to make these maps, job and school data from 2022 is not yet available. The maps on the following pages that include job and school data therefore use 2016 Census data.

In designing the Draft New Network, the network redesign planning team did not rely on Census data alone. The team worked with staff from Waterford Council and Bus Éireann to ensure that the Draft New Network would address current conditions and any imminent development expected by 2026. This group also contributed knowledge of existing bus patronage patterns, currently-unmet needs for service, and changes in bus patronage and demand since the pandemic.

Most of the maps on the following pages show the density of each population group across the area. However, density on its own is not enough to support high patronage. We must examine these maps for all of the land use qualities that indicate high patronage potential, in addition to density:

- Walkability. Even if numerous people are near a stop, for many of them to use public transport the walk to the stop must be a reasonable distance and the walking conditions must be safe and appealing.
- **Mix of Uses.** When places are dense with many types of development, public transport can work efficiently in both directions at many times of the day and week.
- **Continuity**. Crossing rural areas and open space takes time and therefore consumes operating budget. This means that the farther apart built-up areas are, the greater the cost to connect them, or the worse frequency can be offered across that distance.
- Linearity. Only when dense developments are arranged in linear patterns, along bus-operable roads, can bus routes be direct whilst getting close to large numbers of people and activities. This also makes them more efficient, which supports higher frequency.

# **Residential Density**



### Relevance

Understanding where many people live close together can help us see where there is a strong market for public transport. Many journeys start and end at home, so places where many people live have potential for high patronage.

People's homes also serve as destinations for other people's trips such as for visiting, caring for family, or receiving services someone provides from home.

### **Observations**

The map on the previous page shows the density of residents in the Waterford area, as of the 2022 Census. Areas shown in darker shades of blue are home to more residents, which means more potential bus patrons are within walking distance of any given bus stop.

Waterford does not have the pattern of centralised density which is common in other cities. On average, the core of the centre has higher residential density than outlying areas. However, there is moderately dense housing scattered across outlying areas.

The pattern of residential density alone is less important for public transport than the pattern of mixed-use density, which follows in four pages.

# **Job & Education Density**



### Relevance

The density of jobs and school or university positions show the areas to which many people travel on a daily basis. The map on the previous page sums together the number of jobs in each area, plus the number of enrolment positions available in schools, colleges and universities.

However, helping people travel to these destinations is about more than just commutes. Job locations also represent shops, restaurants, hospitals, services, and all of the other places that people go as part of a full life.

University campuses, in addition to attracting students, are also important destinations for the faculty and staff that support their studies, researchers, visitors, and, in the case of medical schools and teaching hospitals, patients seeking care.

### **Observations**

The map on the previous page shows the density of jobs and school enrolments as of 2016 (the latest year for which Census data is available). School data shown here includes primary through university enrolments.

Waterford's centre is dense with jobs and schools. The job density arises from a mix of shops, services, cultural organisations and offices.

High job and school enrolment density appears on this map at the main SETU campus (South East Technological University, formerly Waterford Institute of Technology) near the junction of the Cork Road and Paddy Brown's Road.

Moderate job density also appears at the eastern end of the city at University Hospital Waterford.

To the west of Lismore Road and Lismore Park there is a very large, lumpen-shaped zone. It appears to have moderate density in the map on the previous page. This is a misleading representation of the job location data.

The zone is very large – its outline is visible on the map to the right – but the number of jobs represented across



the entire zone occupies less than half the area of the zone. The jobs are chiefly in the business parks west of Lismore Park, with a smaller number near the junction of the Outer Ring Road and Kilbarry Road. The other half of the large zone is green fields or low density housing, rather than job locations. **Activity Density** 



### Relevance

The map of activity density on the previous page shows the density of residents, jobs, and education positions together.

The Activity Density map allows us to identify corridors that are:

- Continuously dense, so that bus service needn't cross empty gaps; and
- With a *mix of uses*, so that buses will be well-used all day and all week, in both directions.
- Arranged in *linear* patterns, so that buses can offer straight and direct service whilst passing close to many people and destinations.

A map of activity density is generally the most important map for use in the design of high patronage bus routes.

### **Observations**

The map on the previous page combines residential density with job and school density, to show how activity is spread across the Waterford area. (This map uses 2016 Census data, due to the lack of more recently data on jobs and school enrolments.)

Waterford city centre is fairly dense with housing, jobs and school enrolments. To the north of the river, directly across from the centre and close to the railway station, densities are very low.

Outside of the centre, Waterford has some scattered areas of high density. Dense development is not continuous, as there are low-density pockets fairly near to the centre. Dense developments are not arranged in a linear pattern: there are few linear routes that a bus could drive whilst passing continuously high densities of housing, jobs, or a mix of both.

Such a pattern of scattered development makes it difficult for a public transport operator or authority to provide a high frequency network. Lacking a subset of city streets on which land use conditions are really favourable for public transport, bus service is spread evenly across all streets. This usually results in middling frequencies on all routes, rather than high frequencies on a core set of routes that serve large numbers of people.

It is possible that, since 2016 when this data was collected, more recent planning and development work have focused on a subset of streets. If so, that may suggest corridors that are a high priority for frequent bus service.

## **Density of No-Car Households**



### Relevance

The map on the previous page shows where no-car households are concentrated in the study area.

The presence of households with no cars indicates both potential for high patronage and a need for public transport service.

In places that are far from the city centre, people without cars may have few options besides public transport for reaching jobs and services beyond their immediate area.

### **Observations**

Residents without a car at home are very concentrated near the centre of Waterford. They are also concentrated to a lesser degree in Lismore Park, in Ballybeg and along Airport Road.

This geographic concentration explains why the existing bus network is able to provide service within 400m of 75% of households without cars (as shown on page 39).

There may be a positive feedback dynamic at work, which goes two ways: bus operators and authorities place service where there are numerous likely patrons, whilst people who do not own cars are more likely to choose housing, jobs and shops in areas with good bus service.

Local authorities can take advantage of that positive feedback dynamic, by sending clear signals about the areas where public transport will be highly useful. When those areas are arranged in linear, continuous patterns, then they can be operated efficiently, which supports high frequencies and long hours of service. The end result of this type of planning is that people who want to depend on public transport can make good choices about where to work, go to school or make a home.

# **Density of Unemployed Residents**



### Relevance

The map on the previous page shows where people who were unemployed in 2022 were concentrated. This data does not include people who were enrolled in university, permanently disabled or retired, only those actively seeking work.

It may seem strange to focus on unemployed people as a source of transport demand or need, given that unemployment typically requires less travel than employment. However, a map of unemployment density adds important context. It helps identify areas where many people may benefit from better access to employment and educational opportunities.

A map of unemployment can help planners identify areas where public transport is valuable for social reasons. In denser and more central areas, this need complements patronage goals. In outlying areas with low density, public transport may not attract high patronage but can fulfil coverage and inclusion goals.

### **Observations**

The map showing the density of unemployed residents shows a similar pattern to the map of households without cars. However, unemployed residents appear to be slightly more dispersed, living slightly further from the centre and further from existing bus routes. **Youth Density** 



### Relevance

Children are not legally able to drive. Nonetheless, they travel to schools, to see friends and family and to attend various activities.

Driving children around is a major consumer of parents' and other care-givers' time. Public transport can be both a relief to busy adults and a source of independence and empowerment for young people. Children have access to discounted youth fares which provide an extra incentive.

A map of youth density combines both a certain level of need, and a certain amount of potential for high patronage, as many people who have travelled on a bus at 4 pm on a weekday can attest.

### **Observations**

The map of youth density looks very similar to the map on page 47 of overall residential density. Children and young people live across the entire study area, in rough proportion to adult residents. A few small areas stand out as having especially numerous young people, such as Ballybeg; Kilbarry Road; Ballytruckle and Airport Roads; Newton Glen in Ferrybank; and in some areas of the city centre. **Density of Seniors** 



### Relevance

Older people have a propensity for using public transport, due to fixed incomes, lower rates of driver licensing, difficulty maintaining driving skills, and the Free Travel Scheme.

However, as a group, they tend to have different preferences for transport service design than younger people and working people:

- They often have a strong preference for short walks to and from the bus stop, or are physically unable to walk very far at all.
- They often have more time to make their journey.
- They are less likely to make trips for which they do not control the timing (such as to a job or school). Therefore, they are able to schedule more of their trips around the bus timetable.

For these reasons, retirees and seniors tend to be more concerned that transport routes get close to their homes and destinations, and less concerned about whether the service is frequent or fast, compared to younger and working people.

### **Observations**

Whilst there are older people living in every area to some degree, the density of seniors is higher in older areas of the city, especially Ballybricken and Lismore Park.

# Patronage, Efficiency and the Built Environment

Public transport providers can attract more passengers by offering service that more people find useful.

However, land use and street design have a huge impact on how many people will find a service useful, how much patronage it will attract, and how much it costs to provide.

Five land use factors are especially suggestive of high patronage potential and service efficiency:

- Density
- Walkability
- Linearity
- Continuity
- Mix of Uses

The way these factors affect patronage and cost are described on the following pages, and illustrative examples are given from Waterford.

### Density

The graphic on the right shows two identical bus routes. The route on the top is travelling in an area that has twice as many homes as the route on the bottom.

All else being equal, the route on top will attract higher patronage, because there are simply more people who will want to travel to and from the area.

Density answers the basic question, "How many kilometres must we drive a bus to reach 100 people?" The more spread apart the people are, the farther public transport must drive to reach them, which results in higher costs (or poorer frequency).

The images on the next page show example densities in Waterford.

While family and household size affect density, the major determinants are the type, size and spacing of buildings.

Housing, jobs and schools are most concentrated in Waterford city centre. Beyond the centre, moderately dense developments tend to be separated from one another by low density development or by open land. Most outlying developed areas have low

#### How many people, jobs and activities are near each stop?

**Better:** Many people and jobs are within walking distance of a bus stop.

#### 

**Worse:** Fewer people and jobs are within walking distance of a bus stop.

density, with ample space between shops, employment buildings and houses either for parking cars or for landscaping.

#### **Density Examples in Waterford**



Low density: North of Williamstown Road, homes are far apart, resulting in few people walking distance from each bus stop.



Moderate density: South of Williamstown Road, an area of small homes placed close to each other and to the road has higher density.



Low density: Commercial development can also happen at low densities, as in the case of business parks near the Outer Ring Road. Most of the land is devoted to car parks and roads, resulting in few workers or visitors close to any given bus stop.



**Moderate density:** Even car-oriented business parks, like this one west of Paddy Brown's Road, can be moderately dense as long as the buildings and activities are close together and close to the streets.

# Walkability & Permeability

Density alone is not enough to ensure high patronage at a bus stop. To use a bus stop, people need to be able to get to the stop. The vast majority of urban public transport start with walking.

The street network, footpaths and crossings around a bus stop affect how many people are willing and able to walk to the stop. If a street network is disconnected, with poor permeability, the bus stop on a main road may be close as-the-crow-flies but quite far away by walking. As a result, it will be useful to relatively few people.

At large junctions and roundabouts, bus stops are often located far from the junction. This adds extra distance to the walk to any point on the intersecting street.

#### In Waterford, walkability has been undermined by the lack of pedestrian permeability between estates.

This is true of both residential and commercial/industrial estates. For decades, developments have shied away from main roads, and some have walled themselves off from

#### Is it easy to walk between the stop and the activities nearby?



**Better:** In a connected street network, most nearby places are a short distance away by foot.

Wor netw are le

**Worse:** In a disconnected street network, walks to nearby places are long and circuitous.

adjacent areas. This undermines public transport. The walk from one main road to the next one over is often indirect, and in many cases effectively impossible. This is a major impediment to providing service within a short walk of most people and destinations.

Two examples are shown on the following page, but many other examples could be made as poor street connectivity is a major problem across Waterford.



**Better:** For people to use a bus service both ways, it must be safe to cross the road near the stop.

# Permeability Examples in Waterford

Many residential areas, for example in Kilcohan, shown below, were built without street or footpath connections between developments. The residential street and path networks are entirely separate - they do not cross the yellow



line marked on the map.

Residents of this area can walk to either Ballytruckle Road or Airport Road, but not both. As a result, bus service must be divided onto both main roads, and fewer people are walking distance of each bus stop.

This same problem exists in other residential areas of the city: in Grantstown, Grange Upper and Crescent Drive, a house can be 100-200m from the main road as the crow flies, but 1-3km by walking.

It is unfortunately common for different land uses to be separated from one another, with no pedestrian permeability in between. Not only does this reduce residents' ability to walk to shops or to work, it also undermines the usefulness of public transport.

For example, in the area of Lismore Park shown in the map at right, it is not possible to walk from homes (or a bus stop) into the nearby industrial park without a circuitous routing (marked in yellow). A bus provided for residents of Lismore Park would be a long way from the employees in the industrial park, or vice versa.



The Lismore Park area (shown at right) provides a good example of street and pedestrian permeability, supportive of public transport.

Rather than being effectively walledoff from adjacent developments, Lismore Park has streets that go through, or pedestrian paths that go through. On the map to the right, the existing street or path connections to adjacent areas are circled in yellow.

This makes it possible to run bus routes not only to but also through Lismore Park, and on to other places. Residents and shops in Lismore Park can therefore benefit from a higher level of bus service than the development could justify all by itself.

Street and path connectivity inside the development is fairly good, which means that residents have little out-ofdirection distance to cover when they walk to a nearby bus stop on a main road.

Public transport will be useful to fewer people if each person is walking distance to only one main road and one bus route, and if people's walks to many bus stops are made longer than necessary by the street network.



Poor permeability also pushes the public transport authority to divide the limited service budget into more routes on more parallel roads, which undermines frequencies.

### Linearity

Exactly where development is allowed determines how *linear and direct* public transport routes can be.

The graphic on the right shows destinations aligned in two different ways. In the town on the top, the destinations are on the main road. Public transport can serve all destinations with a straight line. If you are travelling through this area, you're always travelling towards your destination, and never feel that you're being taken out of your way.

The town on the bottom has the same four destinations, but has permitted them to be built far from the main road. To serve these places, a bus needs to drive away from the main road, get to the front door, and then drive back to the main road. If this is your destination, this is great for you... but if you are travelling between any other places, you are taken out of your way and your trip is longer.

Notice that the line serving the town at bottom is much longer than the line in the town at top. At twice the length, it either costs twice as much to operate, or can only be offered at half the

#### Can public transport run in reasonably straight lines?



**Better:** A direct path between places makes public transport more appealing.



**Worse:** Deviations from a straight path discourage people who want to ride through, and increase costs.

frequency. In this way, disconnected and non-linear development makes it harder to afford high frequency bus routes.

Waterford has a number of linear, radial corridors. However, concentrating enough service onto those corridors to offer good frequency is a challenge for two reasons:

• A lack of pedestrian permeability means bus routes must be provided

on many nearby roads, causing routes to be circuitous to run in one-way loops, and dividing service across more roads.

• Dense developments are not concentrated along any subset of linear roads. This makes it harder to justify focusing service into a small, efficient set of high frequency routes.

### Continuity

With public transport, distance is a major contributor to the cost of service.

Connecting places that are far away is more expensive than connecting places that are close by, and – as described on <u>page 27</u> – making routes longer requires either an increase in spending or a decrease of frequencies. For this reason, places that have continuous density and activities along a road will generate higher patronage relative to costs.

Development in Waterford is somewhat patchwork: whilst there are few destinations or developments on the far side of green fields or agricultural lands, there are higherdensity developments scattered among low-density developments. As a result, some bus routes must traverse areas of low demand in order to reach areas of higher demand.

There is a notable exception to the principle that continuity is important for patronage and productivity: intercity routes connecting dense, built-up areas can be quite productive. This is because, for long journeys,

#### Does public transport have to cross long gaps with little demand?



**Better:** Short distances between many destinations are faster and cheaper to serve.



Worse: Long distances between destinations means a higher cost and therefore worse frequency.

many people find it appealing to avoid the stress and cost of driving and take the bus instead.

In urban public transport planning, gaps between dense areas increase public transport operating costs and reduce productivity. But in rural and inter-city public transport planning, long distance between towns and cities is why many people find the service useful in the first place.

This can be observed in the relative

performance of the Waterford urban routes (W1-W5) and the Waterford-Tramore route (360). The 360 traverses a large area of agricultural land, incurring costs to cover the distance without the possibility of picking up patrons. But the journey is long enough that people have an incentive to leave their cars behind. As a result, the Route 360 is more productive than the existing urban routes.

### **Mix of Uses**

The mix of uses along a road affects how many passengers transport can attract, relative to cost. A mix of uses tends to generate patronage in both directions, at many times of day and week.

Public transport in purely residential areas is used mostly in one direction – away from the residences, towards jobs. It is often not well-used outside of rush hours.

There are three ways that mixed-use development patterns can support efficient, high-patronage public transport:

- Vehicles can be full in both directions, rather than being empty half the time. This means that there can be twice as much patronage, relative to operating cost.
- Vehicles can be full all day and all week, rather than only at rush hours. The cost of buying and maintaining the vehicles is supporting more passengers.
- If people board and alight all along the route, then the route is used for many short trips. Each seat on the vehicle is useful to multiple people.

#### Are buses well-used in both directions, throughout the day?



**Better:** A mix of land uses means buses are used in both directions during weekday rush-hours, and throughout the day and week.



**Worse:** Buses serving purely residential areas tend to be used mostly during rush-hours, and mostly in one direction.

Waterford has a high mix of uses in its historic and inner city areas, but most recent developments have been built for one single use. For example, Grantstown, Grange Upper and Kilcohan have been developed as entirely residential, with a few caroriented retail parks nearby. Cleaboy and Gracedieu are also almost entirely residential. The Waterford Industrial

Park, and Cork Road to the west, are entirely employment, with few connections to adjacent residential areas.

In contrast, the Ballybeg and Lismore Park developments include retail as well as dense residential, are close to industrial parks, and are connected to nearby SETU by streets and paths.

# Linearity, Continuity and Mix of Uses in Waterford

As described previously on page 42, existing Route W3 coverages Ballytruckle and Airport Roads in a circuitous one-way loop (shown below). This looping service results from the form of development in the area. The area is mostly low-density, with almost entirely residential development, as shown in the excerpted map of Activity Density



below, at centre.

The area has poor pedestrian permeability, reducing the number of people who are walking distance to bus stops on the main roads, as shown in the map below, to the right (repeated from an earlier page). The yellow line marks the divider across which people cannot walk.

If dense development, and a mix of land uses, is concentrated along a *single* road, with good pedestrian



permeability to that road, then a linear and frequent service is efficient to provide and easy to justify. In this area, neither road has particularly dense housing or activities along it – in fact, the density of residents is slightly higher in the centre of the loop, *away* from the main roads, which puts a large number of residents a longer walk from a bus. And both roads must be covered by bus service, given the impossibility of walking between them.

A one-way loop is a reasonable way



to cover so many kilometres of road that have few potential patrons within walking distance and that aren't on the way to any other major destinations. The circuitousness of the existing service arises from the land use and street planning decisions in the area.

There are areas of Waterford in which development is organised in linear patterns. This is particularly true on the west side of the city, close to the centre.

The map inset to the right, at top, is excerpted from page 51. It shows the density of residents, jobs and school enrolments, as of the 2016 Census. There are many potential routes that a bus could follow in this area of the city which are linear and which pass dense, mixed use and continuous development. Four possibilities are marked in dark lines on the map at top right, though there are other possibilities as well.

The map to the right, at bottom, shows the same area, in aerial footage from 2023. As of 2016, among the linear corridors on the west side of the city Cork Road had the least continuous density (and therefore shows up in white on the upper map). However,



since then, additional development has filled in some of the areas along Cork Road, and more development is imminent.


# **5** The Draft New Network

# How to Read the Network Maps

## **New Route Numbers**

All of the proposed routes have been given unique numbers, without a "W" prefix, to differentiate them from existing routes.

The numbers proposed are not final, and may change before the Final New Network is put in place.

# Line Width Shows Frequency

In the maps on the next two pages **the thickness of the lines represent the route frequency.** Thicker lines are routes coming every 15 minutes, Monday through Sunday, whilst thinner lines are routes coming every 30 minutes.

## **Route Descriptions**

Street-by-street descriptions of each proposed route are provided starting on page 80.

Hour-by-hour frequencies for each proposed route are shown graphically on page 78 and text descriptions of proposed frequencies are given on in the appendix starting on page 103.

## **Route Branching**

Some routes in the Draft New Network would branch, shown on the maps with this diagram:

What does it mean when two branches split on the map?



Route branches continue at lower frequency

#### These

**are not interchanges.** The buses on the less frequent "branches" continue on together to form the more frequent "trunk."

This trunk-and-branch arrangement is proposed for:

- Route 3 at Pearse Park
- Route 4 in Ferrybank and at the Outer Ring Road
- Route 5 at Ballybeg

Route 1 is proposed to have a similar structure, but with only one branch. A high frequency of service would go as far as Waterford Hospital (and the Woodlands Hotel during rush hours) whilst a lower frequency of service continues on past those places to Dunmore and Williamstown. Essentially, every second bus would continue past the hospital. No interchange is necessary between the two segments of the route, but the inner segment would offer a higher frequency than the outer segment.

# **Other Services**

There are more publicly-supported bus services in the Waterford area than are shown on the maps in this report.

BusConnects is focused on the urban Waterford area, whilst planning for connections among cities, towns and rural areas is happening through a separate process called Connecting Ireland.

# Maps of the Draft New Network



For a closer look at the Draft New Network, please visit <u>busconnects.ie</u> and especially the online map linked there.

# **City Centre**



# **Service to More Areas**

The Draft New Network would provide PSO service in certain areas which are not served today. They are marked in yellow on the map below, and include:

- Outer Cork Road and the Western
   Link Road
- Kilkenny Road south of Cork Road
- The IDA Industrial Estate
- Dunmore Road, St. Mary's Place and Williamstown Road
- Ferrybank

The Draft New Network would also remove service on a few streets, which are marked in pink on the map below. In these cases, the total number of people affected would be small. and improved service would be provided within a short walk of all existing bus stops. Removing these few, small segments has a benefit to a large number of people as it allows bus routes to be more linear and direct and the network to be simpler.

Overall the share of residents

within 400 metres of a bus stop (about a five minute walk) would increase from 67% to 73% (measuring on weekdays at midday). Across every demographic group measured the proportion near service would increase with the Draft New Network. The percentage of jobs and school enrolments near bus service would also increase.



# **Higher Frequencies**

The Draft New Network would improve the frequencies offered across the city as well as the hours of service.

The graphic below uses colour to describe each route's proposed frequency by time and day. Text tables with the same information are provided in the appendix starting on page 103.

## **15-Minute Frequency**

In the existing network, three routes offer 20-minute frequency. In the Draft New Network, *four* routes are proposed to offer 15-minute frequency all-day, and these routes cover much more of the busiest parts of the city. An additional two routes would offer 15-minute frequency during weekday rush hours.

Routes with frequencies of 15 minutes or better not only shorten waiting time, they also make it easier for people to interchange and thereby access more of the city.

## **Every-day Frequency**

In the existing network, frequency is worse on Sundays than on other days of the week. In the Draft New Network, the daytime weekday frequencies are also proposed to be the Saturday and Sunday frequencies – which means four routes have buses every 15 minutes all weekend.

# **Earlier Morning Service**

In addition to frequency improvements, some routes would offer a longer span of daily service by starting earlier in the morning, especially on Saturdays and Sundays.



# **Implementing WMATS**

This Draft New Network is a step towards implementing the bus network conceived in the Waterford Metropolitan Area Transport Strategy (WMATS). The map to the right was developed as part of WMATS and shows indicative routes for the year 2040. WMATS anticipated the detailed service planning that is now happening through BusConnects.

All of the routes proposed for 2040 in WMATS are two-way routes, rather than the one-way loops common in the existing network. In keeping with this, most of the service in the Draft New Network is two-way.

The general patterns of WMATSconceived routes are also echoed in the Draft New Network, with high frequencies on trunks that divide into lower-frequency branches to cover lower-density areas. Routes in both networks are quite linear, with minimal deviations from a direct and radial path into and out of the centre.

The WMATS 2040 network includes an orbital route (shown in light blue at right) on the Inner Ring Road and passing through the IDA Industrial Estate. This pattern is partly realised in the Draft New Network by proposed



the Route 7 which would connect Carrickphierish, the IDA Estate and SETU. With further growth in patronage and investment in service, the orbital pattern could be extended eastwards in future years. It would be most useful if it could follow a more path towards University Hospital further south than the Inner Ring Road, but this is not currently possible due to a lack of east-west street connections.

The Draft New Network would be a major step towards implementing the service envisioned in WMATS 2040, while also responding to the imminent needs and opportunities in Waterford.

# **Route Descriptions**

The table on this page provides a detailed text description of every proposed route and branch in the Draft New Network.

Route branches (with A or B) are described including the trunk, because they would offer continuous service along the trunk and the branch without an interchange.

The colours in the first column match the colours for each route on the map.

Route	From	Via	То	How Often
1	SETU	Paddy Brown's Rd – Tycor Rd – Slievekeale Rd – Ard Na Greine – Upper Yellow Rd – Lower Yellow Rd – Ballybricken Green – Thomas St (Outbound) – Penrose Lane (Inbound) – The Quays – The Clock Tower – The Mall – William St – Newtown Rd – Dunmore Rd	University Hospital	15 mins
1 Peak	SETU	Paddy Brown's Rd - Tycor Rd - Slievekeale Rd - Ard Na Greine - Upper Yellow Rd - Lower Yellow Rd - Ballybricken Green - Thomas St (Outbound) - Penrose Lane (Inbound) - The Quays - The Clock Tower - The Mall - William St - Dunmore Rd - Newtown Rd - Dunmore Rd - University Hospital - Dunmore Rd	Woodlands Hotel	15 mins peaks
1B	SETU	Paddy Brown's Rd - Tycor Rd - Slievekeale Rd - Ard Na Greine - Upper Yellow Rd - Lower Yellow Rd - Ballybricken Green - Thomas St (Outbound) - Penrose Lane (Inbound) - The Quays - The Clock Tower - The Mall - William St - Dunmore Rd - Newtown Rd - Dunmore Rd - University Hospital - Dunmore Rd - Saint Mary's Place - Ballygunner - Williamstown Rd - Outer Ring Rd	Ardkeen	30 mins
2	University Hospital	Outer Ring Road - Upper Grange Road - John's Hill - John Street - Parnell Street - The Mall - Meagher's Quay - Bridge Street - Dock Road - Rockshire Road	Rockshire Road	30 mins
3	The Quays	The Mall - Parnell Street - John Street - Ballytruckle Road - Lower Grange Road	Inner Ring Road	15 mins
3A	The Quays	The Mall - Parnell Street - John Street - Ballytruckle Road - Lower Grange Road - Inner Ring Road - Ballytruckle Road - Outer Ring Road - Airport Road - (return to centre)	Ballytruckle & Airport Roads	30 mins
3B	The Quays	The Mall - Parnell Street - John Street - Ballytruckle Road - Lower Grange Road - Airport Road - Outer Ring Road - Ballytruckle Road - (return to centre)	Airport & Ballytruckle Roads	30 mins
4	Outer Ring Road	Cork Road - SETU Main Campus - Cork Road - Manor Street - Parnell Street - The Mall - The Quays - Edmund Rice Bridge - Dock Road - Fountain Street	Ferrybank	15 mins
<b>4</b> A	SETU Arena	Western Link Road - Outer Ring Road - Cork Road - SETU Main Campus - Cork Road - Manor Street - Parnell Street - The Mall - The Quays - Edmund Rice Bridge - Dock Road - Fountain Street - Ross Road - Bullring	Slieverue	30 mins
4B	Whitfield Hospital	IDA Waterford Business & Technology Park - Cork Road - SETU Main Campus - Cork Road - Manor Street - Parnell Street - The Mall - The Quays - Edmund Rice Bridge - Dock Road - Abbey Road	Abbey Park	30 mins
4 Peak	Slieverue	N29	Belview Port	30 mins peaks only
5	The Quays	Thomas Street (Outbound) - Penrose Lane (Inbound) - The Glen - Ballybricken - Stephen's Street (Outbound) - Mayor's Walk (Inbound) - Barrack Street - Cannon Street - Ashe Road - Cork Road - Ballybeg Drive	Ballybeg Drive	15 mins
5A	The Quays	Thomas Street (Outbound) - Penrose Lane (Inbound) - The Glen - Ballybricken - Stephen's Street (Outbound) - Mayor's Walk (Inbound) - Barrack Street - Cannon Street - Ashe Road - Cork Road - Ballybeg Drive - Kilbarry Road	Lacken	30 mins
5B	The Quays	Thomas Street (Outbound) - Penrose Lane (Inbound) - The Glen - Ballybricken - Stephen's Street (Outbound) - Mayor's Walk (Inbound) - Barrack Street - Cannon Street - Ashe Road - Cork Road - Ballybeg Drive - Cork Road	SETU	30 mins
6	The Quays	Thomas Street (Outbound) - Penrose Lane (Inbound) - The Glen - Morgan Street - Gracedieu Road - Dominick Place - Congress Place - Upper Yellow Road - Cleaboy Road - Crescent Drive - Oakwood - Cleaboy Road - Skibbereen Road - Paddy Brown's Road	SETU	30 mins
7	The Quays	Thomas Street (Outbound) - Penrose Lane (Inbound) - The Glen - Morgan Street - Gracedieu Road - Knockhouse Road - Carrickphierish Road - Old Kilmeaden Road - Industrial Estate - Paddy Brown's Road	SETU	30 mins all day 15 mins peaks

## **New and Improved Hubs**

Interchange between services would be possible wherever two routes cross (and especially easy where two routes with 15-minute frequency cross). However interchange would be especially popular and important at two new hubs: one on the Quays, near the Clock Tower; and the other near SETU's main campus.

The change at the Quays is a change in degree, as it is already a major hub for the existing network. Because this network represents an increase in service, the number of buses passing along the Quays would increase. Numerous people would also make interchanges between routes from different sides of the city, and the best



place for most of those interchanges would be along the Quays. Improved infrastructure would be needed both to improve comfort for waiting passengers and to accommodate a few more buses at halts. In addition, some routes would end at the Quays, thus space would need to be provided for buses to be parked between trips on the route and whilst the driver takes a break.

The change at SETU is not simply an increase in service but the introduction of an entirely new hub to support the new network structure. SETU is a major destination in and of itself. It also sits at the crossroads between many other destinations, making it a natural place where people will want to interchange between bus routes.



Offering good interchange on the south side of the city will help people reach some destinations quicker, by relieving them of the need to travel all the way to the north through the centre.

Proposed Routes 1, 4, 5B, 6 and 7 would all pass the SETU Main Campus at Cork Road and Paddy Browne's Road. We have proposed an off-street hub in the southwest corner of the SETU campus, where four of those routes would terminate. The hub would both provide end-of-line space and facilities for the four terminating routes, and a nice environment for people interchanging between them.

Route 4, which would not terminate at SETU, could remain on Cork Road offering direct and fast service to the west, as long as short walks and comfortable crossings were provided for people wishing to interchange between Route 4 and the other routes (as well as for the many people who will want to reach the SETU buildings themselves from Route 4 stops).

## **Route 1** (Including the 1B and 1 Peak)

Route 1 would travel on streets that are today served by Routes W2, W5 and commercial J.J. Kavanagh & Sons Routes 607, 617 and 627.

It would connect SETU, Ballybricken, the city centre, Waterford Hospital, Ballygunner, Williamstown and Ardkeen.

There would be three segments of Route 1:

- Service every 15 minutes, all day and every day, would be available on the route between SETU and Waterford Hospital.
- During rush hours only (peaks), that 15 minute frequency would be extended beyond the hospital along Dunmore Road as far as the Woodlands Hotel.
- All day every day, every second Route 1 bus would continue on beyond Waterford Hospital, to Ballygunner and on back around in to Williamstown and Ardkeen. This is labelled 1B on the map and this extension would operate every 30 minutes, in both directions (inbound

and outbound).

No interchange would be necessary for people along any segment of Route 1 to reach the hospital, the city centre and SETU. The three segments are distinct in their frequencies, but operate as one continuous route.

At its southeastern end, Route 1B would connect residential areas to the hospital, the centre and SETU, but it would also allow for travel between those residential areas. It would offer two-way service around the loop shown on the map, such that someone could (for example) journey from Williamstown to the Woodlands Hotel, and back again; or between St. Mary's Place and the Ardkeen Shopping Centre, and back again.

On its western side, in the Lismore Park area, Route 1 would offer frequent two-way service to replace the one-way service offered by W2 and W5 in that area today. Bus stops would be added to the opposite sides of streets so that people can use the bus in both directions.

# Route 2

Route 2 would operate every 30 minutes between Rockshire Road in County Kilkenny and University Hospital Waterford.

It would connect with the new railway station in Ferrybank and then pass through the city centre and along Upper Grange Road before turning east on the Outer Ring Road to the hospital.

### Route 3 (Including 3A and 3B)

Route 3 would offer frequent service, every 15 minutes, between the Quays, Ballytruckle Road and Pearse Park.

Route 3 buses would continue on south of Pearse Park, with alternating buses going clockwise and then anti-clockwise around the loop of Airport Road, Outer Ring Road and Ballytruckle Road. The anti-clockwise loop would be called Route 3A and the clockwise loop would be called Route 3B.

For people living along the 3A and 3B loops, if they wish to go to the city centre or anywhere else north of Pearse Park, they could take either loop in either direction, whichever is coming next. Their frequency of service, for such a journey, will be approximately every 15 minutes.

People would also be able to use the 3A and 3B loops to travel within the area, for example to and from the Spar on Ballytruckle Road, with a frequency of every 30 minutes. This is not currently possible with the one-way loop offered by Route W3, at least not without either an interchange or a journey all the way to the city centre and back.

## **Route 4**

#### (Including 4A, 4B and 4 Peak)

Route 4 would be a cross-city route connecting the south and north sides of the river.

The core trunk segment of Route 4 would offer two-way 15-minute frequency all day and all week. This core segment would go between the junction of the Cork & Outer Ring Roads in the south, to Ferrybank in the north.

At the southwest end of the route, alternating buses would turn different directions, to offer service every 30 minutes to two different places:

- Half of buses would serve the UPMC Whitfield Hospital and nearby business parks (the 4B branch).
- The other half of buses would go to the SETU arena (the 4A branch).

(Either of the termini of these branches could serve as good Park & Ride locations in the future.)

North of the river, alternating buses would turn different directions in Ferrybank, to offer service every 30 minutes on the two branches:

- Half of buses would serve Abbey Road (the 4B branch).
- The other half of buses would serve Slieverue (the 4A branch).

Reaching Belview Port with bus service is challenging because the most direct road is inoperable by buses (Abbey Road) whilst the road that can be driven by buses (the N29) has no provision for bus stops. The N29 also has no provision for the pedestrian crossings, footpaths and street connections to employment locations that would allow Port workers to reach bus stops on the road.

Future works should improve the

possibility of offering regular public transport service to the port. Until then, a connection during rush hours on weekdays is proposed to be made at Slieverue, which is marked as the Route 4P on the map. This connection could be provided as a separate shuttle or as an extension of the Northern 4A branch through Slieverue.

### Route 5 (Including 5A and 5B)

Route 5 is proposed to offer two-way service, every 15 minutes, all week, between the city centre, Ballybricken, Cannon Street, Ashe Road, and Ballybeg. These areas are currently served by the one-way Routes W1 and W2. In some places, the W1 and W2 combine to offer two-way service, but in other places people are within walking distance from service in one direction, but not in the other.

In general, the current arrangement of one-way loops made by the W1, W2, W4 and W5 is complex. The proposed Routes 1, 4, 5 and 6 will offer two-way services close to all existing bus passengers. The intention is to offer a much simpler network that is easier for Waterford residents to learn and remember. At Ballybeg, alternating buses would turn different directions, offering frequency of every 30 minutes on the two branches:

- Half of buses would proceed along Ballybeg Drive and then come back around via Cork Road to end at the SETU main campus (the 5B branch).
- The other half of buses would proceed south on Kilbarry Road (the 5A branch).

Unlike in the existing network, Ballybeg residents would have two-way service connecting them to SETU in one direction or the city centre in the other direction.

# Route 6

Route 6 would offer 30 minute frequency, every day, between the city centre, Upper Yellow Road, Crescent Drive, Cleaboy Road, Lismore Park and SETU. It is similar to the existing W4.

The service would operate two-way (unlike the existing W5 which serves the area). This would allow people to travel among places on Route 6 without an interchange or a long journey via the centre, which is not possible on the existing W5. Connections with other bus routes, including the frequent Routes 1 and 4, would be available at the SETU main campus as well as in the centre.

# Route 7

Route 7 would connect the city centre, Gracedieu Road, Carrickphierish Road, the IDA Business Park and SETU's main campus on Cork Road.

The frequency of Route 7 would be every 30 minutes, on weekdays and weekends alike. During weekday rush hours, Route 7 would offer 15-minute frequency.

Proposed Route 7 would replace the existing Route W4, with three changes:

- The higher (15-minute) frequency during rush hours.
- Service through the IDA Business Park, ending at SETU on Paddy Brown's Road.
- Two-way service on Gracedieu Road without the one-way loop in the existing W4.

The one-way loop in the existing W4 is made because inbound buses go to the centre via Congress Place, Lower Yellow Road and Military Road, while outbound buses do not serve that loop. People currently using the W4 along that loop would be able to use proposed Routes 1 or 6 instead, and would have service nearby for *both* directions of their journey (rather than only one direction, as is currently provided for). For the other passengers of the W4 coming from all other areas, the route would be more direct and faster into the centre due to the removal of the loop.

Residents of Lismore Park would be close to the proposed Route 7 (as well as proposed Routes 1 and 6) thanks to a new pedestrian path connection that Waterford Council is planning from Lismore Park into the IDA Business Park.

Some residents near the Crescent would be walking distance to Route 7 (and its 15-minute frequency during rush hours) on Carrickphierish Road. However, a lack of pedestrian connections to Carrickphierish Road will prevent people in the Crescent from walking to the service.



# Comparing the Existing and Draft6 New Networks

# **Public Transport and Access to Opportunity**

As described in the Summary chapter of this report, it's impossible to predict exactly how many people might use an improved bus network. The future is inherently unpredictable.

In the face of uncertainty, we can rely on simpler measures that focus on the near-term consequences of a change, and that require fewer assumptions about the future.

An important measure used in public transport planning is "access," also sometimes called "accessibility." Access measures the usefulness of a public transport network for any person who has a limited amount of time to spend traveling.

Public transport is useful to the extent that it allows people to go where they want in a reasonable amount of time. **The more destinations you can reach in a reasonable amount of time, the greater your access to opportunity.** 

Designing cities and their public transport networks so that more people have access to more opportunities, within a reasonable journey time, is a reliable way to increase patronage.



# What affects public transport access?

Access to opportunity via public transport is affected by:

- How many destinations are near public transport
- How long a person has to walk to and from service
- How long they have to wait for the service
- How far they have to travel in the public transport vehicle
- The **speed** of the vehicle
- How long they have to wait to interchange between services

All of these sources of travel time and access to destination were taken into account for the analysis of the Draft New Network, as reported on the following pages.

# **Estimating Journey Times**

Often when people describe public transport journey time they focus on the time spent on the bus. Public transport journeys also include time spent walking and waiting, which can exceed the time spent on the vehicle itself.



Most public transport journeys begin and end with a walk.



Waiting doesn't only happen at the start of your journey, it can also happen at the end. You may leave home shortly before your bus departs, but if your bus comes infrequently you often have to arrive at your destination early to avoid being late.

If you're interchanging, you'll have to wait a second time.

On average, across all passengers, the minutes spent waiting will sum to approximately one-half of the frequencies of the routes in question.



#### On-board the vehicle

Time spent on-board is affected by distance and speed. In summing travel times on the Draft New Network, we used conservative (slow) assumptions, and did not take into account the faster speeds that may result from BusConnects projects. Improvements in speeds will result in greater job access for more people.



# **Access Gains Citywide**

Access improvements that would result from the Draft New Network have been analysed for:

- Door-to-door journeys of 30- or 45-minutes or less.
- Rush hours and midday.
- Weekdays, Saturdays and Sundays.
- To jobs and to education (primary, secondary, and third-level).
- For all residents, and for residents of areas of social deprivation; unemployed residents, young and senior<sup>1</sup> residents.

The tables at on the following page report the median<sup>2</sup> increase in access that would be provided, for all residents and by demographic group,

2 "Median" is similar to "average" but it represents the point in the middle of the range of all experiences, rather than being a numerical average of all experiences. *Median* is a better representation of the most common experience Waterford residents would have with the Draft New Network than is *average*. within 30- and 45-minutes of travel, and to either jobs or education.

The Draft New Network would increase residents' access to jobs by +36% on weekdays all day, and +47% on weekdays at rush-hours, within 30 minutes of travel. On Sundays, the increases are particularly large, with +67% more jobs accessible within 30 minutes.

Access to jobs within 45 minutes of travel would improve for all groups, though generally by a smaller degree than access within 30 minutes would improve. Whilst 45 minutes sounds like a long commute time for a small city like Waterford, it is necessary for some cross-city journeys once one accounts for all walking and waiting time, and when one considers residents of more distant areas such as Tramore (who were included in this measure).

To measure access to education, we measured travel times from residents to primary schools, secondary schools, colleges and universities, with the number of enrolments available at each building accounted for. Access to educational enrolments would improve for all residents and specifically for youths. Maps showing changes in access within 30- or 45-minute journeys, for any specific location in Waterford, can be made using the interactive online map linked from <u>busconnects.ie</u>.

Access to a greater number of jobs can indicate access to more destinations, because many places people visit (such as shops, schools, restaurants and clinics) are also places of work.

<sup>1</sup> Access to jobs for senior residents was measured not because seniors are likely to hold a job, but because job locations often represent areas with shops, services and social opportunities. Access for seniors would improve on all days, and especially on Sundays.

Changes	in	Access	to	Jobs	within	30	Minutes
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Waterford-area residents, by demographic	Weekday midday increase in jobs reachable within 30 minutes of travel	Weekday rush-hours increase in jobs reachable within 30 minutes of travel	Saturday increase in jobs reachable within 30 minutes of travel	Sunday increase in jobs reachable within 30 minutes of travel
All	+36%	+47%	+30%	+67%
Residents in Disadvantaged Areas	+12%	+15%	+13%	+37%
Unemployed Residents	+23%	+40%	+15%	+69%
Young Residents	+41%	+46%	+36%	+56%
Senior Residents	+15%	+17%	+17%	+35%

#### **Changes in Access to Jobs within 45 Minutes**

Waterford-area residents, by demographic	Weekday midday increase in jobs reachable within 45 minutes of travel	Weekday rush-hours increase in jobs reachable within 45 minutes of travel	Saturday increase in jobs reachable within 45 minutes of travel	Sunday increase in jobs reachable within 45 minutes of travel
All	+18%	+19%	+23%	+28%
Residents in Disadvantaged Areas	+19%	+12%	+20%	+4%
Unemployed Residents	+15%	+15%	+22%	+32%
Young Residents	+21%	+16%	+23%	+11%
Senior Residents	+20%	+15%	+24%	+18%

#### **Changes in Access to Education with 30 or 45 Minutes**

Waterford-area residents, by demographic	Weekday midday increase in education reachable within 30 minutes of travel	Weekday rush-hours increase in education reachable within 30 minutes of travel	Waterford-area residents, by demographic	Weekday midday increase in education reachable within 45 minutes of travel	Weekday rush-hours increase in education reachable within 45 minutes of travel
All	+19%	+19%	All	+6%	+19%
Young Residents	+15%	+17%	Young Residents	+18%	+20%

# **Improved Access from Example Locations**

Maps on the following pages show how access would change with the Draft New Network, from six example locations, on weekdays.

# What These Maps Show

These maps are meant to answer the questions:

- How many places could I reach from each place, in a reasonable amount of time?
- How would this be different from where I can go today?

The reader is encouraged to make their own map for any place the Waterford urban area using the online map linked from the <u>project website</u>.

# Assumptions

#### You're walking and using any available public transport. These maps illustrate improvement in the bus network, comparing the Draft New Network to Existing. They are not comparing the car or bicycle to public transport.

In other networks, all public transport lines are included, not only the urban routes but also Routes 360, 360a, 40, 354, etc., and the railway. Some of the accessible places shown on the maps are therefore beyond the focus area for this study.

You walk at a moderate speed. The maps assume a walking speed of 1 metre per second, which is a bit slow for an able-bodied and unencumbered adult. This reflects things that can slow people down like street crossings.

You wouldn't walk for more than 30 minutes total, in any one-way journey. Walking trips are included, even all the way to a destination if it is faster to reach that destination by foot than by bus, and if the walk doesn't exceed 30 minutes.

# Most bus stops would be located in the same places as they are now.

In cases of different streets being served, we've made some assumptions about where stops would be located. Stop locations will be decided more precisely during implementation of the final network.

#### On average, your wait to use a bus would be half its frequency, for the

reasons explained on <u>page 87</u>. For example, if the bus comes every 15 minutes, you'll wait 7.5 minutes on average. If it comes every 30 minutes, you'll wait 15 minutes on average. You won't necessarily spend this waiting time at the bus stop, but you will often spend it at your destination, and so we have counted it in the total time needed to use the bus.

**Buses would travel at similar speeds as they do now.** BusConnects will increase bus speeds, but for this analysis we have assumed 2023 bus speeds. Any improvements in speeds from BusConnects will result in greater increases in access than are shown here.

You would interchange if it made your trip quicker overall. BusConnects Waterford will include the elimination of interchange fares between buses.

If you were to interchange, you would have to wait for the second bus as well. As with the first bus, the assumed wait time would be half the frequency of the second bus route.

You're travelling on a weekday,

**around midday.** Better access would be available at weekday rush hours. Similar access would be available on weekends because the same frequencies would be offered on each route all week long.

## **Clock Tower**

How far could I travel from

## **i** Clock Tower

in a reasonable amount of time?

Weekdays, in the Daytime

**30 minutes** N25 M9 N24 N29 vhouse Ro Green Rd N25 Old Kilmeadan Rd Passage Sun Rd Old Tramore Por "hore Rd Dunmore pirport Rd PO **Change in Access** 0 2 km 1 +600 (+4%) Jobs: Residents: +1,600 (+5%)



# **Ballybricken Green**

How far could I travel from **Ballybricken Green** in a reasonable amount of time? Weekdays, in the Daytime

**30 minutes** 





## **SETU Main Campus**

How far could I travel from SETU Main Campus in a reasonable amount of time? Weekdays, in the Daytime

**30 minutes** 





# **University Hospital**

How far could I travel from **University Hospital Waterford** in a reasonable amount of time? Weekdays, in the Daytime





# De La Salle GAA Club

How far could I travel from De La Salle GAA Club in a reasonable amount of time? Weekdays, in the Daytime



+2,800 (+25%)

**30** minutes



1

## **IDA Business Park**

How far could I travel from **IDA Business Park** in a reasonable amount of time?

## Weekdays, in the Daytime



Retained New Access Access Lost Access 45 minutes M9 RO Dock Rd N25 Ord Kilmeadan Rd Cork Rd Ballytruckle Rc Butlerstown Rd Airport Rd Old Tran ANOTE Rd 0 2 km

## **Kilkenny Library, Ferrybank**

How far could I travel from Kilkenny Library, Ferrybank in a reasonable amount of time? Weekdays, in the Daytime



**Draft New Networks** and Existing **Comparing the** ശ

N29

2 km





# **Proximity to Service of Various Frequencies**

The Draft New Network would increase the number of residents, jobs and school enrolments near bus service. Among residents of the Waterford area, 67% are today within a 400 m walk of bus service all day on weekdays, whereas 73% would be in the Draft New Network. For schools and jobs, the number near bus service would increase by four and five percentage points, respectively.

On the next four pages, graphics show how people's proximity to bus service would change with the Draft New Network at four different times of the week. This analysis has been performed for all jobs, all schools (primary through third-level) and all residents, and for residents living in areas of high deprivation, seniors and youths. It has counted all bus services in the Waterford area, both the urban PSO routes and the longer-distance and commercial services.

# Walking Distance

Someone is considered "proximate" if they are within a 400 m walk of a bus stop. This walk is measured along the pedestrian network, and is therefore sensitive to barriers such as motorways, cul de sacs or walls.

Most people can walk 400 m in about 5 minutes. Some people cannot walk that distance, either all the time or in certain situations (such as when carrying packages or wrangling small children). Other people regularly walk much longer than 5 mins. and would happily walk longer to reach public transport, especially if is frequent, fast and reliable.

It is not possible to set one or even multiple walking distance limits that reflect the great diversity of walking abilities and desires among Waterford residents. For the purpose analysing the Draft New Network, a 5 minute walk has been assumed.

# Frequencies by Time of Day and Week

The number of residents and jobs within 400 m of service has been measured at these times for the Existing and Draft New Networks:

• Weekdays at midday, reflecting the service offered between the AM and PM rush hours. For many routes this is also the same level of service offered in the early morning and evening.

- Weekdays at rush hour. Most existing and proposed routes offers consistent frequencies all weekday long. Two proposed routes would offer better frequency at rush hours than in the rest of the weekday.
- Saturdays at midday, reflecting the service offered during most of the day.
- Sundays at midday, reflecting the service offered during most of the day.

#### Map Colours Show Frequency

The charts on each page are accompanied by small maps. These maps use colour-coding of the Waterford urban PSO routes to give a visual impression of the frequency of the networks during each of these four days and times.

- **Red** lines indicate frequent service, every 15 minutes.
- **Purple** lines indicate routes that come every 20 minutes.
- **Dark blue** lines indicate routes that come every 30 minutes.
- Light blue lines indicate routes that come every 60 minutes.

# Weekdays, Daytime



Many people need to travel throughout the day, as well as during rush hours, whether to come home from an early work shift, leave work or school early, go to a meeting, or run errands.



#### Weekday, Daytime in the Existing Network





#### Weekday, Daytime in the Draft New Network



# Map Legend Service frequency: 15 minutes 20 minutes 30 minutes 60 minutes

over 60 minutes

#### Graph Legend

Within	Within 400 m walk of service every:							
15 minute	20 minutes	30 minutes	60 minutes	60+ minutes	over 400 m from service			

These graphs show the portion of residents, jobs and educational locations in the Waterford area that are within a 400 metre walk of public transport, and at what frequency, at this particular time of the week.

This analysis includes *all* publicly-supported transport services in the Waterford area, whereas the small maps above show only the urban PSO bus routes.

# Weekdays, Rush Hour



Rush hours often correspond to peak travel, as many office workers commute to or from home. Many people also run errands on the way to or back from work or school.



#### Weekday, Daytime in the Existing Network





#### Weekday, Daytime in the Draft New Network



## Map Legend Service frequency: 15 minutes 20 minutes 30 minutes 60 minutes over 60 minutes

#### Graph Legend

Within	Within 400 m walk of service every:							
15 minute	20 minutes	30 minutes	60 minutes	60+ minutes	over 400 m from service			

These graphs show the portion of residents, jobs and educational locations in the Waterford area that are within a 400 metre walk of public transport, and at what frequency, at this particular time of the week.

This analysis includes *all* publicly-supported transport services in the Waterford area, whereas the small maps above show only the urban PSO bus routes.

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Weekend travel has grown over the last few decades. In addition to travel for errands and socialising, many retail, service, and hospitality workers commute on weekends.

Map Legend

Service frequency:

15 minutes
20 minutes

30 minutes60 minutes

over 60 minutes



#### Weekday, Daytime in the Existing Network





#### Weekday, Daytime in the Draft New Network



#### Graph Legend

Withir	Within 400 m walk of service every:							
15 minute	20 es minutes	30 s minutes	60 minutes	60+ minutes	over 400 m from service			

These graphs show the portion of residents, jobs and educational locations in the Waterford area that are within a 400 metre walk of public transport, and at what frequency, at this particular time of the week.

This analysis includes *all* publicly-supported transport services in the Waterford area, whereas the small maps above show only the urban PSO bus routes.



As traditions relating to Sundays change, more people want to travel for all purposes. Industrial jobs sometimes call for weekend shifts as well.

Map Legend

Service frequency:

15 minutes
20 minutes

30 minutes60 minutes

over 60 minutes



#### Weekday, Daytime in the Existing Network





Late

#### Weekday, Daytime in the Draft New Network



# Graph Legend

Wit	Within 400 m walk of service every:							
m	15 nutes	20 minutes	30 minutes	60 minutes	60+ minutes	over 400 m from service		

These graphs show the portion of residents, jobs and educational locations in the Waterford area that are within a 400 metre walk of public transport, and at what frequency, at this particular time of the week.

This analysis includes *all* publicly-supported transport services in the Waterford area, whereas the small maps above show only the urban PSO bus routes.



# Appendix A Text-based Tables of Route Frequency by Time of Day

# **Existing 2023 Network Frequencies and Spans (Text)**

Existing Route	Weekdays	Saturdays	Sundays	Notes
Route W1 between the Clock Tower and Ballybeg	Every 20 minutes from 6am to 7pm, then every 30 minutes from 7pm to midnight.	Every 30 minutes from 7am to 9am, then every 20 minutes from 9am to 7pm, then every 30 minutes from 7pm to midnight.	Every 30 minutes from 9am to midnight.	Entire route is a one-way loop.
Route W2 between the Clock Tower and SETU	Every 30 minutes from 7am to 9am, then	Every 30 minutes from 7am to 9am, then every 20 minutes from 9am to 7pm, then every 30 minutes from 7pm to midnight.	Every 30 minutes from 9am to midnight.	Entire route is a one-way loop.
Route W3 between the Clock Tower and Outer Ring Road via Ballytruckle	Every 20 minutes from 6am to 6pm, then 30 minutes 6pm to midnight.	Every 30 minutes from 8am to 10am, then every 20 minutes from 10am to 7pm, then every 30 minutes from 7pm to midnight.	Every 30 minutes from 8am to midnight.	Service on Airport and Ballytruckle Roads is in one direction only.
Route W4 between the City Centre and Browne's Road via Carrickphierish	Every 30 minutes from 7am to midnight.	Every 30 minutes from 7am to midnight.	Every 30 minutes from 9am to midnight.	Outbound includes a one-way loop on Military and Congress Streets, whereas inbound the route skips those streets.
Route W5 between University Hospital and Oakwood	Every 30 minutes from 6am to midnight.	Every 30 minutes from 6am to midnight.	Every 30 minutes from 8am to midnight.	Service on Cleaboy and Skibbereen Roads is one-way only.

# **Draft New Network Frequencies and Spans (Text)**

Proposed Route or Branch	Weekdays	Saturdays	Sundays	Notes
Route 1 trunk between University Hospital and SETU via City Centre	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Buses continue beyond the end of the trunk. During peaks, buses would go as far as Woodland Hotel every 15 minutes. All day, buses would continue along the 1B every 30 minutes.
Route 1B extension from University Hospital to Saint Mary's Place	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Two way service, and no interchange necessary to continue as Route 1 into the centre.
Route 1 Peak service extension to Woodlands Hotel	Every 15 minutes 7am to 10 am and 3pm to 7pm.	Served by Route 1B on weekends.	Served by Route 1B on weekends.	No interchange necessary to journey from Woodlands Hotel area into city centre.
Route 2 between Upper Grange Road and Rockshire Road via City Centre	Every 30 minutes from 6am to midnight.	Every 30 minutes from 6am to midnight.	Every 30 minutes from 6am to midnight.	
Route 3 trunk between Inner Ring Road and Waterford Bus Station	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Branches 3A and 3B combine to provide 15-minute frequencies along the trunk.

Proposed Route or Branch	Weekdays	Saturdays	Sundays	Notes
Route 3A between city centre and the Airport/Ballytruckle Roads loop	Service in each direction operates every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	
Route 3B between city centre and the Ballytruckle/Airport Roads loop	Service in each direction operates every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	
Route 4 trunk between Cork Road and Dock Road via City Centre	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Branches 4A and 4B combine to provide 15-minute frequencies between Cork Road and Dock Road
Route 4A branches to SETU West Campus to the Southwest and Slieverue to the Northeast	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	
Route 4B branches to Waterford Business Park to the Southwest and Abbey Park to the Northeast	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	

Proposed Route or Branch	Weekdays	Saturdays	Sundays	Notes
Route 4P to Belview Port from City Centre	Every 30 minutes from 7am to 10am and 3pm to 7pm	No service on weekends.	No service on weekends.	Special service to be developed in coordination with the Port.
Route 5 trunk between City Centre and Ballybeg via Cannon Street	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Every 30 minutes from 6am to 7am, then every 15 minutes from 7am to 8pm, and 30 minutes 8pm to midnight.	Branches 5A and 5B combine to provide 15-minute frequencies along the trunk.
Route 5A branch to Summerfields via Kilbarry Road	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	
Route 5B branch to SETU via Ballybeg Road	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 60 minutes from 6am to 7am, then every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	Every 30 minutes from 7am to 8pm, and 60 minutes 8pm to midnight.	
Route 6 between the Clock Tower to SETU via Cleaboy	Every 30 minutes from 6am to midnight.	Every 30 minutes from 6am to midnight.	Every 30 minutes from 7am to midnight.	
Route 7 between the Clock Tower to SETU via Carrickphierish Road	Every 30 minutes from 6am to 7am, every 15 minutes from 7am to 10am, 30 minutes from 10am to 3pm, 15 minutes from 3pm to 7pm, and 30 minutes 7pm to midnight.	Every 30 minutes from 6am to midnight.	Every 30 minutes from 7am to midnight.	