URBIS

SOCIAL IMPACT ANALYSIS OF OUT-COMMUTING

Prepared for
Central Coast Council
February 2020

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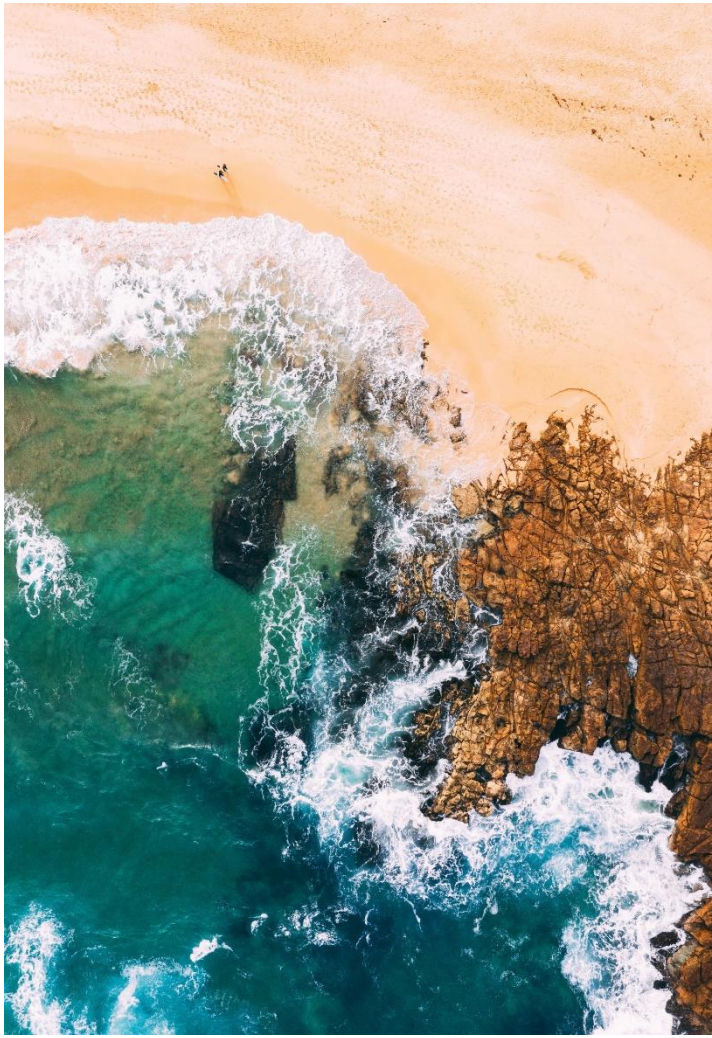


EXECUTIVE SUMMARY

THERE IS A NEED TO ADDRESS THE NEGATIVE IMPACTS OF OUT-COMMUTING ON THE WELLBEING OF INDIVIDUALS, COMMUNITIES AND THE ECONOMY

Up to 44,200 people commute from the Central Coast

commuters travel over 3 hours each day

commuters travel up to 250 kms to Sydney

66% travel by private car

Every **1%** increase in travel time leads to a **13%** increase in fatigue

12% increase in stress

Long commute times have been shown to increase the risk of divorce by **40%**

Congestion between Sydney and the Central Coast results in **$88.1m** in lost time each year

The Central Coast economy loses out on up to **$113.2m** of income spent on workday lunches and beverages each year

SUMMARY OF KEY FINDINGS

- Out-commuters from the Central Coast experience poorer physical and mental health and wellbeing outcomes.
- Central Coast families and communities suffer as commuters can invest less time in those relationships.
- Out-commuting limits the local economy and has wider economic impacts for NSW.

CONSIDERATIONS

Commuters require:

- improved understanding of the health impacts of long commutes
- access to mental health and wellbeing services
- strengthened family support structures
- ways to engage in their community

There is an important need to:

- capture retail spending within the local economy
- increase local capacity for remote working
- generate investment to locate jobs on the Central Coast

INTRODUCTION

UNDERSTANDING THE IMPACTS OF OUT-COMMUTING IS KEY TO SUPPORTING THE CENTRAL COAST COMMUNITY TO THRIVE

ABOUT THE CENTRAL COAST

The Central Coast is located on the coast of New South Wales, 90 kilometres north of Sydney, and 80 kilometres south of Newcastle. The area is known for its bountiful beaches, waterways and national parks, and its rich cultural heritage. Its natural beauty and relaxed lifestyle have made it a popular place to call home for many families and older Australians.

As of June 2018, **333,627 people live on the Central Coast**. The population is expected to grow by 1% annually to **more than 415,050 people by 2036**. Population growth has necessitated investment in employment, infrastructure, housing and transport. In 2016, the NSW Government introduced the *Central Coast Regional Plan 2036* as a blueprint for development in the area over the next 20 years. The Plan anticipates population growth by preparing to create 24,674 jobs and construct 41,500 more dwellings.

However, **more than three quarters of Central Coast commuters (86%) travel 50-250 kilometres to** work, typically to the Sydney CBD. This commute takes over ninety minutes and requires considerable expenditure of time, money and physical effort. **The impact of out-commuting affects people, their families, the local community, and the broader economy**.

Between 2017-2020, state and federal governments have spent $1 billion on infrastructure in and around the Central Coast, including the *Gosford City Centre Masterplan*. Similarly, Regional Development Australia Central Coast has released the *Regional Economic Development and Employment Strategy*, as a long-term framework to promote sustainable economic development and jobs growth in the area.

The extent of state and federal investment in the Central Coast is a clear reflection of the area's importance to NSW and Commonwealth planning and development objectives.

ABOUT THIS REPORT

Urbis has been engaged by the Central Coast Council to assist with assessing the impacts of out-commuting for individuals, families and communities in the Central Coast LGA.

CENTRAL COAST OUT-COMMUTERS CURRENTLY FACE IMMENSE CHALLENGES WITH BALANCING WORK OPPORTUNITIES AND QUALITY OF LIFE

LIVING ON THE CENTRAL COAST

The Central Coast is one of New South Wales' rapidly evolving economies. **People and families continue to relocate to the Central Coast for the increased quality of life.** The Central Coast is conveniently situated within commuting distance to Sydney and Newcastle, which allows individuals to continue travelling to the city for work while enjoying more affordable housing and education options. Similarly, the Central Coast has beautiful natural surrounds, an active local community, diverse recreational activities and a thriving arts, music and cultural scene, making the area an attractive alternative from the intensity of city life.

The region has a skilled workforce and a diverse economy with sector expertise in healthcare and social assistance, food manufacturing, logistics and construction, which offers attractive employment options. However, up to **approximately 44,200 residents journey outside the area to their main place of work in 2016, making more than a quarter of the Central Coast workforce out-commuters**. For every resident that comes in from elsewhere to work in the Central Coast, 3.8 residents are leaving to work elsewhere.

Typically, people commute out of the area to work so that they can access higher salary jobs, while still enjoying the benefits of living on the Central Coast. Figure 1 shows that a larger share of out-commuters are in higher income brackets, in comparison to those not out-commuting.[1] Out-commuting workers tend to earn more in comparison to workers in the same industry who live and work on the Central Coast. This is particularly apparent for workers in sectors with fewer job opportunities on the Central Coast, such as information media and telecommunications, public administration and safety, professional, scientific and technical, and finance and insurance services.

> "I LOVE IT ON THE CENTRAL COAST – COULDN'T THINK OF A BETTER PLACE TO LIVE

Out-commuting can have major impacts on individual wellbeing, the welfare of families and communities, and the economy. In a 2018 Central Coast Council survey, 91% of respondents from the local government area (LGA) rated their quality of life as 'good' 'very good' or 'excellent', indicating the high level of satisfaction that comes with living in the area.

However, the top two issues identified as priority areas for the Council were *transport* and *movement around the Central Coast,* highlighting the community concern associated with out-commuting.

As a result, understanding the social, economic and physical impacts of out-commuting is key to identifying the way it affects the Central Coast community and to helping define the way forward for this pivotal area.

If out-commuting workers were able to fulfil work in the same or similar jobs from the Central Coast, positive income benefits from working in these industries and companies could be maintained while avoiding the negative impacts from out-commuting.

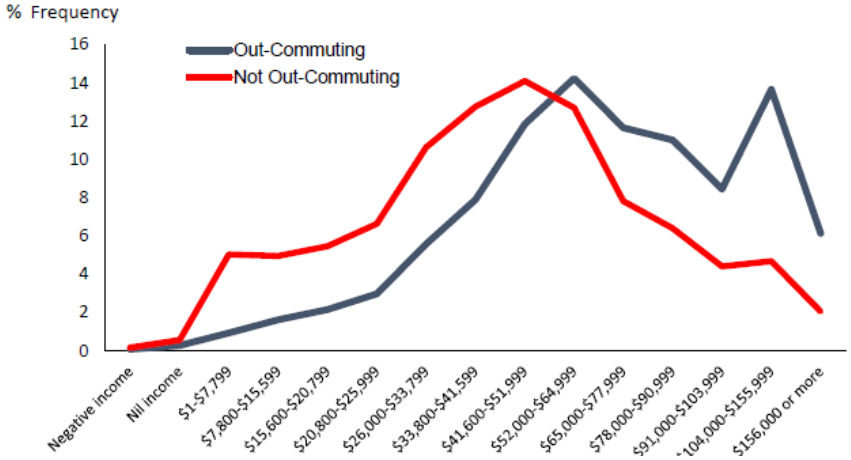


Figure 1 - Income distribution, Out-commuters vs working on the Central Coast
ABS, Census of Population and Housing, 2016

KEY FINDINGS

COMMUTING LONG DISTANCES REDUCES THE TIME PEOPLE CAN SPEND WITH THEIR FAMILIES AND ENGAGING IN THEIR LOCAL COMMUNITIES

A LONG COMMUTE REDUCES TIME FOR PARENTING AND HOUSEHOLD RESPONSIBILITIES

Families are negatively impacted by having a parent commute long distances for work, as commuters have reduced time to spend with their loved ones. Men are disproportionately represented in commuter statistics, suggesting that current long-distance commuting patterns prevent them from being present to perform caring and household responsibilities. Central Coast commuters reported that their commuting routine required them to invest significantly in childcare or rely on their extended family for support. Long-distance commuting also has a negative impact on child behaviour - children with parents who commute have been found to exhibit peer relationship issues and hyperactivity at school.[2] Long-distance commuters have also reported spending less time with their children and lower satisfaction with family life.

Similarly, studies have shown that long commute times increase the risk of divorce by 40%,[3] although the likelihood of divorce is reduced if the long-distance commuter in the couple is a woman. The majority of Central Coast commuters are married or in de-facto relationships, making 9,500 couples vulnerable to the domestic stresses of long commutes. There is also some evidence to suggest that traffic and congestion raises the incidence of domestic violence in communities, indicating that the stress of commuting can exacerbate stress and tension for couples.[4]

OUT-COMMUTERS HAVE LOWER LOCAL ENGAGEMENT, IMPACTING COMMUNITY COHESION

Beyond the impact on individual families, long-distance commuting has broader implications for community cohesion. The Central Coast relies on residents to engage and participate within the area, to cultivate a thriving, connected community. As commuters spend more time away from their local community, they have less time to dedicate to local community activities and initiatives, and are less likely to volunteer, or participate in local clubs and sporting teams.

Studies estimate that for every additional ten minutes spent commuting, a person's engagement in community affairs is reduced by 10%. This significantly reduces civic engagement, and overburdens community members who are currently performing these roles. For commuters who may already volunteer in the community, long-distance commuting has been associated with volunteer burnout.[5] Long-distance commuting can also cause a reduction in political participation and activism.[6]

Supporting Central Coast out-commuters is important for fostering strong families and a thriving community

> "THE OVERWHELMING SENSE OF GUILT YOU FEEL NOT BEING PRESENT [WITH YOUR CHILDREN] WHICH THE STRESS OF COMMUTING CAUSES. THIS DEFINITELY LEFT ME FEELING ANXIOUS AND DEPRESSED.
>
> "AFTERSCHOOL ACTIVITIES GET IMPACTED... I HAVE NO ENERGY... I CAN'T DO IT."

Long commute times have been shown to increase the risk of divorce by

40%

Long commutes affect

9,500

couples on the Central Coast

PEOPLE WITH LONG COMMUTES EXPERIENCE SIGNIFICANTLY POORER PHYSICAL AND MENTAL HEALTH OUTCOMES THAN PEOPLE WITH SHORTER COMMUTES

REDUCED TIME FOR SLEEP AND EXERCISE IMPACTS COMMUTERS' PHYSICAL HEALTH

Long-distance commuting has been linked to a range of physical health issues for individuals. Time use studies from the United States have shown that spending an additional 60 minutes commuting above the average each day is associated with a 6% reduction in time spent on overall health-related activities.[7] Of the additional time out-commuters spent traveling each day, 28 to 35% came from time spent on sleep, 16% to 20% from time spent on physical activity, and 4% to 6% from time spent on food preparation. Reduced time for sleep and exercise means commuters are likely to experience poorer weight outcomes, hypertension and high blood pressure, and hold negative perceptions of personal health.[8]

Two thirds of Central Coast out-commuters drive (66%) – and longer driving times are associated with higher rates of smoking, insufficient physical activity, obesity and inadequate sleep.[9] Studies suggest that many commuters, regardless of their mode of transport, experience unrecognised sleep disorders.[10]

Long-distance commuting can also disproportionately affect certain cohorts. For example, pregnant women who commute are likely to experience stress, under-utilise prenatal care and give birth to babies with a lower birth weight.[11]

LONG COMMUTES INCREASE STRESS WHICH NEGATIVELY AFFECTS MENTAL WELLBEING

Commuters who travel long distances to work exhibit high levels of dissatisfaction with their commute, finding it to be burdensome and stressful. Studies have found a statistically significant and negative association between trip duration and mood, primarily due to rising stress, fatigue and sadness on long commutes.[12] Research shows that a 1% increase in the time devoted to commuting was related to a 12% increase in levels of stress and a 13% increase in levels of fatigue.[13]

The psychological impacts of commuting can continue into the workplace. Commuters have been shown to express more hostility and aggression in the workplace as a result of commuting stress.[14] This was particularly affecting for male commuters.

Finally, a recent British study found that individuals who spend more than six hours a week commuting exhibit lower mental health scores, and express feelings of sadness and fatigue.[15]

Mitigating the mental and physical health implications commuters may face is critical for improving their quality of life and reducing health expenditure

> "BY THE WEEKEND, I'M SHATTERED. I'VE STOPPED DRINKING COFFEE, NO WINE, TO TRY TO GET SOME ENERGY BACK. I HAVE AFTERNOON NAPS ON SATURDAY AND SUNDAY

> "THE TRAIN RIDE IS IMPACTING MY HEALTH IN A NEGATIVE WAY. I DON'T FEEL LIKE EXERCISING WHEN I GET HOME. IT'S ALL GONE, NO FUEL IN THE TANK.

Every **1%** increase in travel time leads to a **12%** increase in stress

13% increase in fatigue

OUT-COMMUTING RESULTS IN A LARGE LOSS IN POTENTIAL LOCAL BUSINESS ACTIVITY AND SIGNIFICANT ECONOMIC COSTS ACROSS NSW

COMMUTERS SHOP WHERE THEY WORK, REDUCING SPENDING WITH LOCAL BUSINESSES

Spending on lunch, snacks and beverages during the workday is potential economic activity lost to retailers in the Central Coast when a worker needs to out-commute. In 2017, Australian employees spent an average of $129 on lunch each month, plus an additional $74 on coffees and energy drinks.[16] If all current out-commuters spent this amount in food and beverage outlets in the Central Coast the local economy could be up to $113.2 million larger each year.

The Central Coast economy loses out on up to

$113.2m

of income spent on workday lunches and beverages each year

CONGESTION HAS SUBSTANTIAL ECONOMIC COSTS FOR NSW MORE BROADLY

The additional costs associated with congestion have significant flow-on effects for the rest of the NSW economy. Currently, 66% of Central Coast commuters travel by private car, resulting in 23,364 more commuters on the road. As a result, the road corridor between the Central Coast and Sydney has been rated the third most congested in Australia and the most congested in the greater Sydney region.[17] Each day, congestion on the corridor results in 12,000 hours of delays with delays set to increase by 53% by 2031. These delays are currently the costing the economy $88.1 million in lost time annually. This represents a proportion of the $14 billion in lost time caused by congestion, Australia-wide, each year. [18]

It is important to note that congestion affects not only Central Coast commuters but can also indirectly affect the many other commuters and drivers who share the road corridor, such as those commuting from the Upper North Shore, and the businesses that employ them. These broader costs include:

- additional vehicle running costs as a result of congestion such as depreciation, fuel, repairs and maintenance, which are estimated to cost Australia a total of $1.5 billion per year[18]
- costs associated with the higher likelihood of low-level road accidents due to congestion
- costs to businesses, including requirements for additional drivers and trucks, missed deliveries and expenses for 'rescue drivers' due to unexpected delays, and increased inventories, logistics and scheduling costs, which are subsequently passed onto customers[19]
- costs of $1 billion to the environment and to public health as a result of increased air pollution in the form of greenhouse gases, nitrous oxide, sulphur dioxide and particulate matter.

A reduction in the number of Central Coast out-commuters would contribute greatly to alleviating congestion, with indirect benefits to other commuters and road users across NSW.

Action is needed to reduce traffic and improve transport options to prevent loss of time and money due to congestion and long-distance commuting

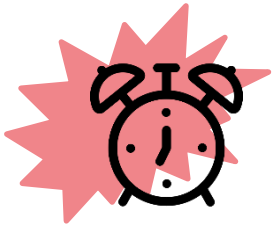
> "ON FRIDAY THE TRAFFIC IS HORRENDOUS. IT CAN TAKE 2.5 TO 3 HOURS TO GET HOME BY CAR.

> "JOBS RARELY COME UP, WE NEED BIGGER COMPANIES SETTING UP ON THE CENTRAL COAST.

Congestion between Sydney and the Central Coast results in

$88.1m

in lost time each year



A REDUCTION IN THE NUMBER OF OUT-COMMUTERS FROM THE CENTRAL COAST COULD LEAD TO SIGNIFICANT BENEFITS FOR OTHER COMMUTERS

TAKING OUT-COMMUTERS OFF THE ROAD CAN GREATLY REDUCE TRAVEL TIMES AND FREES UP SPACE

Currently, out-commuters from Central Coast who travel by car contribute significantly to the number of cars on the main roads between the Central Coast and Sydney CBD. Analysis of data from the 2016 Census and from the Transport for NSW Traffic Volume Viewer identified the Pacific Highway, Pennant Hills Road, Mona Vale Road and Ryde Road amongst the four main routes that out-commuters from Central Coast take to reach their respective workplaces.

Currently, Central Coast out-commuters comprise a large proportion of unnecessary congestion on these roads. By generating more local employment opportunities in the Central Coast and removing out-commuters from these main thoroughfares, significant benefits are likely to accrue to other commuters who share these roads, especially for commuters from key residential areas such as Hornsby who travel via Pacific Highway into the Sydney CBD.

Given the importance of this road to the routes of most daily commuters in Sydney, transport modelling was undertaken to estimate the time and space that would be saved by removing Central Coast out-commuters from peak hour traffic (i.e. 6-9AM) on the Pacific Highway. According to analysis, it is estimated that there are 2,376 cars on average per hour on the Pacific Highway during the peak period, of which 1,032 are driven by Central Coast out-commuters. This estimate is largely comprised of workers in 'white collar' industries, given the higher likelihood of such workers to be commuting at peak hour to the Sydney CBD, but also includes a proportion of workers in other industries (see 'Approach to traffic flow calculations' in Appendix A for assumptions).

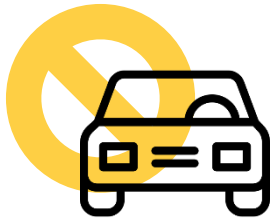
Assuming all Central Coast out-commuters who drive on the Pacific Highway during peak hour are taken off the road as they no longer need to out-commute, it is estimated that the number of cars on the road would fall to an average of 1,344 per hour. As a result, other morning peak hour commuters on the Pacific Highway would save a total of 81 hours of time in traffic for each hour of driving during the morning peak period while the reduction in cars would free up enough space to fill 0.86 lanes.

The potential for this reduction depends greatly on the amount of local employment opportunities that would be created in the Central Coast, as well as the proportion of workers in 'white collar' and other industries that this would affect. As a result, additional scenarios were modelled to account for different possibilities, producing the following results:

- removal of all 'white collar' out-commuters from the road would result in a total travel time saving of 61 hours per hour for other commuters and a freeing up of 0.63 lanes of space
- removal of 50% of all 'white collar' out-commuters from the road would result in a total travel time saving of 34 hours per hour for other commuters and a freeing up of 0.31 lanes of space.

As these time and lane capacity savings have only been calculated for the morning peak, overall savings across the day and all routes are likely to be much higher.

Removing all Central Coast out-commuters from the Pacific Highway during peak hour would result in a total of



81 HOURS

in time saved for all other commuters per hour of travel

"

THE INTENT WAS TO GET A JOB UP HERE...7 YEARS LATER, I'M STILL LOOKING

LONG DISTANCE COMMUTERS ARE MORE LIKELY TO EXPERIENCE LOWER MOODS, DISSATISFACTION WITH THEIR JOBS, AND LOWER PRODUCTIVITY

STRESSFUL LONG COMMUTES REDUCE WELLBEING AND JOB SATISFACTION

Long-distance commuting has a significant impact on people's mood and overall happiness levels and reduces their capacity to spend time on social and leisure activities.

A recent UK study reported that commuting causes high levels of stress, caused by congestion and traffic, crowding, unpredictability and a lack of control.[20] These stresses 'spill over' into work and home life. Commutes over thirty minutes in length have been linked to lower vitality and poor sleep quality that result in a lowered sense of 'subjective wellbeing'.[21]

Based on an Australian study, commuters who travel more than an hour to work reported to be less satisfied with their jobs compared with people who commute shorter distances.[22]

OUT-COMMUTERS ARE ABSENT MORE AND PERFORM BELOW CAPABILITY

Workers who travel long commuting distances have been shown to have higher rates of absences from work due to sickness.[23] A study of German employees found that those who commute long distances are absent 20% more than employees with shorter commutes.[24] Another study found that absenteeism would be 15 to 20% less if all workers did not have a long commute.[25] Businesses whose employees have long commutes are likely to see higher rates of absenteeism than if those workers could fulfil the same roles closer to home.

Stressful commuting has also been found to reduce worker performance. A study conducted on drivers revealed that those who had experienced more stress took longer to complete moderate puzzle tasks.[26] Stressful commutes make it harder to deal with frustration and lower the ability of workers to work productively.[27] Data from Sweden tells us that long-distance commuting results in earlier retirement, especially for men with higher education.[28]

Addressing the impacts of long commuting is essential for job satisfaction and productivity

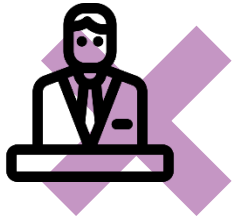
> "I'VE TRIED VARIOUS TECHNIQUES TO DEAL WITH THE EXHAUSTION, STAYING IN CHEAP HOTELS MID-WEEK, WORKING A COUPLE OF CONSECUTIVE TEN HOUR DAYS. SO THAT I DON'T... BECOME ABSENT WITH MY FAMILY.

> "ON THE WEEKEND, WE SLEEP. THERE'S NO TIME ON THE WEEKEND TO ENJOY OURSELVES.

Employees who commute long distances are

20%

more likely to be absent from work than employees with shorter commutes



CONCLUSION

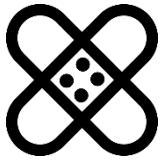
THERE EXIST SIGNIFICANT OPPORTUNITIES TO ADDRESS THE IMPACTS OF OUT-COMMUTING FOR PEOPLE, THEIR FAMILIES AND THE ECONOMY

KEY IMPLICATIONS

SOCIAL IMPACTS

Central Coast families and communities suffer as commuters can invest less time in those relationships. Out-commuters are less present for caring and household responsibilities, which contributes to marriage breakdowns, can negatively impact children's behaviour, and places increased demand on extended family for childcare support. Additional time commuting also undermines community cohesion as commuters have less time for civic engagement and political participation, which increases the burden on other community members.

HEALTH AND WELLBEING



Out-commuters from the Central Coast experience poorer physical and mental health and wellbeing outcomes. As commuters sacrifice sleep and exercise in order to travel, they have higher rates of obesity, high blood pressure, and hypertension. Commuters also experience increased stress and fatigue, which have a negative impact on their mental wellbeing.

ECONOMIC COSTS

Out-commuting limits the local economy and has wider economic impacts. The Central Coast economy could be $90 million larger if out-commuter spending on food, beverages, and retail was retained with local businesses. Out-commuters have higher absenteeism impacting productivity. The Central Coast to Sydney commuter corridor is the third busiest in Australia, significantly contributing to the estimated $15 billion in economic and environmental costs of congestion to Australia each year. Removal of all Central Coast out-commuters from the Pacific Highway during peak hour would result in an annual time saving of 847 days for all other commuters.

CONSIDERATIONS FOR ACTION

The implications and impacts of out-commuting are wide reaching and require a range of responses to the negative impacts on health, family, community, and economic outcomes. When formulating responses to the issues associated with out-commuting, stakeholders should consider:

- **how to improve commuter understanding of the health impacts of long commutes** and support commuters to manage their health needs and access prevention or treatment services
- **the accessibility of mental health and wellbeing services** to support out-commuters with managing the increased stress and fatigue associated with long commutes
- **ways to strengthen family support structures** so families can better manage the increased stress associated with long commuting and reduce the burden placed on other family members
- **community engagement initiatives** which enable and encourage out-commuter participation to help strengthen community cohesion
- **ways to capture commuter food, beverage, and retail spending** within the local Central Coast economy
- **how to increase the capacity for and up-take of remote working** to reduce the need for employees to travel out of the LGA as frequently
- **strategies to encourage economic and businesses investment**, to locate more jobs on the Central Coast, which capture the benefit of the Central Coast workforce's high skills base and allow more residents to work locally

APPENDICES

ABOUT THIS REPORT

METHODOLOGY

This project was conducted for the Central Coast Council between December 2019 and January 2020. The process included a literature review and the development of a report detailing the research findings and presentation of these findings to councillors. This report follows three reports from the Hunter Research Foundation based on 2016 Census data about the commuting population and one from Astrolabe Group about the social and economic costs of commuting.

The Central Coast Council also provided transcripts from ten interviews conducted with commuters from the LGA, from which the quotes throughout this report are taken. These interviews were conducted in December 2019.

The research team undertook a literature review using Google Scholar, to identify existing evidence and studies about the social, economic and health impacts of commuting. Studies completed in the last decade, and from Western countries or contexts, were included in the review. These were used to inform the synthesis of findings. Table 1 below outlines the search terms used for the literature review.

Table 1 – Literature review search terms

Physical	health commuting long	health commuting long Australia	long commuting stress
Social	community long journey social impact	family commuting long distance	social commuting long distance
Economic	economic impact commuting to work	productivity long commuting to work	

LIMITATIONS

The following limitations should be considered when reviewing this report:

- There is limited statistical data that explores the social and economic impact of commuting, especially from Australian contexts. Therefore, caution should be exercised when inferring a causal relationship between commuting and some of the impacts listed in this report.
- This report is informed by limited qualitative data. Interviews conducted by Council were analysed, however there were from a small sample size.

CALCULATIONS

The estimate for the number of out-commuters from the Central Coast includes individuals who reported workplace addresses outside of the LGA (35,386) and those without a fixed workplace address (8,814) on the 2016 Census.

The amount spent by Central Coast out-commuters on food and drink during their workday was calculated using the average monthly expenditure findings from a 2017 ING Direct/Galaxy study, multiplied by the number of aggregate months worked annually by out-commuters. The study found that on average, Australian workers spend $129 on lunch and $74 on coffee/energy drinks every month. These amounts were adjusted from 2017 prices to 2020 prices using an annual inflation rate of 1.69%, calculated as the compound average annual CPI change between March 2017 and March 2019. The aggregate number of months worked by out-commuters each year was calculated by multiplying the number of out-commuters and those without a fixed workplace address (44,200) by 12.

The annual time cost of congestion on the Central Coast to Sydney corridor has been calculated by adjusting the Infrastructure Australia[17] estimates of $165,000 in AM peak time and $153,000 in PM peak time in 2016. These amounts were adjusted from 2016 prices to 2020 prices using an annual inflation rate of 1.93%, calculated as the compound average annual CPI change between March 2016 and March 2019 The daily cost estimate in 2020 dollars of $343,206 has been multiplied by the number of working days in a year (i.e. 251).

ABOUT THIS REPORT

APPROACH TO TRAFFIC FLOW CALCULATIONS

Breakdown of routes

The 2016 Census was used as a source data for where Central Coast residents work in Sydney. Residents from Central Coast who work in Greater Sydney were divided into five different groups based on the route they are assumed to take to work. Assignment of routes was by SA3 and SA4. Table 2 shows which route an area of Sydney was assigned to.

Number of white collar workers

The number of workers by region of Sydney was cross-referenced by industry. The number of workers in the following industries were combined to produce the total number of 'white collar' workers:

- Information Media and Telecommunications
- Financial and Insurance Services
- Rental, Hiring and Real Estate Services
- Professional, Scientific and Technical Services
- Administrative and Support Services
- Public Administration and Safety

Traffic Volumes

Traffic volumes were sourced from Transport for NSW Traffic Volume Viewer. Traffic counts were used from 2016 to align with the 2016 census. Traffic counts were taken at the following locations for each respective route:

- A1 – Pacific Highway, Gordon
- A3 – Mona Vale Road, East Gordon
- A3 – Ryde Road, West Pymble
- A28 – Pennant Hills Road, Thornleigh

Table 2 – Grouping of workplace addresses by Greater Sydney Areas (SA3s and SA4s) and the assumed route of travel

A1 – Pacific Highway	▪ Sydney – Eastern Suburbs ▪ Sydney – City and Inner South ▪ Sutherland Shire – Cronulla, Miranda & Caringbah ▪ North Sydney - Mosman ▪ Manly ▪ Gordon ▪ Lindfield – Roseville ▪ Southern Half of Warringah
A3 – Mona Vale Road	▪ St Ives ▪ Pittwater ▪ Northern Half of Warringah
A3 – Ryde Road	▪ Sydney – Ryde ▪ Sydney – Inner West ▪ Sutherland, Heathcote, Menai
A28 – Pennant Hills Road	▪ Sydney – Paramatta ▪ Sydney – Outer West ▪ Sydney – South West ▪ Sydney – Outer West and Blue Mountains ▪ Sydney – Blacktown
Hornsby	▪ Hornsby

ABOUT THIS REPORT

APPROACH TO TRAFFIC FLOW CALCULATIONS (CONTINUED)

Scenarios

Travel time savings and lane capacity savings were calculated for the time period of 6-9 AM on the Pacific Highway for the following 3 scenarios (see Table 3):

- Scenario 1 – All Central Coast out-commuters (i.e. all 'white collar' workers and some workers from other industries) have been removed from the road
- Scenario 2 – All Central Coast 'white collar' workers have been removed from the road
- Scenario 3 – 50% of all Central Coast 'white collar' workers have been removed from the road

Traffic time savings

The following variables were used to determine the magnitude of traffic reduction by bringing jobs locally to the Central Coast. In order to determine traffic time savings, the following variables were used:

- length of road (Google Maps);
- number of traffic lights (Nearmap aerials);
- intersection spacing (i.e. the number of traffic lights was divided by the length of the road to ascertain average intersection spacing);
- speed limit (Google Maps);

The estimates of 'white collar' workers and workers from other industries, as taken from the Census, were adjusted by 60% and 10% respectively, to produce the number of Central Coast out-commuters expected to be commuting at peak hour i.e. 8-9AM. This figure was assumed to be an average hourly rate for the entire morning peak. These figures are based on standard industry estimates in transport planning for the proportion of Central Coast out-commuters who will be travelling during peak hour.

The travel time savings on the A1 – Pacific Highway were calculated using a formula that considers the above variables. Road volume was adjusted in accordance with each of the three scenarios outlined. It was assumed that there is one vehicle per Central Coast out-commuter. Travel time savings were calculated as the total hours saved per hour of travel (i.e. between 6-9AM). In short, time savings are expressed as the combined total hours of time savings per one hour of road use for all remaining commuters on the road following the removal of Central Coast out-commuters.

Effective lane capacity savings

Lane savings on the A1 – Pacific Highway were calculated by dividing the number of vehicles removed from the road by 1,200 (the assumed lane capacity per hour). This means that reducing the volume of vehicles is comparable to removing *n* lanes worth of vehicles.

Limitations

As noted, this analysis assumes that 60% of Central Coast 'white collar' workers and 10% of Central Coast workers from other industries will be out-commuting via the Pacific Highway during the peak hour of 6-9AM.

All calculations were made for the hour 8-9 AM. The figure was then used as an hourly average across the entire morning peak (6-9 AM)

No further data was available to inform the exact proportions of who drive during the busiest hour of the morning peak period.

Table 3 – Scenario modelling of removal of Central Coast out-commuters from the Pacific Highway during peak hour

Scenario	Number of Vehicles During Peak Hour	Total Travel Time Saved (hours)	Lane Capacity Saved (no. of lanes)
Status quo	2,376	-	-
Scenario 1	1,344	81	0.86
Scenario 2	1,621	61	0.63
Scenario 3	1,999	34	0.31

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