Study Report
August 2024

WSDOT Commute Trip Reduction Program Equity Study

Washington State Department of Transportation
24564401

steer

Study Report
August 2024

WSDOT Commute Trip Reduction Program Equity Study

Prepared by:

Steer
1111 Broadway, 3rd Floor
Oakland CA 94607
USA

+1 (213) 425 0990
www.steergroup.com

Prepared for:

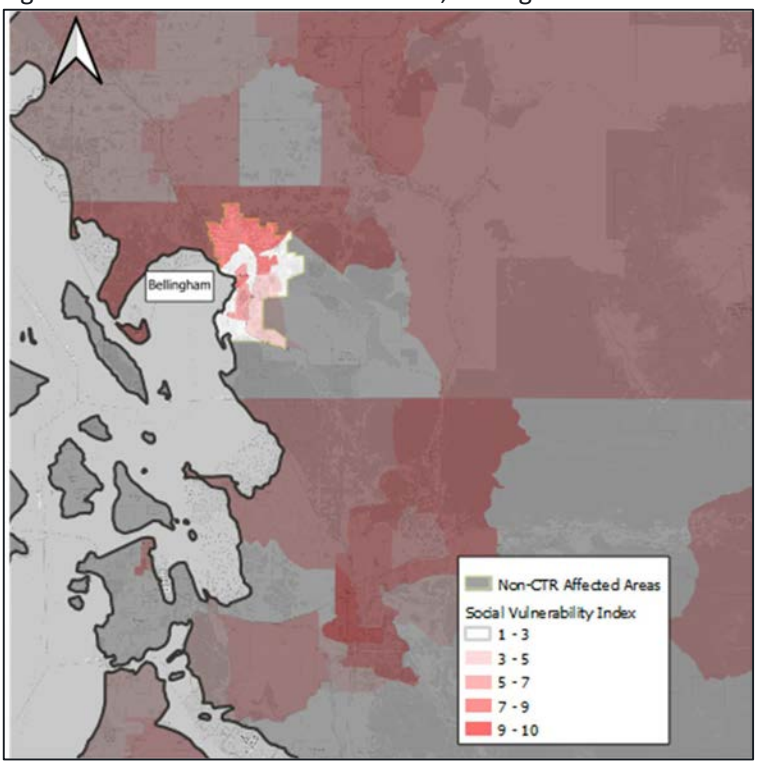
Washington State Department of Transportation
Transportation Building
310 Maple Park Avenue S.E.
Olympia WA 98504-7300

24564401

Contents

Figures

Figure 4-5: SVI and CTR-affected cities, Bellingham



Tables

Appendices

English

Title VI Notice to Public

It is the Washington State Department of Transportation's (WSDOT) policy to assure that no person shall, on the grounds of race, color, national origin, as provided by Title VI of the Civil Rights Act of 1964, be excluded from participation in, be denied the benefits of, or be otherwise discriminated against under any of its programs and activities. Any person who believes his/her Title VI protection has been violated, may file a complaint with WSDOT's Office of Equity and Civil Rights (OECR). For additional information regarding Title VI complaint procedures and/or information regarding our non-discrimination obligations, please contact OECR's Title VI Coordinator at (360) 705-7090.

Americans with Disabilities Act (ADA) Information

This material can be made available in an alternate format by emailing the Office of Equity and Civil Rights at **wsdotada@wsdot.wa.gov o**r by calling toll free, 855-362-4ADA(4232). Persons who are deaf or hard of hearing may make a request by calling the Washington State Relay at 711.

Español

Notificación de Titulo VI al Público

La política del Departamento de Transporte del Estado de Washington (Washington State Department of Transportation, WSDOT) es garantizar que ninguna persona, por motivos de raza, color u origen nacional, según lo dispuesto en el Título VI de la Ley de Derechos Civiles de 1964, sea excluida de la participación, se le nieguen los beneficios o se le discrimine de otro modo en cualquiera de sus programas y actividades. Cualquier persona que considere que se ha violado su protección del Título VI puede presentar una queja ante la Oficina de Equidad y Derechos Civiles (Office of Equity and Civil Rights, OECR) del WSDOT. Para obtener más información sobre los procedimientos de queja del Título VI o información sobre nuestras obligaciones contra la discriminación, comuníquese con el coordinador del Título VI de la OECR al (360) 705-7090.

Información de la Ley sobre Estadounidenses con Discapacidades (ADA, por sus siglas en inglés)

Este material puede estar disponible en un formato alternativo al enviar un correo electrónico a la Oficina de Equidad y Derechos Civiles a **wsdotada@wsdot.wa.gov o** llamando a la línea sin cargo 855-362-4ADA(4232). Personas sordas o con discapacidad auditiva pueden solicitar la misma información llamando al Washington State Relay al 711.

한국어-Korean

제6조 관련 공지사항

워싱턴 주 교통부(WSDOT)는 1964년 민권법 타이틀 VI 규정에 따라, 누구도 인종, 피부색 또는 출신 국가를 근거로 본 부서의 모든 프로그램 및 활동에 대한 참여가 배제되거나 혜택이 거부되거나, 또는 달리 차별받지 않도록 하는 것을 정책으로 하고 있습니다. 타이틀 VI에 따른 그/그녀에 대한 보호 조항이 위반되었다고 생각된다면 누구든지 WSDOT의 평등 및 민권 사무국(OECR)에 민원을 제기할 수 있습니다. 타이틀 VI에 따른 민원 처리 절차에 관한 보다 자세한 정보 및/또는 본 부서의 차별금지 의무에 관한 정보를 원하신다면, (360) 705-7090으로 OECR의 타이틀 VI 담당자에게 연락해주십시오.

미국 장애인법(ADA) 정보

본 자료는 또한 평등 및 민권 사무국에 이메일 **wsdotada@wsdot.wa.gov** 을 보내시거나 무료 전화 855-362-4ADA(4232)로 연락하셔서 대체 형식으로 받아보실 수 있습니다. 청각장애인은 워싱턴주 중계 711로 전화하여 요청하실 수 있습니다.

русский-Russian

Раздел VI Общественное заявление

Политика Департамента транспорта штата Вашингтон (WSDOT) заключается в том, чтобы исключить любые случаи дискриминации по признаку расы, цвета кожи или национального происхождения, как это предусмотрено Разделом VI Закона о гражданских правах 1964 года, а также случаи недопущения участия, лишения льгот или другие формы дискриминации в рамках любой из своих программ и мероприятий. Любое лицо, которое считает, что его средства защиты в рамках раздела VI были нарушены, может подать жалобу в Ведомство по вопросам равенства и гражданских прав WSDOT (OECR). Для дополнительной информации о процедуре подачи жалобы на несоблюдение требований раздела VI, а также получения информации о наших обязательствах по борьбе с дискриминацией, пожалуйста, свяжитесь с координатором OECR по разделу VI по телефону (360) 705-7090.

Закон США о защите прав граждан с ограниченными возможностями (ADA)

Эту информацию можно получить в альтернативном формате, отправив электронное письмо в Ведомство по вопросам равенства и гражданских прав по адресу **wsdotada@wsdot.wa.gov** или позвонив по бесплатному телефону 855-362-4ADA(4232). Глухие и слабослышащие лица могут сделать запрос, позвонив в специальную диспетчерскую службу штата Вашингтон по номеру 711.

tiếng Việt-Vietnamese

Thông báo Khoản VI dành cho công chúng

Chính sách của Sở Giao Thông Vận Tải Tiểu Bang Washington (WSDOT) là bảo đảm không để cho ai bị loại khỏi sự tham gia, bị từ khước quyền lợi, hoặc bị kỳ thị trong bất cứ chương trình hay hoạt động nào vì lý do chủng tộc, màu da, hoặc nguồn gốc quốc gia, theo như quy định trong Mục VI của Đạo Luật Dân Quyền năm 1964. Bất cứ ai tin rằng quyền bảo vệ trong Mục VI của họ bị vi phạm, đều có thể nộp đơn khiếu nại cho Văn Phòng Bảo Vệ Dân Quyền và Bình Đẳng (OECR) của WSDOT. Muốn biết thêm chi tiết liên quan đến thủ tục khiếu nại Mục VI và/hoặc chi tiết liên quan đến trách nhiệm không kỳ thị của chúng tôi, xin liên lạc với Phối Trí Viên Mục VI của OECR số (360) 705-7090.

Thông tin về Đạo luật Người Mỹ tàn tật (Americans with Disabilities Act, ADA)

Tài liệu này có thể thực hiện bằng một hình thức khác bằng cách email cho Văn Phòng Bảo Vệ Dân Quyền và Bình Đẳng **wsdotada@wsdot.wa.gov** hoặc gọi điện thoại miễn phí số, 855-362- 4ADA(4232). Người điếc hoặc khiếm thính có thể yêu cầu bằng cách gọi cho Dịch vụ Tiếp âm Tiểu bang Washington theo số 711.

Arabic - العَرَبِيّة

في ضمان عدم استبعاد أي شخص، على أساس العرق (WSDOT) إشعار للجمهور تتمثل سياسة وزارة النقل في والية واشنطن 6العنوان أو اللون أو االصل القومي من المشاركة في أي من برامجها وأنشطتها أو الحرمان من الفوائد المتاحة بموجبها أو التعرض للتمييز فيها ويمكن ألي شخص يعتقد أنه تم انتهاك 1964.بخالف ذلك، كما هو منصوص عليه في الباب السادس من قانون الحقوق المدنية لعام . التابع لوزارة النقل في والية واشنطن(OECR)حقوقه التي يكفلها الباب السادس تقديم شكوى إلى مكتب المساواة والحقوق المدنية أو بشأن التزاماتنا بعدم التمييز بموجب الباب السادس، يرجى االتصال بمنسق /للحصول على معلومات إضافية بشأن إجراءات الشكاوى و الباب
السادس في مكتب المساواة والحقوق المدنية على الرقم 7090-705 (360).

معلومات قانون األمريكيين ذوي اإلعاقة (ADA)

يمكن توفير هذه المواد في تنسيق بديل عن طريق إرسال رسالة بريد إلكتروني إلى مكتب المساواة والحقوق المدنية على wsdotada@wsdot.wa.gov أو عن طريق االتصال بالرقم المجاني: 855-362-4ADA (4232) يمكن لألشخاص الصم أو ضعاف السمع تقديم طلب عن طريق االتصال بخدمة Washington State Relay على الرقم 711.

中文 – Chinese

《权利法案》Title VI公告

<華盛頓州交通部(WSDOT)政策規定，按照《1964　　年民權法案》第六篇規定，確保無人因種族、膚色或國籍而被排除在WSDOT任何計畫和活動之外，被剝奪相關權益或以其他方式遭到歧視。如任何人認為其第六篇保護權益遭到侵犯，則可向WSDOT的公平和民權辦公室(OECR)提交投訴。如需關於第六篇投訴程式的更多資訊和/或關於我們非歧視義務的資訊，請聯絡OECR的第六篇協調員，電話 (360) 705-7090。

《美国残疾人法案》(ADA)信息

可向公平和民權辦公室發送電子郵件wsdotada@wsdot.wa.gov或撥打免費電話

855-362-4ADA(4232)，以其他格式獲取此資料。听力丧失或听觉障碍人士可拨打711联系Washington州转接站。

Af-soomaaliga – Somali

Ciwaanka VI Ogeysiiska Dadweynaha

Waa siyaasada Waaxda Gaadiidka Gobolka Washington (WSDOT) in la xaqiijiyo in aan qofna, ayadoo la cuskanaayo sababo la xariira isir, midab, ama wadanku kasoo jeedo, sida ku qoran Title VI (Qodobka VI) ee Sharciga Xaquuqda Madaniga ah ah oo soo baxay 1964, laga saarin ka qaybgalka, loo diidin faa'iidooyinka, ama si kale loogu takoorin barnaamijyadeeda iyo shaqooyinkeeda. Qof kasta oo aaminsan in difaaciisa Title VI la jebiyay, ayaa cabasho u gudbin kara Xafiiska Sinaanta iyo Xaquuqda Madaniga ah (OECR) ee WSDOT. Si aad u hesho xog dheeraad ah oo ku saabsan hanaannada cabashada Title VI iyo/ama xogta la xariirta waajibaadkeena ka caagan takoorka, fadlan la xariir Iskuduwaha Title VI ee OECR oo aad ka wacayso (360) 705-7090.

Macluumaadka Xeerka Naafada Marykanka (ADA)

Agabkaan ayaad ku heli kartaa qaab kale adoo iimeel u diraaya Xafiiska Sinaanta iyo Xaquuqda Madaniga ah oo aad ka helayso wsdotada@wsdot.wa.gov ama adoo wacaaya laynka bilaashka ah, 855-362-4ADA(4232). Dadka naafada maqalka ama maqalku ku adag yahay waxay ku codsan karaan wicitaanka Adeega Gudbinta Gobolka Washington 711.

Translation Services

If you have difficulty understanding English, you may, free of charge, request language assistance services by calling 360-705-7921 or email us at: **PubTrans@wsdot.wa.gov**

Español - Spanish

Servicios de traducción

Aviso a personas con dominio limitado del idioma inglés: Si usted tiene alguna dificultad en entender el idioma inglés, puede, sin costo alguno, solicitar asistencia lingüística con respecto a esta información llamando al 360-705-7921, o envíe un mensaje de correo electrónico a: **PubTrans@wsdot.wa.gov**

tiếng Việt-Vietnamese

các dịch vụ dịch thuật

Nếu quý vị không hiểu tiếng Anh, quý vị có thể yêu cầu dịch vụ trợ giúp ngôn ngữ, miễn phí, bằng cách gọi số 360-705-7921 hoặc email cho chúng tôi tại: **PubTrans@wsdot.wa.gov**

한국어-**Korean**

번역 서비스

영어로 소통하는 것이 불편하시다면, 360-705-7921 으로 전화하시거나 다음 이메일로 연락하셔서 무료 언어 지원 서비스를 요청하실 수 있습니다: **PubTrans@wsdot.wa.gov**

русский-Russian

Услуги перевода

Если вам трудно понимать английский язык, вы можете запросить бесплатные языковые услуги, позвонив по телефону 360-705-7921 или написав нам на электронную почту: **PubTrans@wsdot.wa.gov**

اَلْعَرَبِيَّةُ - Arabic

الترجمة دمات خ

عن اللغوية المساعدة خدمات طلب نا مجا فيمكنك ،الإنجليزية اللغة فهم في صعوبة تجد كنت إذا

الإلكتروني البريد عبر مراسلتنا أو 360-705-7921 بالرقم الاتصال يق طر:**PubTrans@wsdot.wa.gov**

Af-soomaaliga - Somali

Adeegyada Turjumaada

Haddii ay kugu adag tahay inaad fahamtid Ingiriisida, waxaad, bilaash, ku codsan kartaa adeegyada caawimada luuqada adoo wacaaya 360-705-7921 ama iimayl noogu soo dir: **PubTrans@wsdot.wa.gov**

中文 – Chinese

翻译服务

如果您难以理解英文，则请致电：360-705-7921，**或**给我们发送电子邮件：**PubTrans@wsdot.wa.gov**，请求获取免费语言援助服务。

1 Introduction

1.1 Background

Since its initial implementation in 1991, the State of Washington's Commute Trip Reduction (CTR) law (RCW 70A.15.4000-4110) has set goals of improving air quality, easing congestion, and reducing gasoline consumption. As required by the CTR law for over 30 years, the CTR programs administrated by local and regional governments focus largely on employers that have 100 or more full-time employees who commute to a worksite on weekdays between 6 and 9 a.m.

1.2 Why an equity study of the CTR Program?

The Washington Legislature recently passed the Healthy Environment for All (HEAL) Act and Climate Commitment Act (CCA) to increase investment in environmental justice and remediate past harms. These acts direct specific proportions of funds toward vulnerable populations in overburdened communities and tribally sponsored or supported projects. WSDOT therefore commissioned Steer to conduct an equity study of the State CTR Program to assess how well it addresses equity in its current practice. The study aims to:

- Provide critical analysis to support the development of equity strategies for both CTR and broader transportation demand management (TDM) initiatives.
- Inform how the State CTR Program can align with and comply with the requirements set forth in the HEAL Act and CCA.
- Directly inform the equity components of the 2029-2033 local, regional and state CTR plans.

1.3 Scope and approach

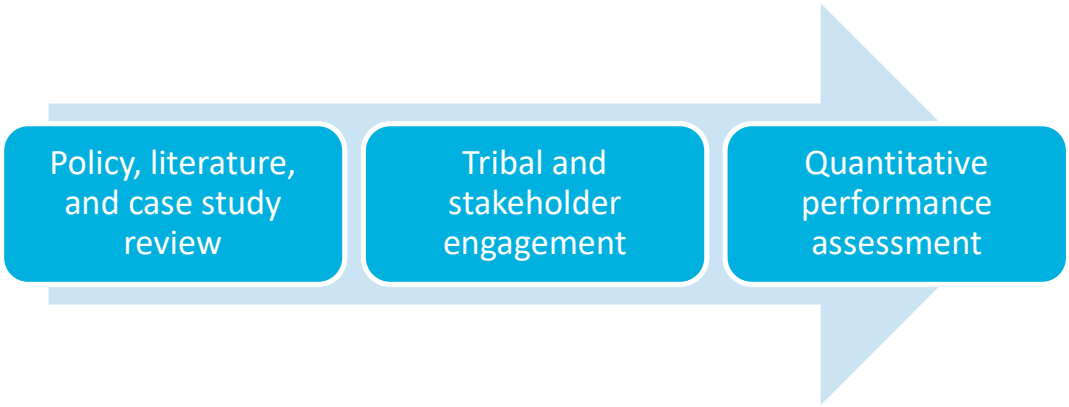
The scope for the CTR Program Equity Study includes three main elements, summarized in Figure 1-1. This report summarizes findings for the overall project, and presents detailed findings for the quantitative performance assessment, with findings from the other two elements included in the appendices.

For the purposes of this study, equity priority groups included:

- **Vulnerable populations:** populations defined by the State of Washington's Social Vulnerability Index.
- **Overburdened communities:** communities defined by the State of Washington's Environmental Health Disparities Index.
- **Tribes**: tribal governments defined as federally recognized tribes.

- **Other populations:** populations that may need equity or accessibility considerations, including essential workers, shift workers, and people with disabilities.

Figure 1-1: Overview of CTR Equity Study approach



The purpose of the policy, literature, and case study review was to inform the study's definition and measurement of equity through reviewing:

- Local, regional, and state CTR-related legislation, policy, and reports.
- Additional informative literature that speaks to equity within CTR specifically and TDM programs with CTR components.

Steer selected four case studies (three from the US and one from Mexico) to gain insight into how other jurisdictions have embedded equity into their CTR programs. We evaluated the case studies on:

- Relevance to Washington's CTR Program.
- Articulation of equity in written policy or objectives.
- Operational features supporting equity outcomes.
- Any published data or results, as well as any lessons or transferability to CTR.

We engaged with tribal planners and program implementors for CTR-program-implementing jurisdictions selected by WSDOT to better understand their needs and perspectives on the equity constraints and opportunities of the program. Engagement objectives included:

- Informing the definition of what equity means within the context of the program.
- Helping understand how the current program serves or underserves equity priority groups.
- Informing equity performance assessment priorities.
- Identifying opportunities and challenges related to engaging with and serving the needs of equity priority groups.

We scoped tribal and stakeholder engagement within the time window available to conduct interviews. We selected interviewees in coordination with WSDOT staff.

Note that the focus of the study was assessing how the state's CTR Program **directly addresses equity** and serves equity priority groups, rather than the wider, second-order effects of the program. For example, in addition to directly serving socially vulnerable areas, the program also contributes towards reducing traffic congestion on the state's busiest commute routes. This delivers a range of wider benefits, from reducing automobile-related air pollution to improving the habitability of many of Washington's cities and suburban areas, some of which will flow to vulnerable populations in overburdened communities but are outside the scope of this assessment.

1.4 Report structure

Steer structured this report as follows:

- **Section 2** – **Key findings**: summarizes findings from tribal and stakeholder engagement overall and the quantitative assessment by analytic category.
- **Section 3** – **Quantitative performance assessment approach**: provides an overview of the three dimensions of equity considered in the assessment – spatial, social, and procedural – and limitations of the study.
- **Sections 4 to 9** – **Detailed results**: presents findings of the quantitative assessment through the five lenses explored: social vulnerability, overburdened communities, drive-alone rates/employee origins, presence of "equity" industries, federally recognized tribal lands, and per-capita CTR funding allocation.
- **Section 10** – **Conclusions**: discusses potential areas for further study through engagement and quantitative analysis.

Findings from the first two stages of this study are in:

- **Appendix A** – Literature review and case : results of the background research and case study review.
- **Appendix B – Engagement summary :** summaries of Steer's engagement with tribal planners and CTR-implementing public agencies and key takeaways.

2 Key findings

2.1 Program challenges hinder the ability to serve vulnerable populations

Stakeholder engagement with WSDOT staff, tribal planners, and program implementers revealed structural challenges within the State CTR Program that hinder its ability to effectively address equity. The program's design exempts many worksites employing vulnerable populations, such as those in retail and hospitality sectors, thus limiting its reach to those who might benefit most.

Since CTR surveys rarely reach vulnerable populations, there's a lack of consistent, reliable sociodemographic data about their involvement in the program, impeding identification and engagement efforts. High turnover among employee transportation coordinators at CTR-affected worksites, except for the state's largest companies, presents an additional challenge in consistently engaging and educating any non-exempt vulnerable populations about CTR benefits.

Implementing agencies also struggle to design effective strategies to understand the needs of diverse communities, particularly vulnerable populations unfamiliar with CTR programs. A lack of standardized, culturally sensitive outreach materials exacerbates this challenge. Moreover, the requirement that CTR-related funds be spent on program administration limits implementing jurisdictions' ability to serve vulnerable populations outside of CTR-affected worksites.

2.2 Social vulnerability

Statistical analysis of the social vulnerability index (SVI)[1] in CTR-affected cities and areas with CTR worksites reveal that this indicator significantly differs between affected and unaffected areas in Washington. In general, **the State CTR Program is currently being implemented in socially vulnerable areas, which should make it easier to provide benefits to these community members.** Specifically:

- CTR-affected cities generally have a higher proportion of socially vulnerable populations compared to unaffected areas.
- CTR worksites are also more likely to be in block groups with a high prevalence of social vulnerability.

Statewide and metropolitan area-specific maps support these findings, showing an overlap between areas of high SVI, CTR-affected cities, and CTR worksite density.

[1] SVI is a place-based indicator developed by the Centers for Disease Control's Agency for Toxic Substances Disease Registry to identify and quantify the level of community susceptibility to public health emergencies.

2.3 Overburdened communities

Statistical analysis of the environmental health disparities (EHD) ranking [2] in CTR-affected cities and areas with CTR worksites reveal that this indicator differs significantly between affected and unaffected areas in Washington. In general, **the State CTR Program is currently being implemented in overburdened communities, which should mean that the environmental benefits of the program are accruing in these communities.** In particular:

- CTR-affected cities generally have a significantly higher EHD ranking compared to unaffected areas.
- CTR worksites are also more likely to be in block groups with a high EHD ranking.

Statewide and metropolitan area-specific maps support these findings, showing an overlap between areas of high EHD ranking, CTR-affected cities, and CTR worksite density. This makes sense given urban and commercial nature of areas targeted by CTR programs. An expected outcome of this benefit distribution could be a reduction in transportation-related emissions, improving air quality and environmental risk factors.

2.4 Drive-alone rates

Drive-alone rates vary by employment status and employee-origin zip code, implying compounding factors contributing to a person's commute mode choice.

Drive-alone rates and employee type

Part-time CTR employees are more likely to drive alone compared to full-time CTR employees, indicating that employment status may influence commute mode. Steer found that those working 20-34 hours per week to have higher average drive-alone rates than those working less than 20 hours per week, indicating variation among part-time classification. These findings suggest a need for targeted interventions to reduce single-occupancy vehicle use among part-time workers. Such interventions must consider that part-time workers often have unique commuting habits and needs.

Drive-alone rates and employee-origin zip codes

Analysis of drive-alone rates by employee-origin zip code reveals that origin location may influence a person's commute mode choice. **There are statistically significant differences in drive-alone capture rates among different zip codes, suggesting that geographic factors significantly influence commuting patterns.**

Central and eastern Washington, along with parts of Idaho and northern Oregon, have the highest drive-alone rates. Conversely, western Washington, particularly around the Seattle metropolitan area, exhibits lower drive-alone rates. This underscores differences in commuting behaviors

[2] The Washington State Department of Health's Washington Tracking Network EHD Map compares environmental health risk factors across communities. The map combines comprehensive data to rank communities based on environmental risk factors affecting health outcomes.

between urban and rural areas, with urban areas generally showing less car-oriented commuting patterns.

2.5 Equity and CTR industries

The analysis of "equity industries" focuses on sectors most likely to employ essential workers, shift workers, and people with disabilities. These groups represent vulnerable populations with specific transportation needs that can be addressed through supplemental support.

The findings indicate that equity industries employing essential workers, shift workers, and people with disabilities aren't limited to urban centers but are also spread across rural and less populated areas that aren't covered by CTR legislation. This widespread distribution suggests that supplemental resources/support need to be tailored to address the unique needs of these workers, especially those not living in CTR-affected areas. Essential workers require reliable and flexible transportation options, particularly in areas surrounding major urban centers. Shift workers, facing non-traditional hours, require safe and reliable commuting options during off-peak times. People with disabilities need accessible and frequent public transit to travel safely and independently.

2.6 Federally recognized tribal lands, equity, and CTR industries

There are tribal lands (not affected by CTR) that display social, economic, and environmental characteristics that indicate a potential need for additional commute support.

Many tribal lands overlap with regions of high social vulnerability, indicating that significant populations within these areas could benefit from improved transportation options and resources.

Several tribal lands, particularly in southcentral Washington and the Tacoma region, **coincide with areas with high EHD rankings,** suggesting these regions face significant environmental health and social challenges. Despite this, some tribal lands, such as those in western Washington, have lower EHD rankings, indicating a mixed scenario across different regions. **This mixed distribution highlights the need for targeted interventions that consider the specific conditions of each area.**

There are generally few equity industry jobs within tribal land boundaries, suggesting limited access to employment opportunities in sectors that typically employ essential workers, shift workers, and people with disabilities.

2.7 Funding assessment

Analysis of per-capital biennial funding per CTR-affected city by SVI and EHD ranking reveals **no clear correlation between equity indicators and funding allocation.**

Steer expected this result given that the State CTR Program wasn't designed to advance equity outcomes. Also, the current funding formula considers density of CTR worksites as a primary factor, as opposed to variation in equity markers at the city level.

A CTR program whose funding formula considers equity indicators might consider distributing more resources to cities with higher SVI or EHD rankings. This could result in a better alignment between funding and state equity objectives.

3 Quantitative performance assessment approach

3.1 Approach

Steer structured the quantitative performance assessment around three key aspects of equity:

- **Social**: this aspect focuses on who the State CTR Program is affecting and benefiting. It involves defining vulnerable populations, overburdened communities, essential workers, and people with special transportation needs. The task proposes a disproportionality assessment to compare the sociodemographic characteristics of CTR participants with the broader state population.
- **Spatial**: this component examines where the State CTR Program is being applied. It involves mapping communities with higher proportions of equity populations and comparing this with the distribution of CTR-implementing jurisdictions and major employers.
- **Procedural**: this aspect considers how the State CTR Program was developed and is being used. In practice, it compares the distribution of WSDOT's funding for CTR programming to implementors with the presence of equity priority groups.

The performance assessment methodology relies on a combination of quantitative analysis, including disproportionality assessments, and qualitative evaluation of the program's regulations and implementation.

3.2 Limitations and considerations

The State CTR Program, first implemented in 1991, wasn't designed to advance equity and doesn't include any equity-specific objectives or requirements. This study considers the equity effects of the program as legislated and implemented, noting several key limitations and considerations with both the tribal and stakeholder engagement and quantitative performance assessment:

- From what implementers and the WSDOT understand, the program doesn't currently serve many equity priority groups, particularly low-income individuals, people with disabilities, indigenous communities, and others with special transportation needs. The study quantifies this disparity.
- CTR programs currently don't collect demographic data directly from program participants. This required Steer to seek alternative data sources, primarily the US Census.

Throughout the analysis, we've focused on CTR-affected cities rather than specific employers or worksites. CTR-affected cities are implementing cities or cities within implementing jurisdictions

that have CTR worksites within their boundaries. This definition avoids misattribution of unincorporated county characteristics to implementing jurisdiction profiles during spatial analysis.

4 Detailed results – social vulnerability

4.1 Statistical analysis

SVI is a place-based indicator to identify and quantify the level of community susceptibility to public health emergencies. SVI uses 16 U.S. Census variables from the 5-year American Communities Survey grouped into four themes:

- Socioeconomic status
- Household characteristics
- Racial and ethnic minority status
- Housing Type/Transportation

Full documentation on the SVI is at **www.atsdr.cdc.gov/placeandhealth/svi/index.html**. Steer retrieved indices for census tracts in Washington state from the 2022 SVI Database.

We assessed SVI for this study to provide an understanding of the prevalence of vulnerable populations in CTR-affected cities and in areas with CTR worksites. We used a mix of spatial and statistical methods to generate insights into the equity of CTR implementation as it relates to social vulnerability.

4.2 Methodology

Steer constructed assessments to test for correlation between social vulnerability and CTR-affected cities or areas with CTR worksites:

- Socially vulnerable populations in CTR-affected cities (SVI assessment 1).
- Prevalence of CTR worksites in socially vulnerable communities (SVI assessment 2).

First, we flagged all census tracts in Washington state as being located within CTR-affected cities via spatial intersection (polygon-to-polygon). We further identified CTR-affected city tracts as containing CTR worksites via spatial intersection (polygon-to-point).

Next, we constructed a statistical test for **SVI assessment 1** using the following framework:

- **T-test:** assess whether the average prevalence of vulnerable population characteristics in CTR affected cities is significantly different than in non-CTR affected areas.
- **Independent variable:** determine whether a block group is within a CTR affected city or not (binary).

- **Dependent variable:** determine SVI ranking from 1-10.

Similarly, we constructed statistical test for **SVI assessment 2** using the following framework:

- **T-test:** assess whether the average prevalence of socially vulnerable communities in areas with CTR worksites is significantly different than in areas without CTR worksites.
- **Independent variable:** determine whether a block group in a CTR affected city is categorized as a CTR site (binary).
- **Dependent variable:** determine SVI ranking from 1-10.

Finally, we calculated a mean SVI rank for census tracts given their CTR-affected city and/or CTR worksite status. Determining the significance of difference in SVI rank by geography validates comparison of average vulnerability between spatial groups.

4.3 Results

The table below outlines results from all statistical assessments of SVI.

Table 4.3.1: Results of social vulnerability statistical analysis

Test	T stat	Degrees of freedom	P value	Outcome
SVI rank by CTR affected city status (SVI assessment 1)	-3.665	1297.89	<0.001	Sig. diff
SVI rank by CTR site (SVI assessment 2)	-5.493	632.83	<0.001	Sig. diff

These figures show that SVI is significantly different depending on whether a tract is in a CTR-affected city and whether a tract contains a CTR worksite.

The table below compares mean SVI rankings between tracts identified as CTR-affected cities and unaffected areas, as well as between tracts with CTR worksites and non-CTR sites (within CTR affected cities).

4.3.1 Mean SVI rank by CTR city or worksite status

Table 4.3.2: Mean SVI ranking by geography type

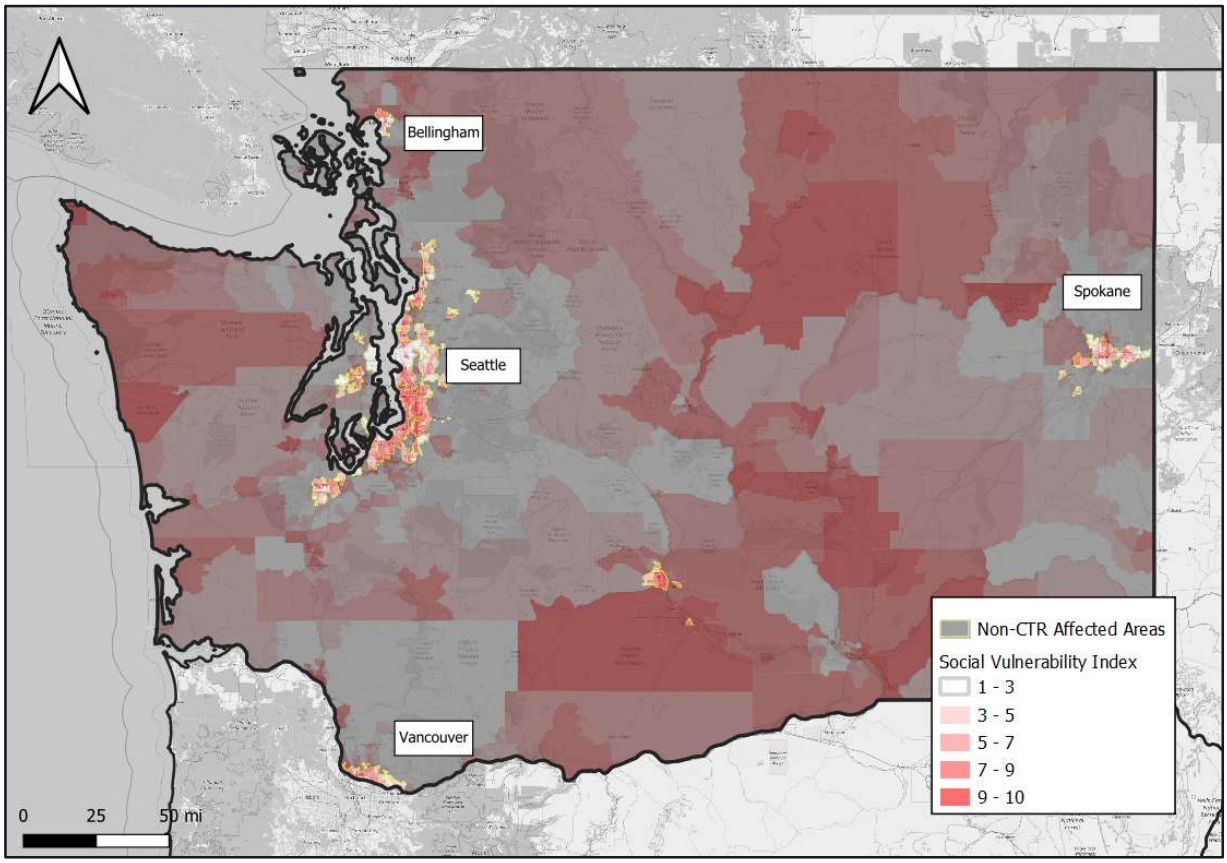
Test	Mean SVI rank if TRUE	Mean SVI ranking if FALSE
CTR-affected cities	5.79	5.23
Area in CTR-affected Cities with CTR worksites	6.51	5.44

These analyses reveal that SVI ranking is generally slightly higher in CTR-affected cities. They also indicate that within CTR-affected cities, socially vulnerable communities are more prevalent in areas with CTR worksites. Together, these tests reveal that a relatively higher proportion of vulnerable populations are found in CTR-affected cities and CTR worksite areas, compared to their counterparts. Thus, **the State CTR Program is currently being implemented in socially vulnerable areas**, which should make it easier to provide benefits to these community members.

4.3.2 Maps

The following maps show SVI by tract overlaid with boundaries of CTR-affected cities.

Figure 4-1: SVI and CTR-affected cities, statewide



The statewide map visually confirms the results of the above statistical analyses and reveals that CTR-affected cities have more census tracts with high SVI. There are pockets of high social vulnerability in non-CTR areas as well, but these are typically balanced with low scores elsewhere.

Figure 4-2: SVI and CTR-affected cities, King County

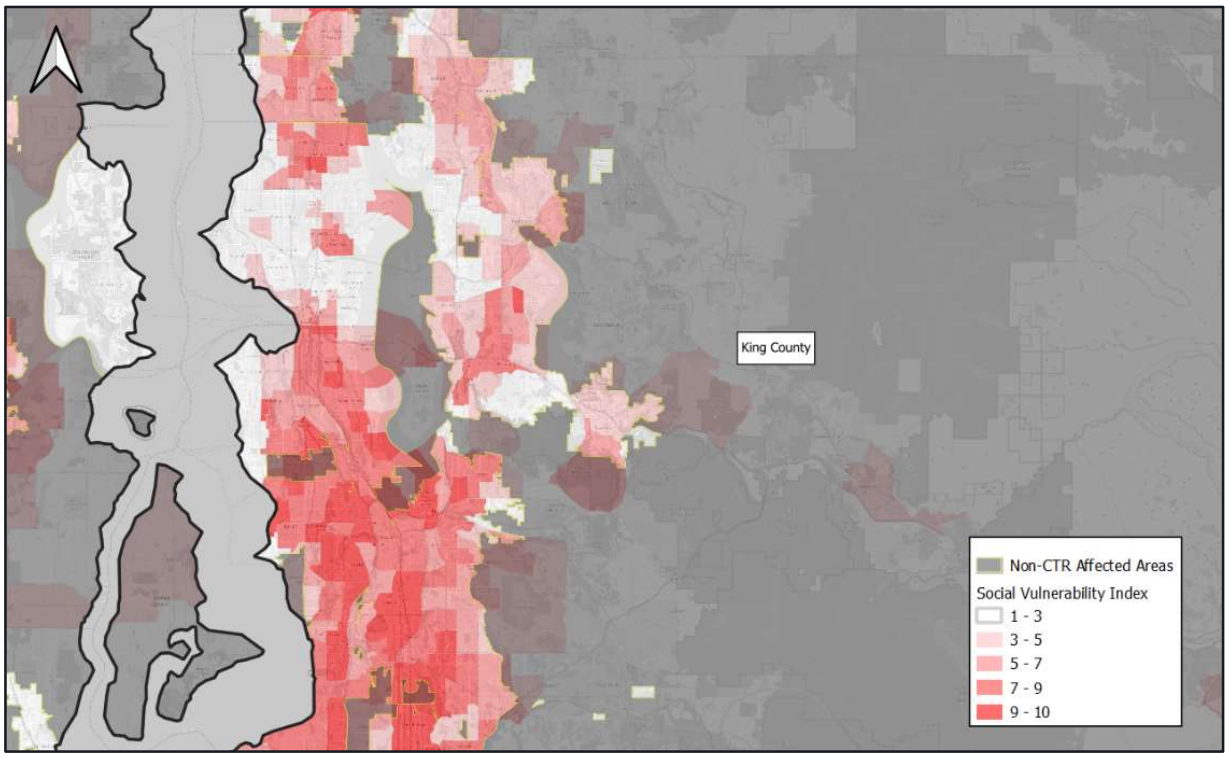


Figure 4-3: SVI and CTR-affected cities, Pierce County

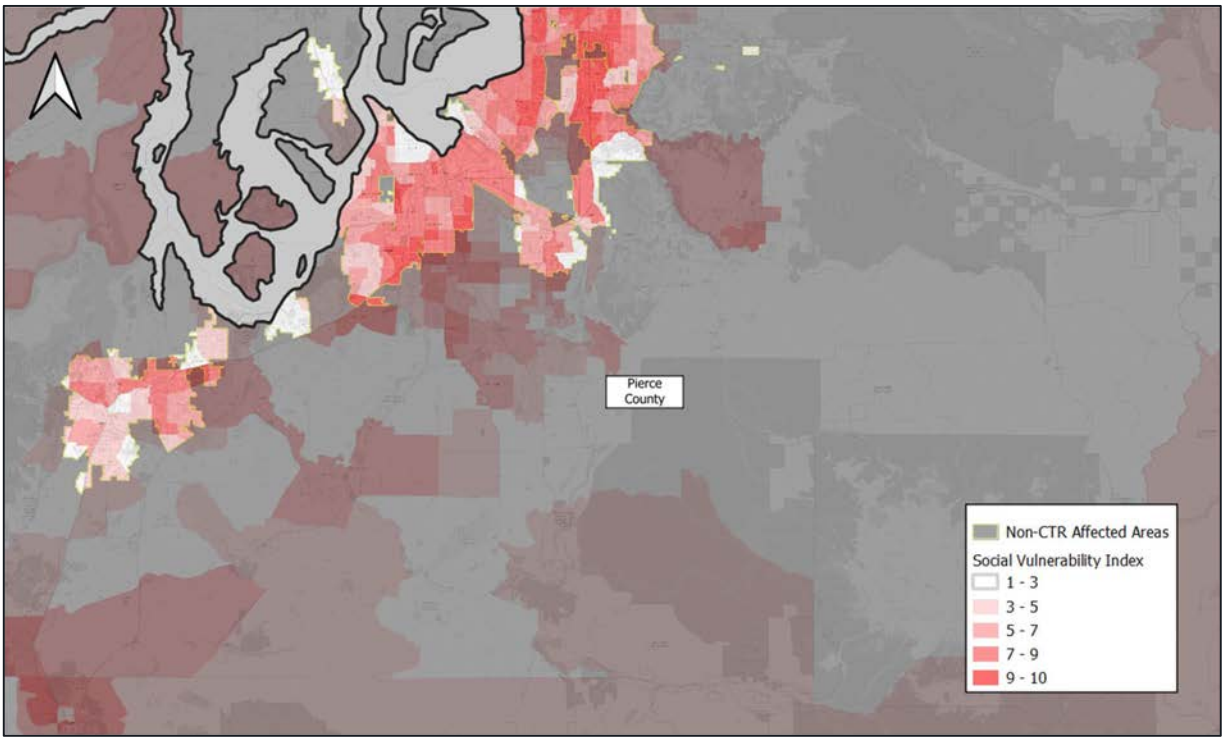


Figure 4-4: SVI and CTR-affected cities, Snohomish County

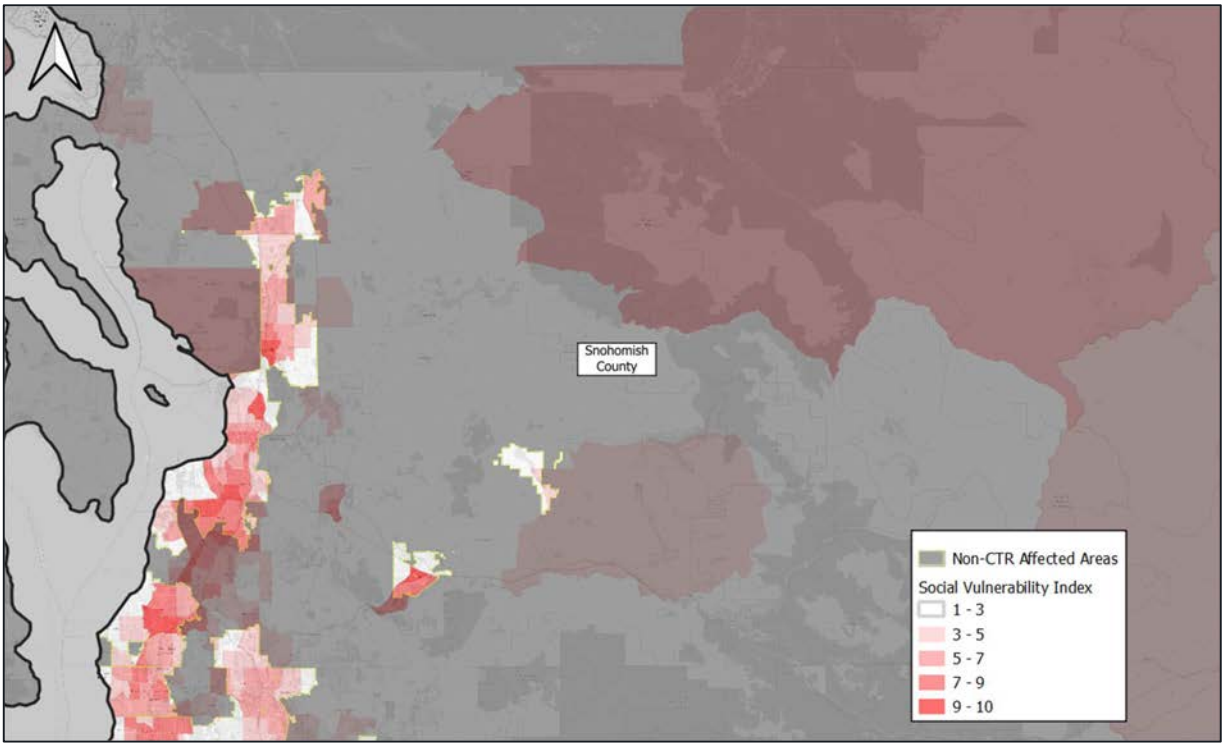


Figure 4-5: SVI and CTR-affected cities, Bellingham

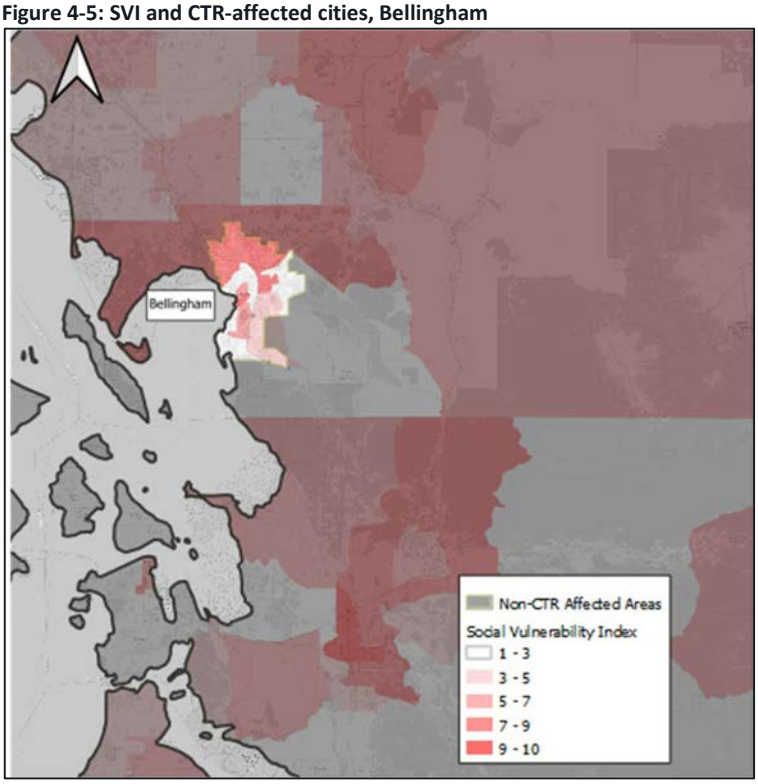


Figure 4-6: SVI and CTR-affected cities, Vancouver

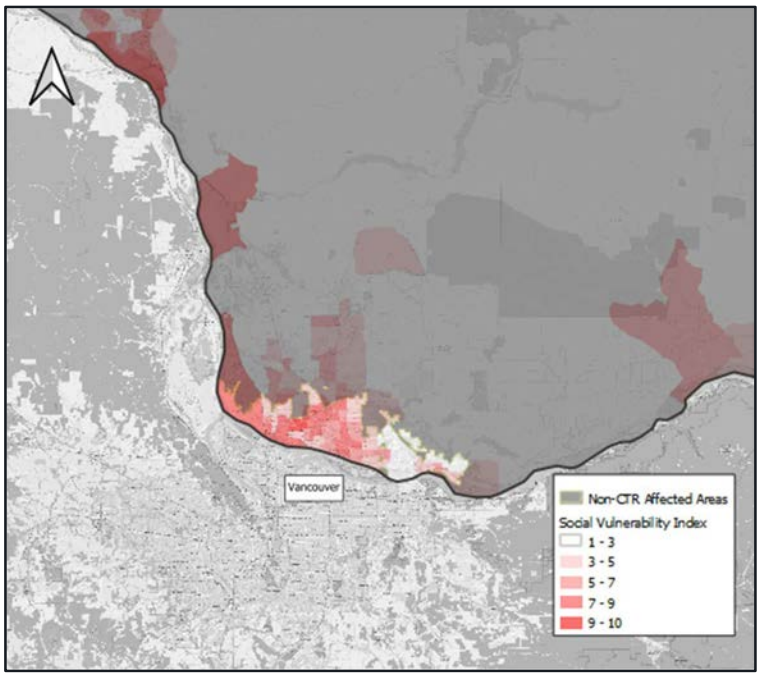
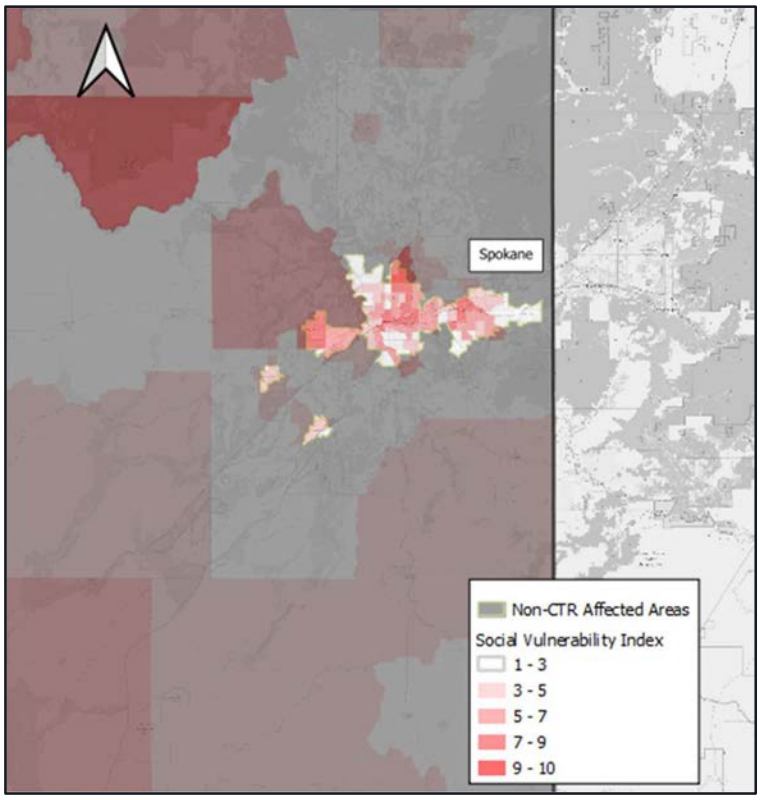


Figure 4-7: SVI and CTR-affected cities, Spokane



Taken together, these maps support the finding that, on average, social vulnerability is higher in CTR-affected cities than in non CTR areas across the state. Thus, these vulnerable populations should be able to receive benefits. Vehicle-worker mismatch (when a household has more workers than vehicles available) and percentage of households with zero-vehicles are examples of vulnerability indicator that CTR programs can address through introduction and promotion of non-vehicle commuting modes.

The next set of maps show SVI (like above) overlaid with CTR worksites (as green dots indicating the location of workplaces). Since CTR worksites are primarily located within CTR-affected cities, the takeaways from the visuals below are similar to the maps above.

Figure 4-8: SVI and CTR worksites, statewide

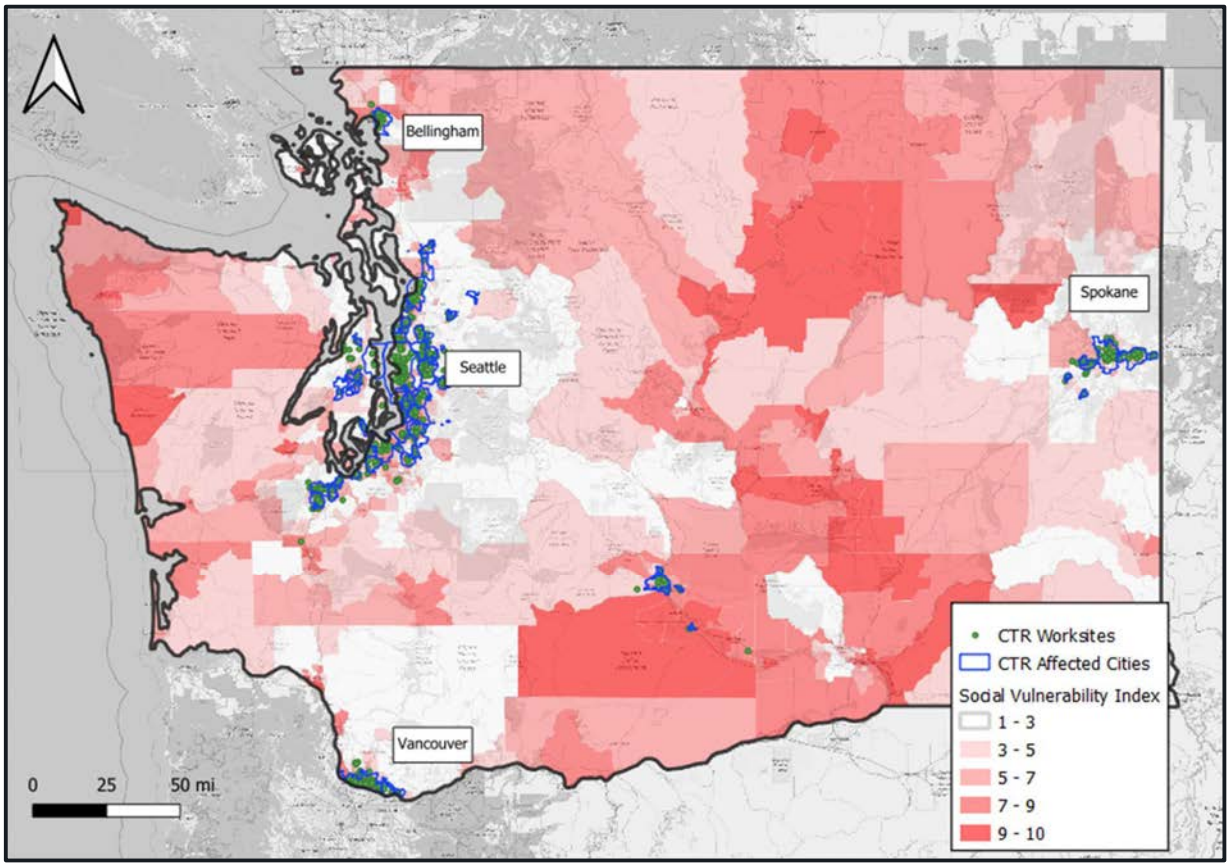


Figure 4-9: SVI and CTR worksites, King County

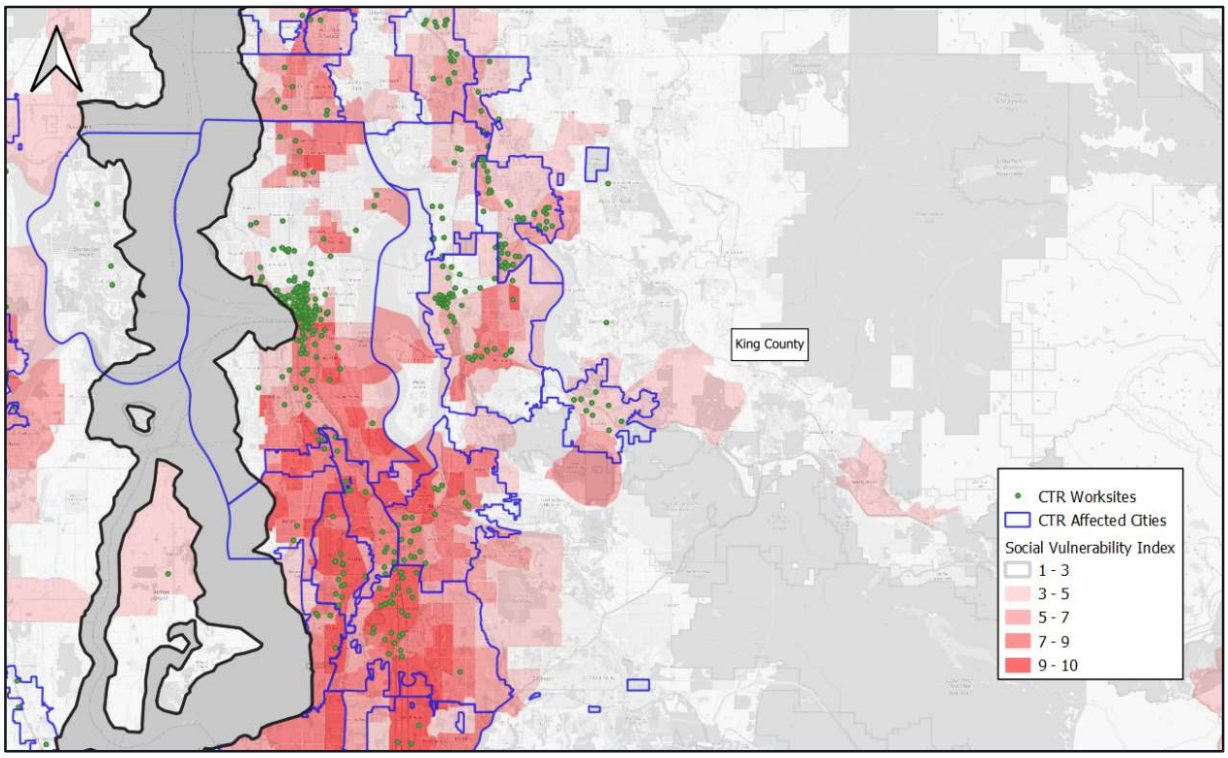


Figure 4-10: SVI and CTR worksites, Pierce County

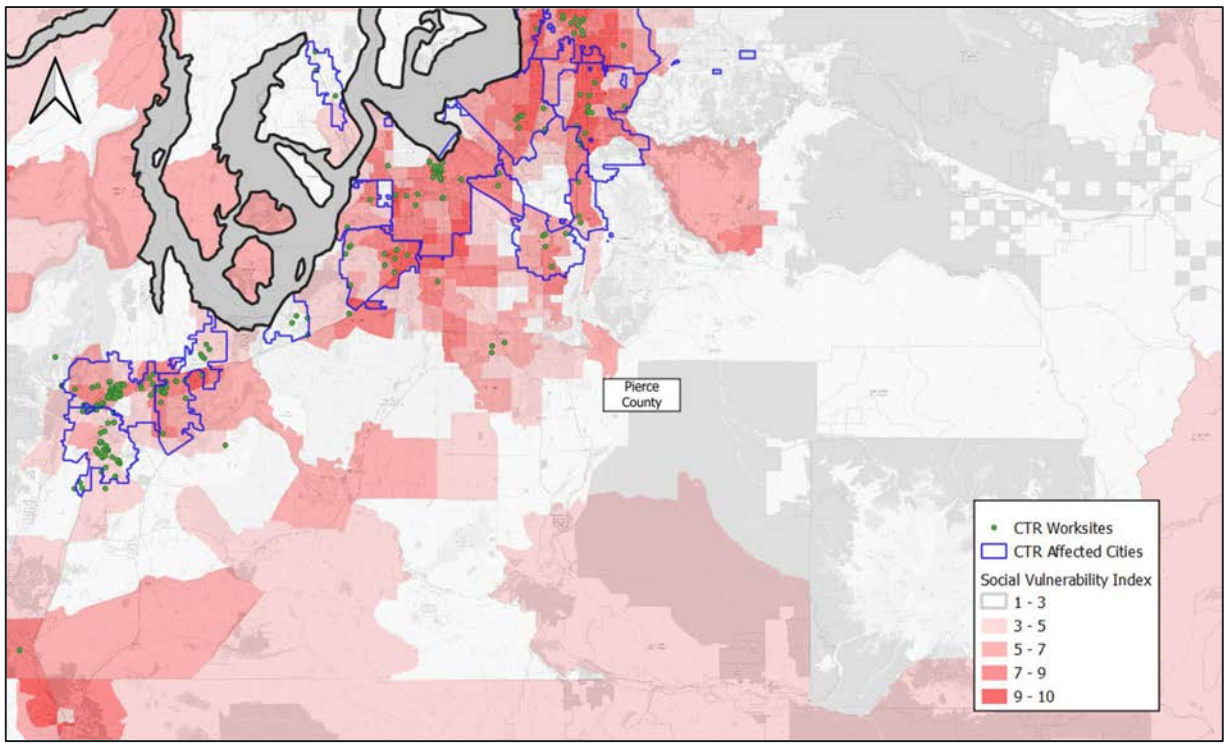


Figure 4-11: SVI and CTR worksites, Snohomish County

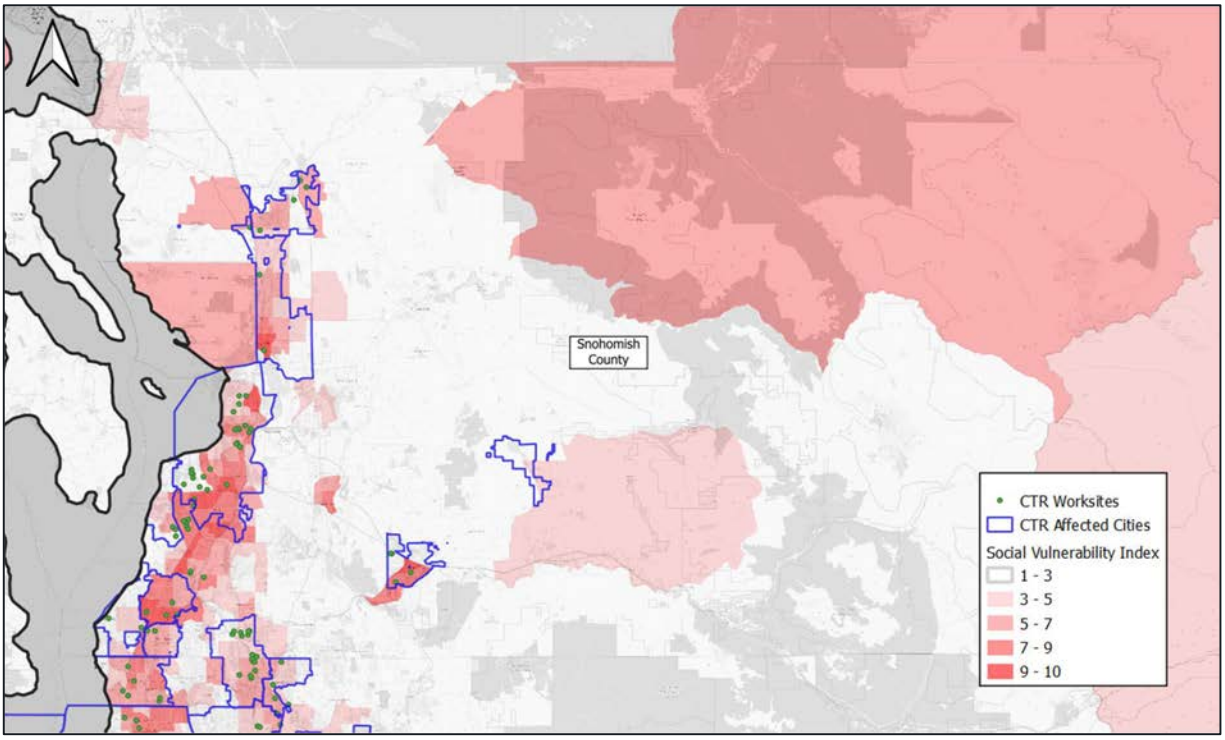


Figure 4-12: SVI and CTR worksites, Bellingham

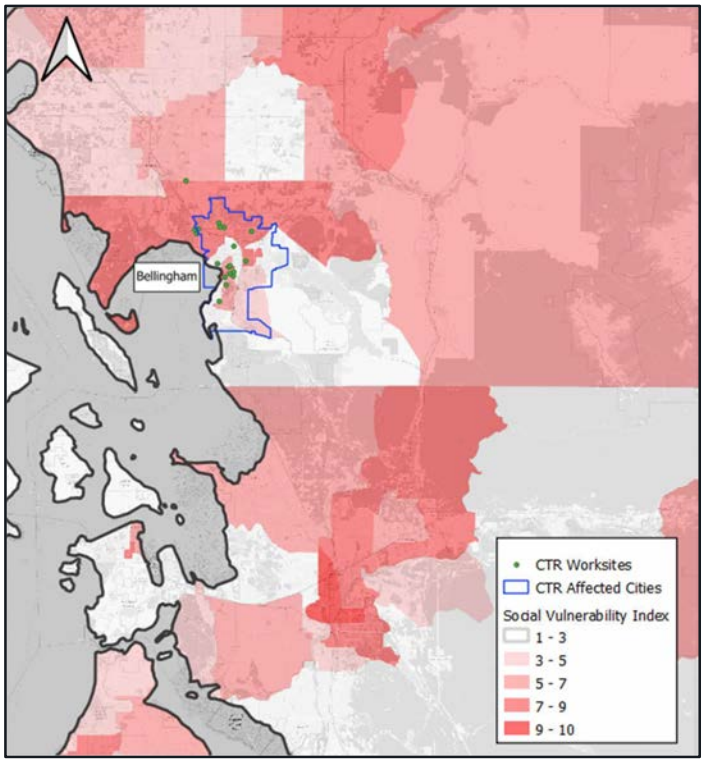


Figure 4-13: SVI and CTR worksites, Vancouver

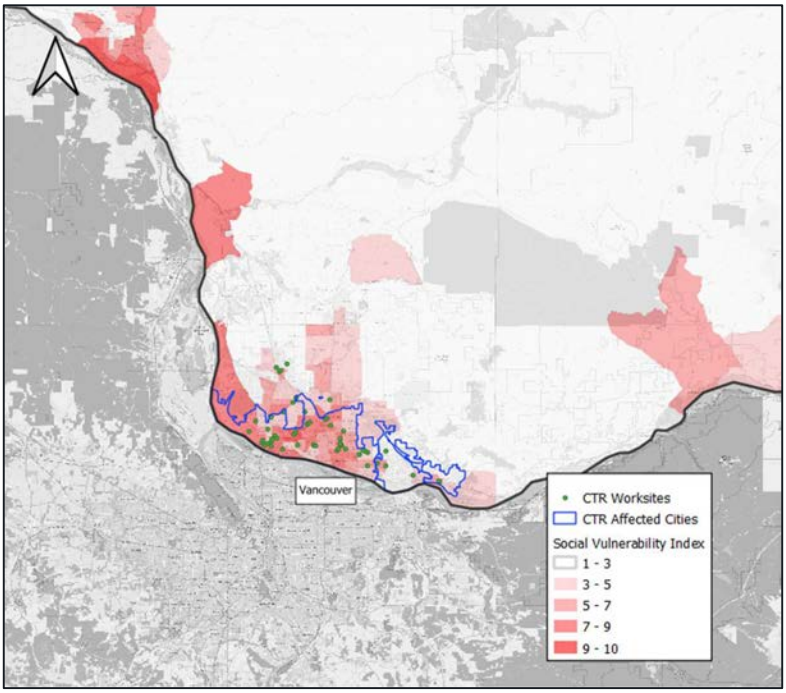
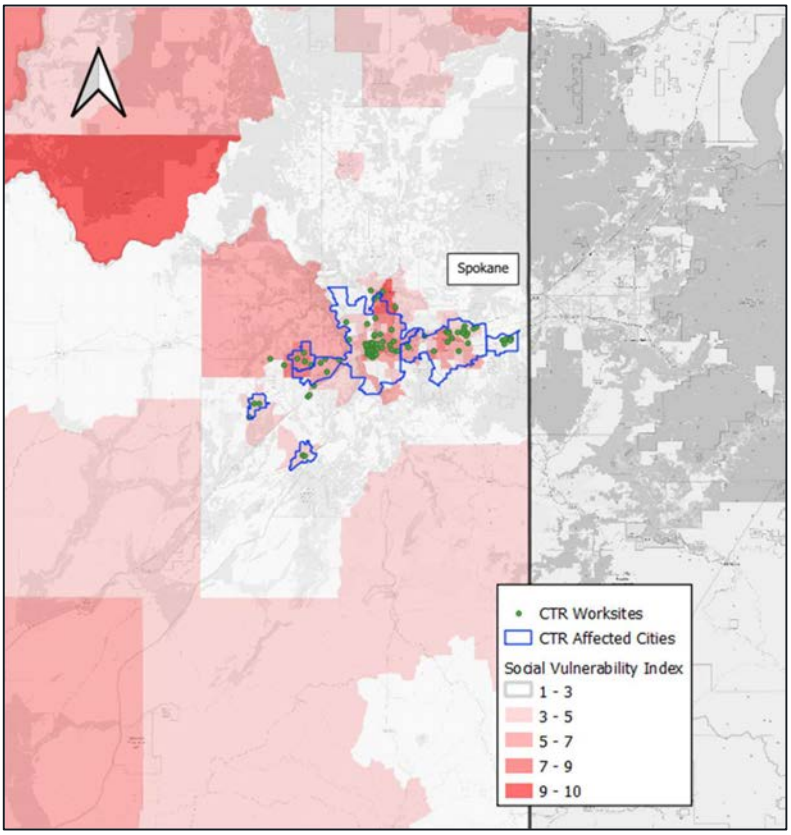


Figure 4-14: SVI and CTR worksites, Spokane



5 Detailed results – overburdened communities

5.1 Statistical analysis

The Washington State Department of Health's Washington Tracking Network EHD map compares environmental health risk factors across communities. This tool combines comprehensive data to rank communities based on environmental risk factors affecting health outcomes. The tool considers 19 state and national data indicators, grouped into the following categories:

- Environmental exposures
- Environmental effects
- Socioeconomic factors
- Sensitive populations

Full documentation on the EHD map is at doh.wa.gov/sites/default/files/2022-07/311-011-EHD-Map-Tech-Report_0.pdf?uid=62e46bbc98fad. This assessment uses data from Version 2.0 of the EHD map.

Steer assessed EHD ranking (on a scale from 1-10) for this study to provide an understanding of the prevalence of environmental health risks in CTR-affected cities and in areas with CTR worksites. We used a mix of spatial and statistical methods to generate insights into the equity of CTR implementation as it relates to overburdened communities (i.e., areas with relatively high EHD rankings, typically 7 and above).

5.2 Methodology

Steer constructed assessments to test for correlation between social vulnerability and CTR-affected cities or areas with CTR worksites:

- Overburdened communities in CTR-affected cities (EHD assessment 1).
- Prevalence of CTR worksites in overburdened communities (EHD assessment 2).

First, we flagged all census tracts in Washington state as being located within CTR-affected cities via spatial intersection (polygon-to-polygon). We further identified CTR-affected city tracts as containing CTR worksites via spatial intersection (polygon-to-point).

Next, we constructed a statistical test for EHD assessment 1 using the following framework:

- **T-test:** assess whether the average prevalence of overburdened communities in CTR-affected cities is significantly different than in non-CTR affected areas.

- **Independent variable:** determine whether a block group is within a CTR affected city or not (binary).
- **Dependent variable:** determine EHD, ranked from 1-10.

Similarly, we constructed a statistical test for EHD assessment 2 using the following framework:

- **T-test:** assess whether the average prevalence of overburdened communities in areas with CTR worksites is significantly different than in areas without CTR worksites.
- **Independent variable:** determine if block group in a CTR affected city is categorized as a CTR site (binary).
- **Dependent Variable:** Determine EHD, ranked from 1-10.

Finally, we calculated a mean EHD ranking for census tracts given their CTR-affected city and/or CTR worksite status. Determining the significance of difference in EHD rank by geography validates comparison of average vulnerability between spatial groups.

5.3 Results

The table below shows results from all statistical assessments of SVI.

Table 5.3.1: Results of overburdened communities statistical analysis

Test	T stat	Degrees of freedom	P value	Outcome
EHD rank by CTR-affected city status (EHD assessment 1)	-20.839	597.4	<0.001	Sig. diff
EHD rank by CTR site (EHD assessment 2)	-3.708	589.63	<0.001	Sig. diff

These figures show that EHD ranking is significantly different depending on whether a tract is in a CTR-affected city and whether a tract contains a CTR worksite.

The table below compares mean EHD rankings between tracts identified as CTR-affected cities and unaffected areas, as well as between tracts with CTR worksites and non-CTR sites (within CTR affected cities).

5.3.1 Mean SVI ranking by CTR city or worksite status:

Table 5.3.2: Mean EHD ranking by geography type

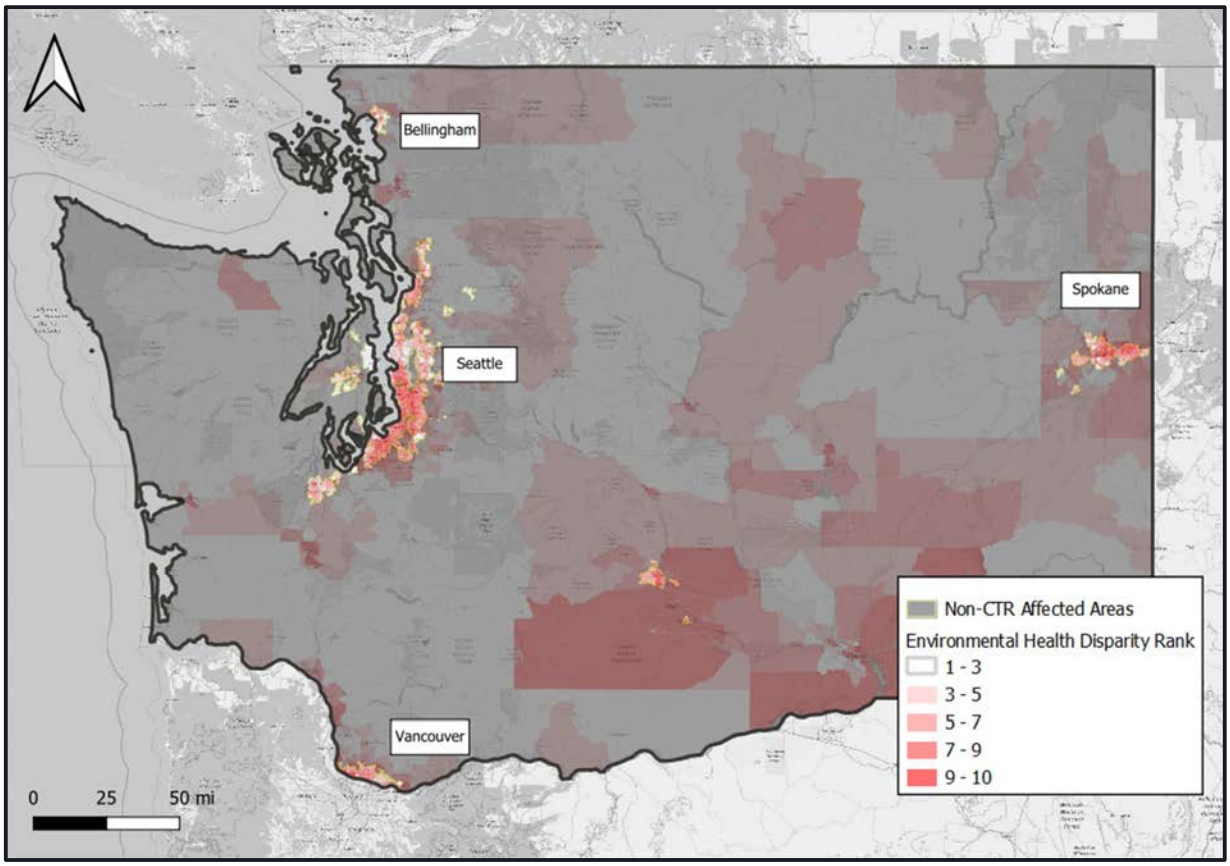
Test	Mean EHD ranking if TRUE	Mean EHD ranking if FALSE
CTR-affected cities	6.72	3.95
Area in CTR-affected cities with CTR worksites	7.18	6.50

These analyses reveal that EHD ranking is generally higher in CTR affected cities, with mean EHD rankings separated by almost four points between CTR-affected cities and non-CTR areas. They also indicate that, within CTR affected cities, overburdened communities are more prevalent in areas with CTR worksites. Note that the difference in mean EHD rank between areas with CTR worksites and non-CTR sites is less than a point. However, this brings the average EHD rank over the state-defined threshold of 7, indicating that the average CTR cite is in an overburdened area. Together, these tests reveal that a relatively higher proportion of overburdened communities are in CTR affected cities and CTR worksite areas, compared to their counterparts. Thus, **the State CTR Program is currently being implemented in overburdened communities**, which should mean that the environmental benefits of the program are accruing in these communities. For example, shifting trips away from vehicles should reduce vehicle miles traveled, air pollution, and greenhouse gas emissions due to the clustering of worksites in overburdened communities.

5.3.2 Maps

The following maps show SVI by tract overlaid with boundaries of CTR-affected cities.

Figure 5-1: EHD ranking and CTR-affected cities, statewide



The statewide map visually confirms the results of the above statistical analyses and reveals that CTR-affected cities have more census tracts with a high EHD ranking. The disparity between tracts in CTR-affected cities and non-CTR areas is clearer here than in the SVI analysis, likely due to the effects of traffic and industrial emissions in metropolitan areas. The next several maps provide zoomed-in versions of selected areas in the state.

Figure 5-2: EHD ranking and CTR-affected cities, King County

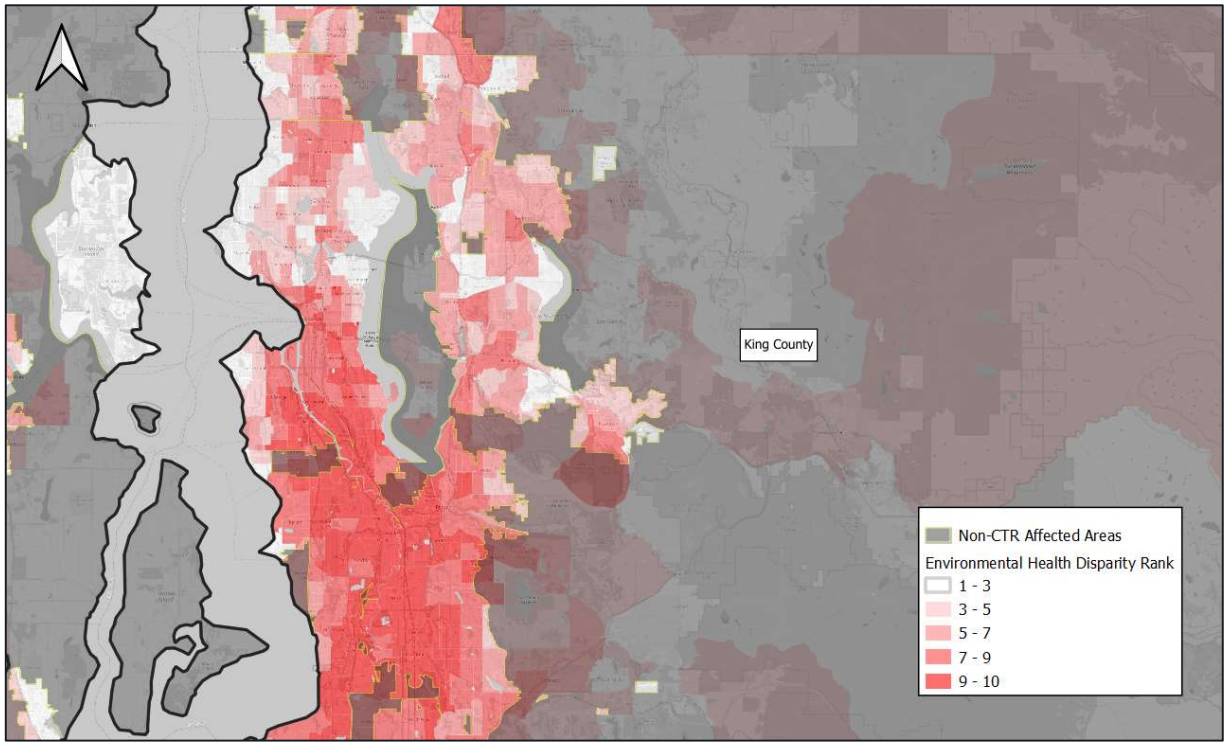


Figure 5-3: EHD ranking and CTR-affected cities, Pierce County

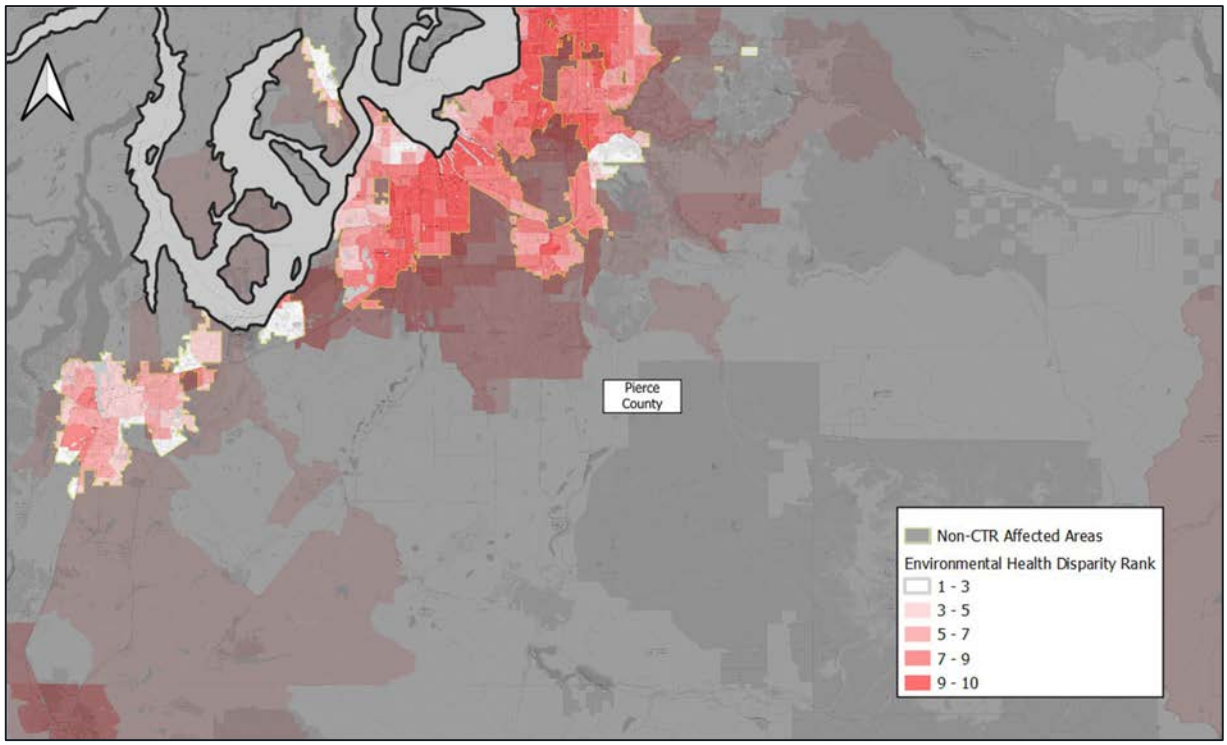


Figure 5-4: EHD ranking and CTR-affected cities, Snohomish County

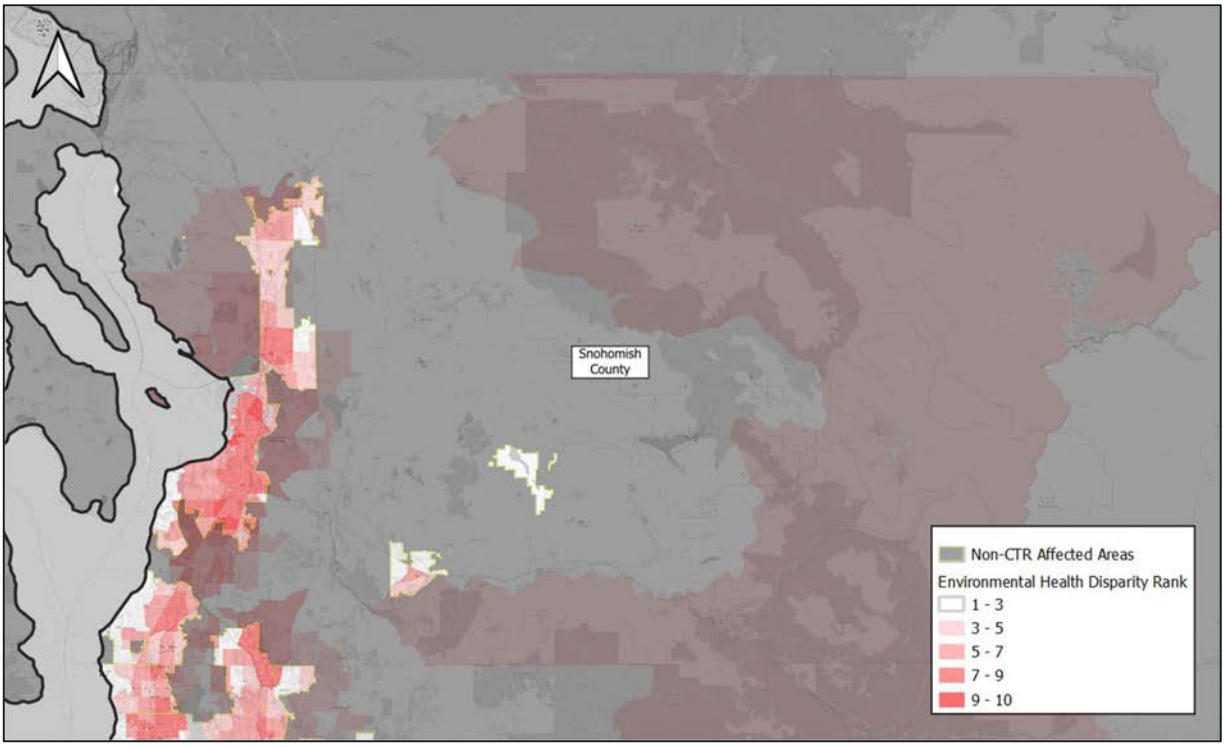


Figure 5-5: EHD ranking and CTR-affected cities, Bellingham

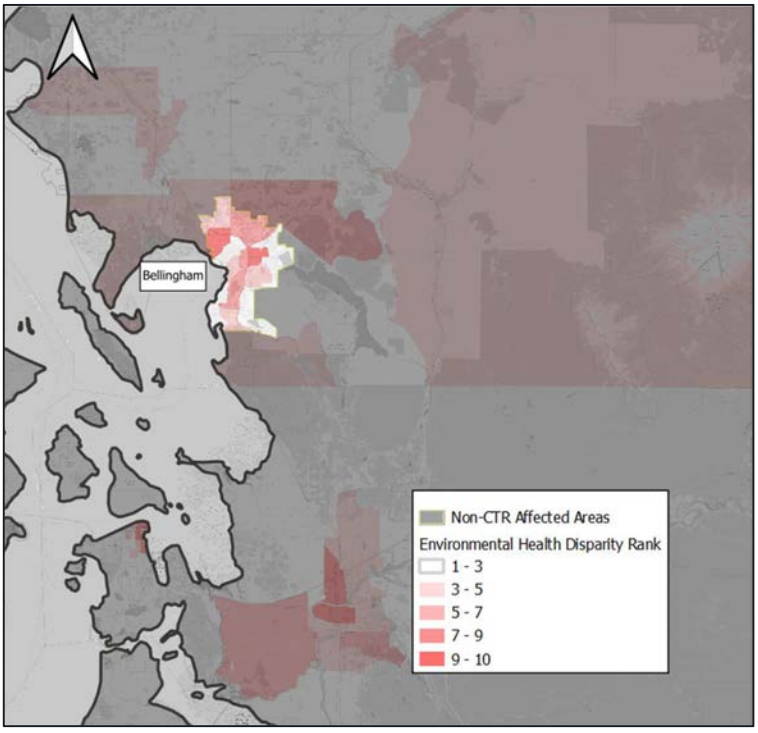


Figure 5-6: EHD ranking and CTR-affected cities, Vancouver

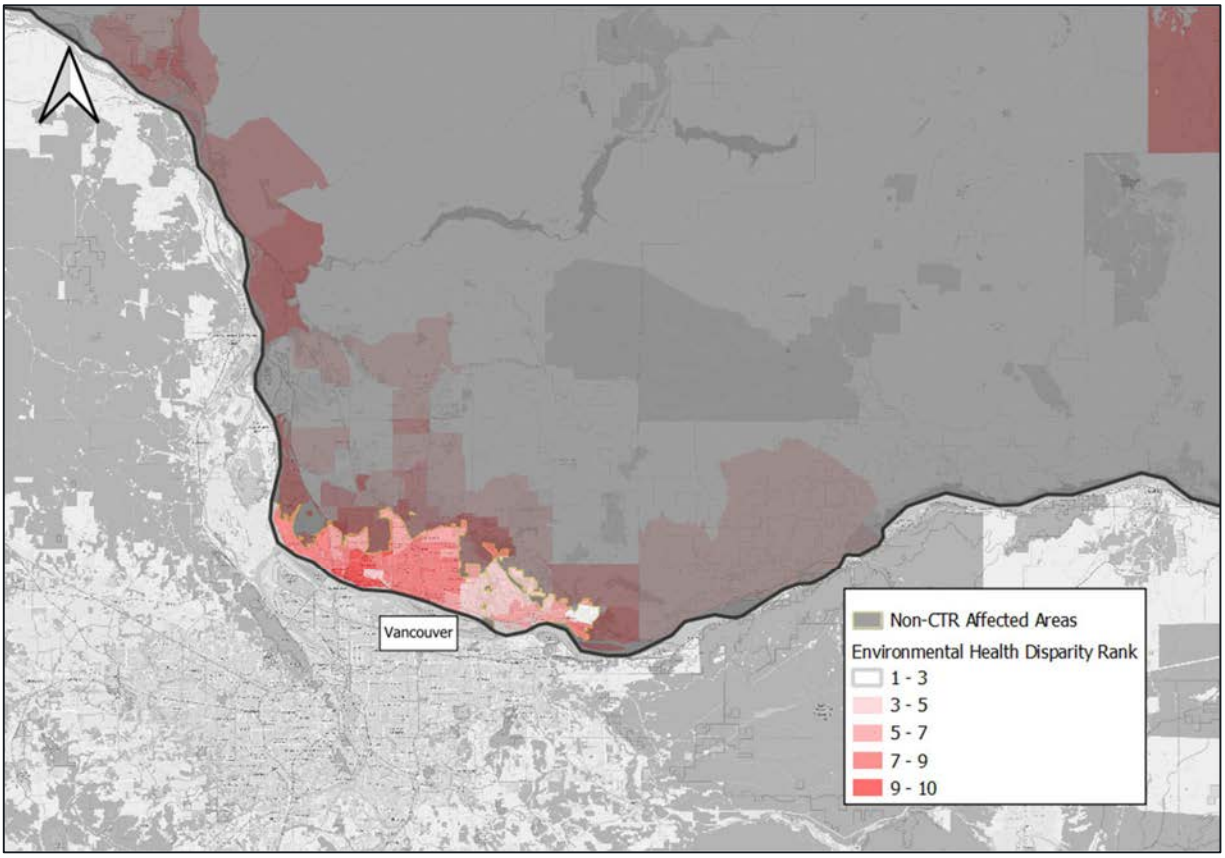
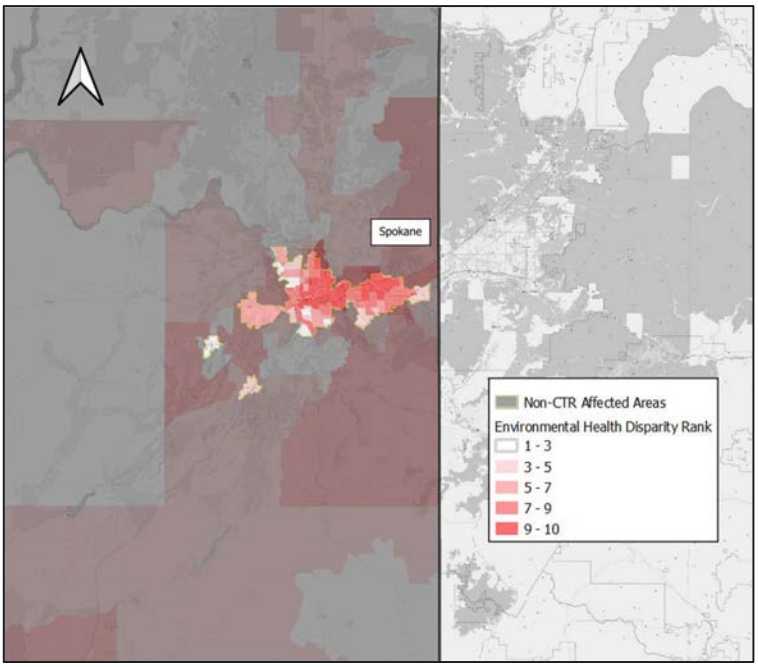


Figure 5-7: EHD ranking and CTR-affected cities, Spokane



These figures highlight that census tracts with high EHD rankings are densely distributed within CTR-affected cities, given the urban nature of the jurisdictions. High EHD ranking can occur due to many environmental attributes, but transportation-related emissions (including single-occupancy vehicles) are likely a contributing factor. Thus, implementation of CTR programs should allow benefits to accrue in overburdened communities via the environmental benefits associated with vehicle miles traveled reduction.

The next set of maps show EHD ranking (like above) overlaid with CTR worksites (as green dots indicating the location of workplaces). Since CTR worksites are primarily located within CTR-affected cities, the takeaways from the visuals below are largely like those from maps above.

Figure 5-8: EHD ranking and CTR worksites, statewide

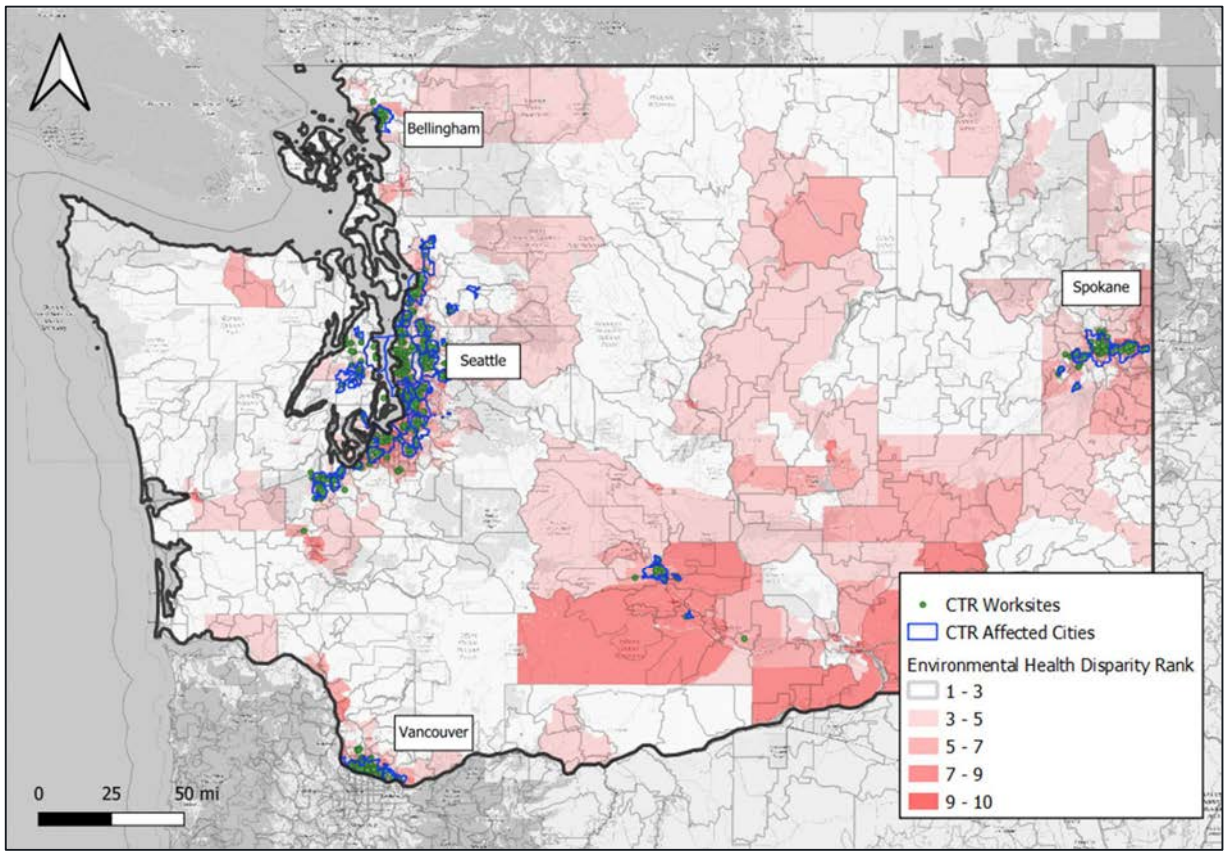


Figure 5-9: EHD ranking and CTR worksites, King County

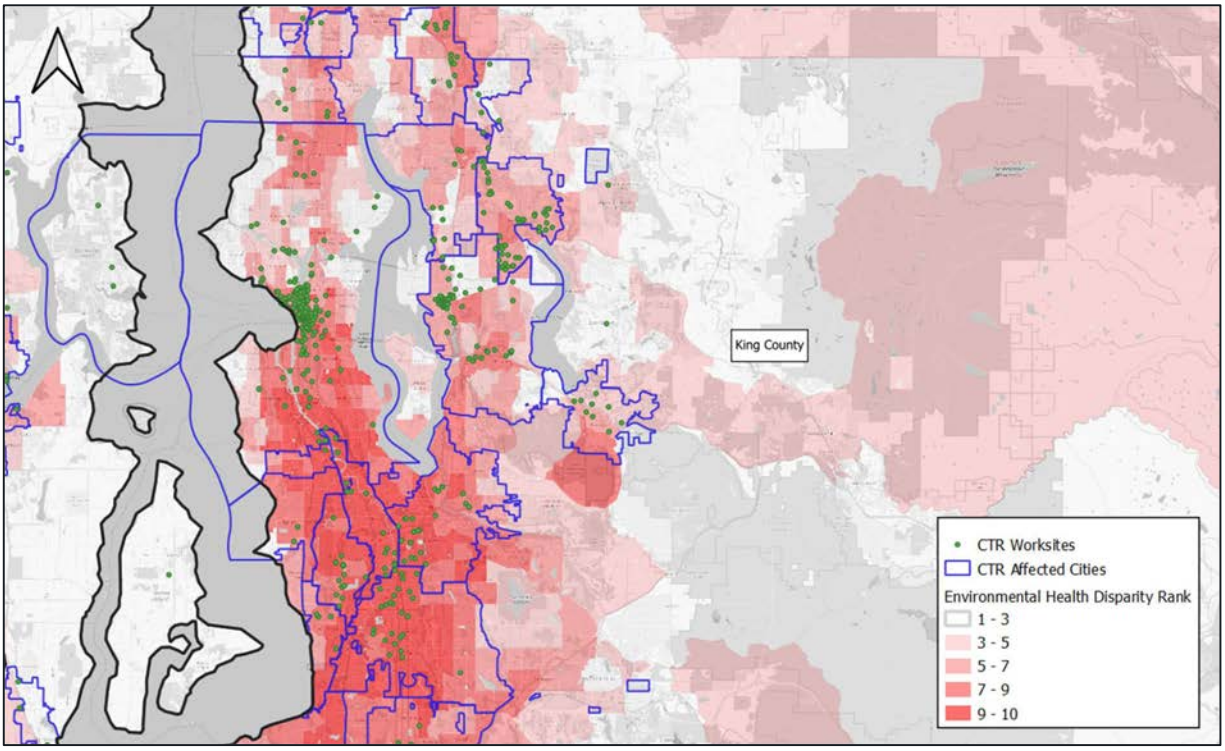


Figure 5-10: EHD ranking and CTR worksites, Pierce County

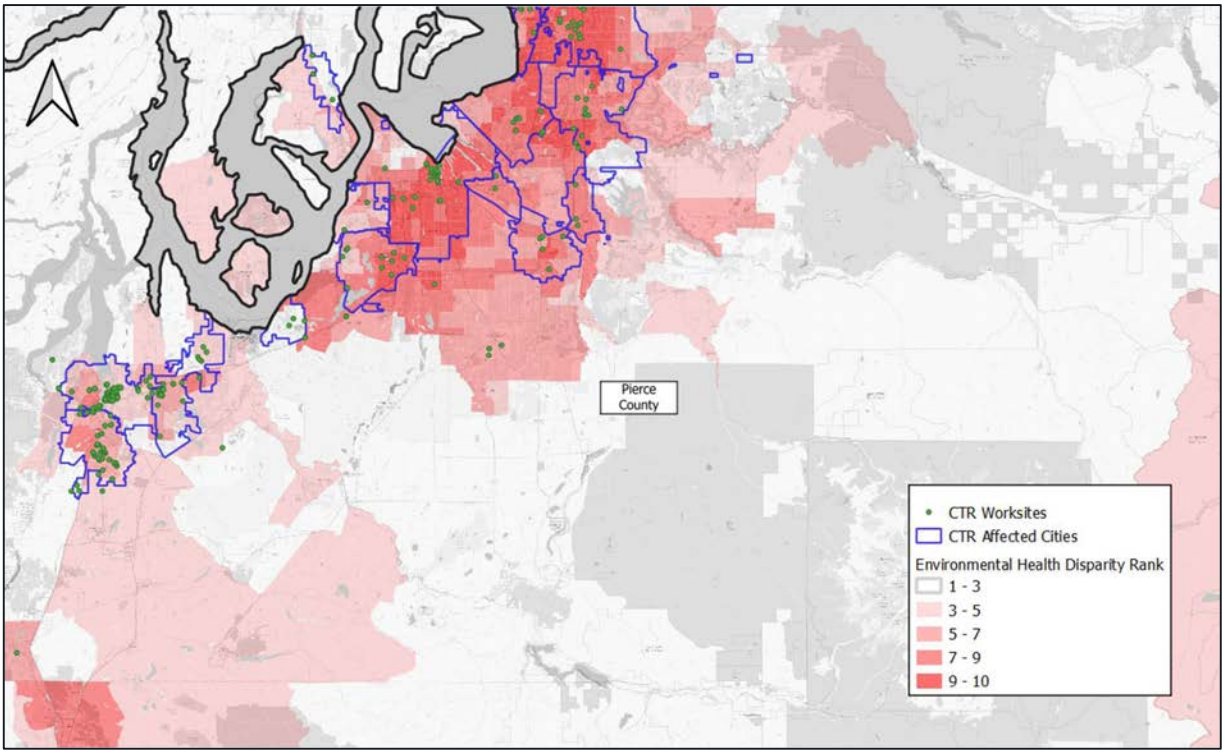


Figure 5-11: EHD ranking and CTR worksites, Snohomish County

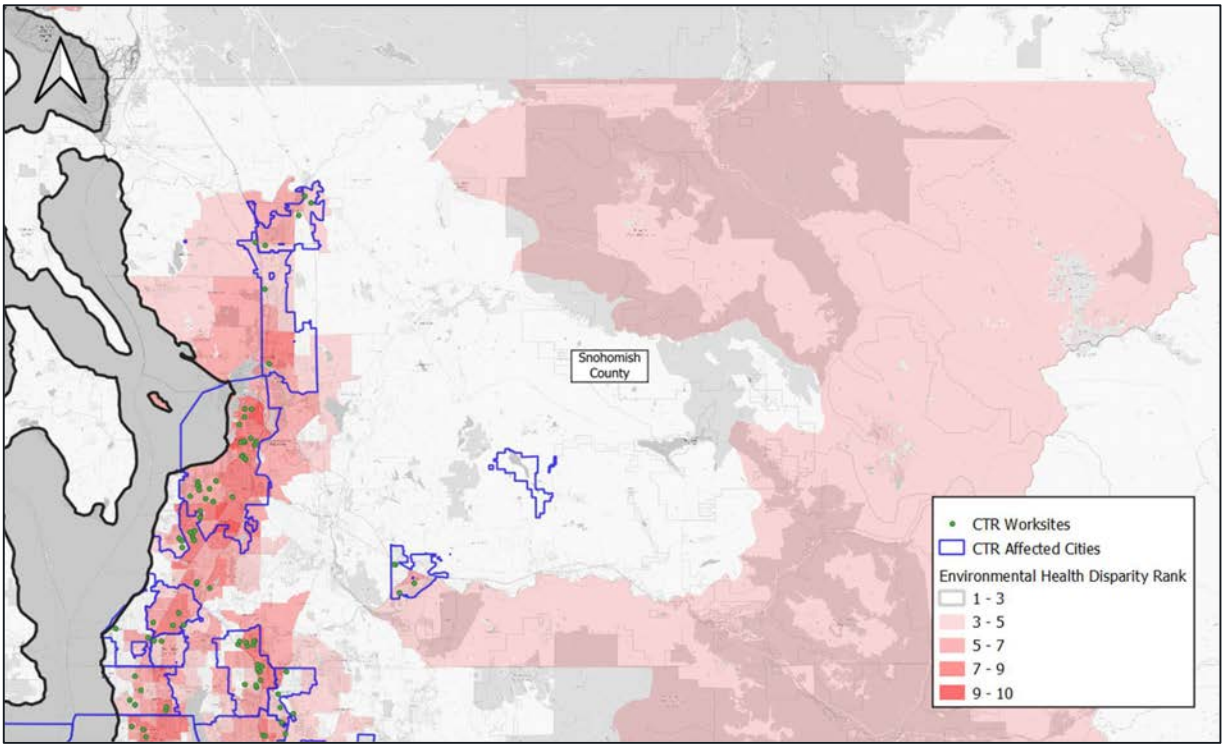


Figure 5-12: EHD ranking and CTR worksites, Bellingham

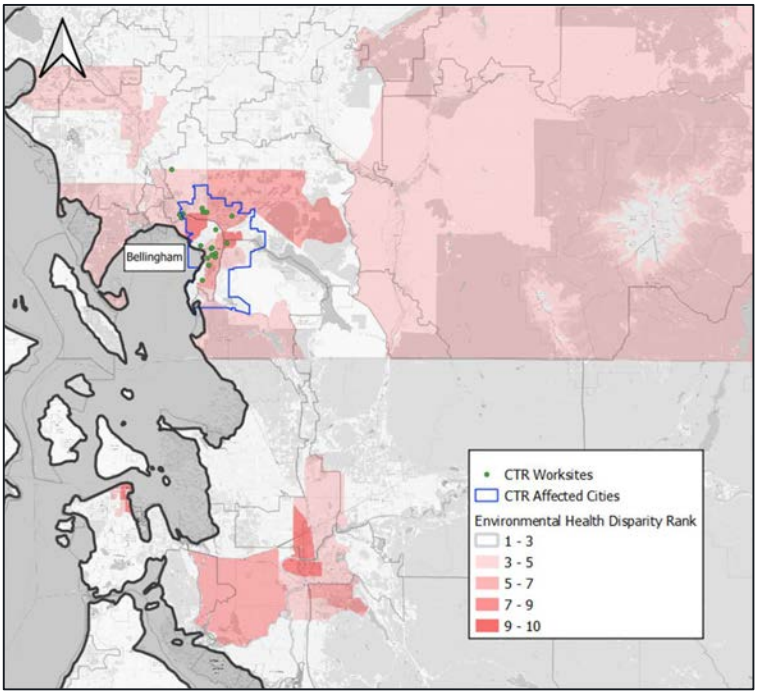


Figure 5-13: EHD ranking and CTR worksites, Vancouver

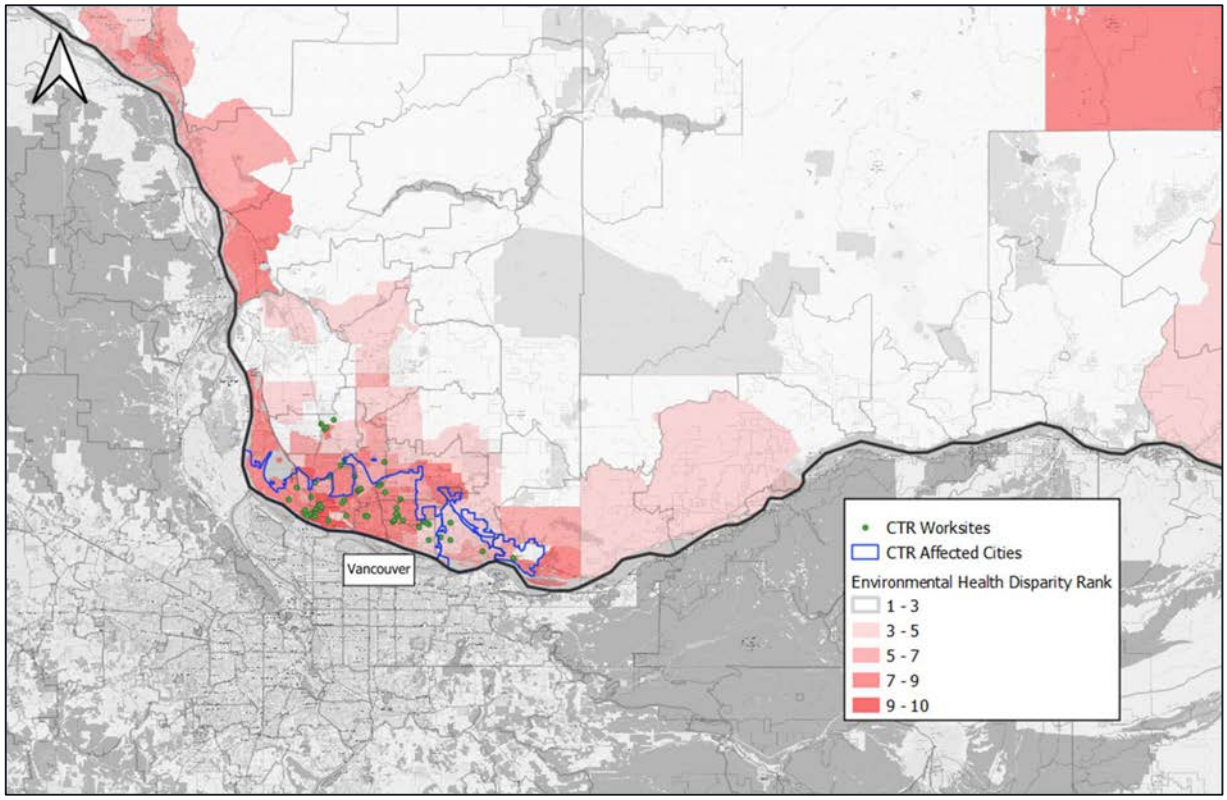
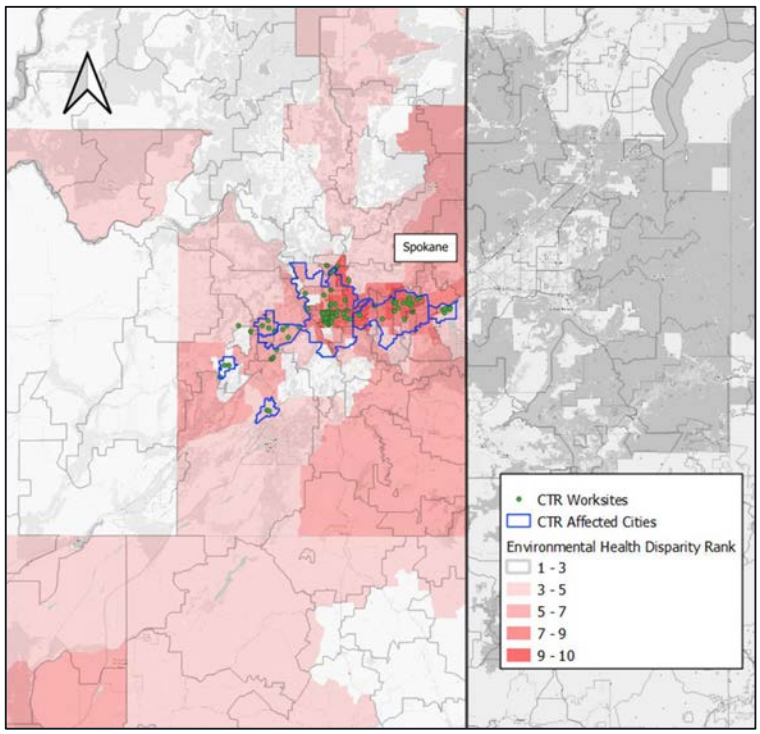


Figure 5-14: EHD ranking and CTR worksites, Spokane



6 Detailed results – drive-alone rates/employee origins

6.1 Survey background

Steer conducted a detailed survey analysis to analyze drive-alone rates by employment status and employee-origin zip code. We used data from a CTR equity survey, which collected employee commute data over three survey cycles (Jan. 1, 2017–Dec. 31, 2018; Jan. 1, 2019–June 30, 2021; and July 1, 2021-June 30, 2023). The survey respondents included those currently working at CTR worksites. Data collected of interest included origin zip code, vehicle miles traveled, and commute mode by day of week.

6.1.1 Survey cleaning

Steer imported the survey data from an Excel file and subsequently cleaned and prepared it for analysis in R. This preparation involved appending city and state information to each employee's origin zip code and filtering the data to include only relevant states (Washington and states surrounding Washington, including Idaho and Oregon). We also calculated the number of days each respondent worked per week, excluding those who didn't work any days (which accounted for less than 1 percent of the respondents). Additionally, we removed ambiguous employment status entries from the dataset.

6.2 Survey results by employment status

6.2.1 Statistical analysis

Methodology

The primary focus of the analysis was to determine if there were statistically significant differences in drive-alone capture rates based on employment statuses. Steer calculated the drive-alone capture rate by identifying the number of days respondents drove alone or used a motorcycle/moped and dividing this by the total number of days worked per week.

We employed various statistical methods to analyze the data. We calculated the mean drive-alone capture rate for different employment status groups and visualized using bar graphs. Streer used Levene's test to assess the homogeneity of variances, which indicated the need for a Kruskal-Wallis test given the non-normal distribution and unequal variances. The Kruskal-Wallis test confirmed significant differences in drive-alone rates among different employment groups.

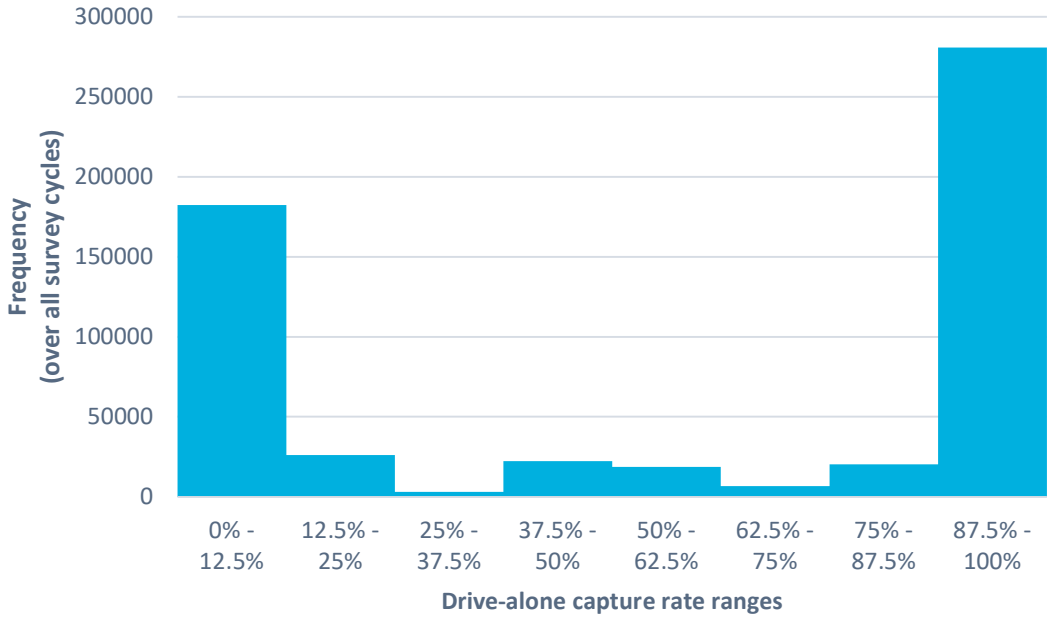
To further explore these differences, we conducted pairwise t-tests. These tests compared drive-alone rates between all part-time and full-time employees, as well as between different part-time

categories. The results highlighted significant differences, although the magnitude of these differences was relatively small in some cases.

Results

A distribution of drive-alone capture rates among all the survey respondents (over the three survey cycles) is in Figure 6-1. Most respondents fall into the extreme ends of the spectrum, with a largest proportion having drive-alone rates between 87.5 and 100 percent. and another substantial group between 0 and 12.5 percent. This bimodal distribution indicates that while most employees drive alone at least four days per week, a significant number of employees rarely drive alone, which highlights that CTR employees have polarized commuting behaviors.

Figure 6-1: Distribution of drive alone capture rates



Overall, the analysis revealed that part-time employees are more likely to drive alone compared to full-time employees. Figure 6-2 highlights the differences between average drive alone capture rates[3] based on employment status. Full-time employees, defined as those working 35 hours or more each week, have an average drive-alone capture rate of 58.1 percent. In contrast, part-time employees working between 20 to 34 hours each week have a significantly higher average drive-alone capture rate of 69.4 percent. Similarly, part-time employees working less than 20 hours each week have an average rate of 67.4 percent. The differences between all three of these groups are statistically significant, according to the Kruskal-Wallis and Welch Two Sample T-tests results shown in Table 6.2.1.

[3] Drive-alone capture rate averages include those who telework full time, and therefore have a drive alone capture rate of 0 percent that skews the rate down.

Figure 6-2: drive-alone capture rates by employment status

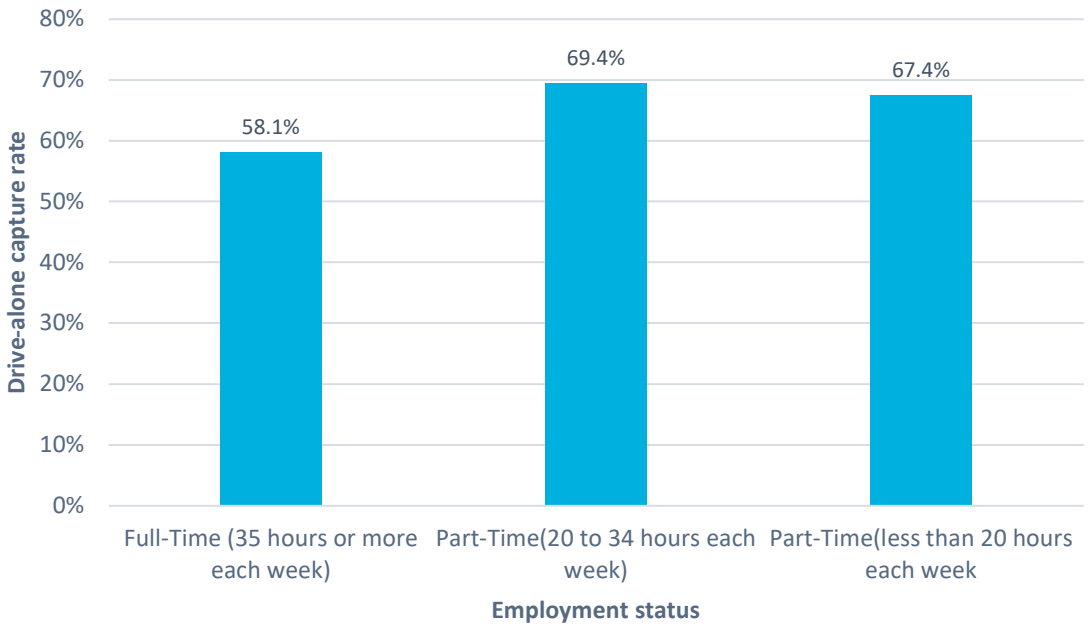


Table 6.2.1: Statistical results examining drive-alone capture rates by employment status

Groups rested	Test type	Kruskal-Wallis chi-squared or T-value	Degrees of freedom	P-value *(* statistical significance at the p <.01 level)*	Finding
• Full-time (35 hours or more each week) • Part-time (20 to 34 hours each week) • Part-time (less than 20 hours each week)	Kruskal-Wallis	1680.5	2	< 2.2e-16*	**There are statistically significant differences in drive alone rates between all three employment groups.**
• Part-time (20 to 34 hours each week) • Part-time (less than 20 hours each week)	Welch Two Sample T-test	3.1381	10001	0.001705*	**There is a statistically significant difference in drive alone rates between the two part-time groups, although the magnitude of this difference is small (< 2 percentage points).**
• Full-time (35 hours or more each week) • Part-time (all)	Welch two sample T-test	-40.892	32105	< 2.2e-16	**There are statistically significant differences in drive alone rates between full-time and all part-time employees.**

6.3 Survey results by employee-origin zip code

6.3.1 Statistical analysis

Methodology

The primary focus of the analysis was to determine if there were statistically significant differences in drive-alone capture rate by employee origin zip code. Steer used various statistical methods to analyze the data. We generated summary statistics for each zip code, including the number of respondents, average drive-alone capture rate, median drive-alone capture rate, standard deviation, and coefficient of variation. This allowed for a comprehensive view of drive-alone behaviors across different geographic areas.

We then used Levene's test to assess the homogeneity of variances across zip codes. The test results indicated a very small p-value (2.2e-16), suggesting significant variability in drive-alone capture rate variances among the zip codes. Given the non-normal distribution and unequal variances, we chose the Kruskal-Wallis test to compare the drive-alone capture rates across zip codes. To facilitate further analysis and visualization, we exported the summary statistics for each zip code to a comma-separated values file for subsequent use in Geographic Information System (GIS) applications.

Results

The Kruskal-Wallis test results (Table 6.3.1) were highly significant, with a p-value less than 2.2e-16 and a large chi-squared value of 66622, indicating substantial differences in drive-alone capture rates among different employee zip codes. These results indicate that resident geographic factors have an influence on commuting behaviors.

Table 6.3.1: Kruskal-Wallis test results

Test variables	Kruskal-Wallis chi-squared	Degrees of freedom	P-value (** = statistical significance at the p <.01 level)*	Outcome
Drive-alone rate by zip code	66622	948	< 2.2e-16*	Significant differences in drive alone rates based on employee home zip codes.

6.3.2 Maps

Figure 6-3 shows the geographic distribution of survey respondents across Washington, Idaho, and Oregon, with higher concentrations indicated by darker shades of blue. The Seattle metropolitan area has the highest concentration of respondents, followed by significant clusters in Spokane and Vancouver. In contrast, central Washington as well as Oregon and Idaho have significantly lower respondent counts. It's important to note that some survey respondents teleworked all days per week, which may explain some clusters of respondents in areas far from CTR cities, as these individuals don't commute regularly.

Figure 6-3: Geographic distribution of survey respondents per zip code

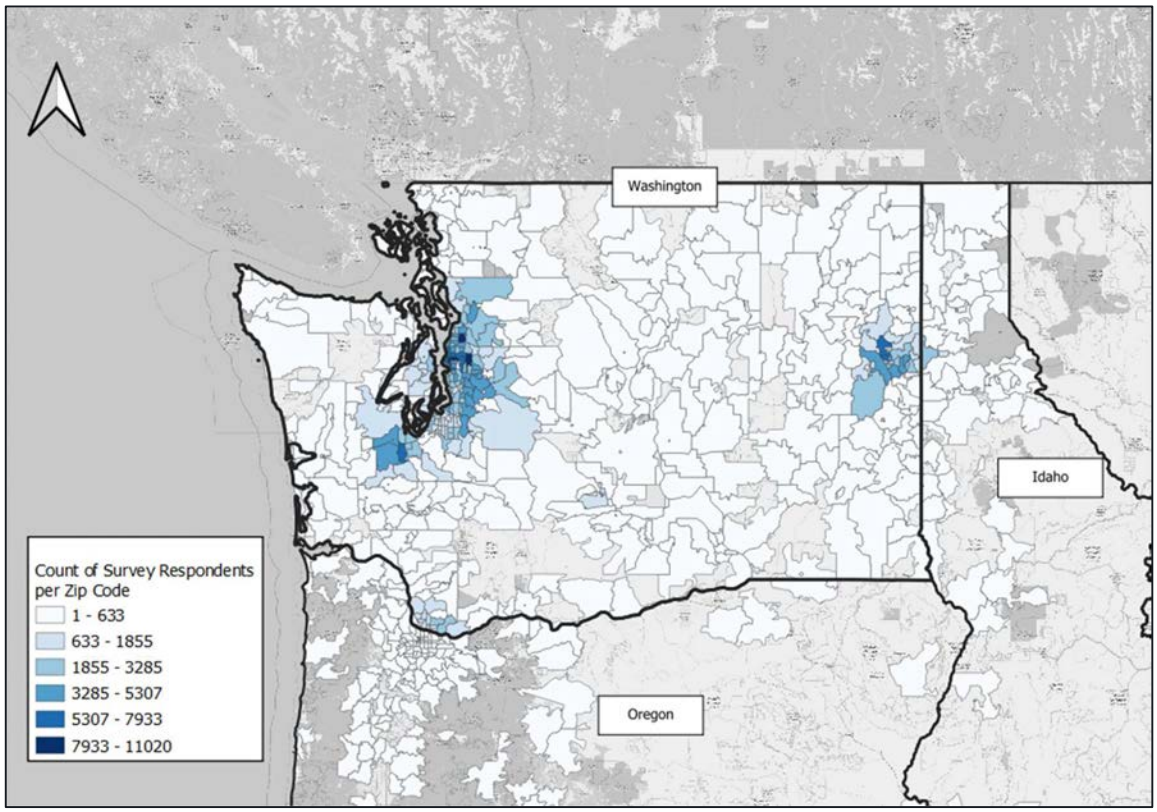


Figure 6-4 shows the average drive-alone capture rates across Washington, Idaho, and Oregon, with darker shades of green indicating higher rates. The map reveals that central and eastern Washington, as well as parts of Idaho and northern Oregon have the highest drive-alone rates, often exceeding 70 percent. In contrast, western Washington, particularly around the Seattle metropolitan area, exhibits lower drive-alone rates, typically ranging from 0 to 55 percent. Additionally, there are areas within central Washington with lower average drive alone rates, which may be reflective of telecommuters in those regions far from urban centers. This geographical variation highlights significant differences in commuting behaviors, with urban areas generally showing more sustainable commuting patterns compared to rural areas.

Figure 6-4: Geographic distribution of drive-alone capture rates per zip code

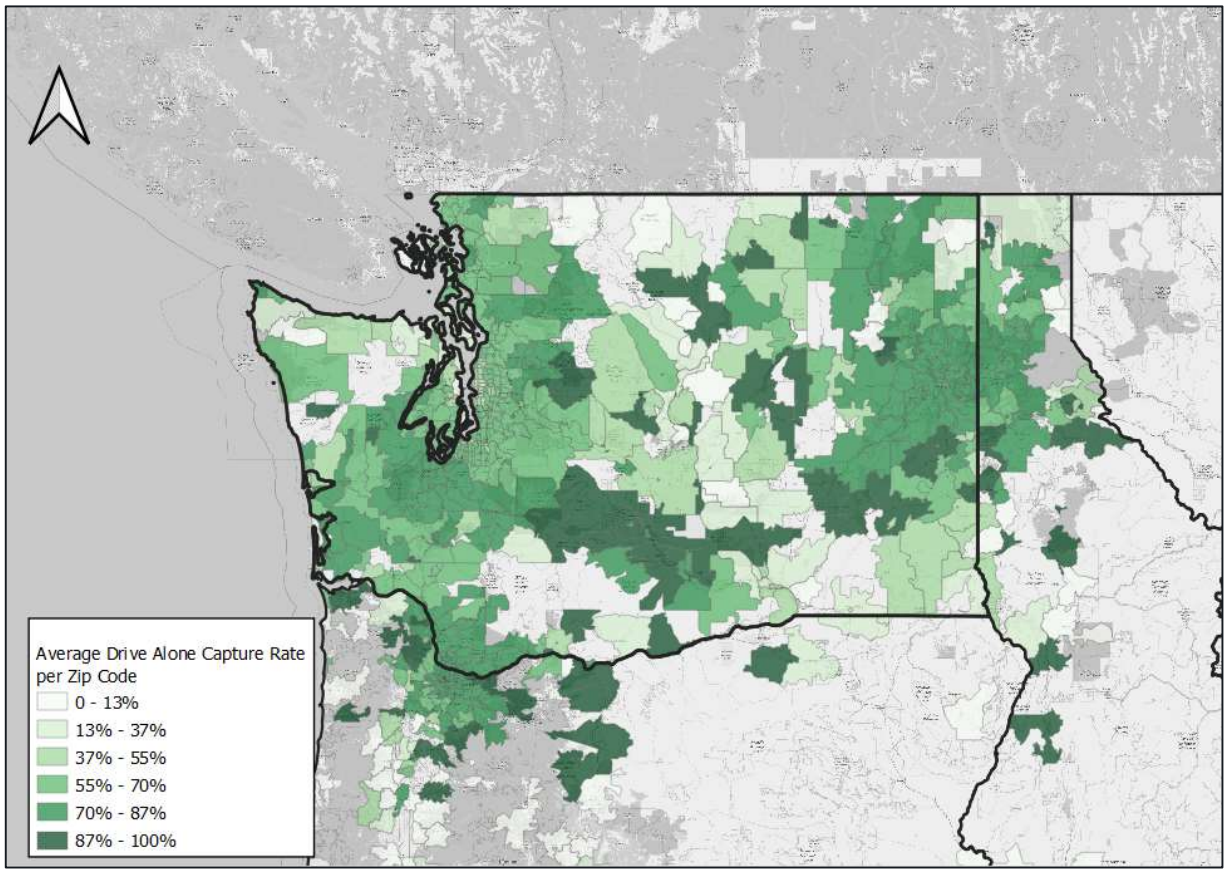


Figure 6-5 to Figure 6-11 show the number of survey respondents (serving as a proxy for the number of CTR employees by residential zip code) in relation to SVI. In some urban areas where CTR is implemented, there's a noticeable trend: zip codes with higher concentrations of survey respondents tend to be in areas with lower social vulnerability indexes. This suggests that CTR workers are more likely to reside in less socially vulnerable areas, highlighting potential equity gaps in the program's reach.

Figure 6-5: Employee origins and social vulnerability

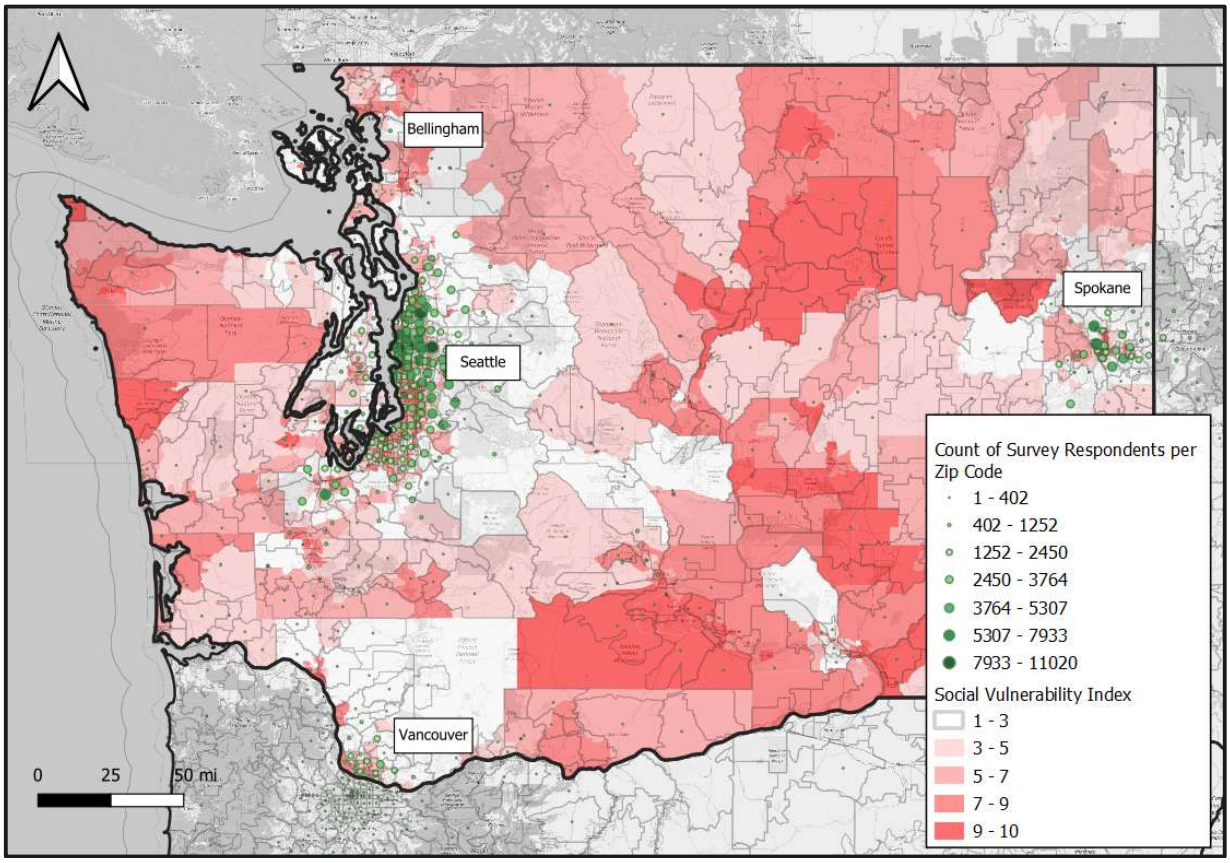


Figure 6-6: Employee origins and social vulnerability, King County

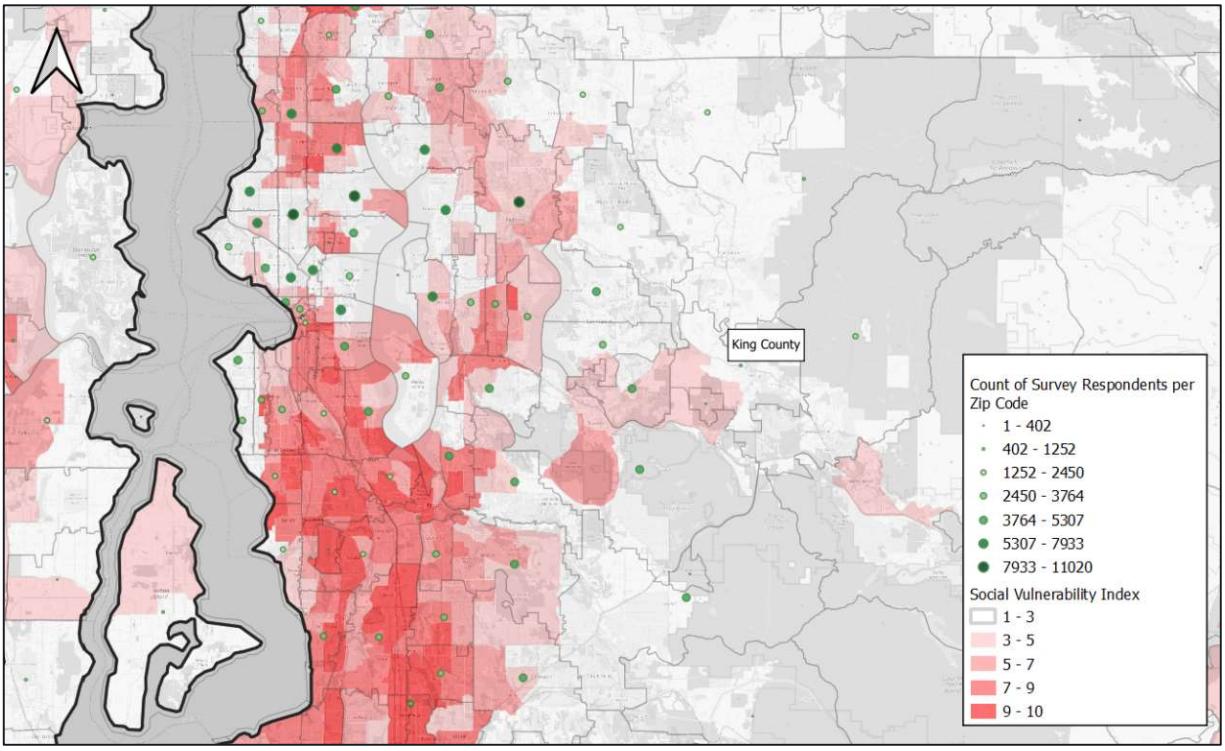


Figure 6-7: Employee origins and social vulnerability, Pierce County

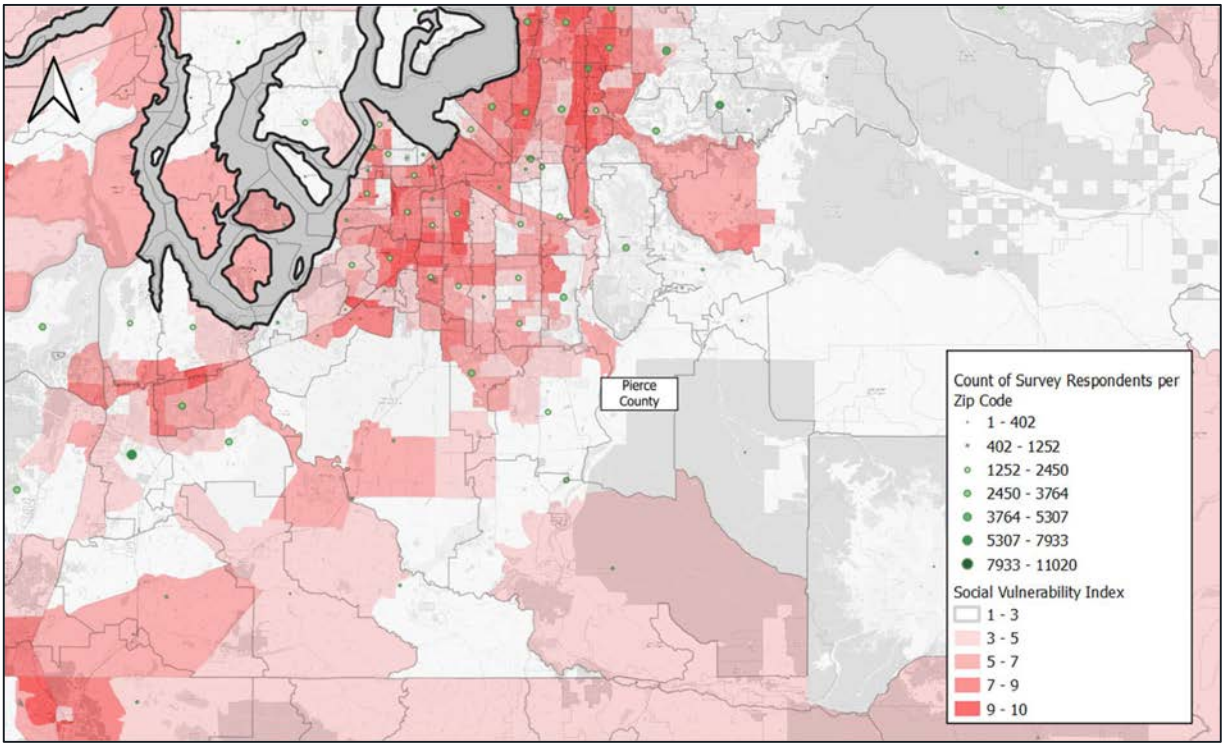


Figure 6-8: Employee origins and social vulnerability, Snohomish County

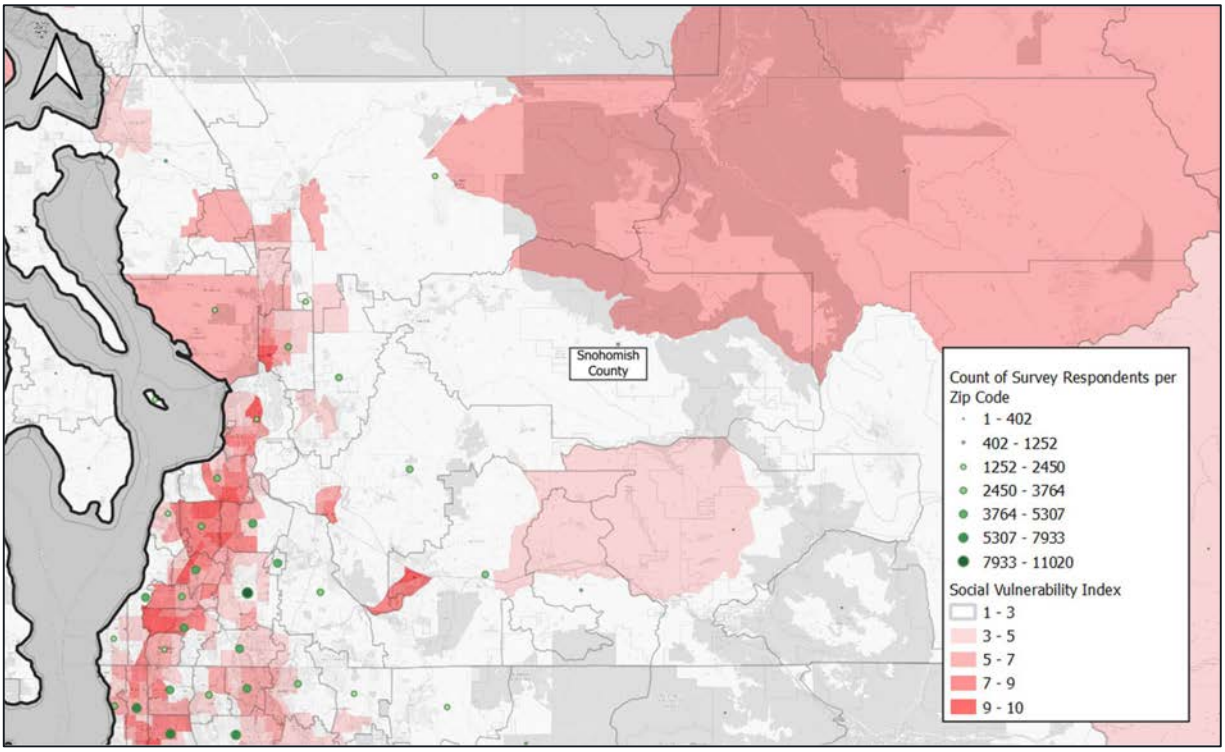


Figure 6-9: Employee origins and social vulnerability, Bellingham

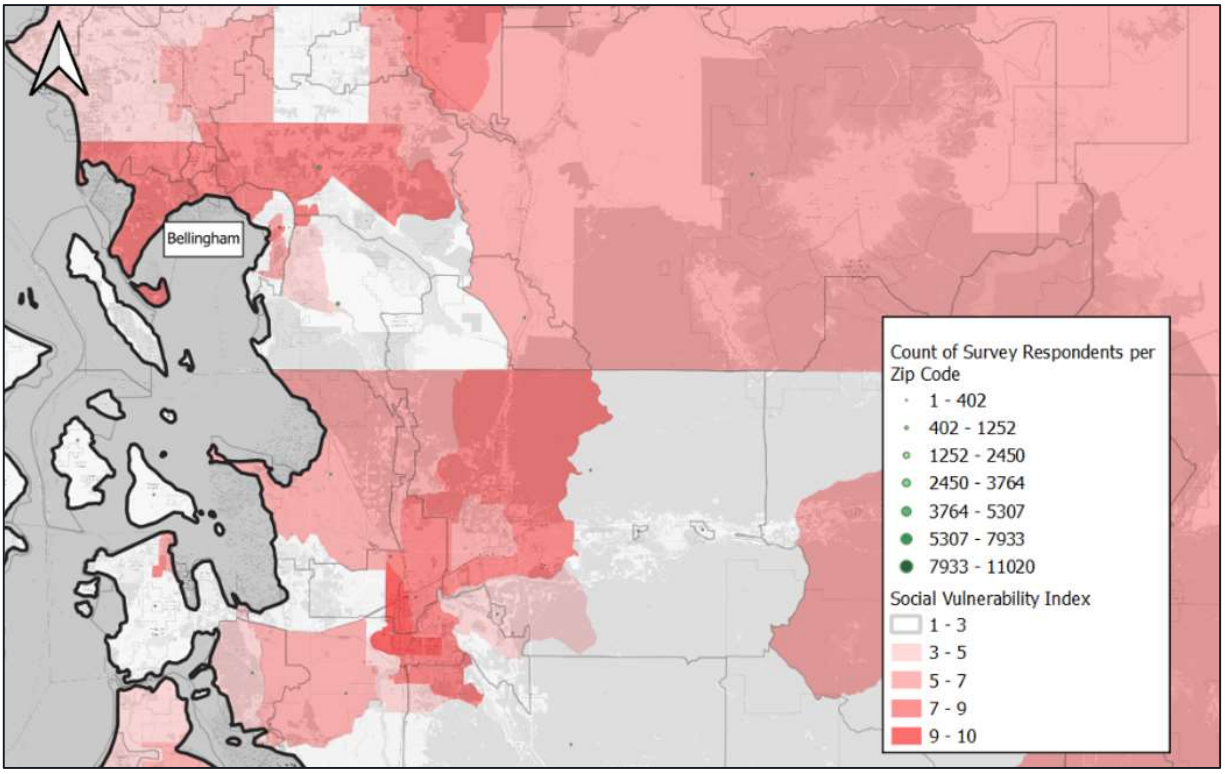


Figure 6-10: Employee origins and social vulnerability, Vancouver

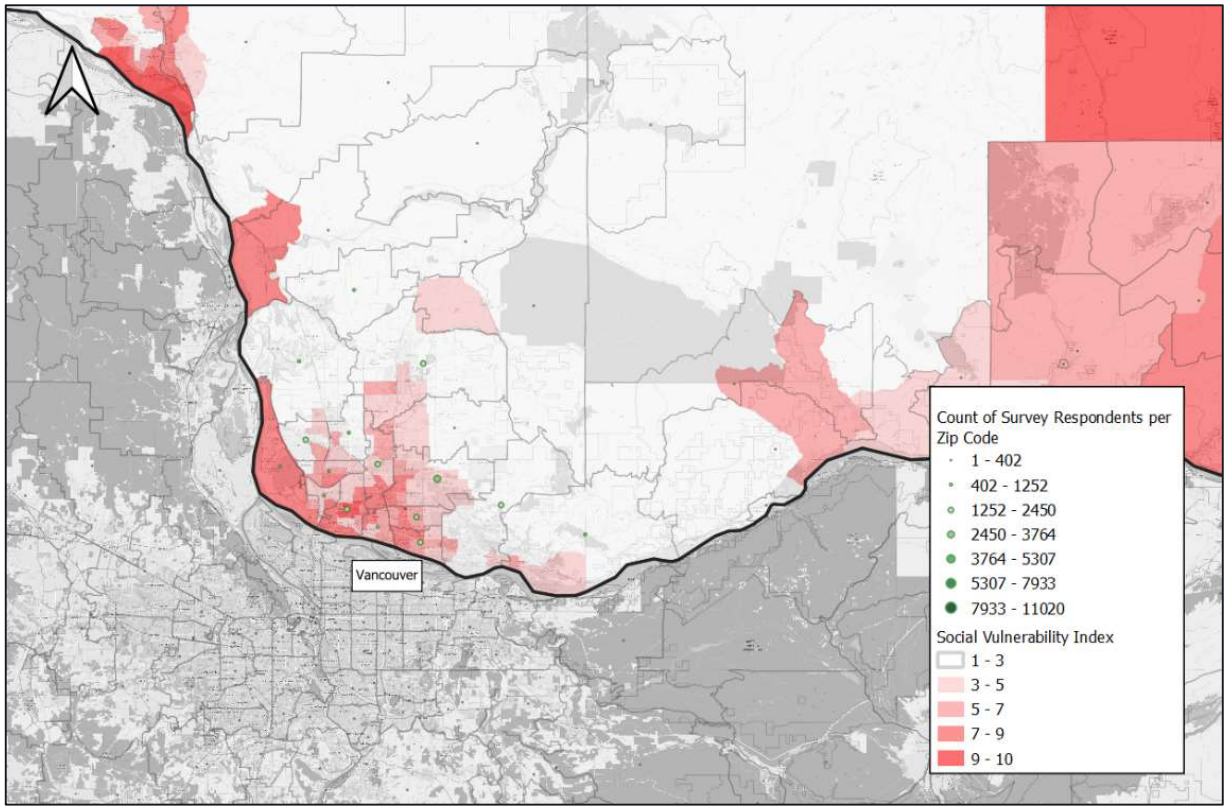


Figure 6-11: Employee origins and social vulnerability, Spokane

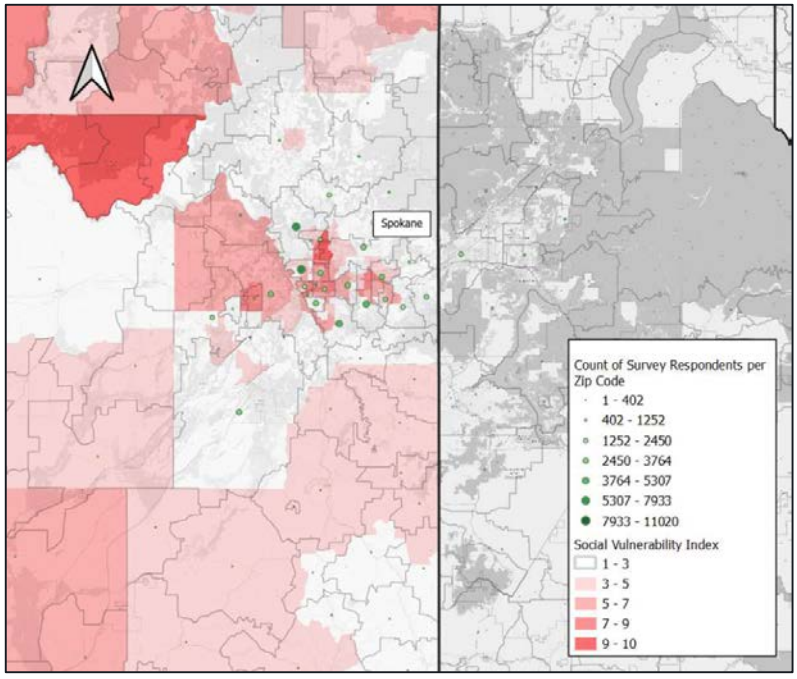


Figure 6-12 to Figure 6-18 show the number of survey respondents in relation to overburdened communities. In more urban centers, such as Seattle and Spokane, where there are higher numbers of CTR employees, there tends to be higher EHD rankings due to urban factors and levels of pollution. Outside of these urban cores, survey respondents are distributed across both high and low EHD ranked areas, indicating no explicit correlation between EHD ranking and employee-origin zip codes. This suggests that while urban areas with higher pollution levels show a link between CTR employee concentrations and high EHD rankings, this pattern isn't consistent across more rural or suburban regions.

Figure 6-12: Employee origins and overburdened communities

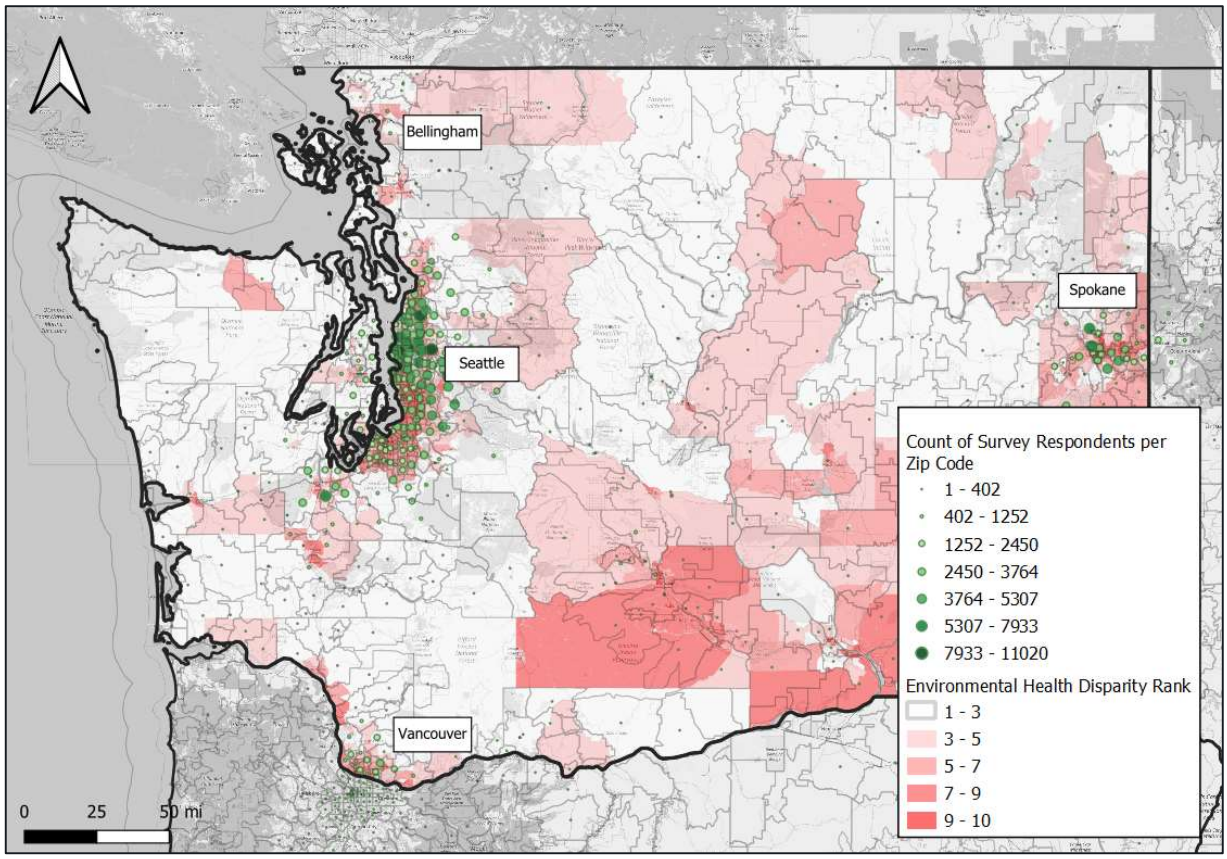


Figure 6-13: Employee origins and overburdened communities, King County

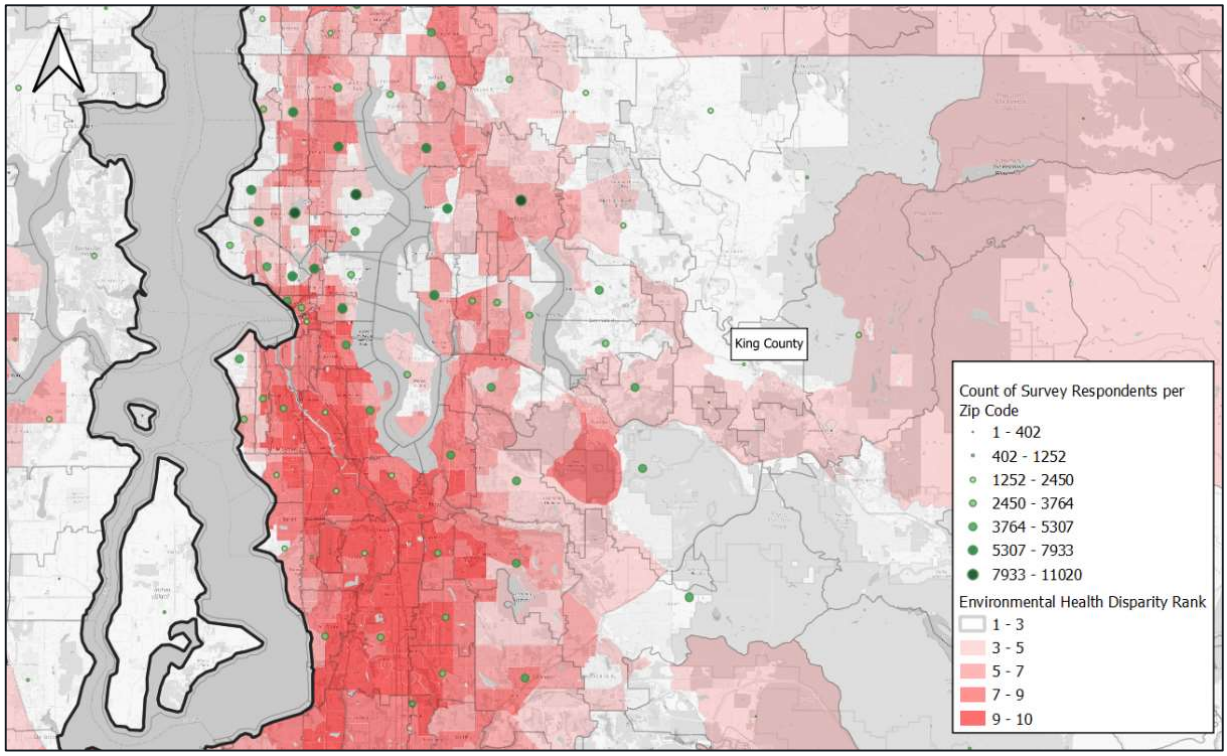


Figure 6-14: Employee origins and overburdened communities, Pierce County

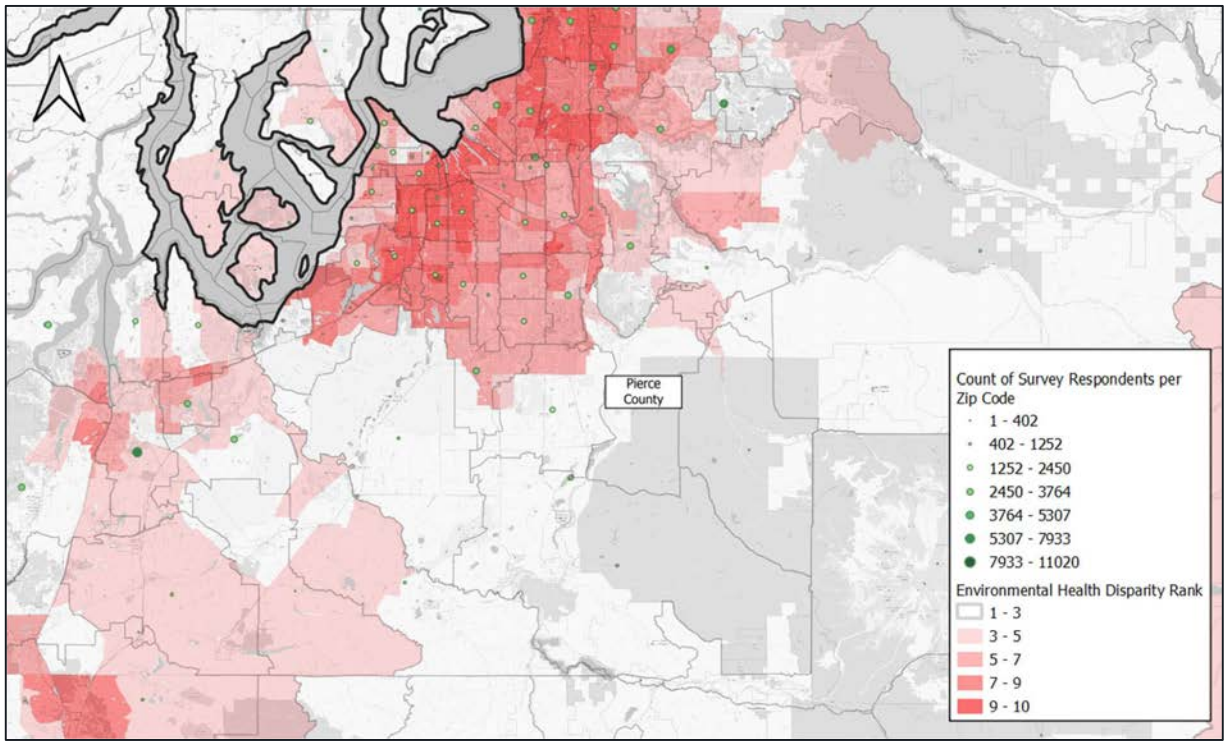


Figure 6-15: Employee origins and overburdened communities, Snohomish County

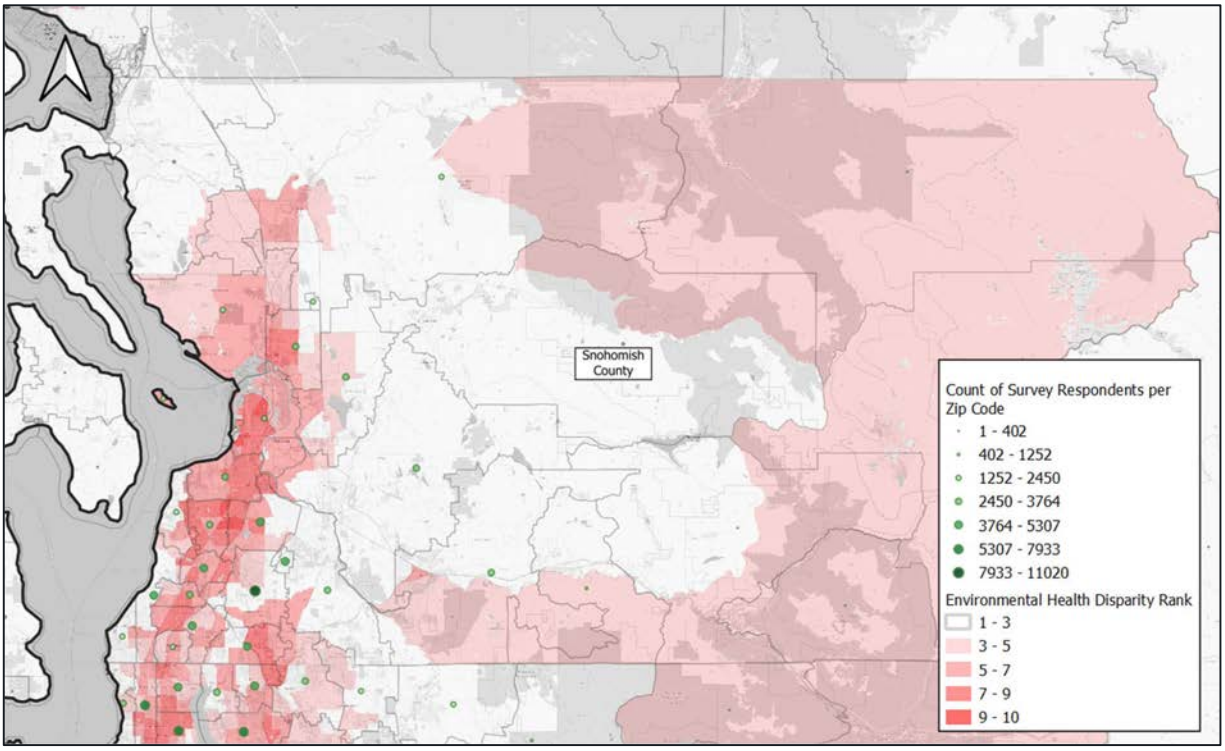


Figure 6-16: Employee origins and overburdened communities, Bellingham

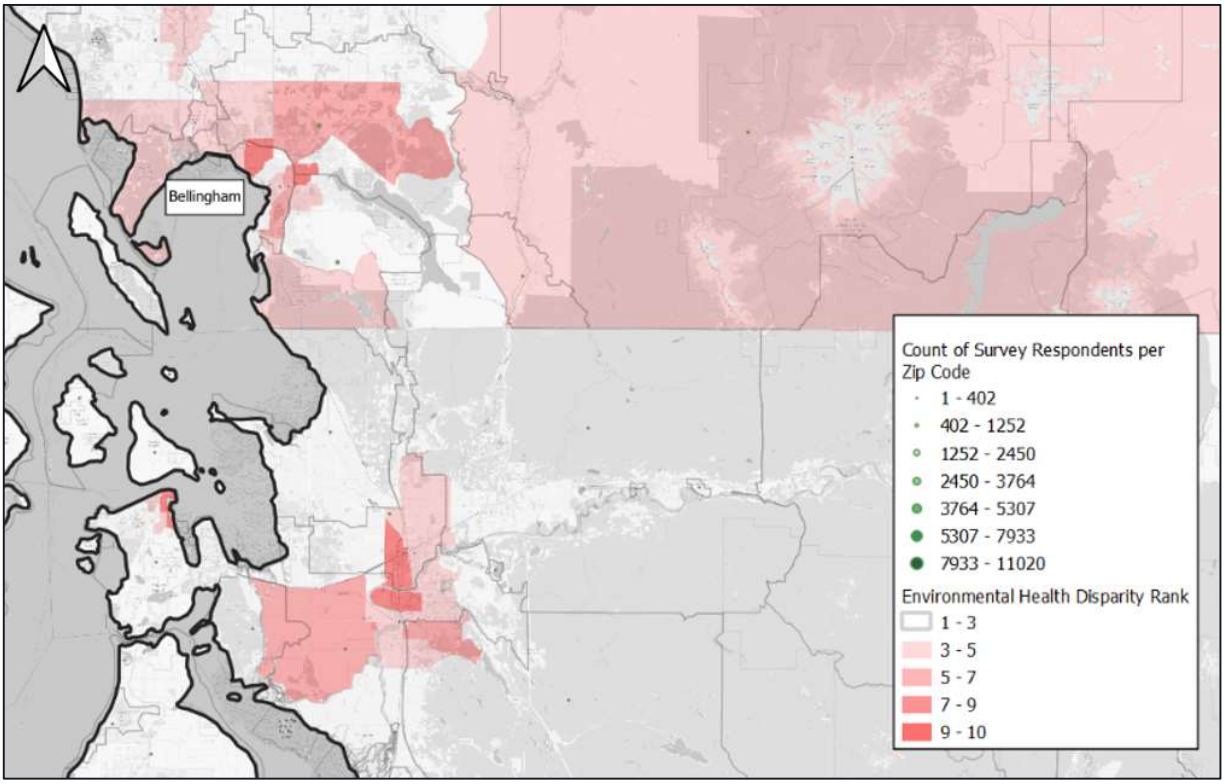


Figure 6-17: Employee origins and overburdened communities, Vancouver

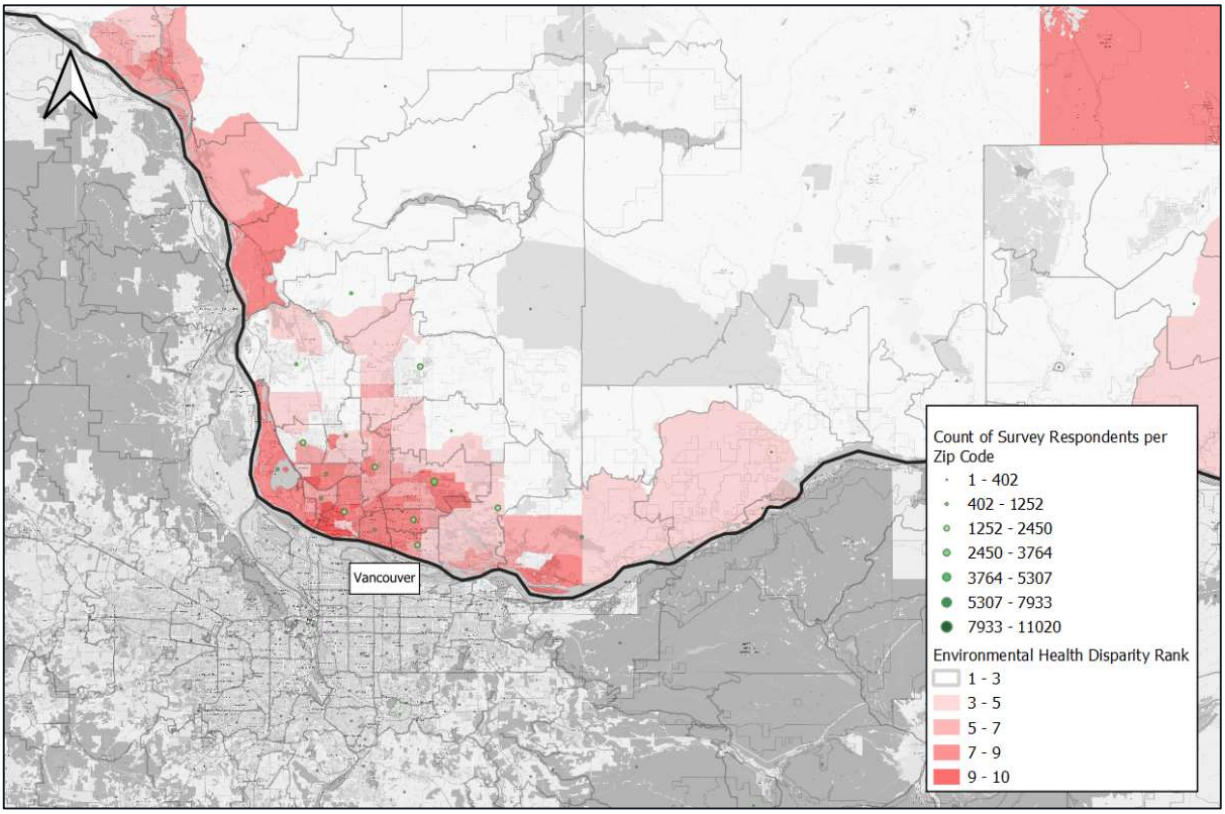
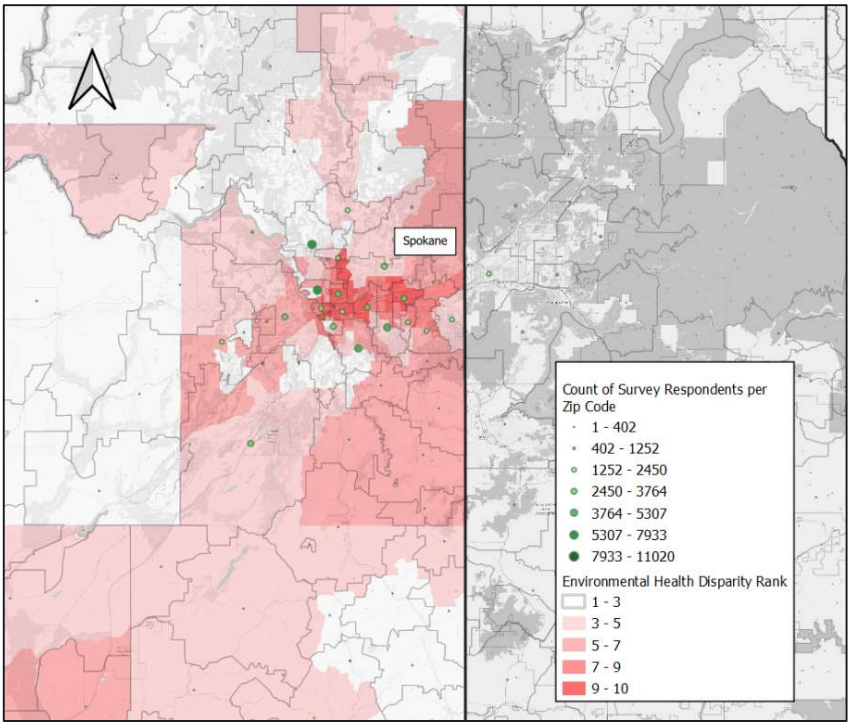


Figure 6-18: Employee origins and overburdened communities, Spokane



7 Detailed results – equity and CTR industries

For the purposes of this study, Steer focused on analyzing “equity industries” — those sectors most likely to employ equity priority groups, including vulnerable populations and other groups requiring additional transportation considerations. we identified three primary equity priority groups: essential workers, shift workers, and workers with disabilities. These groups not only represent vulnerable populations but also have specific transportation needs that can be addressed through targeted transportation policies and supplemental support.

7.1 Data source

The US Census Longitudinal Employer-Household Dynamics (LEHD) makes available origin-destination employment statistics (LODES), from which residence-area characteristics (RAC) and workplace-area characteristics (WAC) can be used to analyze counts of jobs filled per census tract in Washington state. The datasets include number of jobs in North American Industry Classification System (NAICS) sectors. Steer cross walked the equity industries identified below to the industry categories in the NAICS sectors to identify the number of jobs in each sector.

7.2 Essential workers

7.2.1 Definition

The Bureau of Labor Statistics (BLS) defines essential workers as those employees who provide goods or services that are considered vital, in some way, to life and welfare. This categorization is often used in states of emergency in which essential workers continue to work when other organizations may close or adapt their work to respond to the crisis. The COVID-19 pandemic made visible this large group of employees who were required to continue to go to work despite the national state of emergency. The pandemic also highlighted that many of these essential workers are transit-dependent and/or have unique transportation needs. These workers often have limited flexibility in their work schedules and locations, making it essential to address their specific commuting needs.

While there’s no universal definition of occupations that qualify as “essential”, the Department of Homeland Security suggest that the essential workforce include those who provide public health and safety, essential products, and other infrastructure support. For purposes of this study, Steer defined and identified essential workers using NAICS categories, although job functions may vary for employees within these sectors.

7.2.2 Methodology

We chose the following NAICS categories for overlapping with the BLS “essential” designation:

- 11 (agriculture, forestry, fishing and hunting)
- 22 (utilities)
- 31-33 (manufacturing)
- 48-49 (transportation and warehousing)
- 51 (information)
- 52 (finance and insurance)
- 56 (administrative and support and waste management and remediation services)
- 62 (health care and social assistance)

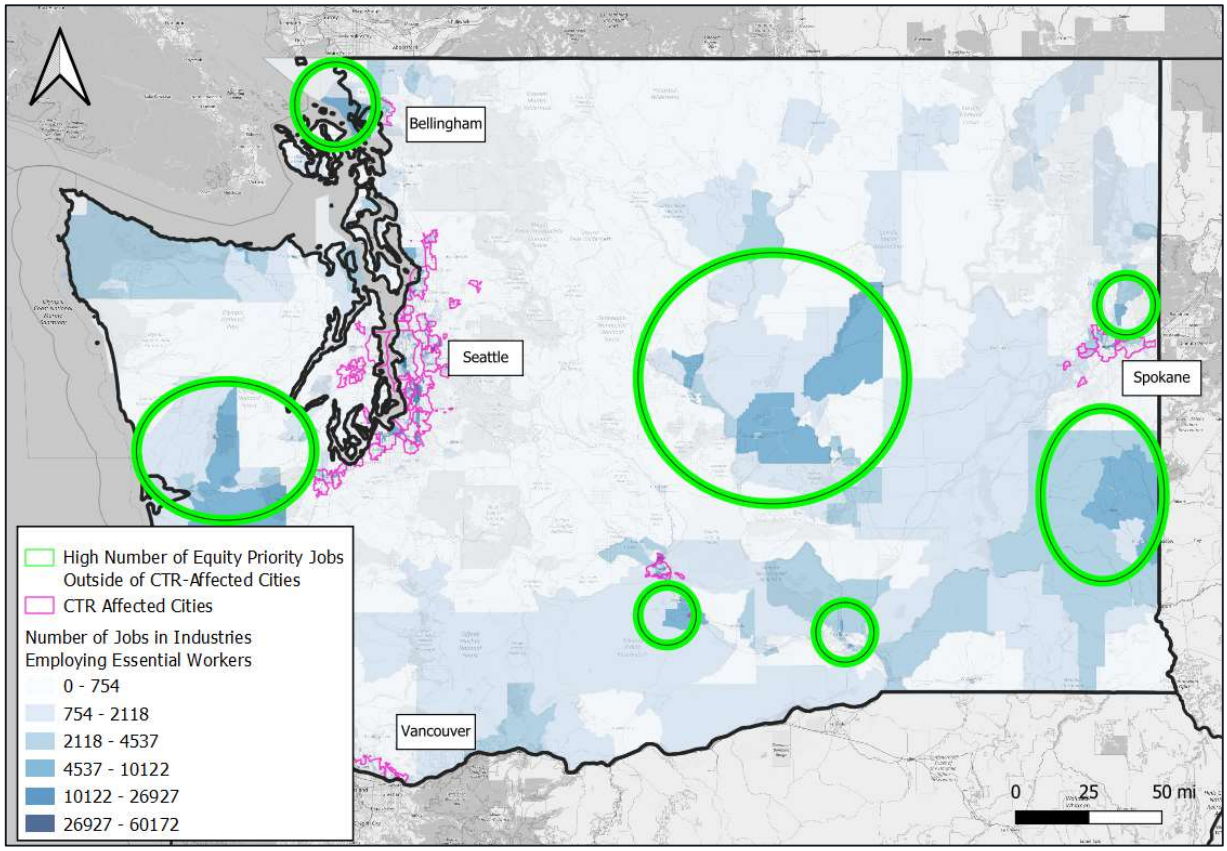
From the LODES data, we aggregated the number of jobs in each identified industry across each census block group to create a "jobs in industries employing essential workers" data column. We then aggregated these block group data to the census tract level and imported the date into GIS for further analysis.

7.2.3 Results

Figure 7-1 shows the distribution of jobs in industries employing essential workers across Washington state. The distribution of essential worker jobs is widespread, both within and outside of CTR-affected cities. This indicates that essential industries aren’t confined to metropolitan areas but are also present in less densely populated regions and areas.

In addition, significant clusters of essential worker jobs are evident in areas closely surrounding major urban centers affected by CTR. This includes areas surrounding Bellingham, Yakima, and Spokane. Overall, this map highlights several key areas outside of CTR-affected cities with high numbers of jobs employing essential workers that may have unique travel needs and a necessity for reliable transportation options.

Figure 7-1: Distribution of essential worker jobs across Washington state



7.3 People with disabilities

7.3.1 Definition

The ACS defines a person with a disability as someone who has significant difficulties in hearing, vision, cognitive function, ambulatory movement, self-care, or independent living. These individuals may have special transportation needs, such as accessible vehicles, more frequent and reliable public transit options, and assistance with navigation, to ensure they can travel independently and safely.

7.3.2 Methodology

For the purposes of this study, Steer categorized the top five industries that employ workers with disabilities (employs at least 9 percent of the entire U.S. disability workforce) as industries most likely to employ shift workers. We determined these industries using 2022 ACS data showing the percent of the entire disability workforce in each industry. These industries were:

- Educational services, and health care and social assistance
- Retail trade
- Professional, scientific, and management, and administrative and waste management services

- Arts, entertainment, and recreation, and accommodation and food services
- Manufacturing

We then cross-walked these identified industries were to NAICS categories to be used by LODES data. The crosswalk process is in Table 7.3.1:

Table 7.3.1: NAICS – LODES data crosswalk

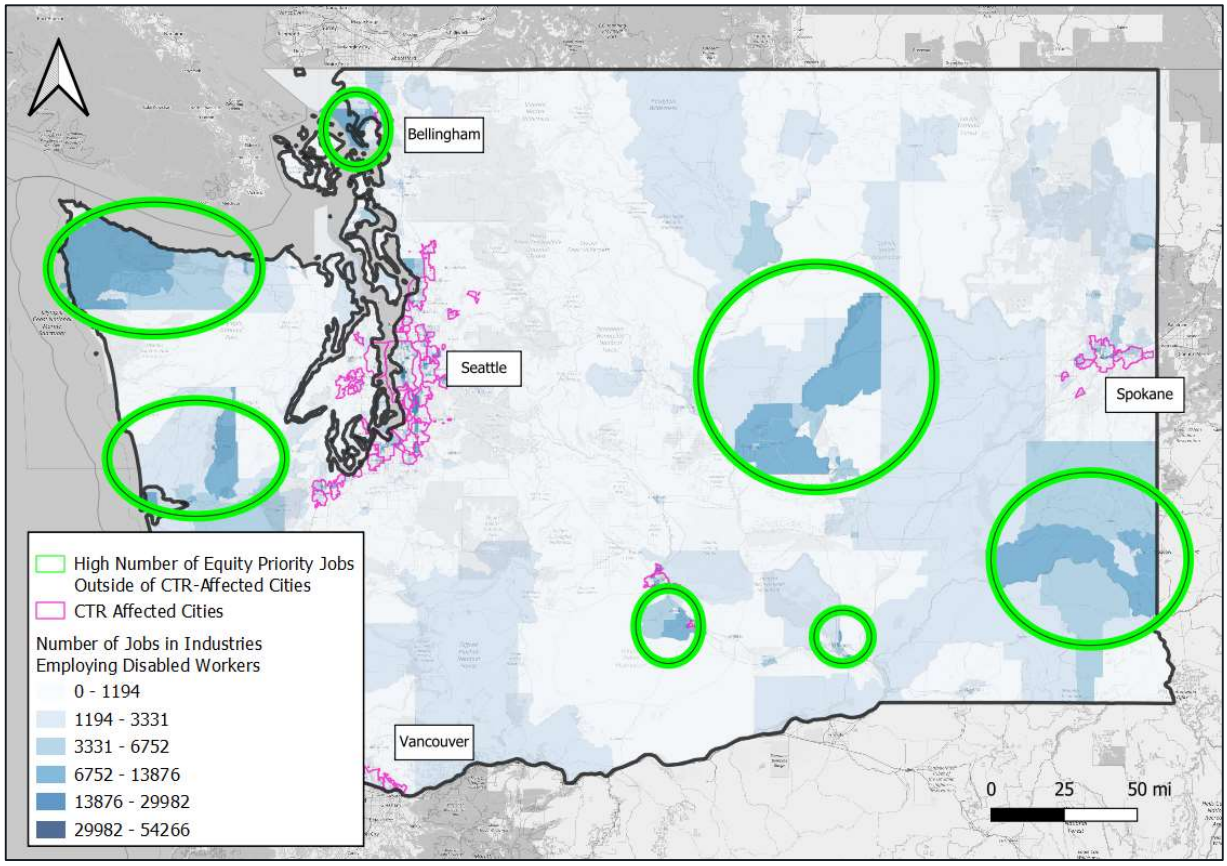
Industry category	Crosswalk code
Mining, quarrying, and oil and gas extraction	2 (mining, quarrying, and oil and gas extraction)
Leisure and hospitality	17 (arts, entertainment, and recreation)
	18 (accommodation and food services)
Transportation and utilities	3 (utilities)
	8 (transportation and warehousing)
Wholesale and retail trade	6 (wholesale trade)
	7 (retail trade)
Manufacturing	5 (manufacturing)
Public administration	20 (public administration)
Education and health services	15 (educational services)
	16 (health care and social assistance)
Other services	19 (other services (except public administration))
Agriculture, forestry, fishing, and hunting	1 (agriculture, forestry, fishing and hunting)

From the LODES data, we aggregated the number of jobs in each identified industry across each census block group to create a "jobs in industries employing disabled workers" data column. We then aggregated these block group data to the census tract level and imported the data into GIS for further analysis.

7.3.3 Results

Figure 7-2 illustrates the distribution of jobs in industries employing disabled workers across Washington state, focusing on areas outside of CTR-affected cities. The distribution of jobs for disabled workers is widespread, with high concentrations (outside of CTR affected cities) in more rural areas throughout the state, including western Washington, central Washington, eastern Washington, and the Richland/Kennewick area.

Figure 7-2: Distribution of disabled worker jobs across Washington state



7.4 Shift workers

7.4.1 Definition

BLS identifies shift workers as individuals who work outside the traditional 9 a.m.-5 p.m. schedule, including evening, night, and rotating shifts; and irregular or split shifts. These workers often encounter unique transportation challenges, such as limited access to public transit during off-peak hours, safety concerns during late-night or early-morning commutes, and the need for flexible commuting options.

7.4.2 Methodology

For the purposes of this study, Steer categorized industries where 10 percent or more of the workforce work a non-regular daytime schedule (including evening, nighttime, rotating, irregular hours, split shift, and other) as industries most likely to employ shift workers. We determined these industries were using 2018 BLS economic data showing the percent of workers in each industry working a non-daytime schedule. The industries are as follows:

- Leisure and hospitality
- Transportation and utilities
- Wholesale and retail trade
- Manufacturing
- Public administration
- Education and health services
- Other services
- Agriculture, forestry, fishing, and hunting

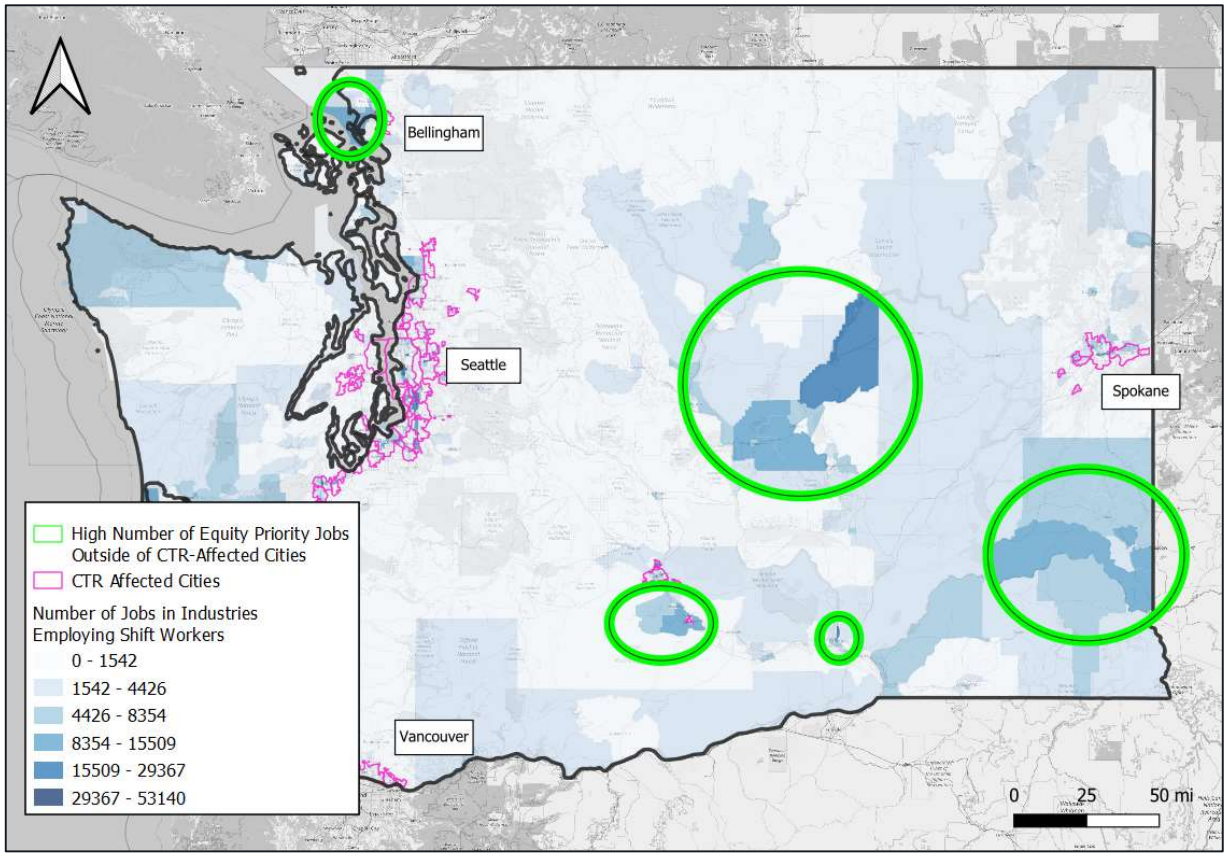
We then cross-walked these identified industries to NAICS categories to be used by LODES data. The crosswalk process is in Table 7.3.1.

From the LODES data, we aggregated the number of jobs in each identified industry across each census block group to create a "jobs in industries employing shift workers" data column. We then aggregated these block group data to the census tract level and imported them into GIS for further analysis.

7.4.3 Results

Figure 7-3 illustrates the distribution of jobs in industries employing shift workers across Washington state, focusing on areas outside of CTR-affected cities. The distribution of jobs for shift workers is widespread, with high concentrations (outside of CTR affected cities) in both areas surrounding CTR cities, as well as more rural areas throughout the state, including central Washington, southeast Washington, and the Richland/Kennewick area.

Figure 7-3: Distribution of shift worker jobs across Washington state



8 Detailed results - federally recognized tribal lands, equity, and CTR industries

While Steer and WSDOT recognize that tribes aren't required to participate in the State CTR Program, engagement with tribal planners has revealed that tribal members often face long commutes. To address this, the WSDOT could provide tribal governments with additional resources through supplemental programs to incentivize non-drive-alone trips. The objective of this assessment is to understand the relationship between federally recognized tribal lands, EHD outcomes, and equity industries.

8.1 Methodology

Steer used a U.S. Census Topologically Integrated Geographic Encoding and Referencing system Tribal lands layer from 2019 to identify federally recognized tribal lands. We integrated this layer with other layers (created using the methodologies outlined above) that display social vulnerability, overburdened communities, and equity industries. By combining these datasets, we were able to conduct a comprehensive spatial analysis to assess the relationship between federally recognized tribal lands and these critical factors.

8.2 Results

Figure 8-1 shows numerous areas where tribal lands overlap with regions of high social vulnerability. This overlap suggests that there are significant populations within these tribal areas that could potentially benefit from supplemental support. These vulnerable populations often face unique challenges that could be mitigated through improved transportation options and resources.

Figure 8-1: Federally recognized tribal lands and vulnerable populations

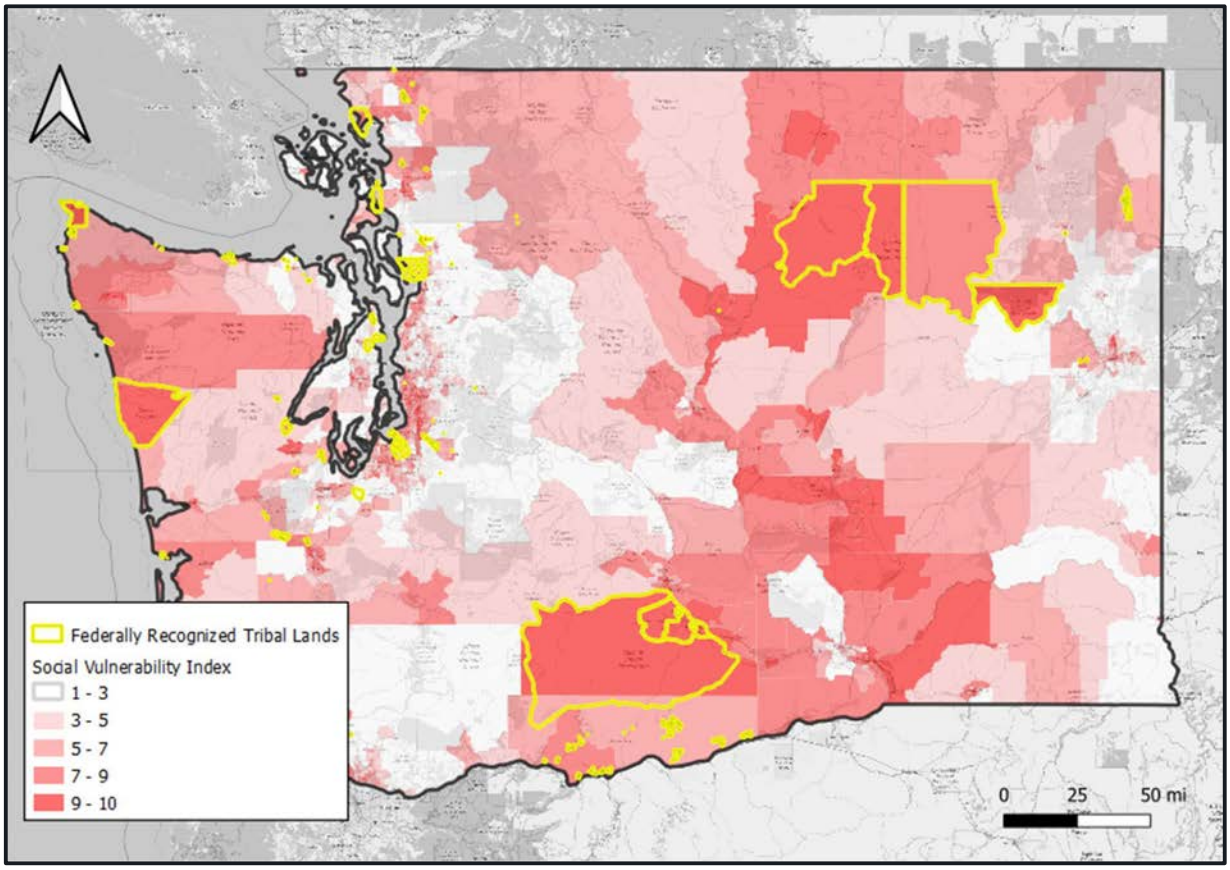


Figure 8-2 shows that several tribal lands, particularly in southcentral Washington and the Tacoma region, coincide with regions exhibiting the highest EHD ranks, suggesting these areas face significant environmental health challenges in addition to social vulnerabilities. However, the map also shows that some tribal lands, such as those in western Washington, have lower EHD ranks, indicating a mixed scenario across different regions. This mixed distribution highlights the need for targeted interventions that consider the specific conditions of each area.

Figure 8-2: Federally recognized tribal lands and overburdened communities

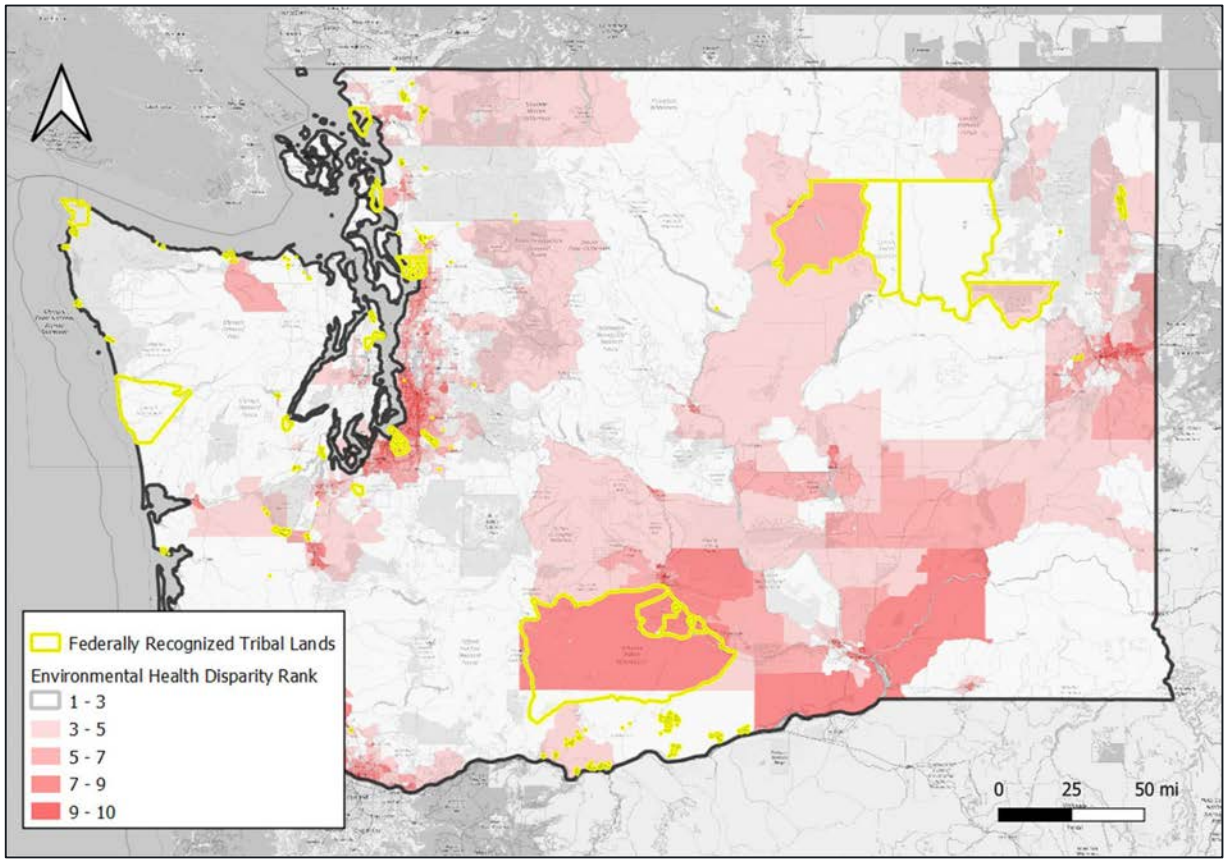


Figure 8-3, Figure 8-4, and Figure 8-5 highlight the overlap between federally recognized tribal lands and the distribution of jobs in "equity industries." These maps show that, in general, there aren't a relatively high number of "equity industry" jobs within tribal land boundaries. This suggests that tribal communities may not have adequate access to employment opportunities in sectors that typically employ equity priority groups, such as essential workers, shift workers, and people with disabilities.

Figure 8-3: Federally recognized tribal lands and distribution of disabled worker jobs

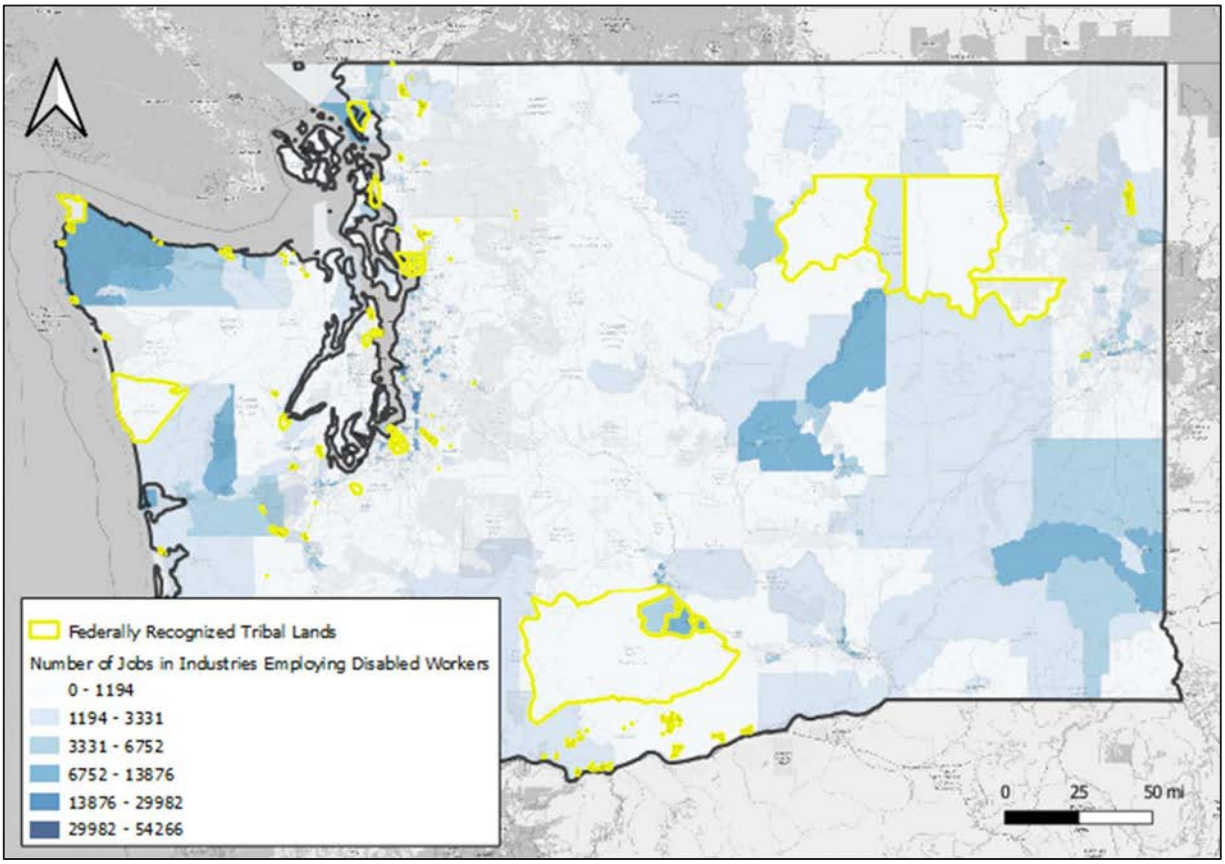


Figure 8-4: Federally recognized tribal lands and distribution of disabled worker jobs

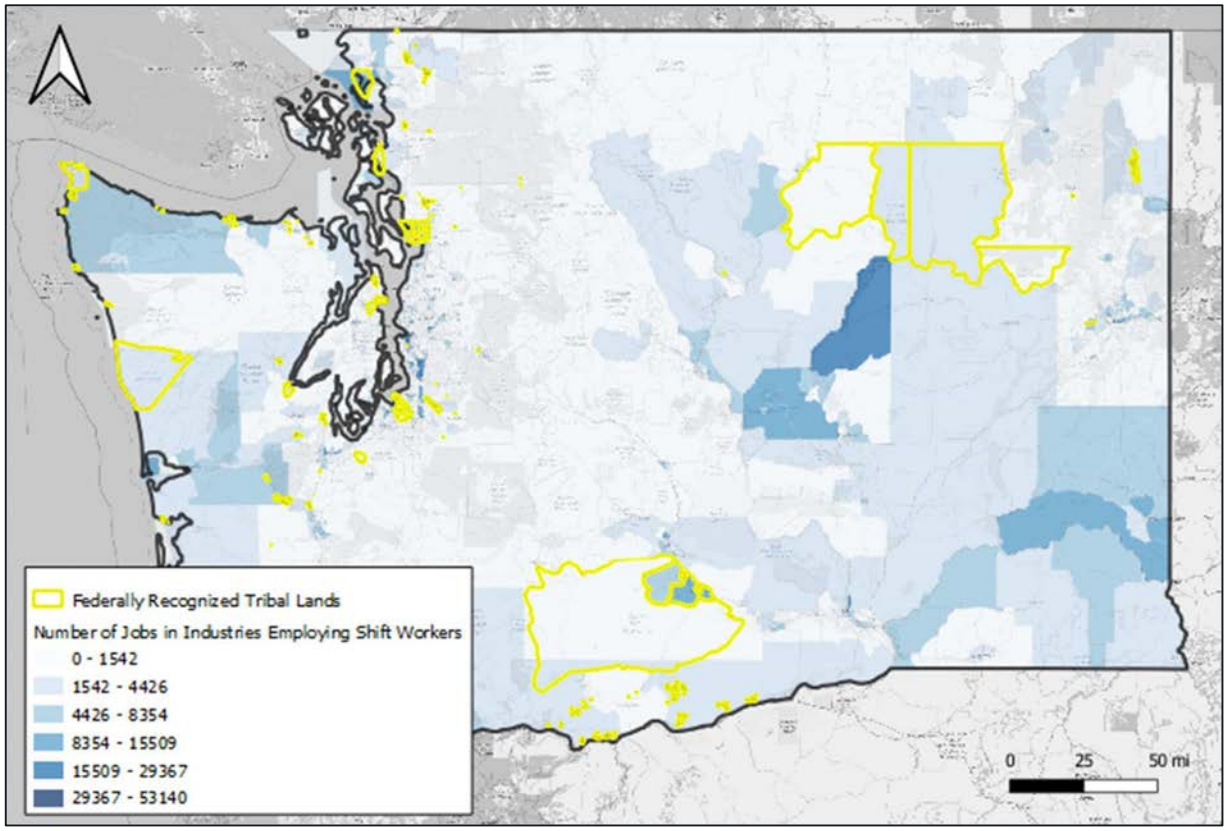
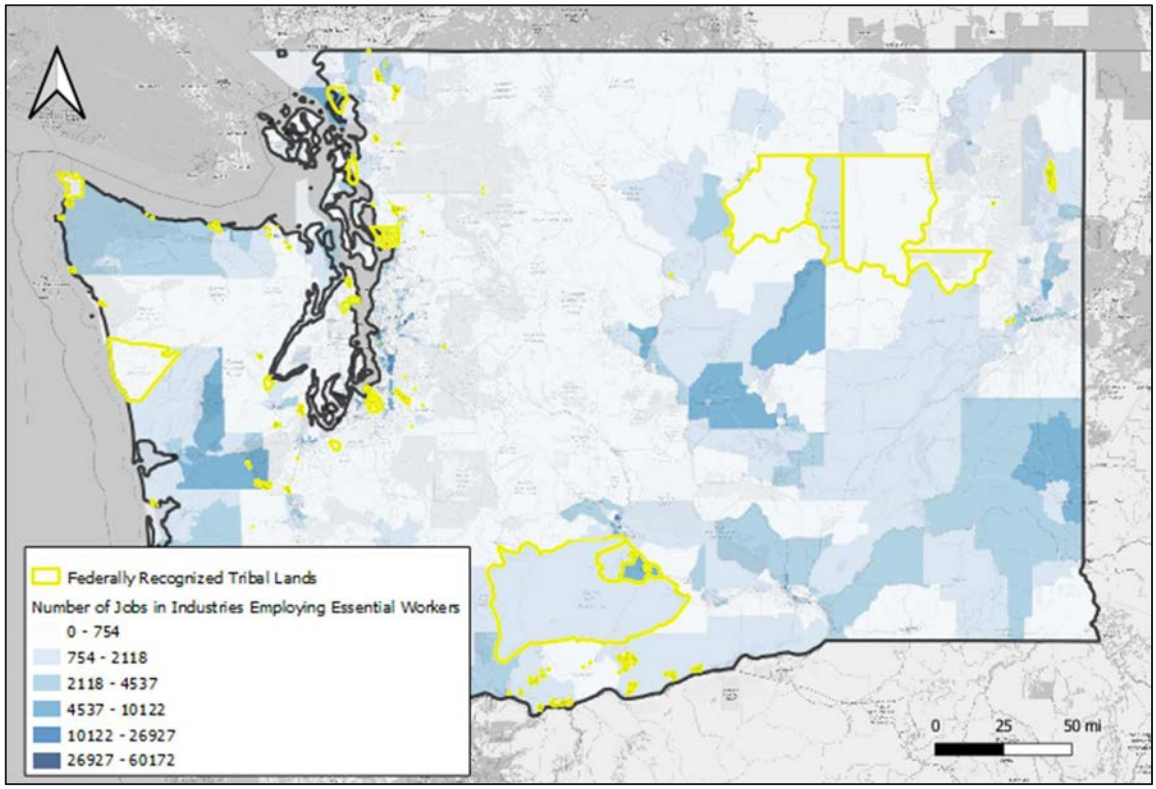


Figure 8-5: Federally recognized tribal lands and distribution of essential worker jobs



9 Detailed results - funding assessment

WSDOT allocates CTR program funding to cities and implementing jurisdictions based in part on the concentration of medium-large employers that fit the commute generation criteria to be a CTR worksite. The funding assessment seeks to determine whether there's a correlation between a city's SVI or EHD ranking and their corresponding per-capita CTR funding allocation.

9.1 Methodology

Steer excluded unincorporated areas from this assessment for consistency with earlier social vulnerability and overburdened communities' analyses. Given that these areas only receive 6 percent of total biennial funding, 94 percent of funding allocation is captured in the analysis of CTR-affected cities.

We took the following steps to assess funding equity:

1. Convert CTR-affected city biennial funding list to spatial layer using city boundaries file.
2. Join census tract centroids to CTR-affected city via spatial intersection (point-to-polygon).
3. Aggregate relevant attributes up to city level:
    a. Population (sum of 2019 ACS tract population estimates).
    b. EHD ranking (mean EHD rank weighted by tract population).
    c. SVI ranking (mean SVI rank weighted by tract population).
4. Calculate per-capita funding (biennial CTR funding allocation divided by city population).
5. Plot SVI/EHD ranking against per-capita CTR funding.

9.2 Results

The following scatter plots show how biennial per capita funding (y-axis) vary by EHD or SVI rank (x-axis). Each data point represents a city, with a smooth trendline assigned via Local Polynomial Regression Fitting in R (smooth.scatter function). A CTR program that considers equity indicators in its funding formula might consider distributing more resources to cities with higher EHD or SVI scores, which would result in a positive sloping trendline.

Figure 9-1: City per-capita CTR funding by EHD rank

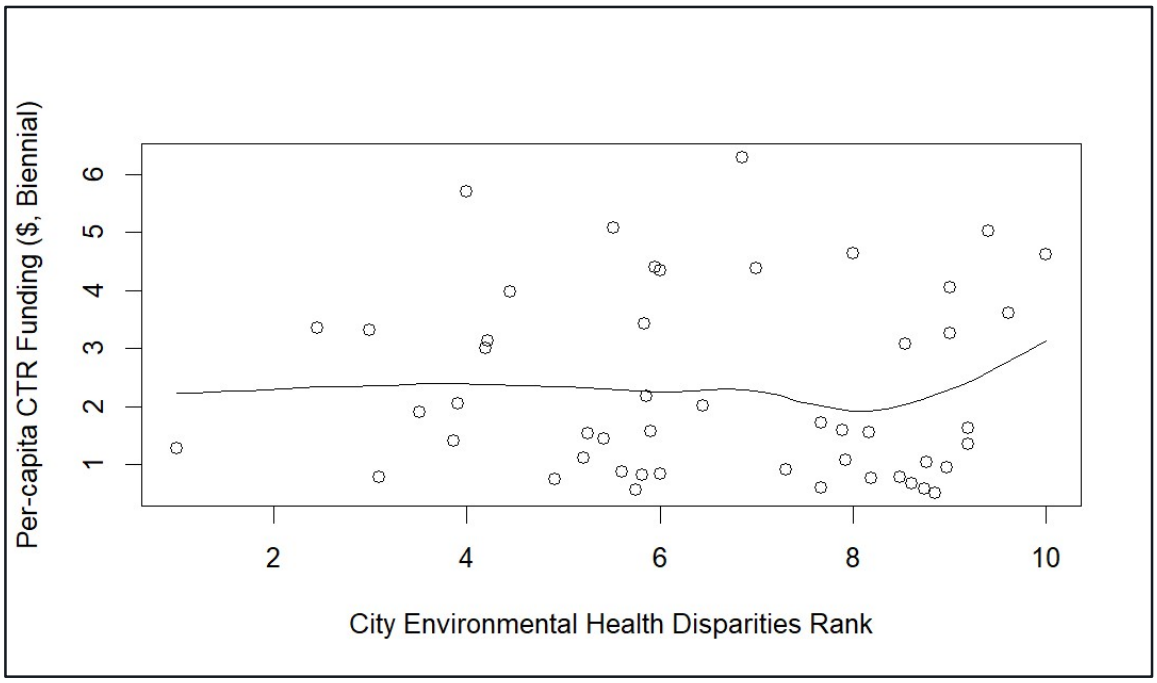
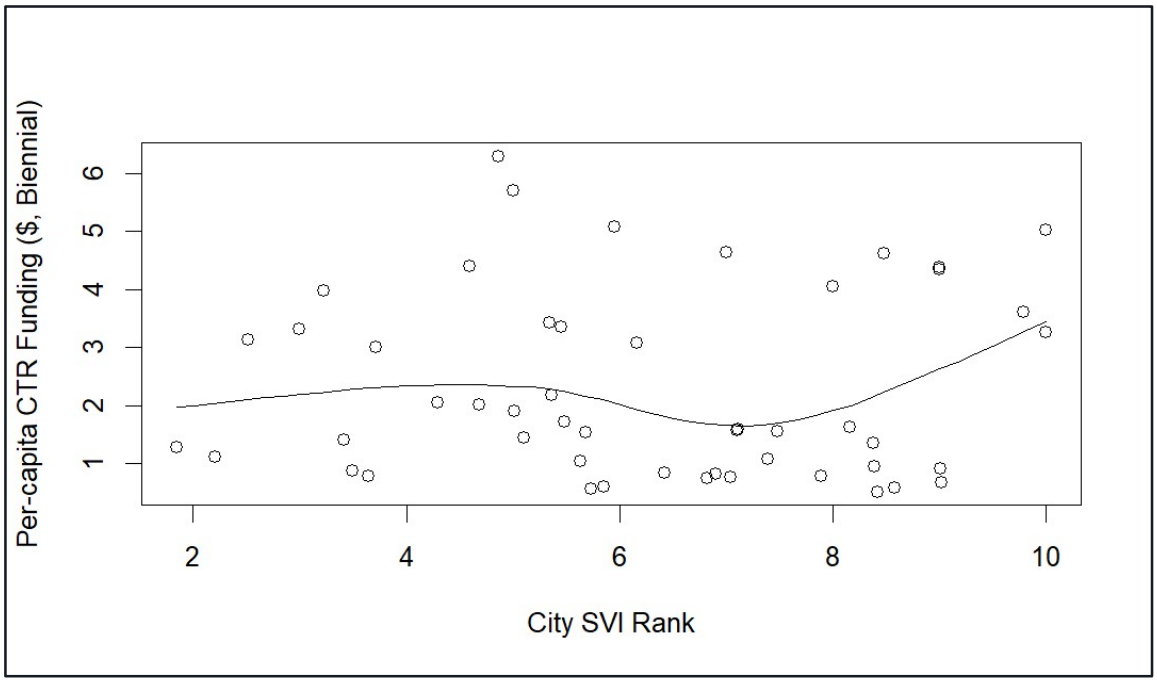


Figure 9-2: City per-capita CTR funding by SVI rank



The figures above reveal no clear correlation between equity priority group indicators (SVI/EHD) and per-capita funding. That said, there's a slight uptick in per-capita funding for the highest-ranking cities. Given that CTR wasn't designed as an equity program, the results of this assessment fit expected behavior.

10 Conclusions

10.1 Potential areas for additional analysis

10.1.1 Targeted engagement of CTR-affected employers and vulnerable populations in overburdened communities within CTR-affected jurisdictions

During stakeholder engagement with implementing jurisdictions, Steer asked interviewees which worksites or industries tended to employ the most vulnerable populations. Interviewees are also in the process of launching their first formal outreach with vulnerable populations to understand how CTR affects them. This provides two areas for potential follow-up analysis:

- Worksites that employ a diversity of staff and job types, both CTR-affected and exempt, can potentially **offer more insight into whom the program is benefitting**, as well as the challenges and opportunities of how the program serves their employees. Based on worksites and sectors suggested by implementors, follow-up engagement could identify good candidate worksites and identify what supports (e.g., administrative, financial) may be needed from WSDOT, other government agencies, and organizations to design and deliver engagement.
- Implementers are grappling with **how to design and improve their approach to engagement** to vulnerable populations around CTR to better understand the needs of residents, employees, and worksites. As outreach occurs over the next year, there could be follow-up interviews with selected implementors. Community-based organizations and/or local ambassadors that supported any outreach could also be interviewed for lessons learned.

10.1.2 Quantitative analysis

There are many ways to group, analyze, and present quantitative analysis of this scale. This study emphasizes statistical analysis of two major equity indicators: SVI and EHD rankings. These indicators are composite scores reflecting a variety of attributes related to social vulnerability and environmental health. Thus, this presents the following areas for potential follow-up analysis:

- **Analysis of SVI/EHD variance:** determine which attributes are the driving factors for variance in SVI/EHD between CTR-affected and unaffected areas. This requires a breakdown of how each variable contributes to SVI and EHD at the census tract level.
- **In-depth analysis of areas outside CTR-affected cities:** conduct a more refined analysis of areas with high concentrations of equity priority jobs outside of CTR-affected cities. Conduct a cross-analysis of SVI/EHD and the distribution of equity industry jobs to explore potential geographic equity gaps in the State CTR Program's reach.
- **Assessment of telecommuting patterns:** using CTR survey data, analyze how telecommuting influences drive-alone rate averages to better understand the relationship between

telecommuting and various factors among CTR workers, such as employment status and origin zip code. This analysis could reveal patterns in how telecommuting is adopted across different regions and worker home zip-code demographics.

- **Longitudinal analysis of commuting patterns:** conduct a longitudinal study of commuting behaviors using data from the CTR equity survey, with a specific focus on comparing pre- and post-COVID/2020 lockdown periods. This analysis could identify significant changes in commuting patterns post-lockdown and the effect of these changes on drive-alone rates

A Literature review and case studies

B Engagement summary report

Control Information

Prepared by

Steer
1111 Broadway, 3rd Floor
Oakland CA 94607
USA
+1 (213) 425 0990
www.steergroup.com

Prepared for

Washington State Department of Transportation
Transportation Building
310 Maple Park Avenue S.E.
Olympia WA 98504-7300

Steer project/proposal number

24564401

Client contract/project number

Author/originator

Emily Alter

Reviewer/approver

Tom Leach

Other contributors

Emily Alter
Noah Larson
Zoe Bertol-Foell
Richard Davis

Distribution

Client:

Steer:

Version control/issue number

V2.0 Draft
V3.0 Draft Final
V4.0 Final Report

Date

August 13, 2024
August 26, 2024
August 30, 2024

steer

QUALITY SYSTEM CERTIFICATION
DNV·GL
ISO 9001:2015

steergroup.com

steer